



Australian Government

THE FISHERIES  
RESEARCH  
AND DEVELOPMENT  
CORPORATION



*Investing for tomorrow's fish*

THE FRDC'S RESEARCH AND DEVELOPMENT PLAN

2005-10

On the web, this plan is at: [www.frdc.com.au/about/plan.htm](http://www.frdc.com.au/about/plan.htm)

*Investing for tomorrow's fish: the FRDC's research and development plan, 2005 to 2010*

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Cover photo: Mulloway © Gary Bell. Mulloway (*Argyrosomus hololepidotus*) is an iconic Australian species important to all three sectors of the fishing industry – it has great cultural significance to many indigenous Australians, it is highly regarded for its fine eating qualities by consumers and it is a valued sports fish. The future for this species will depend on research and development investment in order to develop aquaculture, wild fisheries, recreational and customary opportunities.



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Development Corporation

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## A FIVE-YEAR PLAN, A TWENTY-YEAR VISION

This plan takes account of forecast changes to the FRDC's business environment during the next 20 years, driven by the need for the FRDC to be responsive to long-term changes on a wide front.

A century ago, the combined impact of humans on the global environment was small compared to the natural resource base. This is no longer the case. Globally, economic decision-making is based on processes that are not equipped to deal with relentless long-term impacts of population growth on water, land, air, biological diversity and other natural resources. Economic decision-making is based on cycles that usually operate in periods of three to eight years. Consequently, many decisions are taken that do not reflect the long-term requirements of the population, producing results such as over-harvested fisheries, dryland salinity in inland waterways, and deteriorating estuarine and coastal waters. The time periods for responding to or mitigating the effects of these problems, which have become apparent only after significant periods of poor management, are often substantial — sometimes extending into hundreds of years.

Given the increasing speed with which the human population is closing the gap between under-utilisation and over-exploitation of the resource capital base, the timeframe for decision-making must be modified. It is easy to set a plan for three or five years, then make another plan for a similar time period and feel comfortable that the plan has been implemented. However, such short-term plans are likely to produce mediocre results in comparison to long-term needs. Strategic planning must be based on time periods that

are as long as is possible to predict with reasonable certainty.

The FRDC has therefore evaluated the long-term requirements for Research and Development (R&D) to support a profitable, competitive, resilient and sustainable Australian fishing industry. It has done so by taking a 20-year view of the future.

Making long-term forecasts is fraught with difficulty. Significant developments in the course of world events are often triggered by factors that, individually, may be minor. It is the combination of these triggers that is almost always unforeseeable. Consequently, detailed scenarios of the future usually prove to be wrong. Planning should not therefore be concerned with describing such scenarios but with identifying specific factors that are likely to be important in future. Such identification is a continual process for the FRDC.

At the same time as it takes a 20-year perspective in framing its vision and strategic challenges, the Corporation adopts a 5-year perspective for its detailed planning. While recognising the practical limits to the funds available for fisheries R&D, the FRDC constantly seeks to expand its investment and to maximise returns on behalf of the industry and the Australian people.





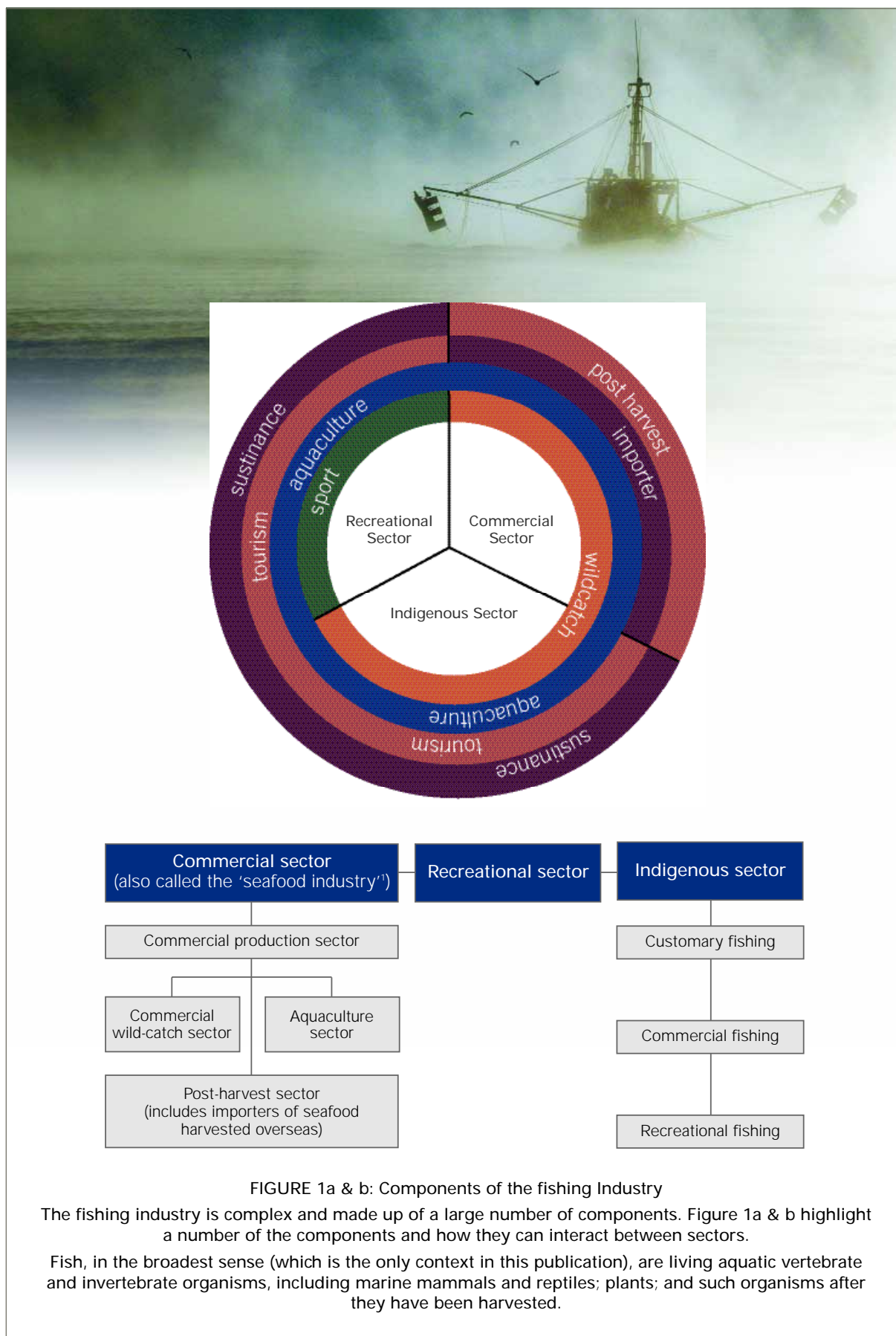


FIGURE 1a & b: Components of the fishing Industry

The fishing industry is complex and made up of a large number of components. Figure 1a & b highlight a number of the components and how they can interact between sectors.

Fish, in the broadest sense (which is the only context in this publication), are living aquatic vertebrate and invertebrate organisms, including marine mammals and reptiles; plants; and such organisms after they have been harvested.

<sup>1</sup> Derived from the Fisheries Research and Development Corporation Amendment Regulations 1991, made under the *Primary Industries and Energy Research and Development Act 1989*.

# THREE VISIONS

## OF THE FISHERIES RESEARCH AND DEVELOPMENT CORPORATION

### For the industry

The commercial sector of the fishing industry is internationally competitive and profitable over the long term.

The commercial, recreational and indigenous sectors use aquatic resources in a sustainable way; are characterised by a learning culture; and are forward-looking, innovative, professional and socially resilient.

### For the community and consumer

Consumers and the community are supportive of the fishing industry and the natural resources on which the industry depends.

### For fisheries and aquaculture research

Fisheries and aquaculture research is innovative and responsive to the needs of the Australian community, the fishing industry, and the aquatic ecosystems on which they depend.

## THE CORPORATION'S MISSION

The FRDC's mission is to maximise economic, environmental and social benefits for its stakeholders through effective investment and partnership in research and development.

## STAKEHOLDERS

Stakeholders in the FRDC are the fishing industry; the federal, state and territory governments; and the people of Australia.





A broad range of stakeholders were consulted and helped develop the R&D Plan.

## ACKNOWLEDGEMENTS

The FRDC is grateful for the enthusiastic cooperation of many people — including members of the FRDC's two representative organisations (the Australian Seafood Industry Council and Recfish Australia) — who gave their expertise and time to review and comment on the text prepared by Corporation staff and the project managers, Peter Dundas-Smith and Clive Huggan.

Some hundreds of other people have also contributed ideas — large and small — at meetings around Australia attended by FRDC staff during the past three years. Collectively, they have made a huge contribution to setting the strategic courses contained in this plan.

The creative work of contributing photographers and graphic designers is also gratefully acknowledged. Photographers are cited next to individual photographs. For details of copyright, please refer to the reverse of the title page.

## ABOUT THIS PLAN

Since this hard-copy version was printed, factors may have arisen that affect this plan. Please check the FRDC website, [www.frdc.com.au](http://www.frdc.com.au)

This is the Fisheries Research and Development Corporation's strategic plan for research and development (R&D) relating to the fishing industry. As the principal source of information about the FRDC's policies, programs and operations, the plan:

- describes the FRDC;
- defines its business environment;
- lays down, against the business environment, the FRDC's planned outcomes for the period 2005 to 2010; and
- outlines the framework for R&D investment that will address national strategic challenges and priorities, and contribute to achieving its planned outcomes.

In doing so, the plan fulfils the requirements for an R&D plan that is prepared under the provisions of section 19 of the FRDC's enabling legislation, the *Primary Industries and Energy Research and Development Act 1989* (the PIERD Act). However, the plan's scope takes it well beyond those requirements. For example, it takes account of important changes to the FRDC's business environment envisaged during the next 20 years.

*The comprehensive coverage of this plan makes it essential reading for anyone with an interest in Australia's fishing industry and the natural resources on which it depends.*

*If you intend to apply for R&D funding from the FRDC, you should read this plan thoroughly and, in particular, achieve a good understanding of the business environment chapter.*

In accordance with section 24 of the PIERD Act, this plan was developed by consulting with, and by regarding the views of, the FRDC's representative organisations (the Australian Seafood Industry Council Ltd and the Australian Recreational and Sport Fishing Industry Confederation Inc., trading as Recfish Australia), and other appropriate persons and organisations.

The plan was submitted to the Parliamentary Secretary to the Minister for Agriculture, Fisheries and Forestry in accordance with sub-section 20(1) of the Act. It was approved on 27 June 2005.

## ABOUT THE CORPORATION

### The rural R&D corporations model on which the FRDC is based

- The rural R&D Corporations (RDCs) take a leading national role in planning, investing in and managing R&D for their respective industries.
- RDCs are accountable to their major stakeholders, and to the wider community.
- RDCs are not research “grant” agencies. Their enabling legislation requires them to treat R&D as an investment of economic, environmental and social benefits to their industries, and to the people of Australia.
- Rather than focusing mainly on generating new knowledge for its own sake, RDCs strive to deliver high rates of return on R&D investment by influencing the full range of interactions along the innovation chain.
- Striving for high returns on investment also leads RDCs to apply significant resources to translating research outputs into practical outcomes and supporting government priorities.
- RDCs are required to conduct their activities in accordance with strategic R&D plans and annual operational plans that take account of the R&D needs of end-users and other stakeholders. The plans are approved at ministerial level.
- Although RDCs fund strategic research, a high proportion of their R&D activity is tactical R&D — both short-term and long-term.

The FRDC was established on 2 July 1991 under the *Primary Industries and Energy Research and Development Act 1989* (the PIERD Act). The Corporation is an Australian Government statutory authority within the portfolio of the Minister for Agriculture, Fisheries and Forestry, jointly funded by the Australian Government and the fishing and aquaculture industry. It is responsible to its stakeholders to:

- plan, invest in and manage fisheries R&D throughout Australia; and
- facilitate the dissemination, adoption and commercialisation of R&D results.

The FRDC has become widely recognised as the leading agency with this role.

*R&D investment underpins the international competitiveness and sustainability of Australia's rural industries, and plays a significant role in the health and welfare of our rural communities.*



## The objects of governing legislation

The objects of R&D corporations, specified by section 3 of the PIERD Act, are to make provision for the funding and administration of research and development relating to primary industries with a view to:

- (a) increasing the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries; and
- (b) achieving the sustainable use and sustainable management of natural resources; and
- (c) making more effective use of the resources and skills of the community in general and the scientific community in particular; and
- (d) improving accountability for expenditure upon research and development activities in relation to primary industries.

