Australian Government

Fisheries Research and Development Corporation

Investing for tomorrow's fish:

the FRDC's Research, Development and Extension Plan 2010–2015

Photo on this and following pages: Fred Hsu. Photos on front and back covers: Dom+Heath.

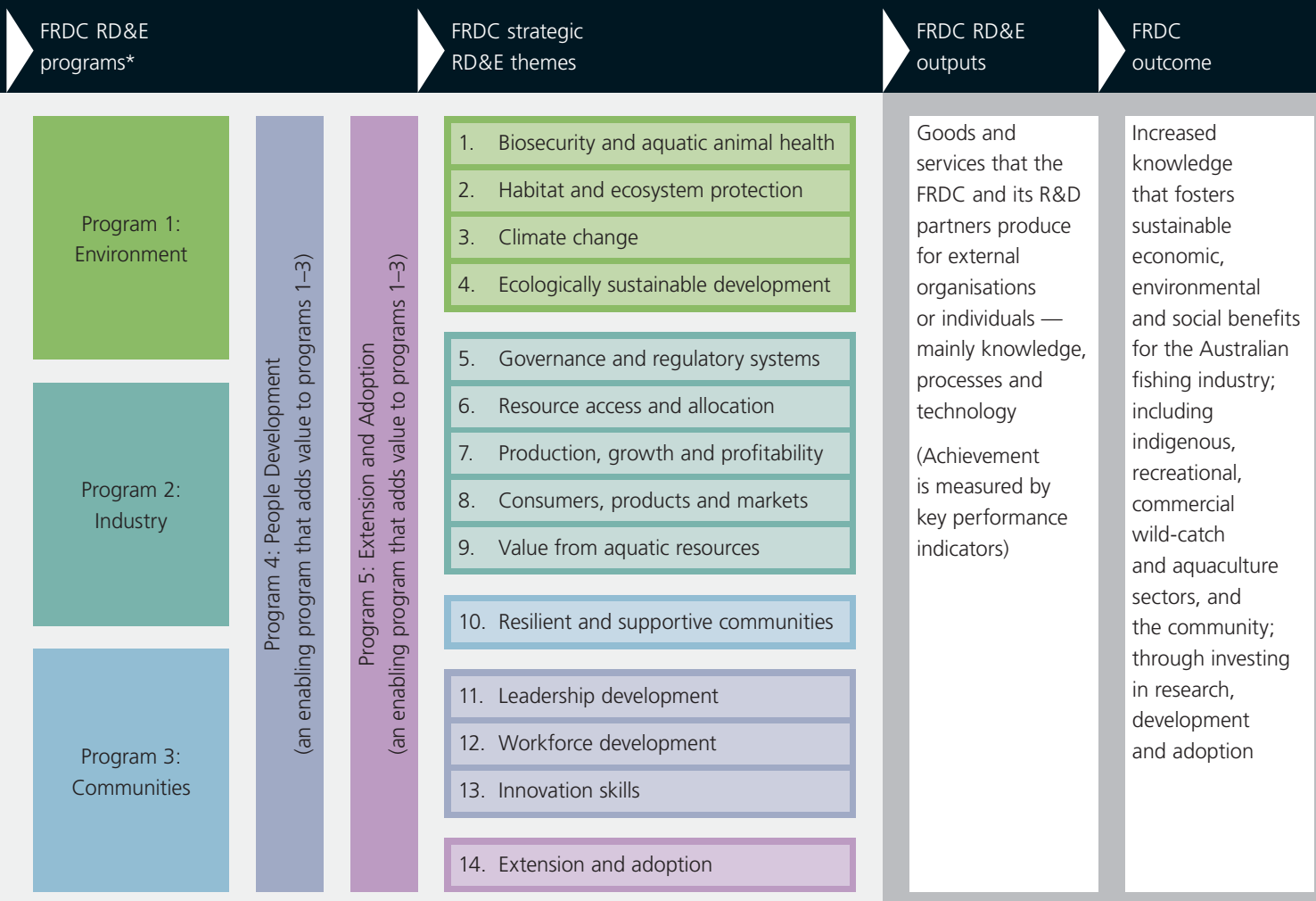
Our vision

A vibrant Australian fishing and aquaculture industry, adopting world-class research to achieve prosperity and to wisely use the natural resources on which it depends.

FIGURE 1: OUR PLANNING ENVIRONMENT

PIERD Act objects	National research priorities	Priorities for rural R&D	Drivers and opportunities	National Fishing and Aquaculture RD&E Strategy	Industry plans
Use and manage natural resources sustainably Increase economic, environmental and social benefits Use human resources and skills more effectively Improve accountability for expenditure on R&D	An environmentally sustainable Australia Promote and maintain good health Safeguard Australia Frontier technologies for building and transforming industries	Productivity and adding value Supply chain and markets Sustainable natural resource management Climate variability and change Biosecurity Innovation skills Technology	Biosecurity and aquatic animal health Ecologically sustainable development Climate change Resource access Food security Productivity Trade and market access Consumers, products and markets Skills and diversity of workforce Consumption and demographic factors	National strategy outcome: – The Australian community derives optimal economic, environmental and social benefits from its fishing and aquaculture resources Value chain outcomes: – 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 Other factors: – Improved extension and adoption – Improved RD&E efficiency – Improved evaluation of RD&E outputs – Improved collaboration	RD&E priorities of the FRDC's representative organisations, plus priorities of national, regional, fishery and local plans throughout the commercial wild-catch, aquaculture, recreational and indigenous customary sectors

GOVERNMENT AND INDUSTRY DRIVERS



* An additional program (the Management, Communications and Accountability Program) derives from the fourth object of s.3 of the PIERD Act. It does not undertake RD&E activities.

During the five-year currency of this RD&E plan, the policy context (left end of diagram) and research structure (right) may well change. For the current diagram, please visit **www.frdc.com.au/plans**

The wording of the PIERD Act objects, national research priorities and priorities for rural R&D has been heavily condensed in this diagram. The full text is available via **www.frdc.com.au/plans**

Sustainable practices safeguard not only the environment but the fishing and aquaculture industry as well.

Photo: Peter Jecks. [This and all other photographs in this plan are copyright. Further information is noted on the inside back cover.]

The context for this plan

This is the fifth statutory strategic plan that the Fisheries Research and Development Corporation (FRDC) has published since its inception in 1992.

At that time, the major focus was on research concerning the management of commercial wild-catch fisheries and, to a lesser extent, aquaculture. Since 1992, the scope has widened greatly to encompass economic, environmental and social aspects of the entire fishing and aquaculture industry — that is, the recreational and indigenous customary sectors in addition to the commercial wild-catch and aquaculture sectors.

A document, *Evolution of the FRDC*, describing how the Corporation's activities have been developed to meet the changing needs of government and industry, is available electronically from www.frdc.com.au/plans

This plan is the first to be prepared within a new, over-arching national framework — the *National Research, Development and Extension Framework* of the Primary Industries Ministerial Council.

The component of the new national framework relevant to fishing and aquaculture is *Working Together: the National Fishing and Aquaculture RD&E Strategy*, prepared through wide-ranging collaboration between key stakeholders in the industry and its research, development and extension partners.

Working Together: the National Fishing and Aquaculture RD&E Strategy is available electronically from www.frdc.com.au/plans and in hard copy from the FRDC — see the inside back cover

The structure of this plan mirrors the triple-bottom-line approach utilised in *Working Together: the National Fishing and Aquaculture RD&E Strategy* and identifies both Australian Government and industry priorities. There is emphasis for the commercial sector on addressing research, development and extension (RD&E) along the entire value chain, and the FRDC has further increased its efforts to extend the results of research and development to end-users. That emphasis, and a corresponding focus in the national framework, is reflected by adding a new Extension and Adoption Program to the Corporation's program structure and including "extension" in the title of this strategic plan.

The plan you are now reading is available in hard copy from the Corporation (02 6285 0400 or frdc@frdc.com.au) and is downloadable from www.frdc.com.au/plans

End-users of RD&E variously include industry enterprises and associations; governments; fisheries managers and other natural resources managers; RD&E partners; and entities in the community, such as advocacy groups.

Value chain is the sequence of activities undertaken to create value, including the various steps of the supply chain but also additional activities, such as marketing, sales, research and development, and product development.

Fish, in the context of this plan, are aquatic vertebrate and invertebrate organisms, both before and after harvest.

The FRDC's stakeholders

Stakeholders in the Corporation are:

- the fishing and aquaculture industry
- the federal, state and territory governments (including their fisheries managers and other natural resource managers)
- research partners (including universities, fisheries research organisations, industry and private sector research providers, and investors)
- the people of Australia (on whose behalf aquatic natural resources are managed, and as consumers).

To reach its production potential, the aquaculture sector needs consistent processes to gain access to suitable sites.

Photo: Julie Haldane.

The FRDC's business model

The FRDC is one of fifteen rural research and development corporations. Six, like the FRDC, are incorporated under the *Primary Industries and Energy Research and Development Act 1989* (PIERD Act). Governance is by a ministerially appointed Board nominated by an independent selection committee in accordance with the Act. The Corporation operates within the provisions of the *Commonwealth Authorities and Companies Act 1997*. Nine, such as Meat & Livestock Australia, have evolved into industry-owned companies established under the *Corporations Act 2001*.

Many entities conduct research relating to the fishing and aquaculture industry, but it is the FRDC that has a leading national role in planning, investing in and managing RD&E. The FRDC's planning environment is shown in figure 1, on pages 2–3.

The Australian Government and the fishing and aquaculture industry co-invest in the FRDC. The Corporation also manages significant federal, state and territory government co-investment in FRDC-funded projects.

Key features of the rural R&D corporations

During the two decades since they were established, the rural research and development corporations (RDCs) have proved to be a successful model for advancing innovation in rural RD&E — especially in the presence of market failure. They have enabled productive partnerships for government and industry investment in science, producing significant benefits to RDC investors and other stakeholders.

Some important characteristics of the RDC model are as follows:

- The RDC model is focused on influencing the full range of interactions along the innovation chain, rather than focusing on generating new knowledge for its own sake. This results in applying significant resources to translating research outputs into practical outcomes and government policies.
- RDCs are not research grant agencies; rather they treat RD&E as an investment in economic, environmental and social benefits to their respective industries and to the people of Australia.
- RDCs are required to conduct their activities in accordance with strategic plans and annual operational plans that must be approved at ministerial level.
- RDCs ensure that a balance is achieved between the respective government and industry priorities.
- RDCs are fully accountable to their major stakeholders and to the wider community.
- In addition to their collaboration on specific RD&E matters, RDCs work closely together on policy issues to increase the effectiveness and efficiency of the national application of rural RD&E.

BUSINESS MODEL

In addition to its reporting to the Minister and Parliament, the FRDC formally reports to the annual meetings of its ministerially appointed representative organisations: the Commonwealth Fisheries Association, the National Aquaculture Council, and Recfish Australia. Appointment of the representative organisations, and the Corporation's consultation with and reporting to them, are in accordance with its enabling legislation.

The FRDC invests in RD&E across the entire fishing and aquaculture industry through a variety of flexible approaches, including open-call applications; formal industry partnership agreements with industry sectors; subprograms and coordination programs tailored to industry sectors or activities; short-term tactical research investment; and specifically targeted commissioned R&D. (More information is at page 39.)

The business environment in which the FRDC operates is characterised by:

- a high emphasis on natural resource management
- specific priorities of the diverse sectors of the fishing and aquaculture industry
- geographic diversity, because Australia's waters extend from the tropics to the Antarctic and include both marine and freshwater
- a broad range of products, including about 600 commercial species, about 1000 recreational species and 100 farmed species; and consideration of more than about 100 protected species.

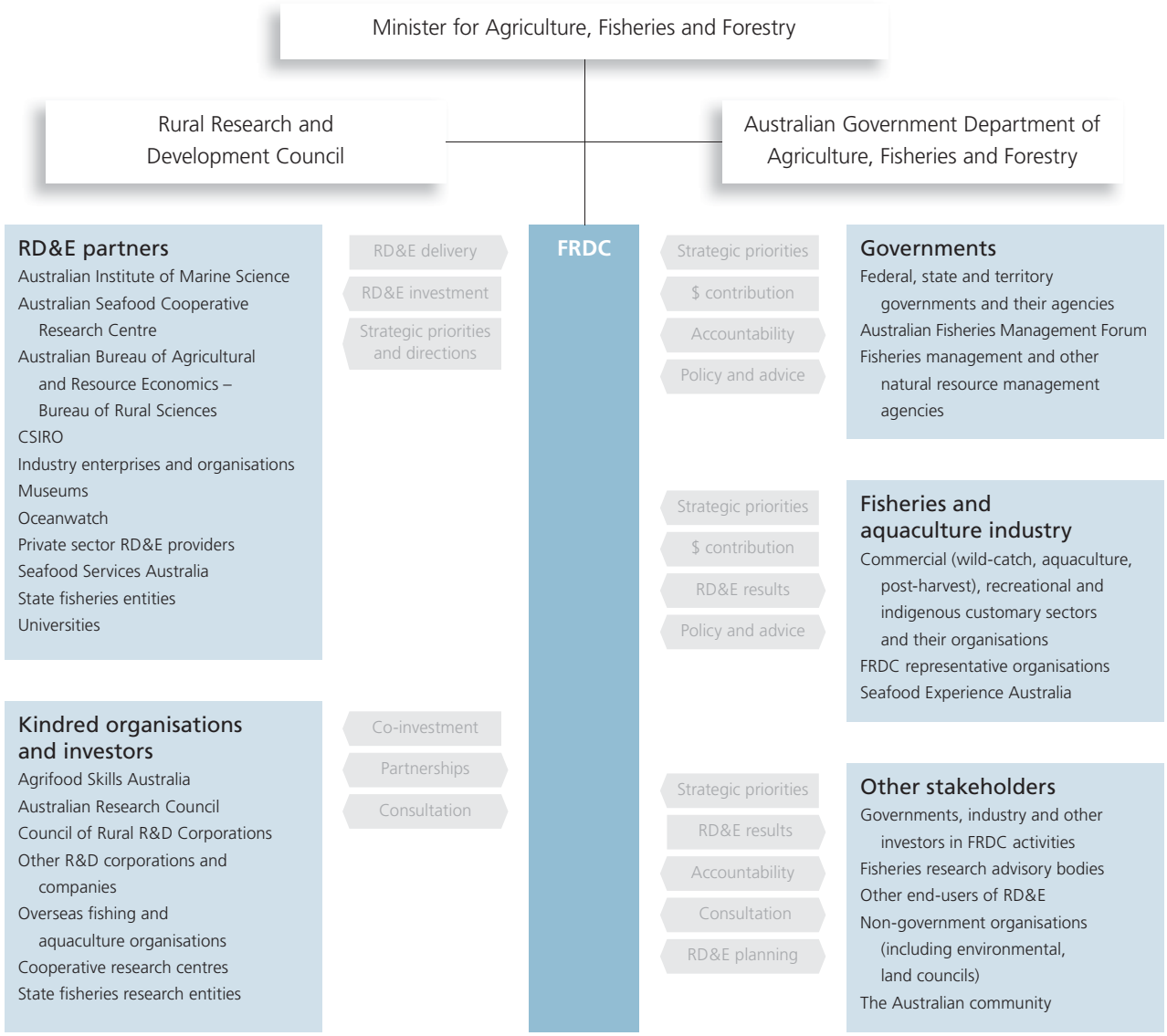
An innovative approach to project management — underpinned by an ISO-certified quality management system — gives the FRDC much flexibility, while at the same time enabling it to work as a virtual organisation many times its actual size.

With its many partners (figure 2, overleaf), the FRDC extends the results of RD&E and pursues adoption (and when appropriate, commercialisation) by the end-users. Its RD&E outputs also raise awareness of vital issues related to the fishing and aquaculture industry such as industry development, social and economic impacts on fishing communities, and the health benefits of seafood.

Recreational fishers derive considerable social and personal value from aquatic resources, and the economic benefits to the community are large. The FRDC's investment in RD&E can enhance these benefits.

Photo: Dylan Skinns.

FIGURE 2: THE FRDC'S ORGANISATIONAL CONTEXT



Not all entities involved with the FRDC are shown.

For simplicity, only the relationships between the FRDC and other entities are shown — not relationships between those entities.

Many of the entities have multiple relationships with the FRDC: for example, CSIRO is a co-investor and a research provider.

Governments intervene in economic activity to improve efficiency (i.e. using resources to produce the greatest net benefits to the community) and equity (i.e. benefits and costs are shared among the community). Outcomes include measurable economic benefits, and environmental and social benefits that are often difficult to express in monetary terms. In relation to fishing and aquaculture RD&E, the Australian Government intervenes because private markets fail to deliver adequate efficiency and equity to the people of Australia.