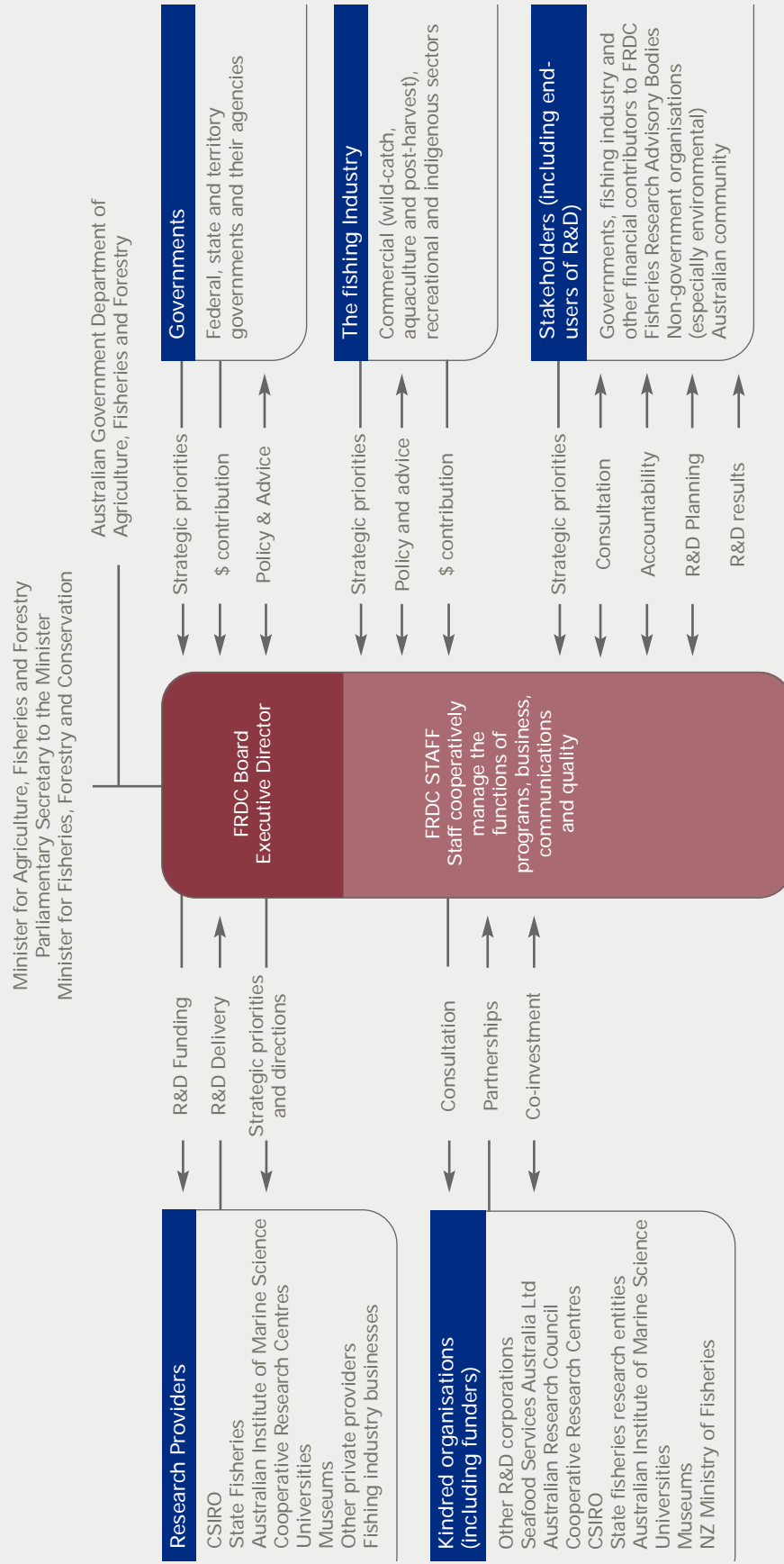
These legislated objects are the basis for the FRDC's four programs and are reflected in the Corporation's visions, mission and planned outcomes.

The FRDC's organisation and the context in which it operates are shown in figure 2.



The fishing industry works in a diverse environment.

FIGURE 2: The FRDC's organisational and operating context



## Corporate governance

The FRDC is governed by a Board of nine directors whose expertise is prescribed by the PIERD Act. The FRDC Board is responsible to the Minister for Agriculture, Fisheries and Forestry; to the Parliamentary Secretary to the Minister; and to the Minister for Fisheries, Forestry and Conservation — and, through them, to Parliament.

To enhance the FRDC's accountability to its stakeholders, the Minister has declared the Australian Seafood Industry Council and the Australian Recreational and Sport Fishing Industry Confederation (trading as Recfish Australia) to be representative organisations in accordance with section 7 of the PIERD Act. The FRDC formally reports to the representative organisations at their annual conferences and has regard to their expectations of the FRDC and to their R&D needs.

## The governance framework

The FRDC has policies and processes in place for good corporate governance, including an ISO-certified quality management system. Each annual report includes a comprehensive summary of corporate governance matters that describes how the policies and processes have been applied during the financial year.

Element	Scope
Enabling legislation	PIERD Act sets out the legislative framework and rules for the establishment and operation of the FRDC.
Governance legislation	Commonwealth Authorities and Companies Act (CAC Act) specifies requirements for good governance and accountability.
Priorities of key stakeholders	Australian Government national research priorities and priorities for rural R&D. R&D priorities of representative organisations: Australian Seafood Industry Council and Recfish Australia.
R&D plan	Requirement of the PIERD Act; ministerially approved. Specifies the framework for R&D investment that will address national strategic challenges and priorities, and contribute to achieving the Corporation's planned outcomes.
Annual operational plan	Requirement of the PIERD Act; ministerially approved. Specifies the broad groupings of R&D activities proposed to be funded during the financial year to give effect to the R&D plan.
Portfolio budget statement	Part of the Australian Government budget process.
Annual report	Requirement of various legislation. Reports to the Australian Parliament and FRDC stakeholders on R&D activities during the financial year, and on measures to ensure good governance.
Quality management system	Systematic processes, certified to quality standard AS/NZS ISO 9001:2000, designed to meet or exceed the expectations of stakeholders and other people and organisations with whom the FRDC does business. Incorporates management of FRDC policies.

Financial control	Conducted in accordance with accepted accounting principles generally applied in commercial practice and complying with legislated requirements.
R&D planning and priority-setting	The FRDC works with nation-wide Fisheries Research Advisory Bodies (FRABs) to undertake planning for R&D in consultation with governments, industry, other stakeholders and research providers. Priorities for R&D at state, regional or fishery level are significantly determined by the FRABs, managed subprograms and other priority setting structures, with the Corporation determining the balance between projects funded within the R&D programs.
Audit processes	Applied to financial, quality and R&D management.
Board governance	Key functions include overseeing corporate governance (including strategic planning and reporting requirements) and investment decisions. Enhanced by Board's spread of skills and experience, independent selection of most directors, code of conduct and ongoing development in directorship.
Risk management	Part of the FRDC quality management system. Includes processes for Corporation, R&D program and project level risk management, general compliance and financial and operational risks.
Performance monitoring	Includes monitoring and measuring of performance to continually improve the FRDC's effectiveness and efficiency.
Reporting to stakeholders	Includes consultation with, and formal reporting to, the two representative organisations; reporting of R&D investment activities via R&D News; and participation in conferences, workshops and other activities.

## Directions and advice from stakeholders

In its R&D investment decisions the FRDC acknowledges the directions and advice it receives from the fishing industry; from federal, state and territory governments; Fisheries Research Advisory Bodies (FRABs); managed subprograms; fisheries managers; policy-makers; industry associations; research providers; and other people who are interested in Australia's fisheries resources and the fishing and aquaculture industry.

The Australian Government, as the FRDC's main stakeholder, periodically issues directions and advice to the FRDC on policies and administrative matters. Of the directions and advice current at the time this plan was published, the most recent were the national research priorities and priorities for rural R&D shown in the diagrams on pages 66, 72 and 77. Details of other directions and advice are provided in each FRDC annual report.



Consumers' are key stakeholders; understanding their role in the supply chain is important.



## Primary revenue source

As stipulated in the PIERD Act, and as shown in figure 3, the FRDC's primary revenue source is based on:

- the Australian Government providing unmatched funds equivalent to 0.5 per cent of the average gross value of Australian fisheries production for the three preceding years (AGVP);
- fishers and aquaculturists providing contributions of at least 0.25 per cent of AGVP; and
- the Australian Government matching contributions by fishers and aquaculturists up to a maximum of 0.25 per cent of AGVP.

There is no legislative impediment to fishers and aquaculturists contributing to the FRDC above the maximum level at which the Australian Government will provide a matching contribution.

Industry contributions for each financial year are provided in the FRDC's annual report.

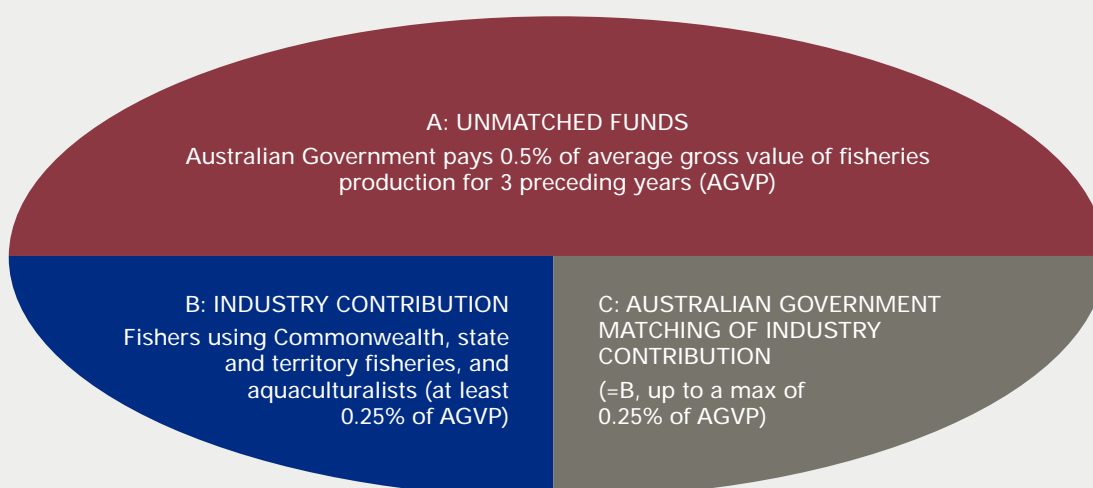
The Australian Government's contribution is made on the grounds that the Australian Government exercises a stewardship role in relation to fisheries resources on behalf of the Australian community. As part of the government investment, a component is allocated for the public good. This has significance to the FRDC's funding base, and how it invests research money.

The industry makes its contributions to the FRDC recognising that fisheries R&D will be oriented to its needs and will deliver environmental, economic and social benefits to it. In turn, the Australian Government's matching of the industry contributions is in line with policy principles that:

- beneficiaries from research should pay roughly in proportion to the benefits received; and
- the greater the spill-over benefits, the greater the proportion the Australian Government should contribute.

The FRDC's revenue base is enhanced by the significant co-investment it receives from partnerships with research providers and other contributors to its research activities, which more than doubles the investment that the FRDC manages. Recently, the FRDC has increased its revenue for R&D through partnerships to manage funds that cannot be matched. Investors are recognising the high quality of the FRDC's governance and management systems, and the FRDC's excellent record for delivering R&D outcomes.

Figure 3: Proportions of the FRDC's principal revenue base





Increased recreational contributions will ensure a more holistic approach to research and development investment.



## THE FRDC'S BUSINESS ENVIRONMENT

This chapter describes the business environment of the fishing industry and the FRDC under the following headings:

### **Australia's aquatic natural resources**

Page 22

This section describes the significance of ecologically sustainable development; the management of wild fisheries and aquaculture resources and access to them; the interactions of fishing activities (commercial wild-catch, aquaculture, recreational and indigenous); and other major interactions.

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### **The fishing industry today**

Page 36

This section describes the three main sectors of the fishing and aquaculture industry and factors of current strategic significance.



BUSINESS ENVIRONMENT

# THE FRDC'S BUSINESS ENVIRONMENT

## AUSTRALIA'S AQUATIC NATURAL RESOURCES

Australia has a diverse range of freshwater and saline marine habitats that support a diverse range of aquatic species. Australia's exclusive economic zone (EEZ) is the third-largest in the world (figure 4).<sup>2</sup> It covers about 10.3 million square kilometres: one-and-a-third times the area of Australia's land mass. The zone contains a diverse range of marine and estuarine species — about 4,500 known species of finfish (and perhaps tens of thousands of invertebrate species) — most in relatively small numbers. More than 800 seafood species are harvested and sold in Australia, under about 300 marketing names, for local and overseas consumption.

The commercial harvest, though low in volume, has high value. Australia has an excellent international reputation for the quality of its abalone, rock lobster, prawn, tuna and salmonid exports. The diversity of habitats — from tropical to temperate and coastal to inland — also support high-quality recreational fisheries.

*The low levels of nutrients and plankton in Australian ocean waters do not support high-tonnage catches of finfish as in other nations' waters*

Under the United Nations Convention on the Law of the Sea 1982, Australia is obliged to ensure that the fisheries resources within its exclusive economic zone are used sustainably. It is considered to have some of the best fisheries management practices in the world.

Although Australian waters are particularly rich in molluscs and crustaceans, and have a high diversity of finfish, the low levels of nutrients and plankton in Australian ocean waters do not support high biomass, resulting in comparatively low-tonnage catches. Consequently, Australia's commercial catch ranks 60th in the world, representing only 0.2 per cent of world tonnage — although it is 2 per cent by value.

The low levels of nutrients and plankton in Australian ocean waters do not support high-tonnage catches of finfish as in other nations' waters

The low yield capabilities of Australia's wild fisheries give little opportunity to increase fish harvests, yet local and international demand for seafood is predicted to grow substantially.

Australia's diverse waters, ranging from the tropics in the north to cold temperate regions in the south, provide significant opportunity for aquaculture development. Historically, aquaculture in Australia has occurred well away from urban areas, in pristine waters, affording a significant advantage compared to aquaculture sites in Asia and the northern hemisphere. Aquaculture occurs in coastal and offshore marine waters, but is also based on land; technologies to utilise inland saline waters have recently been developed.

## The importance of ecologically sustainable development

In recent years, the Australian community has become increasingly aware of the need to protect our natural aquatic resources (ocean, estuary, river, wetland and other aquatic habitats) and to maintain biological diversity in ecosystems that support fisheries and aquaculture. Awareness is

<sup>2</sup> The EEZ extends from 12 nautical miles to 200 nautical miles from the baseline of the territorial sea (the baseline, in effect, is the low-water mark along the coast of continental Australia and its island territories).







Figure 4: Australia's exclusive economic zone



increasing about how fisheries are used, and how ecosystems (such as those of coastal plains and the continental shelf) are inter-connected. An area of growing public interest is the ability of aquatic environments to sustain harvest yields, aquaculture and other benefits such as eco-tourism. All these uses involve aspects of ecologically sustainable development (ESD), which has been defined as:

Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

— National Strategy for Ecologically Sustainable Development, 1992

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

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

In essence, ESD is development that aims to meet the needs of the current generation while conserving

ecosystems for the benefit of future generations. To do this, the environmental resources that form the basis of the fishing industry need to be used in a way that maintains them, and where possible improves them.

There is no identifiable point at which it can be said that ESD has been achieved, because ESD involves a vast number of factors, many unmeasurable, in a system that is not in equilibrium. Even when the factors can be measured, more accurate information usually reveals more variables in the environment, which in turn requires greater variability in our responses. Achieving ESD is more about adoption of processes than achievement of explicit end-points, although — as in any management process — it will be important to make use of explicit targets along the way. Further, ESD end-points evolve with communities' changing expectations about how fisheries and aquaculture utilise the aquatic natural resource.

ESD presents one of the greatest challenges to Australia's governments, industries, businesses and the general community. An effective level of



*Fish worlds* is a painting by Tiffanie Brown commissioned by the FRDC to illustrate the complex factors involved in fisheries ecosystems — that is, not only aquatic organisms themselves but the wider environments in which they live.

In recent years, the fishing industry has acquired considerable knowledge about the more highly valued commercial, recreational and customary species; their supporting environment; human-induced changes to their ecosystems; and the interactions of fishing practices. However, much remains unknown because of the very great diversity of species and their habitats. The change to more ecologically sustainable approaches has also placed additional demands on scientific knowledge. Although the change to more ecologically sustainable approaches should be knowledge-based, fisheries managers and the fishing industry still operate in a context of considerable scientific uncertainty.

Fisheries R&D is increasingly focusing on ecosystems — that is, communities of organisms interacting with each other, and the environment in which they live — because a narrower focus does not take into account the important factors that often lie beyond the immediate habitat. This wider scope is in keeping with the ever-increasing emphasis on ecologically sustainable development.

progress towards ESD requires a strong economy and a vigorous, profitable commercial sector. Businesses struggling for economic survival have little ability to improve their environmental performance. Conversely, some species caught recreationally are not valued as highly as when caught commercially, and are therefore not supported so strongly by fishers for preservation. The FRDC has invested in a partnership with all fisheries and aquaculture management jurisdictions to develop an ESD reporting and assessment framework. The framework provides the basis for all sectors to implement triple-bottom-line reporting, accredited activities (e.g. Marine Stewardship Council and ISO 14000). It also meets the requirements of the Environment Protection and Biodiversity Conservation Act 1999 for strategic assessments.

 [www.fisheries-esd.com](http://www.fisheries-esd.com)

*"In recent years, conferences organised with FRDC support have drawn increasing numbers of stakeholders from across Australia. They have demonstrated a growing unity of purpose between all stakeholders to ensure the sustainability of fisheries and aquaculture resources alike."*  
— Russell Neal, CEO, Australian Seafood Industry Council

In the case of the recreational and indigenous sectors, which do not depend on profit to survive, motivation for high levels of environmental performance comes from social and ecological awareness, self-interest and conscience. These sectors need to conduct fishing in a sustainable manner and to be as willing to accept total catch restrictions as the commercial sector.

Since ESD factors run through so many dimensions of society, an integrated approach to ESD is essential, for reasons that include:

- the need to consider the use of Australia's economic, environmental and social resources on a regional, national and international basis; and

- the significance of potential threats to our economy, environment and society if we do not take action.

ESD has become a major objective of the fisheries and aquaculture legislation of all jurisdictions. A key component is the need to measure and report on performance against ESD objectives. Setting sustainable levels of fishing and aquaculture has been central to fisheries and aquaculture management and science for a long time. The concept of ESD, however, is far broader than the traditional focus on yields derived from target species. This complexity poses difficulties for natural resource managers, partly because of the poor understanding of how aquatic ecosystems work, and how they are affected by their use or by other disturbance or economic activity.

## Management of aquatic habitats

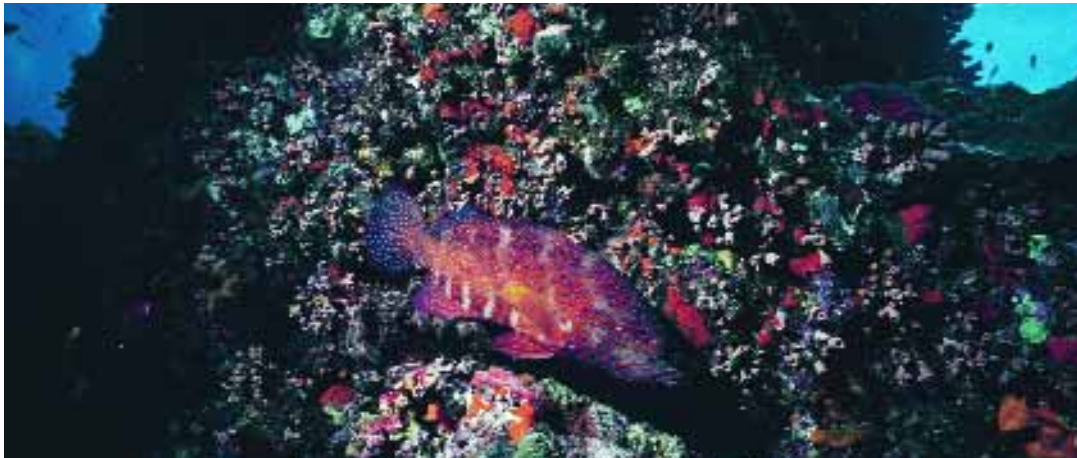
Federal, state and territory governments are responsible for managing fisheries and aquaculture that are within their jurisdictions. Except where agreement is reached to the contrary, Australian Government jurisdiction extends from three nautical miles outside the baseline of the territorial sea to the limit of the EEZ; state and Northern Territory jurisdiction is generally from the baseline to three nautical miles.

By agreement under the Offshore Constitutional Settlement 1983, the Australian Government and state/NT governments may agree to pass management responsibility for a fishery that straddles the three-mile boundary to a single authority, or to undertake co-management.

Commonwealth fisheries are managed by the Australian Fisheries Management Authority, an Australian Government statutory authority. Fisheries management within the states and territories is vested in government departments with responsibility for fisheries and aquaculture.

The rationale for government involvement in fisheries and aquaculture management flows from issues that can arise if everyone is allowed unfettered access to resources (leading to the tragedy of the





Understanding the interactions between fishing and the aquatic habitat is vital for sustainable fisheries management.

commons). In managing fisheries and aquaculture, government institutions employ various regulations governing sites, inputs to fishing effort (i.e., all elements of harvesting capacity, such as number of fishing vessels, type of gear etc) and output (e.g., the amount, sex or size of fish that may be harvested). Input controls have been the preferred management option to date but, increasingly, output controls are now being used. Neither option is perfect; each comes with its own set of challenges.

Risks associated with wild-catch fisheries management decisions are increased by uncertainty about the resource. Specifically, the risks are stock decline — caused, for example, by setting harvesting levels too high — or lost income and jobs from setting harvesting levels too low. The better the information on stock and ecosystems, the more confidence fisheries managers can have that their decisions will address goals for sustainability and economic efficiency in a balanced way. Knowledge of fish stocks and structure are important, but equally important for management is good governance, applied R&D, an appropriate legislative framework, and effective compliance. Importantly, as Ray Hilborn stated in a recent paper, “the key to successful management of marine resources is the establishment of appropriate institutions for governance that include a reward system, so that the individual welfare of fishermen,

managers and scientists is maximised by actions that contribute to a societally desirable outcome”.<sup>3</sup> It is essential to implement management systems that reward environmental stewardship, since it has increasingly become understood that fisheries managers do not manage fish but instead manage human behaviour.

During the past 10 years, fisheries and aquaculture management has undergone profound change world-wide, particularly by adopting an “ecosystem approach” to management. All Australian fisheries and aquaculture management jurisdictions have included ESD in their legislative and regulatory instruments. With respect to wild-catch fisheries, governments have negotiated environmental instruments to achieve management at the international level, especially by “internationalising” fisheries management through cooperation between nations, and by extending compatible management measures from EEZs to the high seas and where stocks straddle these boundaries. Australia is involved in Regional Fisheries Management Organisations (RFMOs) for high seas that are adjacent to its EEZ and for species that cross into this zone. Change at international and national levels has included adoption of ecosystem-based natural resource management. In 2003, the Food and Agriculture Organization of the United Nations provided agreed definitions and guidance for an ecosystems approach to

3 R. Hilborn et al. 2005 Phil. Trans. R Soc. B. vol 360 pp 47-57.





Educating users of aquatic habitats will ensure future generations will also enjoy the experience.

fisheries. In Australia, this approach is supported by two important vehicles for sustainable development of fisheries: the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act), under which fisheries management arrangements are assessed<sup>4</sup>, and Australia's Oceans Policy, which takes a broad approach to marine sustainability. Nevertheless, there are few global standards for marine sustainability, even though seafood is one of the most globally traded products.

*"Australia's Oceans Policy will ensure that the range of marine activities that are being managed individually are sustainable as a whole."*

*— Keith Sainsbury, quoted in 'A view to the future of Australia's fisheries', Ecos, April–June 2004*

It is important to recognise that although local government agencies are not fisheries or aquaculture managers they do have a significant role in planning and approving activities related to fisheries and aquaculture.

A consequence of these changes is an increased need to measure the performance of agencies and the fisheries and aquaculture they manage — as required, for example, by the EPBC Act. Industry is also responding to the need to measure environmental performance by developing environmental management systems that can be audited by third parties.

Over the years, considerable knowledge has been acquired about the more highly valued commercial, recreational and indigenous species, their supporting environment and human-induced changes to their ecosystems, including those arising from fishing and aquaculture practices. However, much remains unknown because of the great diversity of species and habitats, and how they inter-relate. Over all, fisheries and aquaculture managers and the industry still operate in an environment of considerable scientific uncertainty. Australia has implemented the precautionary approach in relation to natural resource management where scientific uncertainty exists.