For the commercial sector, market failure occurs either through not pricing at all, or not pricing equivalently, the environmental regulatory requirements for competitive seafood products. For the recreational and indigenous customary sectors, this occurs because the activity is "non-market". For these fishers, the benefits are not monetary but rather the attainment of a diverse range of social outcomes that depend on healthy aquatic environments. The Australian Government's public good investment in fishing and aquaculture is also in the interests of sustainable stewardship of aquatic resources.

The Australian Government's contribution to the FRDC reflects the broader stewardship role that the Corporation plays in investing in fishing and aquaculture RD&E.

There is no legislative impediment to commercial fishers and aquaculturists contributing to the FRDC above the maximum level at which the Australian Government provides a matching contribution. Investment has risen well above that level in recent years, reflecting industry recognition of the high quality of the FRDC's governance and management systems, and an excellent record for delivering RD&E results. Additionally, other entities can and do contribute to the FRDC.

Government and industry contributions for each financial year are provided in the FRDC's annual report.

The Corporation's revenue base is represented in figure 3 on the following page.

Consumers are paying more attention to the food they eat, the value they get from it, and what it does for them and the world around them. The FRDC's research partners are improving industry's capacity to meet changing expectations.

Photo: Clive Huggan.

REVENUE

FIGURE 3: THE FRDC'S REVENUE BASE

A: PUBLIC GOOD FUNDING BY AUSTRALIAN GOVERNMENT	
Australian Government pays 0.5% of total gross value of production (GVP) of the commercial sector	
B: CONTRIBUTION BY COMMERCIAL SECTOR	**C: AUSTRALIAN GOVERNMENT MATCHING OF CONTRIBUTION BY COMMERCIAL SECTOR**
Commercial fishers and aquaculturists contribute at least 0.25% of GVP	Same amount as B, up to a maximum of 0.25% of GVP
D: ADDITIONAL INVESTMENTS	
By post-harvest, retail, recreational and import sectors, and government agencies	

For more information on these topics, visit www.frdc.com.au/plans

- About the FRDC — including its governing legislation, corporate governance, ministerial directions and revenue sources
- How to apply for funding (also see page 39 of this plan)
- How the FRDC plans, invests in and manages RD&E
- About the FRDC's consultation framework

Australia's fisheries and aquaculture resources

Australia's marine exclusive economic zone is the world's third-largest, covering 8.2 million square kilometres off Australia and its remote offshore territories, and an additional 2 million in Antarctic territorial waters. Its diverse range of freshwater and marine habitats, from tropic to Antarctic, supports more than 4500 marine species, about 600 of which are commercial species.

Fish are a valuable and renewable, but limited, resource. Little can be done to "manage" them in the wild; fisheries management is mainly concerned with influencing the actions of fishers. Fisheries management therefore needs to be as effective and efficient as possible, using the best information obtainable. Although Australia is acknowledged internationally as being at the forefront of fisheries management and environmental practice, there is a need for fisheries management to be further improved in the interests of industry efficiency and resources sustainability.

It is essential to protect the aquatic resources and habitats on which fishing and aquaculture depend. Threats to fish, aquatic habitats and ecosystems from non-fishing activities are a key concern. The sources of such threats include clearing of vegetation from riparian zones; drainage and run-off; infrastructure, including structures for flood mitigation, water storage and irrigation; and urban and industrial development.

Many fisheries management criteria underpin the licensing of commercial fishing and aquaculture. As the community's requirements for demonstration of sustainability increase, and the use of aquatic resources is increasingly contested, so do the demands on the industry to respond. For stakeholders, the main considerations are:

- complexity and cost of regulatory requirements to obtain access to resources and licences to operate
- complexity of governance, including conformity with high seas regional fisheries management organisations and international fisheries agreements
- environmental instruments such as the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* for strategic assessment for all Commonwealth fisheries and for all fisheries that export
- reduction of risk through biosecurity practices and controls
- development and adoption of environmental management systems
- climate change and uncertainty about how it will affect aquatic ecosystems and the industry's capacity to adapt and mitigate its impacts

Aquatic resources have potential for advancing economic self-reliance in many Aboriginal and Torres Strait Islander communities.

Photo: CSIRO.

- regulatory complexity and public opposition in constraining access to sites for aquaculture development and expansion
- continued determinations of indigenous land rights by courts (such as in the High Court's *Blue Mud Bay* decision, which extended rights to land between the high and low-water marks, and others providing for explicit customary rights; the Federal Court's 2010 judgment in *Akiba on behalf of the Torres Strait Islanders of the Regional Seas Claim Group v State of Queensland*, which granted traditional owners non-exclusive native title rights over more than 40,000 square kilometres of the Torres Strait, and associated tidal inlets, bays, estuaries and the ocean floor; and various agreements related to resources such as minerals and petroleum)
- management of interactions involving threatened, endangered and protected species
- the need to respond to, and integrate, developments in both the national system of representative marine protected areas and ecosystem-based management
- the need for enterprises along the seafood value chain, especially large retailers, to demonstrate sustainability.

A 2009 report, *Evaluating Australia's Marine Capture Fisheries*, identified a gap between current and best-use performance. The report proposed the following 10 areas in which to improve fisheries management performance, in order of priority:

- strategic approach to management: more flexible fisheries management to respond to future change and a more strategic approach to management for each fishery, including the setting of clear objectives for performance across all uses
- allocation of shares/rights for all users: efficient, transparent allocation of shares and associated property rights for all commercial, recreational and indigenous customary uses
- better data at fishery level for all users: concerning fish stocks, mortality, total economic value, community views and other data to track performance
- sustainable fishery operations based on sound economics: economically sustainable operation of the fishery, based on a greater awareness and use of economic analysis to inform management decisions about fishing chain values and performances
- a documented harvest and management strategy for each fishery with goals set for sustainability of the ecosystem, biomass and target stock
- participation of users in managing change: increased participation and collaboration of commercial, recreational and indigenous customary fishery users in fisheries management and implementation of change
- integration of recreational fishing into overall sustainability targets and the harvest strategy for the fishery
- adoption of ecosystem or multi-species approaches to fishery management
- education and techniques for all users and managers to achieve best performance
- provision of information to the community on the performance and resource status of wild-catch fisheries, and the need to conserve the fisheries resource.

Many of these challenges require targeted RD&E to facilitate their resolution. The FRDC, through this plan, works closely with bodies such as the Australian Fisheries Management Authority and other members of the Australian Fisheries Management Forum to deliver the research required.

A complex industry in a challenging environment

The fishing and aquaculture industry

The fishing and aquaculture industry includes any industry or activity conducted in or from Australia concerned with taking, culturing, processing, preserving, storing, transporting, marketing or selling fish or fish products.

The industry's three main sectors comprise:

- commercial wild-catch fishers, aquaculture producers and post-harvest enterprises
- recreational fishers and associated commercial enterprises
- indigenous customary fishers.

[The commercial sector is also referred to as the "seafood industry", although non-food items such as pearls are included among its products. Aboriginal and Torres Strait Islander people are involved in the commercial and recreational sectors in addition to fishing in continuance of their ancient customs.]

Although not part of the fishing and aquaculture industry, entities with strong involvement in the industry are:

- the federal, state and territory governments (especially their fisheries managers and other natural resource managers)
- research partners (including universities, fisheries research organisations, and industry and private sector providers) and research investors (such as the Australian Seafood Cooperative Research Centre)
- the people of Australia (on whose behalf aquatic natural resources are managed, and as consumers).

The fishing and aquaculture industry is one of the most complex of Australia's primary industries in terms of both its structure and the natural resources on which it depends. Most of the industry's business environments are made more complex by their dependence on access to natural resources that are publicly managed in the interests of present and future generations.