Fisheries and aquaculture management and industry are driven by economic and social factors. Although many are external to the industry and beyond the control of managers, others can be directly affected

<sup>4</sup> The EPBC Act in relation to strategic assessments covers those fisheries or aquaculture operations within the commercial sector that export native product.



The pearl industry actively invests in maintaining a healthy aquatic environment that is critical to its future.

by industry behaviour, management decisions and community perceptions.

Fisheries and aquaculture managers have no direct influence on the commodity — fish — but only on the behaviour of fishers and, to a severely limited extent, on the factors in the ecosystems on which they depend. A major component of fisheries and aquaculture management is therefore to interact with fishers and aquaculturists, and with people in the community who also seek to use fisheries natural resources. It is necessary to ensure that all of these people have appropriate access to aquatic natural resources in the interests of optimising the economic, environmental and social benefits to the Australian community. Further, fisheries and aquaculture management must ensure that all participants and others who seek to use the resource are aware of the management processes involved and have confidence that their various interests are being taken into account. This leads to a more inclusive, co-management approach to natural resource management that takes into account not only the views of government agencies responsible for fisheries and aquaculture but also of those responsible for the environment, industry development, science, and regional and urban planning; and industry, communications, community and special-interest groups.

## *Fisheries managers cannot manage wild fish — only the behaviour of fishers*

### Access to aquatic resources

Governments exercise a stewardship role in relation to fisheries resources on behalf of the Australian community. The commercial, recreational and indigenous sectors have certain rights to fish these resources, although the nature of the rights varies between fisheries, aquaculture operations, jurisdictions and sectors.

Additionally, aquatic resources are used by non-extractive users and people who particularly value the aquatic environment: for example, people associated with tourism, pleasure boating and non-extractive diving. World-wide demands for the development

of aquatic protected areas as refuges for the maintenance of species and biological diversity have put pressure on access for all sectors of the industry; for example, Australia's marine protected areas presently cover more area than all other marine parks declared in the rest of the world.

Determining access to aquatic resources is complex and varies between jurisdictions. Desirably it involves the application of environmental, economic and social information to maximise returns to the community and the industry through an objective planning and resource allocation process. The process may involve continually adjusting resource allocation as community values change with time.

In an environment in which planning and resource allocations are based on so many diffuse factors, the commercial, recreational and indigenous sectors of the fishing and aquaculture industry must ensure that their claims for access are regarded by those responsible for planning and resource allocation as being justified and rigorously based.

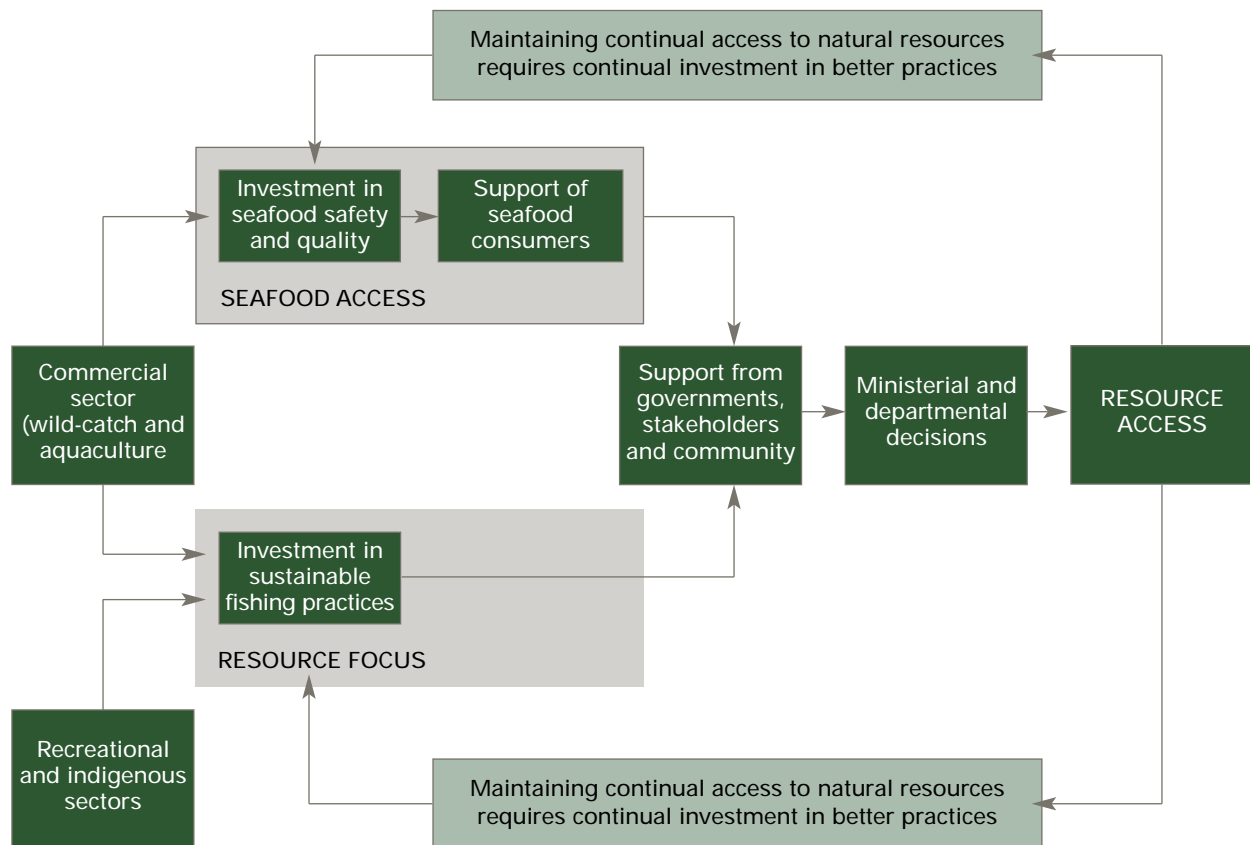
There is a direct link between gaining access to aquatic resources and the fishing and aquaculture industry's investment in gaining the ongoing support of the community and governments (and for the commercial sector, seafood consumers), as outlined in figure 5.

### Commercial wild-catch fishing

The commercial wild-catch sector is extremely diverse. Enterprises range from single low-technology owner-operators for whom the lifestyle is important, to large companies that use technology very efficiently. The sector provides important economic and social benefits within coastal communities.

Regardless of size of enterprise, the sector produces high-quality seafood that is highly regarded internationally. Advances and adoption of best-practice post-harvest processes and practices have resulted in high-quality live, fresh and frozen Australian seafood reaching markets all around the world. The image of Australian seafood is enhanced by the "clean and green" reputation of the catching sector and the environment within which its members work.

Figure 5: Factors involved in access to fisheries resources

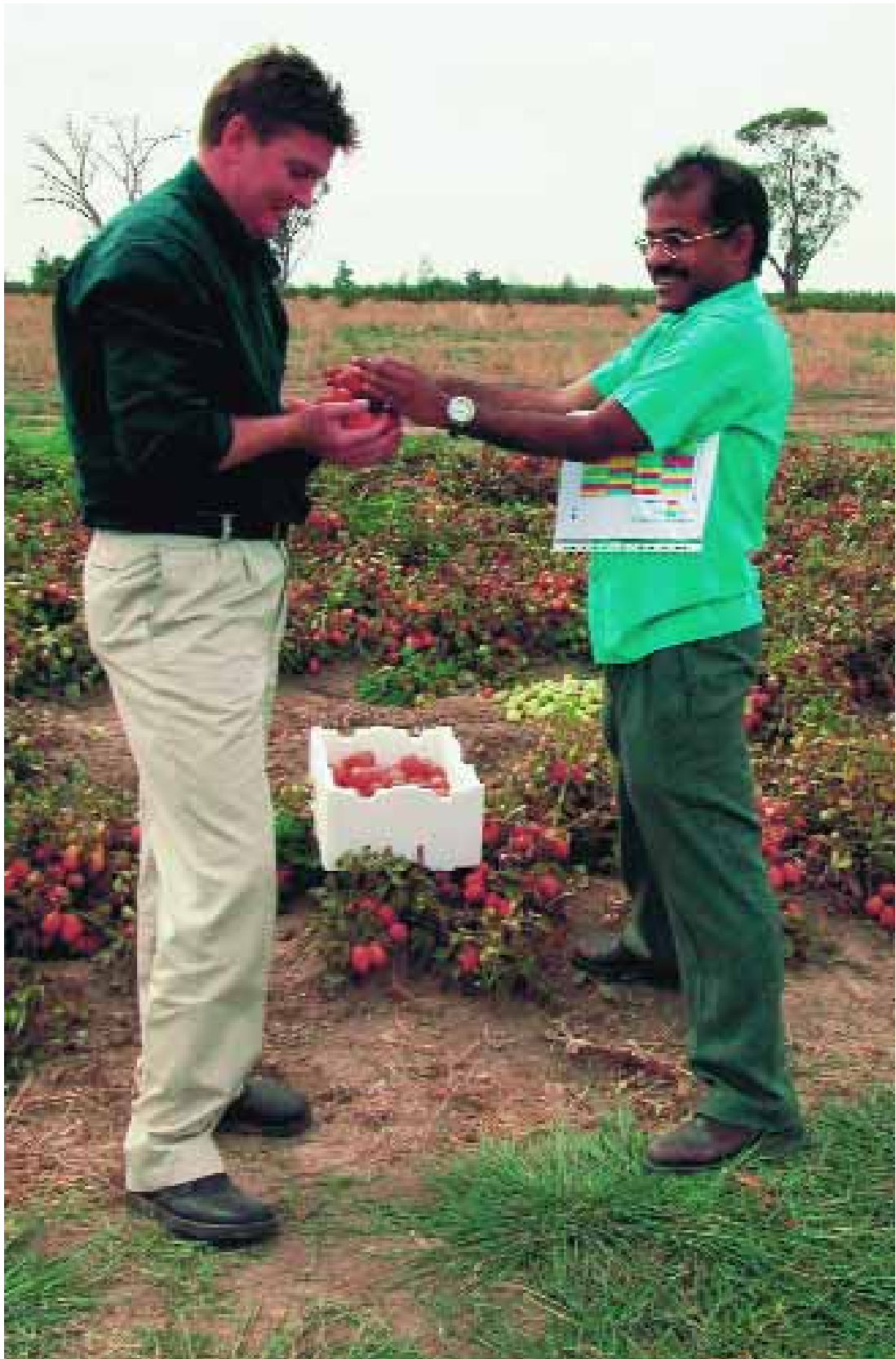


About this diagram . . . The starting points are the commercial sector and recreational/indigenous sector boxes on the left-hand side.

The wild-catch sector of the fishing industry and, to a lesser extent, the aquaculture sector depend on resources owned by the Australian public. When governments provide sectors of the industry with access to those resources and to some form of security in such access, the governments need to be confident that their decisions have the support of the general community and seafood consumers.

The extent of support by consumers and the community depends on the values they place on seafood and on fisheries resources. Since in many political processes “public perception is the reality”, the fishing industry must maximise its capability to state its views clearly to governments and the public. The more the industry sectors harmonise the way in which these views are presented, the more likely it will be that governments will grant them appropriate access rights. Similarly, the more the commercial sector invests in meeting the safety and quality needs of consumers, and demonstrates that it is doing so, the more likely it will be that consumers will support all sectors of the fishing industry.





Fertiliser is one example of how the fishing industry is minimising fish waste.

Aware of its dependence on the health and abundance of natural resources, the wild-catch sector is increasingly adopting the principles of ecologically sustainable development and setting up environmental management systems to implement them. By taking this approach, the sector is taking responsibility for sustainable harvesting of natural resources.

The end-use of seafood is not only on a plate. In the past, fish offcuts from processing were thrown away. Recently, industry has seized the opportunity to turn this fish waste into environmentally friendly fertiliser. A company, Australian Seafood Co-Products (ASCo), was formed to gather fish waste, to use it to extract organic phosphate from fish frames, and to sell it as fertiliser for broad-acre farm use.

Overfishing has been a concern for some time. However, “overfishing” and “overfished” mean different things. The practice of “overfishing” is unsustainable and requires immediate management action to curtail the pressure on targeted fish stocks. “Overfished” does not necessarily imply that the species or fisheries involved are in danger of collapse: the term is used to describe fisheries that have previously been over-exploited, but for which management arrangements are now in place to ensure that stocks rebuild. Often the appropriate management response will be agreed between fisheries managers and industry.

Increasing cost of management of fisheries requires a change in the way the level of exploitation is balanced against the costs of fisheries management. Achieving better balance requires new management approaches that involve less risk and lower cost.

Discarding of catch is attracting widespread attention: it is the practice of throwing away unwanted catch of both target and non-target species, much of which will not survive. Discarding can occur when quotas have been reached; when there is a limited market or no market for the fish caught; or when gear is inappropriate. It is commonly viewed as an unnecessary waste of fish resources. The impacts of discarding on higher-order predators and on aquatic ecosystems are also of concern. High discard rates of dead

catch can result in closure of markets, trade embargos, negative public perception and spatial limitations to avoid interactions with unwanted catch. The industry has been pro-active in responding to this issue by collaborating with researchers and adopting practices that mitigate bycatch and interactions. Successes have occurred in Australian prawn fisheries with the use of turtle excluding devices, effectively reducing turtle interactions to zero; and adoption of bycatch reduction devices in prawn and fish trawl fisheries to reduce bycatch of finfish and seabirds. Agreements to spatial closures in some areas to minimise the discarding of undersized fish have also been adopted in many fisheries. Increasingly, the industry is aware of its responsibilities for the marine resources and the ecosystems that support them and are adopting sustainable practices. Australia is trialling a range of mitigation devices to limit interactions with animals, including seabirds.

*“Bycatch — the unwanted catch of fishing operations — is an issue of increasing concern to a lot of people. Bycatch is not only a threat to the marine environment; discarding unwanted catch is also a wasteful practice.”*

*— Warren Truss, Minister for Agriculture, Fisheries and Forestry and Senator Robert Hill, Minister for the Environment and Heritage, in the foreword to the Commonwealth Policy on Fisheries Bycatch, June 2000*

Of lesser short-term impact on fisheries ecosystems is the significant consumption of fossil fuel in fishing boats; oil spillage and garbage dumping from vessels; and “ghost fishing” — the unintended catching of fish in abandoned fishing gear. Codes of practice are being developed and adopted to reduce the dumping of garbage, and responsible





Salmon aquaculture is one example of industry successfully addressing environmental issues.

practices for refuelling and for changing oil are including waste oil receptacles and oil spill emergency kits on wharves. Fisheries that use bait are increasingly moving towards packaging that is eco-friendly, and are avoiding the use of “straps” that were often associated with entanglements. The use of biodegradable materials and sacrificial anodes on some fishing gear is also reducing the impacts of ghost fishing.

Animal interactions by commercial fishers are unavoidable, but with appropriate management, sound scientific advice, and by industry taking a greater stewardship role, these interactions do not have to be negative.

## Aquaculture

Australian aquaculture is characterised by a few industries that dominate commercial production and by a diversity of products and services that meet the needs of seafood consumers, fish stocking programs, and fisheries rehabilitation and enhancement.

Aquaculture has been one of the fastest growing food primary industry sectors during the last decade. Innovative production methods have evolved by pursuing Australia’s many comparative advantages. One industry that exemplifies this successful development is southern bluefin tuna aquaculture in Port Lincoln. To ensure that aquaculture continues to develop, significant investment will be needed to underpin land and water planning, production technologies, supply chain development, value-adding, marketing and promotion, and people development.

A major component of aquaculture feeds is fishmeal and fish oil. About one-quarter of the world’s wild-catch harvest is utilised to produce these products. Of this, aquaculture consumes about 50 per cent of all fishmeal production and more than 70 per cent of fish oil production. Demand for these products from aquaculture is increasing. However, the overall catch for fishmeal has not changed because demand from other industries such as pig and poultry farming is declining.



Understanding the impact of recreational fishers is important for fisheries management.

Aquaculture has environmental effects. Discharges from aquaculture can include nutrients and organic matter from feed and faeces. The cost of mitigating these discharges can be high. Although the discharges are now generally only 10 per cent of their levels a decade ago, they are still unacceptable to the general community and those who share the same resources.

Like the wild-catch sector, the aquaculture sector is a major user of technology, some of which can have an impact on the marine environment. For example, sea-based grow-out cages can affect seabed flora and fauna, and can entangle aquatic animals.

As with the wild-catch sector, the aquaculture sector and the management agencies that regulate it recognise the foregoing interactions and are working to minimise them. Solutions may nevertheless increase the costs of production.

Aquaculture helps to provide a greater understanding of the biology of fish species. It also improves the catch in some recreational and commercial fisheries through re-stocking programs. It is used to re-

establish populations of endangered species, although the effectiveness of such re-stocking is often inconclusive.

## Recreational fishing


The major difference between managing commercial wild-catch fishing and recreational fishing is that the former has limited entry whereas the latter almost always has open access to fisheries resources. In some fisheries, recreational effort is limited by the number of hooks or rods that can be used (an input control), but more often recreational fishing is managed through output controls such as catch ("bag") and size limits.

Policing and compliance management of recreational fishers is more difficult than with commercial fishers. For example, some recreational fishers fish for food while others fish for the experience. Whereas commercial fishing is subject to both compliance and reporting, most recreational fishing is subject only to compliance. Moreover, people

who go fishing regard the activity as private, and most have little knowledge of fisheries management, particularly as it relates to them.

Household food consumption surveys undertaken by the Australian Bureau of Statistics suggest that the total recreational catch of all seafood may be of the order of 30,000 tonnes — which is greater than the catch from the South East Trawl sector of the Southern and Eastern Scale and Shark Fishery. This figure is corroborated by a finding of the National Recreational and Indigenous Fishing Survey, which estimated that Australian recreational fishers harvested 60.4 million finfish in 2001 (out of a grand total of about 125 million fish, crustaceans and molluscs). For some species, the weight of the recreational catch most likely exceeds the weight of the commercial catch.

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 FRDC-funded project: National Recreational and Indigenous Fishing Survey, completed during 2001-02 (project 1999/158)

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*Recreational catch is estimated at about 30,000 tonnes — similar to the catch from the South East Fishery, Australia's highest-tonnage commercial fishery.*

With ecosystem-based fisheries management requiring fisheries managers to take account of whole-of-catch, among many other things, it is important that recreational fishing mortality be measured. For this reason, fisheries management agencies have committed to undertaking further national recreational (and indigenous) fishing surveys at intervals of not more than five years. In addition, agencies are continuing to undertake finer-scale surveys relating to recreational fishing within their areas of jurisdiction.

One way in which fisheries management agencies can monitor recreational fishing activity is through fishing licences. All states and the Northern Territory have a range of licences, mainly for high-value fisheries or to allow access for spatially explicit fisheries such as impoundments. New South Wales and Victoria have both recently introduced

comprehensive licences for all their waters. Licences may become the norm as governments recognise that they are necessary for effective management, and industry realises the benefits from a “users pays, user says” principle.

To promote ecologically sustainable fishing practices, the recreational sector — like the commercial sector — has developed and promoted a voluntary code of conduct. Its effectiveness is limited by the nature of the activity and the recreational fishers themselves — more importantly those who do not realise their responsibilities. Under the FRDC's National Strategy for the Release of Line-caught Fish, activities are focusing on maximising and measuring the survival of released line-caught fish. Many TV fishing programs and tourist guides advocate catch-and-release fishing.

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 [www.into-fish.net/releasefish](http://www.into-fish.net/releasefish)

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## Indigenous fishing

The National Recreational and Indigenous Fishing Survey indicated that indigenous non-commercial fishers (that is, fishing recreationally or in accordance with customs) harvested more than 3 million aquatic animals, including 900,000 finfish, in 2001.

Indigenous fishers have access to some species that commercial and recreational fishers do not have — for example, turtles and dugongs. Collection of data on target stocks involved in customary fishing is less comprehensive than for the commercial and recreational sectors. Consequently, the impacts of the indigenous sector on both target stocks and broader fisheries ecosystems are the least understood.

Some indigenous fishers are increasing pressure on fisheries resources by using contemporary technologies. In this regard, some indigenous Australians make little distinction between traditional customary or recreational fishing practices.





Tag and release is important to understanding fish stocks and their interactions with fishers.



Customary indigenous fishing has been sustainably carried out for tens of thousands of years.

Aboriginal and Torres Strait Islander people are increasingly involved in fisheries management through consultative processes, employment as rangers and fisheries inspectors, involvement in research, and monitoring of activities of commercial fishers (including indigenous commercial fishers). However, their involvement, by and large, has not matched that of commercial and recreational fishers.

## Major impacts on fisheries and aquaculture resources

### Habitat threats

It is essential to protect habitats, on which fisheries depend, to ensure they are sustainable. Because particular habitat types are vital to the existence of some species, and because the particular habitats may change during a fish's life-cycle, it is appropriate to consider them as parts of a connective chain rather than as isolated entities. When even one critical habitat type is degraded, production from the whole chain is affected.

Threats to habitat from human activity are associated with:

- construction (flood mitigation structures, dams, ponding of pastures, reduction of river flows through irrigation, urban developments, marinas, and reclaiming of wetland nursery grounds);

- drainage (stormwater run-off from urban areas, sediment and pesticide run-off from agriculture, sewage, exposure of acid sulphate soils, and outflow from industrial plants);
- clearing of vegetation from riparian zones and mangrove nursery grounds;
- oil drilling and mineral exploitation;
- salinity of freshwater habitats that support wild-catch and aquaculture;
- water pollution from nutrients, chemicals and organic matter; and
- introduced pests.

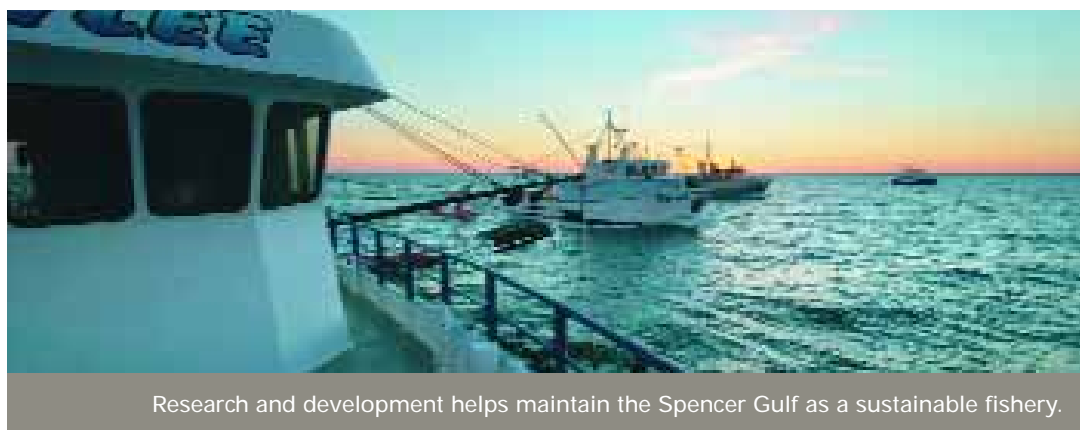
### Illegal, unregulated and unreported fishing and trading

In some fisheries, illegal fishing and subsequent trading has a significant effect on natural resources. In abalone fisheries, for example, perhaps a third of harvested stocks are taken and sold illegally. In the distant waters of the Southern Ocean, as much as three-quarters of the total Patagonian toothfish catch may be illegal. Such a rate of unreported harvesting has major implications for stock assessment and, ultimately, sustainability of the resource.

Other examples of illegal practices include fishing in green zones on the Great Barrier Reef, under-reporting commercial catch, using the wrong fishing gear, stripping reefs of giant clams, and recreational



Policing illegal fishing is a major issue for the fishing industry and fisheries managers.



Research and development helps maintain the Spencer Gulf as a sustainable fishery.

fishers exceeding legal bag limits and retaining under-size fish. Incursions by foreign vessels into Australia's EEZ, and unmanaged fishing activity affecting fish stocks that straddle the EEZ's boundaries, are also causes for concern.

The effectiveness of management strategies is severely compromised by illegal catches. Even if stock assessments were based solely on fishery-independent data that is not compromised by illegal catch levels, management options, when deciding whether to adjust catch quotas, may be limited if the scale of resource theft is unknown. For instance, decreases in legal total allowable catch will not reduce the illegal take, and may precipitate an increase in unlicensed effort. There is little "ownership" by stakeholders of management decisions made under these circumstances.

### Introduced pests and pathogens

A major environmental threat to Australia's fisheries and their ecosystems comes from pest organisms and pathogens, which can reduce production by competing for food or habitat with endemic species, or by predation.

Pathogens or pests can be endemic or exotic. The latter may arrive in imports (for example, aquarium fish, bait fish, aquaculture feeds and other aquatic organisms and foodstuffs), through ballast water discharged by visiting vessels, and as hull-fouling organisms. Recent examples include infestations by European carp, northern sea-star, striped mussel and fanworm. Pathogens can also be transmitted through translocation of species within Australia.