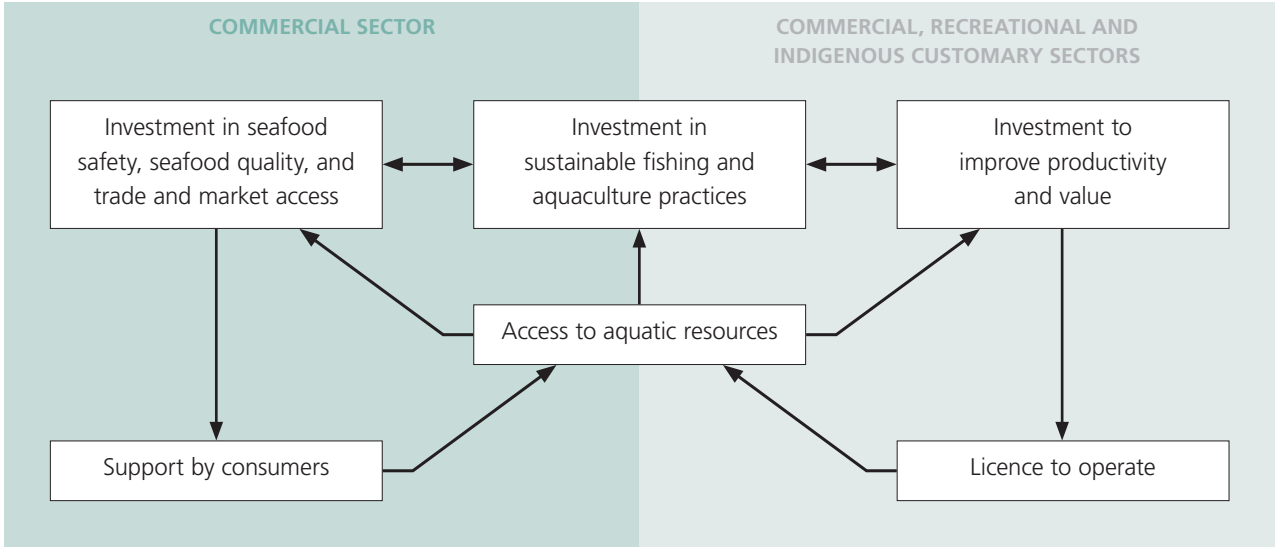
Fisheries managers and industry agree that an important step towards fair resource access and allocation is better understanding, and quantification of, each sector's expectations.

Photo: Roger Charlton.

The industry's operating environments

The principal factors in the operating environments of all sectors of the industry are shown in figure 4, and are intrinsic to the following outline of each sector.

FIGURE 4: PRINCIPAL FACTORS IN THE INDUSTRY'S OPERATING ENVIRONMENTS



Commercial sector

As shown in table 1, in 2007–08 the gross value of commercial fishing and aquaculture production (wharf and farm gate value) was $2.19 billion, making the seafood industry the sixth most valuable food-based primary industry.

TABLE 1: ECONOMIC DATA ON THE COMMERCIAL SECTOR

Sector	Economic value	Volume	Notes
Commercial sector (wild-catch and aquaculture)	Annual gross value of production: $2.19 billion	236,000 tonnes	Estimated direct employment: 30,000
Commercial wild-catch	Annual gross value of production: $1.32 billion	174,000 tonnes	Estimated direct employment: 20,000
Aquaculture	Annual gross value of production: $0.87 billion	62,000 tonnes	Estimated direct employment: 10,000
Export	$1.34 billion	44,000 tonnes	Predominantly high-value, low-volume products: principally Rocklobster, pearls, Abalone and Southern Bluefin Tuna

Reference sources: *Australian Fisheries Statistics 2008*; Australian Bureau of Statistics and industry data. Employment estimates are somewhat approximate because of limitations in census and survey data. Dollar and volume figures are rounded.

SUPPLY AND DEMAND

Demand for seafood is rising in Australia because of increasing affluence and increasing awareness of seafood's prominent role in a healthy diet. In Asian markets, consumption is also increasing with the growth of the middle class. World supply to affluent consumers will continue to be limited, giving rise to higher prices.

Australian commercial seafood production currently meets only about 35 per cent of domestic demand. In part this is because Australia does not have plentiful supplies of low-cost whitefish, as New Zealand and other countries have. In general, therefore, imports are lower-priced seafood and exports are of premium-priced seafood for luxury markets.

A global seafood shortfall of up to 80 million tonnes a year has been projected during the next quarter of a century, based on current trends. If the rate of production during the first decade of this century were maintained until 2050, the underlying gap has been predicted to be as high as 925,000 tonnes (assuming a population of 25 million and depending on per capita seafood consumption).

For three decades, Australia had exported high-value products while imports, although higher in volume, were lower in value. However, in 2007–08, both the volume and the value of seafood imports exceeded Australian commercial production. The high rate at which imports are expected to increase is reflected in the estimate that by 2020, imports may be more than double the value of imports in 2004. This estimate assumes that Australians will continue to pay higher seafood prices resulting from the continuing worldwide gap between supply and demand.

The commercial sector is now making a major re-orientation towards better serving the growing Australian market. Increasingly, value chains will encompass both domestic and imported product. Other factors, such as further improvements in fisheries management and better utilisation of catch, will also be important in meeting domestic demand.

Globally, as population heads towards an estimated 9.2 billion by 2050 (about the maximum carrying capacity of the planet, according to the UN Food and Agriculture Organization), fishing and aquaculture will need to play a large part in meeting world demands — especially aquaculture.

The increasing role of aquaculture is well established, 2009 being the first year in which world aquaculture production for seafood matched wild-catch production. In Australia, marine and onshore aquaculture is a rapidly growing part of the commercial sector. The FRDC and the National Aquaculture Council have set an annual harvest target for aquaculture of 100,000 tonnes of seafood by 2015, double the production of 2003–04.

Despite this strong growth, Australia's "gap" between supply and demand is expected to grow. Yet for the wild-catch sector it will not be increased tonnages that will secure a profitable and therefore viable future but increased value of sustainable catches. For both the wild-catch and aquaculture sectors, improvement in profitability must occur throughout the seafood value chain. Both sectors will need to concentrate on value-adding to products; consistent approaches to product quality; more capital investment; more product promotion; control of rising costs, including energy costs; counteracting barriers to trade access; and better definition of value chains.

Throughout the country, 3.4 million Australians of all ages fish recreationally in cities, towns and in regional and remote areas. Fishing also adds to the experiences of many international tourists.

Photo: Martin Bowerman.

Recreational sector

The recreational sector asserts that recreational fishing contributes to Australians' health and well-being at individual, family and community levels, and that allocation of fish resources should be based on providing optimal benefits to the community. A core belief is that healthy aquatic environments are fundamental to sustainable recreational fishing and fish resources, and that recreational fishers must therefore share in the stewardship of fish resources through partnerships in decision-making. In turn, management decisions affecting recreational fishing should be based on sound scientific ecological, social and economic information. From a low base, progress has recently been made in increasing this information.

TABLE 2: ECONOMIC DATA ON THE RECREATIONAL SECTOR

Sector	Economic value	Volume	Notes
Recreational	Estimated direct expenditure: $1.9 billion per year	At least 30,000 tonnes	Participation: 3.4 million people

Notes: Expenditure items included fishing gear, boats, trailers (purchase, lease or hire), bait, annual fees and licences, travel, camping gear, and accommodation. Dollar and volume figures are rounded.

Reference source: *National Recreational and Indigenous Fishing Survey of Australia, 2001.*

The participation rate and estimated direct expenditure have immense implications for the total economic and social value of the recreational sector. However, data collection, analysis and reporting of resource use, performance and economic factors have been very limited. Knowing more about the quantum and efficiency of the economic value chains for recreational fishing products and services is likely to be highly beneficial.

In common with the indigenous customary and commercial sectors, various forms of social value (e.g. health, lifestyle, community resilience) are high among participants in the recreational sector.

Some forms of recreational fishing are hazardous, as with commercial wild-catch fishing (which has a fatality rate about 16 times higher than the all-industries rate). However, comprehensive statistics are not available for the recreational sector. Improved personal safety equipment is becoming available, but there are many barriers to higher adoption of safe practices.

Indigenous customary sector

Fishing and shell-collecting is a very important part of many Aboriginal and Torres Strait Islander people's cultural life. Harvesting is not only a cultural activity that satisfies personal, domestic, ceremonial, educational and communal needs; it also pre-empts expenditure on purchased food. However, economic and social data encompassing these activities are limited.

The highest participation rate of indigenous customary fishing occurs in the Northern Territory, where 92 per cent of the Aboriginal and Torres Strait Islander population of Northern Australia aged 5 or older are estimated to fish each year. However, the total population of Aboriginal and Torres Strait Islander people is higher in the eastern states than in the Northern Territory, even though the rate of participation is lower. Consequently, customary fishing is carried out in a wide range of urban and rural environments, not only in defined indigenous lands.

Customary rights, which have started to be defined in fisheries management legislation, allow for harvest for communal consumption. They also prescribe access to protected species, including turtles and dugong.

Some indigenous groups have gained explicit rights or commercial access through the courts: for example, in 2008 the High Court of Australia handed down the *Blue Mud Bay* decision, which gave exclusive access rights over the intertidal zone to the Yolngu people of north-east Arnhem Land. Such decisions are giving rise to both social and economic opportunities.