A single national system for the prevention and management of introduced pest incursions has been instigated, with elements dedicated to prevention, emergency management and ongoing control and management. National strategies for fish translocation and fish health are now in place.

### Consumption by marine animals

Consumption of fish by other species in the wild can also have an effect on the number of fish available for human consumption. It is important to understand the feeding regimes, prey needs and habitat requirements of aquatic animals that compete with fishers, especially for higher-order predators. A broader understanding of total fish consumption will ensure an appropriate food allocation within the food chain to all components that compete for food, including humans.

### Climate change and variability

The world has warmed by 0.6 degrees Celsius during the past century and this trend is expected to continue. Ocean temperatures are expected to continue to rise, accompanied by changes in ocean weather systems, including currents.

Possible consequences of this warming include changed and more varied weather patterns and water temperatures affecting the migration patterns of pelagic fish, and changes in the suitability of sites for aquaculture. As in all sectors of the economy, there are three modes by which climate change is expected to affect the industry: the impact of climate on production; the need to reduce greenhouse gas emissions; and through trade, as some regions become more or less advantaged as climate change proceeds.



## THE FISHING INDUSTRY TODAY

### The commercial sector

The commercial sector of the fishing industry is Australia's fourth most valuable food-based primary industry — after beef, wheat and milk. In 2003–04 it produced about 270,000 tonnes of produce, worth about \$2.2 billion ("landed/farmgate value" — that is, before value-adding) or about 7 per cent of the gross value of Australian food production. Most of the sector's product is considered as world-class.

The commercial sector's main strengths include:

- a very high reputation overseas for its best-practice, world-leading fisheries and for environmental management, food safety and quality standards;
- significant association with Australia's international image as a clean and environmentally responsible country with an enjoyable climate, innovative cuisine and cosmopolitan culture — a powerful motivator for inbound tourism;
- proximity to Asian countries, which consume a significant proportion of the world's seafood production and have increasing capacity to afford higher-value premium seafood;
- a focus on international competitiveness and high-value species for premium markets, allowing industry to meet the costs of high environmental management standards and government regulation;
- increasing domestic demand;
- good links with governments to foster maximum growth that is sustainable in the long term;
- its underpinning of many rural and regional communities, economically and socially;
- seasonal production opposite to that of the northern hemisphere, where most exports are destined;
- world-class research and development infrastructure with strong linkages to the industry that focus on solutions highly relevant to the economic, environmental and social dimensions of the industry; and
- innovation in production technologies that utilise Australia's considerable land and water resources for supporting aquaculture production.

The commercial sector's main weaknesses include:

- a poor reputation in the eyes of the Australian community for its perceived record in environmental sustainability;
- complex government management arrangements for wild-catch and aquaculture sectors;

- dependence on community and government attitudes to commercial fishing and aquaculture for access to natural resources;
- sensitivity to changing fuel costs and exchange rates for the Australian dollar;
- ability to compete in the domestic market for labour;
- lack of industry cohesion and infrastructure for effective advocacy and improving the sector's national profile;
- high dependence of exports on South-east Asian markets adjacent to each other — hence vulnerability to sudden market swings as a result of currency changes, fluctuating economies and human epidemics such as the SARS viral outbreak;
- lack of a well-funded, dedicated national entity that would, among other things, enhance national opportunities for market development and product promotion, increase industry and consumer education, and capitalise on wider food industry opportunities;
- lack of vertically integrated companies that provide financial and product handling efficiencies; and
- lack of integration of supply chain management. Australian seafood's main strengths include:
  - high quality;
  - freshness in domestic and international markets;
  - its reputation for premium, high-value product (e.g. abalone, rock lobster);
  - its range of more than 800 species from many marine and freshwater fisheries and many climates, ranging from sub-Antarctic to tropical; and
  - its association with Australia's healthy, innovative, cosmopolitan cuisine.

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 FRDC project: 2001/309, Bureau of Rural Sciences: Community perceptions of fishing: Implications for industry image, marketing and sustainability.

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Australian seafood's main weaknesses include:

- low levels of production, making economies of scale and access to volume markets difficult to achieve;
- a relatively under-developed supply chain;
- high cost of transport to European and US export markets;
- high production cost, which reduces competitiveness at convenience food outlets such as supermarkets; and
- inability to compete with products imported from countries with low production costs.



Commercial fishers deliver premium product fresh for sale to the consumer.

## Recent commercial production

More information on production is in *Australian Fisheries Statistics 2004*, published by the Australian Bureau of Agricultural and Resource Economics and available as a free download from <http://abareonlineshop.com>

Figure 6: Value of commercial production (wild-catch plus aquaculture) by jurisdiction, 2003-04 and ten years earlier)

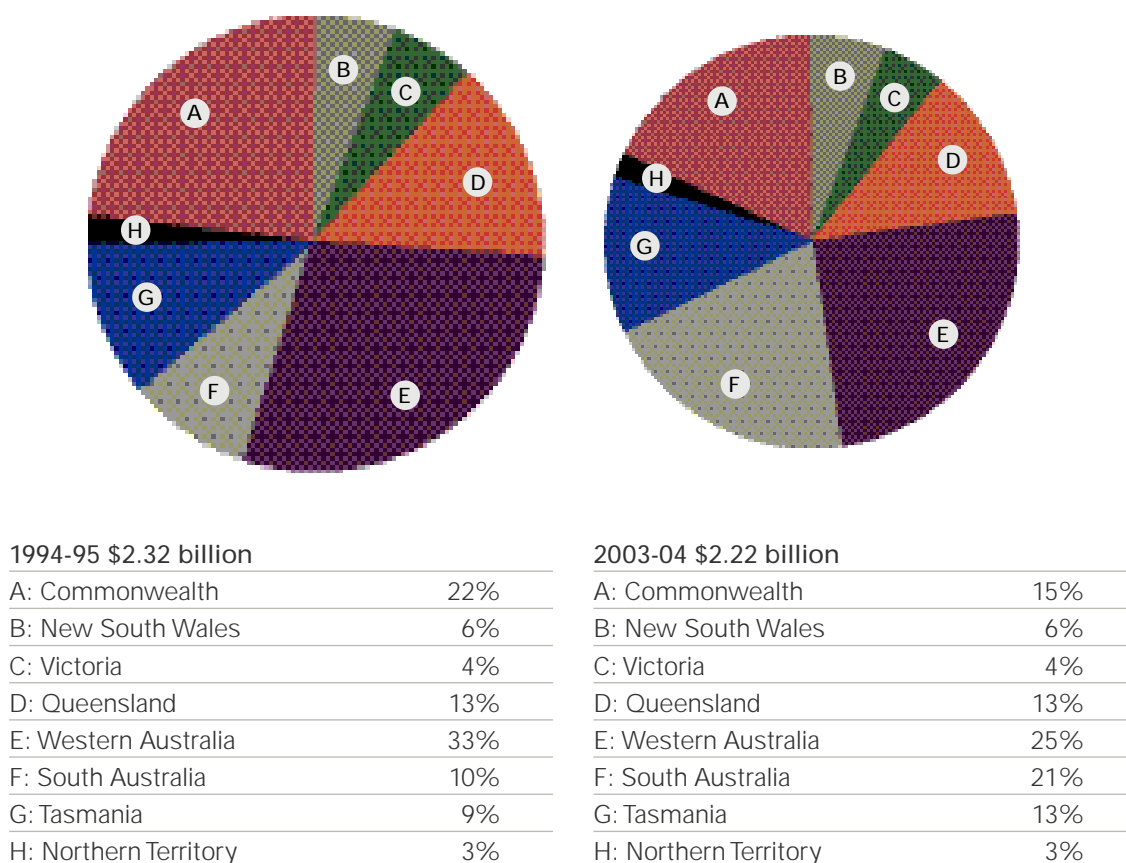


Figure 7: Commercial sector production for the past 10 years

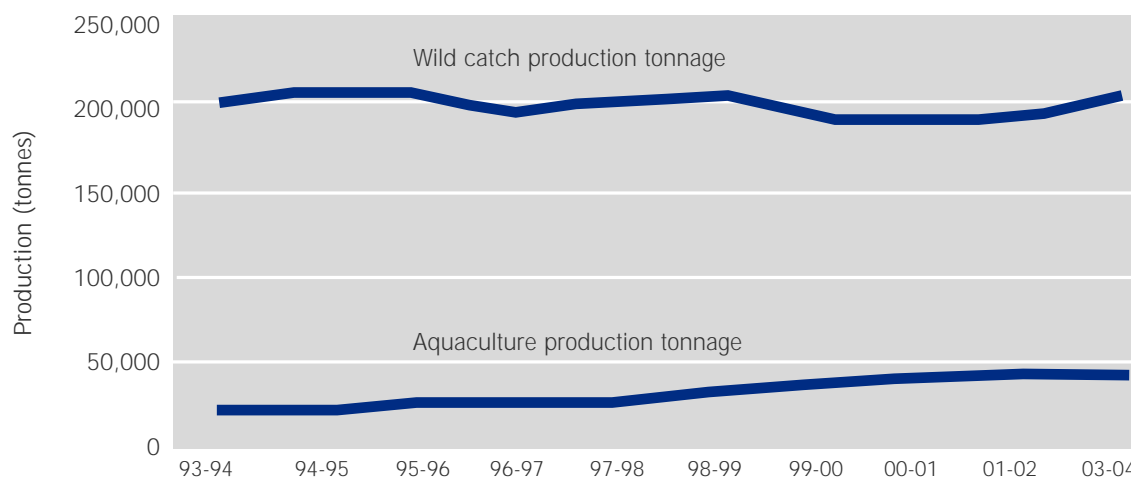
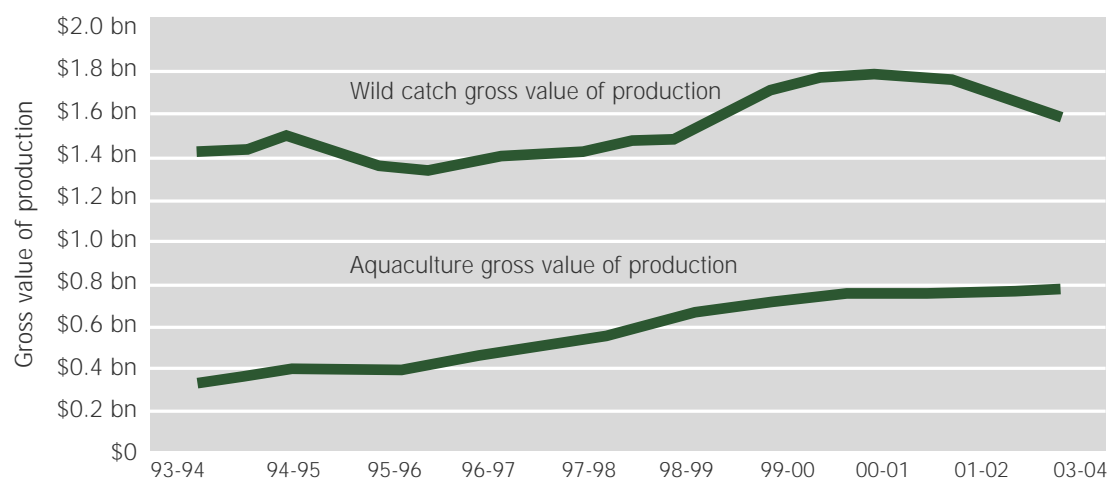


Figure 8: Value of commercial sector production for the past 10 years



## Commercial wild-catch fishing

The landed value of the commercial wild-catch increased from \$1.3 billion in 1994–95 to \$1.48 billion in 2003–04.

FIGURE 9: The top five wild-catch species by value, 2003-04

Rock lobster	Prawns	Abalone	Tuna	Pilchards	All other finfish	Other species
\$404m	\$300m	\$189m	\$48m	\$27m	\$262m	\$26m

Commercial wild-catch fishing activities take many forms, as reflected in table 1, and occur in almost 80 fisheries around Australia. In rural and coastal communities, commercial fishing — for which there are more than 15,000 licences — provides significant employment and often provides robustness to communities whose economic prosperity would otherwise be in question.

table 1: The main Australian commercial wild-catch fishery types

Fishery type (major method)	Target species
Finfish trawling / Danish seining	Multiple or single species
Prawn / scallop trawling	Single species and/or groups of species
Scallop dredging	Single species
Purse seining	Single species and/or groups of species
Net hauling	Multiple species or single species
Meshing	Multiple species
Line fishing	Single species or multiple species
Trapping	Multiple species
Potting	Largely single species (e.g. lobsters, crabs)
Hand gathering	Usually single species (e.g. abalone)
Mixed (no single clear method)	Multiple species
Exploratory	Single or multiple species

Increasingly, leading individuals and enterprises in the commercial wild-catch sector are improving quality and are value-adding by developing new products and processing techniques. They are becoming more strategic and are opening up new markets, developing niche products and marketing more efficiently. Consequently, they are earning better returns on their investment.