In addition to their customary activities, Aboriginal and Torres Strait Islander people also participate in commercial and recreational fishing. The challenges and opportunities for their involvement in the commercial and recreational sectors are similar to those of other participants, although associated cultural and social factors are often different: for example, Aboriginal and Torres Strait Islander fishers consider that although barter between communities may provide an economic benefit, it is a customary activity that needs to be recognised in fishing rights.

Aboriginal and Torres Strait Islander people have fished for cultural and religious reasons for thousands of years. Fish are not only a food source: they and their habitats are an important element in daily life, rich in social and economic value.

Photo: Ludo Kuipers.

More information:

Fishing and aquaculture statistics by ABARE–BRS:
www.frdc.com.au/resources/australian-fisheries-statistics

Comprehensive description of the industry's business environment:
www.frdc.com.au/plans then select *Overview of the Australian fishing and aquaculture industry*

RD&E investment in *Penaeus monodon* domestication has doubled yields at Gold Coast Marine Aquaculture. Earlier harvesting, through faster growth and predictable stocking times, puts the "Holy Grail" of a Christmas crop within reach.

Photo: CSIRO.

Achievements under the previous plan

Both industry and government investors benefit from the FRDC's RD&E outputs, details of which are published in the Corporation's annual reports. The efficiency of production of RD&E outputs has benefited from continual improvement in the collaborative planning approaches pursued by the Corporation.

The FRDC's investment portfolio includes a high proportion of RD&E that targets public-good natural resource management. This makes assessment of the performance of investment during the past five years difficult, since the methodology for assessing quantitative benefits from this type of research is still relatively under-developed.

To ensure independent rigour in assessing FRDC's investment portfolio, the Corporation has collaborated with the other rural R&D corporations in developing a national rural research evaluation framework. The methodology for the framework and the collective reports across the corporations can be found at **http://www.ruralrdc.com.au/Page/Evaluation+/Methodology.aspx**

The main conclusion of the independent analysis of RD&E investment is that benefits accruing from FRDC-funded RD&E are about two-thirds to the fishing industry (that is, the commercial wild-catch and aquaculture, recreational and indigenous customary sectors) and about one-third to the public good.

The benefits from the total RD&E investment (measured over 30 years using a discount rate of 5%) in 18 randomly selected clusters of investment completed during the past five years was estimated as $1,200 million. In these clusters, FRDC investment was 38.9% of total investment of $214 million (present value terms). The net present value, $986 million, gave a benefit–cost ratio of 5.6 to 1 for each dollar invested by the FRDC and its partners. This was lower than the 10.5:1 recently identified for all rural R&D corporations (over similar but not identical periods), reflecting the high proportion of fishing and aquaculture RD&E that has a spill-over into public good.

In terms of benefits from specific FRDC program outputs, table 3 shows that the return on investment was highest for Programs 1 and 2, the (then) Natural Resources Sustainability and Industry Development programs. Program 3, the People Development program, had a lower benefit–cost ratio but a higher rate of return. The findings indicated considerable public good spill-over, both quantitatively and qualitatively, as shown in table 4.

Further analysis, especially of environmental and social benefits, will form a basis for fine-tuning future RD&E investment. Consideration of public spill-over will include the need to quantify the industry's and public's willingness to pay for environmental and social benefits.

TABLE 3: AGGREGATE INVESTMENT CRITERIA FOR THE 18 CLUSTERS BY FRDC PROGRAM

Criterion or characteristic	Program 1: Natural Resources Sustainability	Program 2: Industry Development	Program 3: People Development	Total
Present value of benefits	$536.9 m	$642.6 m	$20.7 m	$1,200.1 m
Present value of costs	$102.0 m	$104.5 m	$7.6 m	$214.1 m
Net present value	$434.9 m	$538.1 m	$13.1 m	$986.1 m
Benefit–cost ratio	5.3:1	6.1:1	2.7:1	5.6:1
Internal rate of return	25.1%	23.0%	60.7%	24.3%
FRDC contribution to total resources invested	40.6%	37.5%	34.7%	38.9%

Note: For total investment, discount rate 5%, 2008–09 dollar terms, discounting to year 2008–09, benefits extend 30 years from the final year of investment.

TABLE 4: QUALITATIVE WEIGHTED BENEFITS IDENTIFIED FOR ALL CLUSTERS

Benefit	Fishing industry (all three sectors)	Spill-over to non-fishing industries	Spill-over to public good
Economic	155	4	21
Environmental	6	0	40
Social	23	0	52
Total	**184**	**4**	**113**

The report containing the above analysis is available via www.frdc.com.au/plans

In partnership with researchers and end-users, the FRDC's investment in RD&E delivers significant benefits for the fishing and aquaculture industry and the Australian community.

Photo: Frank Filippi.

How the FRDC plans its RD&E

Fishing and aquaculture RD&E has to be well tuned to the many diverse — and often competing — uses of aquatic resources. The FRDC has therefore established strong, wide-ranging links with its stakeholders. Government entities (especially fisheries management and other natural resources management agencies) are equal with industry entities in their significance.

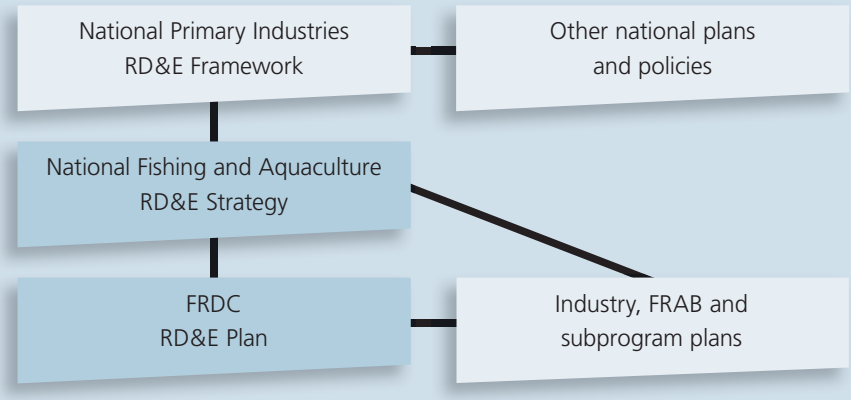
The FRDC sets its strategic directions by facilitating and consolidating the views and priorities of all its key stakeholders. Chief among them are government investors and the Corporation's industry representative organisations: the Commonwealth Fisheries Association, the National Aquaculture Council, and Recfish Australia.

As shown in figure 1 (pages 2–3), the FRDC has directly aligned its planning, management and reporting of RD&E program activities to the objects of the PIERD Act.

The FRDC's programs incorporate responses to a wide range of Australian Government priorities, including the National Research Priorities and the Priorities for Rural R&D relevant to the FRDC; and to significant national plans and policies including those of the fishing and aquaculture industry.

The immediate relationships of the FRDC's RD&E plan with other plans are shown in figure 5.

FIGURE 5: RELATIONSHIPS OF THE FRDC'S RD&E PLAN WITH OTHER PLANS



To undertake its RD&E planning activities, the FRDC maintains formal structures and processes. They include Commonwealth, state and territory Fisheries Research Advisory Bodies (FRABs) that undertake RD&E planning relating to their respective jurisdictions; and subprograms (such as the aquatic animal health subprogram) and coordination programs (such as the social sciences research coordination program) that undertake RD&E planning on a national scale. In addition, to provide more certainty for planning, investing in and managing RD&E, the Corporation enters partnership agreements with major industry sectors. The specific RD&E is identified through sector-specific strategic plans that cover the ways in which the partners will collectively invest in the RD&E activities.

Integration with national primary industries RD&E policy and processes

The over-arching framework for primary industries is the National Primary Industries Research, Development and Extension Framework, to which governments, the research and development corporations, research providers and primary industry peak bodies have contributed. The document that outlines the future RD&E directions of the fishing and aquaculture industry within that framework is *Working Together: the National Fishing and Aquaculture RD&E Strategy*.

This strategy, in advancing the principles of the Primary Industries Ministerial Council's Statement of Intent, describes the systems and processes to:

- cooperate to encourage the establishment of a more efficient and effective RD&E system nationally
- maintain RD&E funding levels and improve the capability of the national system in priority areas
- share information, plans and priorities for investment in RD&E
- facilitate access to national research capability (people, infrastructure and information) by industry and R&D partners across Australia
- refresh the rural R&D priorities and encourage more consistent, rigorous monitoring of performance of R&D targeting and delivery
- facilitate rapid uptake of research and innovation
- work cooperatively to improve the administrative processes and effectiveness of information sharing and management
- freely share knowledge, including through minimising barriers to RD&E created by intellectual property protection
- monitor, evaluate and report on the performance of the national fishing and aquaculture industry RD&E system.

About the national framework for primary industries RD&E

In 2005, the Primary Industries Ministerial Council 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.

Subsequently, the Ministerial Council agreed to principles for further cooperation between agencies and industry to improve the efficiency and effectiveness of national primary industries RD&E, and agreed to develop a National Research, Development and Extension Framework to provide a more comprehensive, structured approach.

In 2009, the Ministerial Council endorsed a "statement of intent" to implement the National RD&E Framework through 14 primary industry sectors and 7 cross-industry sectors. Within the framework, each industry sector and cross-sectoral issue is assessed for its RD&E capacity, research priorities, emerging needs and opportunities. Resource and implementation factors are identified by consulting with a wide range of collaborators in each sector.

Photo: Martin Bowerman.

The FRDC's programs

RD&E provides tools to drive change

The FRDC and its stakeholders are focused on what the Corporation has adopted as its vision:

> A vibrant Australian fishing and aquaculture industry, adopting world-class research to achieve prosperity and to wisely use the natural resources on which it depends.

"Prosperity" in this sense encompasses not only the financial wellbeing of the commercial sector but also the many social and environmental values related to the commercial, recreational and indigenous customary sectors.

Neither the Corporation nor its RD&E partners can implement the principal actions that will achieve this vision; their role is to add to the knowledge that will allow end-users of the RD&E to do so. Hence the Corporation's planned outcome, as specified by the Australian Government, is:

> Increased knowledge that fosters sustainable economic, environmental and social benefits for the Australian fishing industry; including indigenous, recreational, commercial and aquaculture sectors, and the community; through investing in research, development and adoption.

Implementation of RD&E

As shown in figure 1 (pages 2–3), the FRDC has three primary RD&E programs that address the "triple bottom line" of environmental, economic and social factors:

- Program 1: Environment
- Program 2: Industry
- Program 3: Communities.

In addition, two enabling programs address various aspects of programs 1–3 and add value to them:

- Program 4: People Development
- Program 5: Extension and Adoption.

The proportions of each year's investment in these programs are forecast in the FRDC's annual operational plans and subsequently reported in the annual report.

As part of its quality management system certified under AS/NZS ISO 9001:2008, the FRDC continually improves its performance and reporting. Among other elements, the current key performance indicators (shown under each theme on the following pages) may therefore change during the life of this plan. Annual operational plans and annual reports will contain any such amendments.

For annual research priority areas, visit www.frdc.com.au/plans

Program 1: Environment

Australian Government and industry priorities for the Environment Program

National research priorities

- An environmentally sustainable Australia.
- Safeguarding Australia.
- Frontier technologies for building and transforming Australian industries.

Priorities for rural R&D

- Support effective management of Australia's natural resources to ensure primary industries are both economically and environmentally sustainable.
- Build resilience to climate variability and adapt to, and mitigate, the effects of climate change.
- Protecting Australia's community, primary industries and environment from biosecurity threats.
- Promote the development of new and existing technologies.

Industry priorities

- Ensure sustainable utilisation of the resource.
- Respond to climate change.
- Ensure the health of aquatic habitats and ecosystems.
- Prevent and manage disease incursions.

Photo: CSIRO.

1. Biosecurity and aquatic animal health theme

Theme 1 description

This theme is concerned with protection of fisheries and ecosystems from diseases caused by infectious organisms.

Disease-causing organisms, including exotic and emerging pathogens, are an increasing threat to Australian fisheries and their ecosystems. They are often conveyed by movement of live animals or animal products to and within Australia, interactions between cultured and wild stocks, increased global goods transportation, intensification of aquaculture production, and human travel. The risk will continue to rise in concert with globalisation and climate change.

Theme 1 objectives

Develop the capability, systems, knowledge and technologies to detect and identify pathogens to mitigate their impact on aquatic animals, ecosystems, profitability and viability.

Theme 1 priorities

RD&E outputs will assist end-users to:

- prevent and manage disease incursions
- develop diagnostic procedures and techniques to rapidly detect and identify pathogens
- develop protocols to ensure biosecurity within the fishing and aquaculture industry to mitigate and control disease
- improve access to fit-for-purpose aquacultural veterinary chemicals and vaccines.

Theme 1 key performance indicators

- development and dissemination of protocols, techniques and technologies to mitigate and minimise the impact of disease outbreaks
- development of knowledge to assist industry to register vaccines and veterinary chemicals.

2. Habitat and ecosystem protection theme

Theme 2 description

This theme is concerned with effects of fishing and non-fishing 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 affects the productivity of fisheries, the health of the catch, and food safety. Degradation and destruction of habitat, 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.

Theme 2 objective

Minimise the effects of fishing, aquaculture, pollution, habitat destruction and land-based activities, and non-fishing occurrences, on fish, aquatic habitats and ecosystems.

Theme 2 priorities

RD&E outputs will assist end-users to:

- mitigate the impacts of fishing, aquaculture, pollution, habitat destruction and land-based activities, and non-fishing occurrences, on fish, aquatic habitats and ecosystems
- develop and adapt technologies to reduce bycatch; impacts on threatened, endangered and protected species; and the effects of fishing on aquatic habitats
- enhance recreational fishing experiences through enhancement of fish habitats
- provide information to the community to demonstrate improvements in the fishing and aquaculture industry's environmental performance.

Theme 2 key performance indicators

- demonstrated improved sustainability performance from the use of RD&E outputs
- development of innovative technologies to reduce fishery take and interaction with bycatch and with threatened, endangered and protected species.

3. Climate change theme

Theme 3 description

This theme is concerned with adaptation to, and mitigation of, the effects of climate change and variability.

A changing and increasingly variable climate poses challenges and opportunities for Australia's wild-catch fisheries, aquaculture resources, and the communities related to them. Many impacts presently unforeseen will change where and how we fish and farm in the future.

Investment in this theme targets the priorities identified in the National Climate Change Action Plan for Fisheries and Aquaculture, and the National Adaptation Research Plan for Marine Biodiversity and Resources.

Theme 3 objective

Adapt to and mitigate the effects of climate change and variability on the fishing and aquaculture industry.

Theme 3 priorities

RD&E outputs will assist end-users to:

- understand the vulnerability of fish stocks and ecosystems to climate change
- adapt to the impacts of climate change, including the impacts on resource access
- reduce the greenhouse gas emissions of the fishing and aquaculture industry, with a focus on energy efficiency
- develop tools to improve cross-jurisdictional resource access and management as part of adaptation to climate change.

Theme 3 key performance indicators

- improvement in understanding of the impacts of climate change that leads to adaptation by fisheries management and industry
- development of mitigation methods to reduce greenhouse gas emissions of industry.

Photo: Leonard Low.

4. Ecologically sustainable development theme

Theme 4 description

This theme is concerned with use and management of aquatic resources.

The community's focus has changed from single-issue sustainability to broader environmental and community interactions and being cognisant of all of the resource. Both wild-catch fishing and fish farming must limit impacts on ecosystems and ensure that the community derives maximum value from use of the aquatic resource.

Responding to changes in community expectations, the industry is increasingly demonstrating ecological sustainability through environmental management systems and third-party certification.

Fisheries management agencies have agreed to implement ecosystem-based fisheries management systems. In parallel, harvest strategy evaluation policies (encompassing ecological, economic and social performance indicators) are being developed as the preferred fisheries management tool.

Theme 4 objective

Ensure the ecologically sustainable use of aquatic natural resources by the fishing and aquaculture industry.

Theme 4 priorities

RD&E outputs will assist end-users to:

- improve their knowledge of key biological attributes for target species
- develop practical tools that implement ecosystem-based fisheries management and incorporate understandings of the cumulative impacts of fishing into fisheries management plans
- incorporate improved understanding of environmental factors, including oceanographic and ecological processes, into fisheries management
- develop tools and technologies to acquire environmental, economic and social data underpinning harvest strategy evaluation systems, especially for data-poor fisheries
- quantify the environmental carrying capacity of aquaculture operations
- develop and implement standardised environmental impact assessments and statements for the aquaculture sector
- implement environmental management systems and acquire third-party certification, including eco-labelling
- improve recreational sector performance based on acquiring information about sustainable, ethical fishing; motivations; demographics; participation; fishing methods; and catch-and-effort.

Theme 4 key performance indicators

- development of mechanisms and technologies to collect economic, environmental and social data to inform management processes
- improvement in knowledge of the relationship between environmental processes and known biological processes
- development of techniques for incorporation of ecosystem-based fisheries management in fisheries
- development of knowledge to help the industry to meet environmental standards.