The commercial wild-catch sector is increasing its contribution to fisheries R&D, recognising that profits, sustainability and future access to resources depend on the outcomes of its contribution. The sector is strengthening its role in R&D planning

and adoption of R&D results. Oceanwatch, a national organisation funded by the Australian Government, also plays an important role in facilitating adoption of improved fishing technology.

## Aquaculture

Aquaculture is one of Australia's fastest-growing primary food industries. The farm gate value of aquaculture production increased from \$302 million in 2003-04 to \$732 million in 2003-04. It now equates to 30 per cent of the landed value of all commercial sector production, up from 20 per cent in 1994-95.

Figure 10: The top eight aquaculture species by value, 2003-04

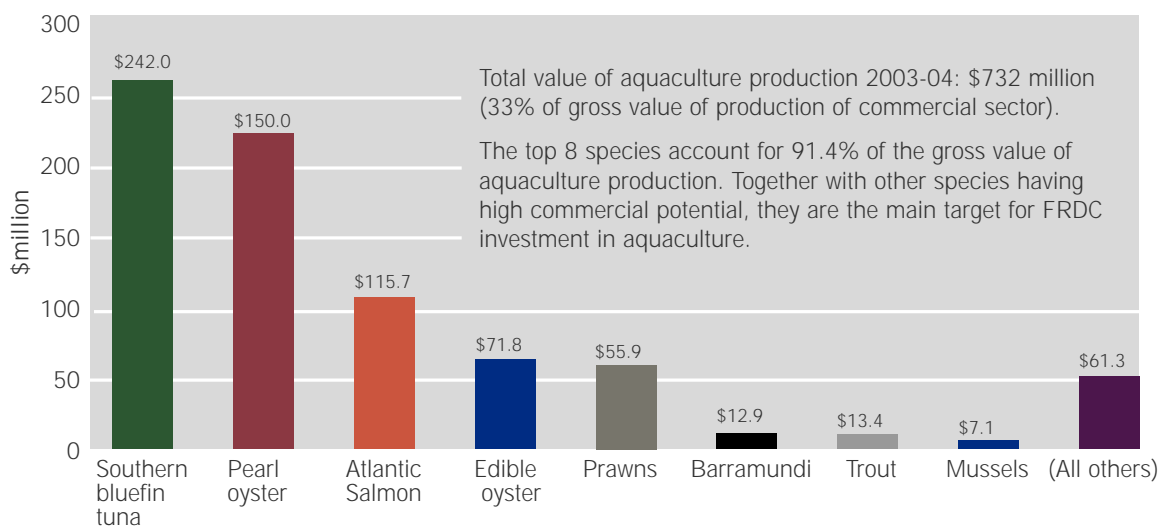
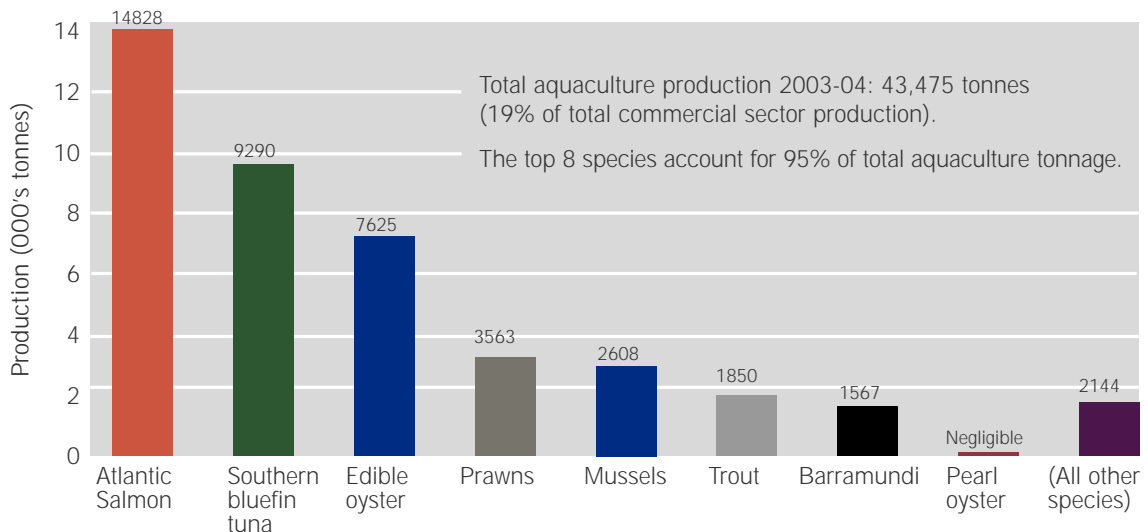


Figure 11: The top eight aquaculture species by production







The future of aquaculture will depend on developing new efficient technologies that are environmentally friendly.



Understanding the Japanese consumer has enabled the tuna industry to refine its practices to deliver the best product.

The aquaculture sector's expansion during the 1990s was underpinned by innovation in southern bluefin tuna farming, growth in existing industries — including pearling, edible oyster, prawn and salmonid aquaculture — and significant developments in new industries — including barramundi, yellowtail kingfish and abalone. The aquaculture sector has developed a diverse resource base of species being farmed and technologies being used. This diversity offers many opportunities

for small to medium enterprises to take advantage of niche markets.

Like its wild-catch counterpart, aquaculture provides development and employment opportunities in rural Australia, and contributes to export growth. More than 3,000 aquaculture licences are currently held in Australia, although many are held by small-scale operators for whom aquaculture may not be the primary source of income.

The farmgate value of aquaculture in 2003-04 equated to 30 per cent of the landed value of all



commercial sector production, up from 15 per cent in 1989–90.

Australian aquaculture uses both marine and freshwater resources, although most production is from the coastal zone. Although more than 70 species are being produced commercially, the most valuable are the eight species shown in figure 10, which account for 93 per cent of the total gross value of aquaculture production. If pearl oysters are removed from the list, the remaining seven (edible) species account for 96 per cent of the weight of Australian farmed seafood. Emerging species include abalone, silver perch, yellowtail kingfish, mulloway and, in the longer term, rock lobster.

*The farmgate value of aquaculture in 2003–04 equated to 30 per cent of the landed value of all commercial sector production, up from 15 per cent in 1989–90.*

Exports account for more than 60 per cent of the value of Australian aquaculture. Some aquaculture species are produced exclusively for the export market, such as southern bluefin tuna and kuruma prawns for export to Japan, and abalone for export

to Asia. Other species such as Atlantic salmon, edible oysters, prawns, trout, barramundi, mussels and silver perch are sold mostly in the domestic market.

Operational responsibility for the development and management of aquaculture in Australia rests with state and territory governments. In some jurisdictions, local government plays a key role in planning and approving aquaculture sites. Several states have in place aquaculture and coastal development plans that take into account the needs of multiple user groups, providing the conditions and constraints for access to the water and land that aquaculture requires.

Notwithstanding these plans, approval delays and lack of certainty in gaining access to sites remains both a significant obstacle to the expansion of existing aquaculture operations and an entry barrier for new investment. There are further investment challenges once businesses are established, including competing effectively against imports.

The aquaculture industry, with funding by the Australian Government, has completed an Australian Aquaculture Industry Action Plan which addresses the regulatory and business environment, industry development in an ecologically sustainable framework, enhancement of aquatic animal health and bio-security, global and local product promotion, and people development.



Technology developed through research and development has delivered more efficient growing methods for abalone farmers.



Seafood, the healthy alternative on display.

### Domestic supply and demand

More than 90 per cent of Australians eat seafood. A survey conducted in Sydney in 1999 showed total seafood consumption of 15.3 kilograms per person per year.<sup>6</sup>

Consumption of seafood outside the home has been growing steadily during the past decade — because people eat out more often and because various types of eating places have become very innovative. Strong demand for seafood from the catering and restaurant sector has been a boon to producers, because it has led to increased prices. However, the demand is also adding pressure to retailers' declining profit margins as they try to curb the per-kilo price of seafood in their windows. Consequently, the older "high street" stores are finding it difficult to survive in competition against new shopping malls with large supermarket seafood counters, and new specialist seafood markets.

Most enterprises are continuing to adapt to these market signals and to be innovative in addressing the resultant challenges. Nevertheless, in recent years business has become difficult for operators


throughout the commercial sector supply chain, from the fisher or farmer through to the retailer and restaurateur. The main causes have been changes to regulatory limits or quotas; competition from cheaper imported seafood; increased operating and licensing costs; and consumer resistance to rising prices in the retail store.

*I note how much value we got, in practice, out of the FRDC-funded Consumption Survey (Sydney) by Ruello & Associates. The benefit was substantial to canned tuna, because there is no other totally independent assessment. As you know, the cannery is now the largest private employer in regional SA. Its future is integral to the whole tuna industry.*

*— Brian Jeffriess, President, Tuna Boat Owners Association of SA*

<sup>6</sup> Average seafood consumption nationally is considered to be lower than in Sydney but has not been quantified recently because of the very high cost of repeating the 1991 National Seafood Consumption Study (PA Consulting Group — FRDC project 1990/116). The 1999 survey project was 'A study of the retail sale and consumption of seafood in Sydney' (Ruello & Associates Pty Ltd — FRDC project 1998/345); its data, gathered over two quarters, was compared with Sydney data for corresponding quarters in 1991.

The benefits of seafood as a cornerstone of a healthy diet have been widely acknowledged for a long time. However, stronger links have recently been made between seafood consumption and positive effects on a range of diseases and conditions. There is substantial evidence that coronary heart disease, heart arrhythmia, rheumatoid arthritis, diabetes, obesity and hypertension may benefit from seafood, or fish oil, intake as part of a balanced diet. Preliminary results from studies indicate other health benefits, but with less certainty. Australian consumers are keenly interested in health information; and seafood consumption is rising in response to this new knowledge.

 FRDC project: 2002/242: University of Western Australia: A health promotion program incorporating fish for withdrawal of anti-hypersensitive drugs in overweight hypersensitives

*Seafood is one of Australia's top four food export earners, with annual sales of \$1.4 billion.*

### Overseas supply and demand

In 2003–04, the industry's export sales totalled \$1.65 billion, placing it fourth among food-based primary industries — after beef, wheat and dairy products. The Australian seafood industry, although diversified, depends strongly on exports to the Asian market.

In 2003–04, sales to Asia accounted for about 85 per cent of the total value of Australian seafood exports, as shown in figure 12. Other significant Asian markets for Australian seafood not shown in the diagram are Malaysia and Thailand; and outside Asia are Spain, Greece, New Zealand and France.

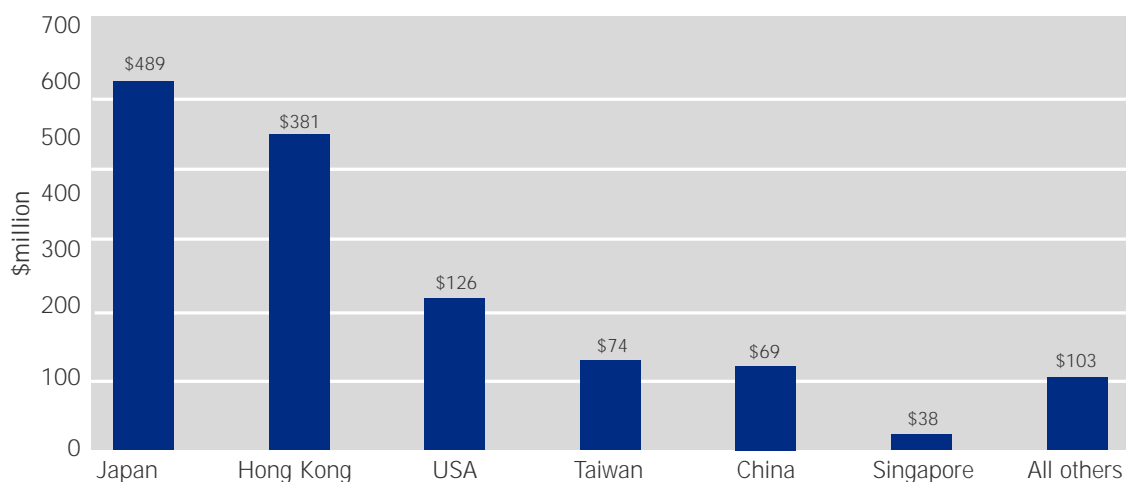
In a 2001 survey, Asian buyers rated Australia as a supplier of premium quality wild-caught and aquaculture products. The survey showed that Australia is able to out-compete many trade competitors on quality and food safety. The Asian buyers stated that “proximity and relationships are the best part of doing business with Australia.”<sup>7</sup>

Because Australia's non-export seafood production supplies only about 60 per cent of the domestic seafood needed, Australia is a large importer of seafood — especially from New Zealand, South Africa and South-east Asia. Imports are a significant competitive factor for pricing and quality against Australian products.