Program 2: Industry

Australian Government and industry priorities for the Industry Program

National research priorities

- Frontier technologies for building and transforming Australian industries.
- Promoting and maintaining good health.

Priorities for rural R&D

- Promote the development of new and existing technologies.
- Improve the productivity and profitability of existing industries and support the development of viable new industries.
- Better understand and respond to domestic and international market and consumer requirements and improve the flow of such information through the whole supply chain, including to consumers.

Industry priorities

- Be profitable and domestically and internationally competitive.
- Meet consumer needs in a changing market.
- Manage value chains efficiently and effectively.
- Maintain food security.
- Deliver high-quality recreational fishing experiences.
- Maintain indigenous customary fishing incorporating traditional knowledge.
- Improve access to sites for aquaculture.
- Effectively manage competition for resources between sectors.

Photo: Dylan Skinns.

5. Governance and regulatory systems theme

Theme 5 description

This theme is concerned with better, simpler, more cost-effective regulation of industry.

Good governance is recognised by stakeholders as essential to sustainable fishing and aquaculture. Regulatory systems need to be further developed to meet changing industry and community aspirations.

Natural resources management must be innovative and cost-effective. It must build cooperation and trust between regulators and fishers, and confidence for investors and the community. Components may include more efficient data collection systems (e.g. e-monitoring and log books), and research to support co-management, reduced complexity, cost-effective survey techniques, and inclusion of recreational and indigenous customary fishing in management arrangements.

Theme 5 objective

Develop more cost-effective, efficient regulatory processes and co-management arrangements.

Theme 5 priorities

RD&E outputs will assist end-users to:

- reduce the costs, complexity and duplication inherent in existing regulatory systems
- participate more collaboratively in fisheries and aquaculture management, including co-management
- develop fine-scale and spatial approaches to improve local fisheries management
- develop efficient multi-fishery and multi-sector fisheries management arrangements when more than one jurisdiction is spanned
- develop fisheries management that enables maximum economic yield.

Theme 5 key performance indicators

- development of processes and technologies to improve the efficiency of governance and regulatory systems for fishing and aquaculture
- development of methods to incorporate economic knowledge into fisheries management.

6. Resource access and allocation theme

Theme 6 description

This theme is concerned with resource access and allocation within a rights-based framework.

Access to and allocation of aquatic resources is subject to increasing competition. These factors will need to be adjusted as the Australian community's values and activities change and public expectations for use of aquatic resources evolve, such as in relation to marine protected areas. Management outcomes can be improved and conflict reduced by establishing the economic, environmental and social values of activities, and processes to clearly establish the access rights of users. Adjustment mechanisms need to be developed to autonomously adjust access shares between sectors, including access by non-extractive users.

Theme 6 objective

Develop and maintain access to aquatic resources, and effectively manage competition between the users of aquatic resources.

Theme 6 priorities

RD&E outputs will assist end-users to:

- develop improved processes and technologies to quantify rights between users and mechanisms for allocating shares
- develop methods to value the rights of recreational and indigenous customary users
- increase knowledge among diverse groups of stakeholders about each other's expectations about resource access and allocation.

Theme 6 key performance indicator

- development of processes for efficient, transparent allocation of shares and associated property rights for all aquatic resource users.

7. Production, growth and profitability theme

Theme 7 description

This theme is concerned with improving productivity, economic value and efficiency of production. It is particularly important because of the increasing gap between world demand for seafood and the capacity for seafood supply.

Productivity of commercial wild-catch and aquaculture depends on innovation and the implementation of technologies and processes to build efficiencies along the value chain.

Aquaculture has strong growth prospects and will focus on domestication and breeding genetics for disease resistance and growth. The commercial wild-catch sector has potential to improve operational efficiencies and add value to the catch.

Some sections of the indigenous customary and recreational sectors may seek to generate growth and derive profit from tapping into other markets such as regional tourism.

Theme 7 objective

Increase the gross value of production, profit margins, productivity and opportunities throughout the fishing and aquaculture industry (as applicable within the three main industry sectors).

Theme 7 priorities

RD&E outputs will assist end-users to:

- increase and diversify opportunities for the aquaculture sector and other sectors
- improve productivity through operational efficiencies, new technologies and better utilisation of energy sources, and reduction of wastage
- develop new business opportunities
- develop improved business models and building business modelling skills.

Theme 7 key performance indicators

- development of knowledge, processes and technologies to improve productivity and profitability of the commercial sectors
- development of knowledge and technologies in the areas of domestication and breeding genetics to support growth of the aquaculture sector.

Photo: Dom+Heath.

8. Consumers, products and markets theme

Theme 8 description

This theme is concerned with satisfying consumer expectations and developing and maintaining markets.

Consumers are important stakeholders in the fishing and aquaculture industry. The commercial sector needs to satisfy its consumers by producing a consistently high-quality product, in a desirable form, that has good shelf life and is delivered cost-effectively and reliably.

In addition, 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 therefore increase its knowledge of consumer expectations and value chains; develop new products specifically for their target markets; explore and develop new niche export markets; and demonstrate credence values (e.g. food safety, environmental sustainability, and animal welfare).

Theme 8 objective

Produce high-quality products that satisfy expectations of existing and potential consumers.

Theme 8 priorities

RD&E outputs will assist end-users to:

- build efficient, effective seafood value chains
- develop new products and processes that meet the demands of consumers
- improve trade and market access
- improve recognition of Australian products internationally and domestically.

Theme 8 key performance indicators

- development of knowledge and technologies to support the industry's development of new products
- development of knowledge and technologies to improve seafood value chains and support trade and market access.

9. Value from aquatic resources theme

Theme 9 description

This theme is concerned with deriving increased social and personal value from natural resources.

Value means different things to different sectors of the fishing and aquaculture industry. All sectors need to look for ways to maximise the value of their resources.

The values of natural resources other than economic include cultural, societal, spiritual, ceremonial and personal values enjoyed from the aquatic environment by recreational and indigenous fishers and others in the community. The mode of deriving this value varies. In the recreational sector, for example, value is provided through technology, knowledge and access to recreational fishing activities.

Values may also be enhanced through developing new methods to improve the productivity of the natural systems, replenishing the resource, or creating new resources to be used.

Theme 9 objective

Enhance the value derived from recreational and indigenous customary fishing activities.

Theme 9 priorities

RD&E outputs will assist end-users to:

- incorporate indigenous customary practices into fisheries management
- enhance experiences through adoption of best-practice fishing, including catch-and-release practices
- enhance fish stocks
- advance economic self-reliance of indigenous communities based on the use of fish resources
- quantify the social, health and economic benefits of recreational and indigenous customary fishing.

Theme 9 key performance indicators

- development of knowledge, processes and technologies to understand and enhance the societal and personal values obtained from recreational and indigenous customary fishing
- development of knowledge regarding indigenous customary fishing practices, and processes to incorporate this knowledge into fisheries management.

Photo: Marine Discovery Centre.

Program 3: Communities

Australian Government and industry priorities for the Communities Program

National research priorities

- Frontier technologies for building and transforming Australian industries.
- Promoting and maintaining good health.

Priorities for rural R&D

- Improve the skills to undertake research and apply its findings.
- Promote the development of new and existing technologies.

Industry priorities

- Build community support for the industry.
- Foster strong regional communities in which the industry operates, resilient fishing and aquaculture communities, better links with government, and better links between industry stakeholders.

10. Resilient and supportive communities theme

Theme 10 description

This theme is concerned with resilience and development of communities in which the fishing and aquaculture industry operates, and support by the wider Australian community for the benefits of the three main sectors of the industry.

Australian communities have long-established relationships with the commercial sector of the fishing and aquaculture industry 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. Sometimes, such dissonance can be highly detrimental to the interests of both parties. It is important that the broader benefits of industry are promoted and better understood within the community.

The long-term prosperity of many rural and urban communities is interwoven with that of the fishing and aquaculture industry — 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 strategies and approaches to maximise the social, environmental and economic development of communities in which the industry operates.

Theme 10 objectives

Improve the resilience of the fishing and aquaculture industry and the communities in which the industry operates. Improve community support for the benefits provided by the fishing and aquaculture industry.

Theme 10 priorities

RD&E outputs will assist end-users to:

- improve the resilience of the fishing and aquaculture industry and the communities in which the industry operates
- understand and influence the perceptions that the community holds about the fishing and aquaculture industry and improve interactions between them
- increase the community's capacity to accept and incorporate higher levels of fishing and aquaculture activity
- address the social impacts of change in industry business environments.

Theme 10 key performance indicators

- development of knowledge to better inform the community's perceptions of the industry and to increase support for the industry
- development of knowledge that can help the industry to adapt to change.

Photo: Julie Haldane.

Program 4: People Development

Australian Government and industry priorities for the People Development Program

Government priorities

This enabling program addresses the national research priorities and the priorities for rural R&D addressed by programs 1–3 (shown on pages 23, 27 and 32).

Industry priorities

- Foster leadership, professionalism and capability to contribute to decision-making and implementing change.
- Develop attraction, development and retention strategies for a skilled workforce across all sectors of the fishing and aquaculture industry, including researchers and resource managers.
- Address research capability gaps and increase the industry's capacity to innovate.
- Encourage a diversity of people in the industry.

11. Leadership development theme

Theme 11 description

This theme is concerned with developing leadership, professionalism and capability for current and future decision-making at all levels of industry and across all sectors.

The fishing industry is highly complex, and decision-makers need skills, networks and a whole-of-industry perspective to contribute effectively to debate and policy development for many challenges, including access to fish resources and co-management.

Research is needed to identify and address impediments to individuals taking on representational and leadership roles at local and sector levels.

Theme 11 objective

Develop the skills and networks of leaders within all sectors so they can better contribute to decision-making and implementing change.

Theme 11 priorities

RD&E outputs will assist end-users to:

- develop industry leadership across all stakeholder groups
- move to co-management of fisheries
- build industry capacity to drive change, including to manage resource conflicts.

Theme 11 key performance indicators

- provision of knowledge and opportunities to develop leadership skills and diversity across all sectors of the industry and across aligned stakeholder groups, including researchers and resource managers
- development of knowledge, skills and processes to support industry to engage in debate, adapt to change, and move toward co-management of fisheries.

12. Workforce development theme

Theme 12 description

This theme is concerned with ensuring a skilled workforce into the future.

The fishing and aquaculture industry has a history of limited uptake of formalised training or adoption of innovative human resource management practices. Workforce profiles and dynamics are poorly understood. These factors limit the industry's ability to meet the future need for technical, managerial, professional and semi-skilled people. Strategic approaches to attracting people to the fishing and aquaculture industry are required; managers need the skills to retain and optimise the workforce.

Theme 12 objective

Understand, and plan to meet, the needed capabilities of the industry's future workforce.

Photo: Bruce Miller.

13. Innovation skills theme

Theme 12 priorities

RD&E outputs will assist end-users to:

- plan for future workforce needs
- improve workplace health and safety
- identify and address reasons for poor uptake of training and education in the fishing industry
- identify education and training needs and preferred delivery mechanisms.

Theme 12 key performance indicator

- development of knowledge and tools to meet future workforce and skill needs.

Theme 13 description

This theme is concerned with building RD&E capability and innovation skills within the fishing and aquaculture industry and its supporting research community.

There is a need to develop capacity in identified RD&E gaps and to nurture the next generation of researchers and innovators. The industry will need to embrace a "knowledge and innovation" culture to benefit from investment in RD&E and profit from new opportunities to grow their businesses.

In building a culture of innovation, relationships need to be built across industries, value chains, regions and jurisdictions, and beyond Australia's borders.

Theme 13 objective

Build human capability to produce and adopt knowledge, technologies and innovative practices.

Theme 13 priorities

RD&E outputs will assist end-users to:

- be responsive towards new practices and innovation
- develop relationships that encourage new ideas and make more effective use of scientific and community resources, knowledge and skills
- ensure human RD&E capability is available to meet end-users' future needs.

Theme 13 key performance indicators

- mechanisms and tools to attract and nurture RD&E capability in priority areas
- opportunities to acquire insights, knowledge and skills to create innovative, market-driven enterprises and organisations.

Program 5: Extension and Adoption

Australian Government and industry priorities for the Extension and Adoption Program

Government priorities

This enabling program addresses the national research priorities and the priorities for rural R&D addressed by programs 1–3 (shown on pages 23, 27 and 32).

Industry priorities

- Consolidate existing information, particularly concerning sustainability and extension to the broader public.
- Promote best practices in recreational fishing.
- Improve capability to undertake own extension activities.
- Improve timely access to knowledge and information.

Photo: Jorge Lascar.

14. Extension and adoption theme

Extension and adoption is crucial to delivering outcomes from investment in R&D. Current capabilities have been recognised by the National Fishing and Aquaculture RD&E Strategy as a significant gap. The Australian Government and the industry have expressed the need to do more in this area.

Theme 14 description

This theme is concerned with bringing about positive change in practices and attitudes through effective transfer of R&D outputs to end-users from both domestic and international activities. Extension activities are prioritised in the FRDC's Extension and Adoption Plan.

Theme 14 objective

Achieve change through timely delivery of accessible, accurate RD&E outputs to all stakeholders, including governments, managers, industry, the research community and the broader public.

Theme 14 priorities

RD&E outputs will assist end-users to:

- have timely access to RD&E project outputs and other knowledge
- be part of appropriate knowledge management systems that build extension and adoption capacity.

Theme 14 key performance indicator

- increase in rates of adoption.

Applying for RD&E funding

The FRDC employs a mixed investment model that achieves flexibility in working towards the Corporation's planned outcome. Partnerships give emphasis to strategic and tactical RD&E priorities of industry while investment in blue-sky ideas is also part of the pursuit of innovation. The avenues for FRDC investment are as follows.

Information on applying for RD&E funding from the FRDC is downloadable via www.frdc.com.au/research/applying-for-funding

Annual open call

An annual competitive round ensures a transparent, competitive process and encourages a broad range of researchers and projects. The open call also encourages novel ideas for fishing and aquaculture RD&E.

The call begins about March or April, when the FRABs, subprograms and coordination programs call for expressions of interest based on the needs of stakeholders or to address priorities in their strategic plans.

Tactical Research Fund

A competitive round, three times a year, enables investment to be secured in a timely manner to address subjects of immediate concern to industry stakeholders. The fund covers short tactical projects to the direct benefit of the industry.

National initiatives

The FRDC invests in issues of national importance. In doing so, it has regard for national and rural research priorities and the National Fishing and Aquaculture RD&E Strategy. Subprograms and coordination programs may be established to drive forward specific initiatives. Examples include the Aquatic Animal Health Program and the Social Sciences Research Coordination Program.

Major Sector Fund

The FRDC may enter into a partnership agreement with a major industry sector, providing the sector with more certainty for planning, investing in and managing R&D and adopting results. RD&E needs are outlined in the strategic plans required by the partnership agreement. Investment may be made through open or closed tender, commissioned activity, or competitive rounds. Examples are agreements with the Tasmanian Salmon Growers Association and the Australian Southern Bluefin Tuna Industry Association. The FRDC's investment in the Australian Seafood Cooperative Research Centre also occurs within the Major Sector Fund.

Photo: Matt Daniels.

People Development Program

The FRDC invests in activities to achieve the goals of its People Development Program through the program's annual operational plan. Professional development awards, which support individuals and groups to build skills, knowledge and networks, are a significant component of the program. Other activities may be commissioned or tendered. Applications addressing program goals are also welcomed through the annual competitive or Tactical Research Fund rounds.

Extension and Adoption Program

Through this program the FRDC invests in activities to support effective transfer of RD&E outputs to end-users and to improve the likelihood of end-users implementing change as a result of FRDC investment. Priorities and activities are described in the FRDC's Extension and Adoption Plan. Applications addressing program goals are also welcomed through open or closed tender, commissioned activity, or competitive rounds.

Applying for funding

Applications are submitted through the FRDC online application system — Fishnet (**www.frdc.com.au**). Exceptions are specific professional development awards, for which application forms are downloadable from the Community and People page (**www.frdc.com.au**).

What the FRDC does not invest in

The FRDC's charter provides for a broad definition of RD&E to achieve innovation throughout the value chain from production to the consumer. However, it is not appropriate for the FRDC to fund any of the:

- direct costs of:
  - routine stock assessment or other routine management activities
  - fisheries re-stocking
  - exploratory fishing
- direct marketing of fish and fish products
- direct promotion of the fishing and aquaculture industry
- attainment of environmental or quality certification of fisheries or enterprises
- training when other funding sources are more appropriate
- capital, unless related directly to the marginal costs of undertaking RD&E
- venture capital.

If you are interested in engaging with the FRDC on a research, development or extension activity, visit www.frdc.com.au/plans for information and guidelines about each investment vehicle.

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Investing for tomorrow's fish:
the FRDC's Research, Development and Extension Plan 2010–2015

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Investing for tomorrow's fish:
the FRDC's Research, Development and Extension Plan 2010–2015