Changing overseas demand affects Australia's exports, as do international exchange rates, international agreements and trade negotiations. Some of the major impacts on the commercial sector of the fishing industry come from international agreements and trade negotiations.

Fishery products are one of the most internationally traded of all foodstuffs, with about 35–40 per cent

Figure 12: The top six countries to which Australia exported seafood, 2003–04 — This figure excludes live product



<sup>7</sup> Agri Chain Solutions Ltd., Canberra 2005. Asian Foodbuyers' Survey, prepared for the Food and Fibre Chains Programme within the Prime Minister's Supermarket to Asia Strategy in conjunction with Australian Business Ltd.





Sophisticated supply chain management ensures high quality product is delivered to consumers around the world.



Discerning Australia and overseas consumers will continue to seek high quality seafood.



of fisheries production traded annually. To optimise access for Australian commodities into overseas markets, and to ensure its trade interests are protected, Australia engages in international forums such as the World Trade Organization, Asia-Pacific Economic Cooperation, and the Organisation for Economic Co-operation and Development. World Trade Organization agreements have been ratified by a large majority of the world's trading nations. Essentially they are contracts that guarantee member countries important trade rights, and bind them to keep their trade policies within agreed limits.

Governments and private companies also engage with other countries through bilateral arrangements. For example, substantial lobbying of the European Union by the Australian Prawn Promotion Association, Western Australian Fishing Industry Council and the Australian Government resulted in EU import tariffs for prawns and rock lobsters being reduced, albeit only temporarily.

Tariff barriers are an impediment to efficient trading in seafood that affects Australian exporters. However, the majority of Australian seafood exports are subject to non-tariff barriers, such as import quotas, food safety regulations, quarantine regulations, subsidies to domestic producers, and even delays by the importing country in clearing and forwarding imported goods. Meeting increasingly strict food safety and quarantine import requirements from countries also adds to the cost of exporting. On the other hand, recent free-trade agreements with Thailand and the US and further agreements proposed offer excellent opportunities for Australian seafood.

Other forms of non-tariff barriers are requirements by importing countries for traceability and certification and labelling to identify genetically modified organisms in human foods and in feed for animals destined for human consumption. Some countries also require certification of particular fishing practices (for example, the US in relation to the use of turtle exclusion devices) before access can be gained to their markets.

Given the difficulty in quantifying non-tariff barriers, it is difficult to estimate the extent to which Australian exports are impeded.

## Value-adding and promotion of seafood

More than ever, commercial enterprises are recognising that higher long-term incomes will be derived not from increasing wild-catch production tonnages but from increasing the value of sustainable catches and aquaculture.

The form of value-adding for Australian seafood varies according to consumers' preferences and the species in question. At one end of the market is live fish. This product (exemplified by rock lobster, abalone, kuruma prawns and tropical species) is generally exported to exclusive markets in Asia. Domestically, oysters almost exclusively comprise the live product market. A much smaller domestic market exists, exemplified by rock lobster and barramundi that are mainly sold to restaurants where they are kept in display tanks until selected for cooking. Codes of practice govern the procedures in this latter supply chain because effective handling, including quick delivery, is critical to survivability after capture, and to taste and appearance.

Very little value-added processing of fish products occurs in Australia for either export or domestic consumption compared with other food commodities. Processing establishments vary in size, scope of operations and sophistication of technologies employed. The majority of establishments undertake only basic processing, such as cleaning, filleting, chilling, freezing and packaging, but some have the capacity for significant product transformation — as in the development of smoked Atlantic salmon products. Edible fish for local consumption are mainly sent fresh-chilled to markets. However, this situation is changing as consumers and food service providers demand “ready-to-eat meal solutions” and portion-controlled fresh fish. The industry's capacity to meet this demand is expanding accordingly.

Seafood Services Australia Ltd — the company set up by the FRDC and the Australian Seafood Industry Council to develop the seafood industry — encourages value-adding by helping innovative businesses to target niche markets with premium products and brands.

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 More information about Seafood Services Australia is on page 84

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Australia's reputation for quality seafood provides a competitive edge in the world market.

Like other primary industries, the seafood industry remains largely production-driven, and is a price-taker, not a price-maker. It differs from the other industries, however, by not having an industry-wide marketing capability. Marketing of high-value, premium seafood products is currently undertaken on an enterprise and species basis — for example, western rock lobster, southern bluefin tuna, Atlantic salmon and wild-caught prawns. The lack of a well-funded, dedicated national product promotion capability significantly reduces opportunities for value-adding through market development and for improving the sector's national profile.

The commercial sector is acting to change this situation, as shown by the Australian Seafood Industry Council forming a seafood promotion committee; development of a marketing, promotion and branding strategy by the Aquaculture Industry Action Agenda funded by the Australian Government and industry; and establishment of a Seafood Enterprise Alliance by the National Food Industry Strategy Ltd. Recently, the industry has adopted an integrated, whole-of-seafood approach to these developments.

Business-to-business e-commerce trading for the seafood industry was first introduced several years ago and is expanding: for example, the Internet-based system of Sydney Fish Market Pty Ltd, SFMlive, accounted for 10 per cent of the Market's sales in 2003–04. Expansion of the system will

depend on the confidence of buyers. With FRDC funding assistance, action is under way to develop a nationally recognised, well-understood, practical and uniform system of accurately describing the size grade, quality and name of the products on sale, along the lines of the Quality Index Method (QIM) now widely adopted by European seafood industries.

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🐟 FRDC project: 2003/237: Sydney Fish Market Pty Ltd: Development of a quality index for Australian seafoods

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Lack of consistency in fish names is one of the major impediments to consumers' confidence when buying seafood. The Fish Names Committee has issued, and is continuing to develop, a national Fish Names List to standardise seafood names across Australia. The Australian Government has set up a telephone hotline for people to report inaccurate labelling of seafood by retailers. The lack of appropriate legislation, regulations and sanctions for fish names is being addressed through the development of food standard codes.

## Socio-economic factors relating to the commercial sector

### Employment

It is important to have accurate, timely information on employment in the fishing industry, not least because of the industry's significant contribution



Coastal communities are dependent on the fishing industry for their social and economic well being.

*Significant obstacles stand in the way of unambiguously attributing employment to the fishing industry.*

to communities in rural and regional Australia. Unfortunately, such information continues to be elusive, other than for the aquaculture sector. Data collected by the Australian Bureau of Statistics (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, during 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. The FRDC will continue to work with the ABS, in concert with the Australian Seafood Industry

Council, to determine the best options for improving the accuracy and availability of employment information for all sectors. Significant obstacles nevertheless stand in the way of unambiguously attributing employment to the fishing industry.

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, and that during the four years before 2000–01 employment in aquaculture grew by 260 per cent, making it the sixth-fastest-growing occupation in Australia and the fastest-growing sector among primary industries.

It has previously been estimated that employment in the commercial sector beyond production and processing — in the transportation, storage, wholesaling and retailing sectors — may well be as high as 80,000. However, all such estimates are based on assumptions that are not (and cannot be) rigorous; the FRDC considers that 80,000 is somewhat high, and has adopted a conservative estimate of 20,000–30,000.

Until accurate information is available, the FRDC’s broad — but highly conjectural — estimate of direct and indirect commercial sector employment is between 100,000 and 120,000.<sup>8</sup> This estimate

<sup>8</sup> The break-down of this conjectural estimate of direct-plus-indirect employment by sectors is: wild-catch 60,000; aquaculture 20,000; post-harvest 20,000–30,000.

includes wild-catch, aquaculture and all post-harvest processes, including putative seafood components of transport, wholesaling, retailing and restaurants.

Significant obstacles stand in the way of unambiguously attributing employment to the fishing industry.

### Occupational health and safety

Commercial wild-catch fishing is a very hazardous occupation because the sea is an inherently dangerous environment. The fishing industry mainly uses small boats; ports are often distant from fishing grounds; and workers are on a mobile platform, usually wet and often at night, close to moving machinery. The fatality rate, at 89 deaths per 100,000 workers per year, is 16 times higher than the all-industry rate of 5.5 deaths. Among the barriers to higher adoption of safety practices is the isolation of many commercial fishers in their work, leading to fewer opportunities to impart a safety awareness culture. The commercial sector is increasingly becoming aware of its duty-of-care responsibilities in this regard, and is addressing the issue by investing in improvements in workplace safety and associated training.

### Social fabric

Australians are increasingly realising the economic and social benefits of the fishing industry, especially to rural communities. It is evident that commercial wild-catch fishing is a major social resource in many small coastal communities. Such activity often involves several generations of family members; it fosters a unique blend of self-reliance and teamwork; it provides a core for related activities; and it engenders strong levels of “ownership” of the industry by the local community. Commercial wild-catch fishing and aquaculture activities carry high cultural values that add to the richness and robustness of their community.

People in the fishing industry who support wild-catch and aquaculture activities — such as transporters, wholesalers, retailers (including

restaurant operators), and suppliers of commercial and recreational gear — also add to Australia's social fabric.

The current state of knowledge of the social importance of fisheries to the Australian community is nevertheless inadequate, given the management challenges of the next decades. Increasing this knowledge will be important to fisheries management, which needs to encompass the social impacts of implementing management strategies, particularly those that reduce fishing effort for reasons of sustainability.

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 FRDC project: 2002/242: Bureau of Rural Sciences: Community perceptions of fishing: Implications for industry image, marketing and sustainability

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*“Fisheries science needs to include not just the biological resource, the fleet and market economics — but the whole system of fisheries politics and management.”*

*— Dr Meryl Williams, formerly  
Director-General of the  
WorldFish Center*

More effective consultation within fisheries management advisory committees, at workshops and at venues such as the FRDC-initiated *Seafood Directions* and *Australasian Aquaculture* conferences is bringing diverse points of view into a common forum and working towards consensus on effective fisheries management. This is very important, because the efforts of the seafood industry, governments and other stakeholders to reduce environmental damage, increase profitability and enhance employment and other social factors are underpinning the industry's sustainable growth. It will be a continuing challenge to ensure that these efforts keep the respective stakeholders' interests in balance.





Fish are not the only reason people go fishing.


## The recreational sector

There is a good deal of commonality in the economic, environmental and social factors affecting all three of the main sectors of the fishing industry. Some comments in the discussion of the commercial and indigenous sectors therefore apply to the recreational sector.

Australians enjoy a wide range of recreational fisheries — from northern estuaries for barramundi, to southern waters for snapper and King George whiting, and inland waters for trout and native fish. About 80 per cent of the recreational catch is from salt water — in estuaries, off beaches and in the seas. The remaining 20 per cent is taken from freshwater — in rivers, lakes, dams and ponds.

Recreational fishing is an important activity for about 3.4 million Australians who fish each year. The National Recreational and Indigenous Fishing Survey showed that the rate of participation in fishing varies greatly among these people, as shown in figure 13, and that only 4.3 per cent are members of fishing clubs. The recreational sector of the fishing industry is larger and more widely dispersed than in any other natural resource industry that supports a prominent commercial sector. The marine finfish

most frequently caught are whiting, followed by flathead, Australian herring, Australian salmon, bream, mullet, garfish, tailor and pink snapper.

 FRDC project 1999/158: National Recreational and Indigenous Fishing Survey, completed during 2001-02

*For some species, the size of the recreational catch exceeds the commercial catch.*

The National Recreational and Indigenous Fishing Survey showed significant economic benefits from recreational fishing. Recreational fishers were estimated to spend \$1.8 billion per year on fishing-related items. Survey participants reported more than 45 different expenditure categories, of which boats and trailers (\$940 million) was the highest, followed by travel associated with fishing (\$395 million) and fishing gear (\$182 million).

An earlier, smaller, survey had estimated employment from national recreational fishing expenditure was between 27,000 and 54,000 jobs nationally, using expenditure multiplier estimates.

Other studies have shown that significant economic benefits from recreational fishing flow to many regional areas — including jobs in the tourism, tackle, boating and charter industries. Charter boats

Figure 13: Age and gender of Australian recreational fishers

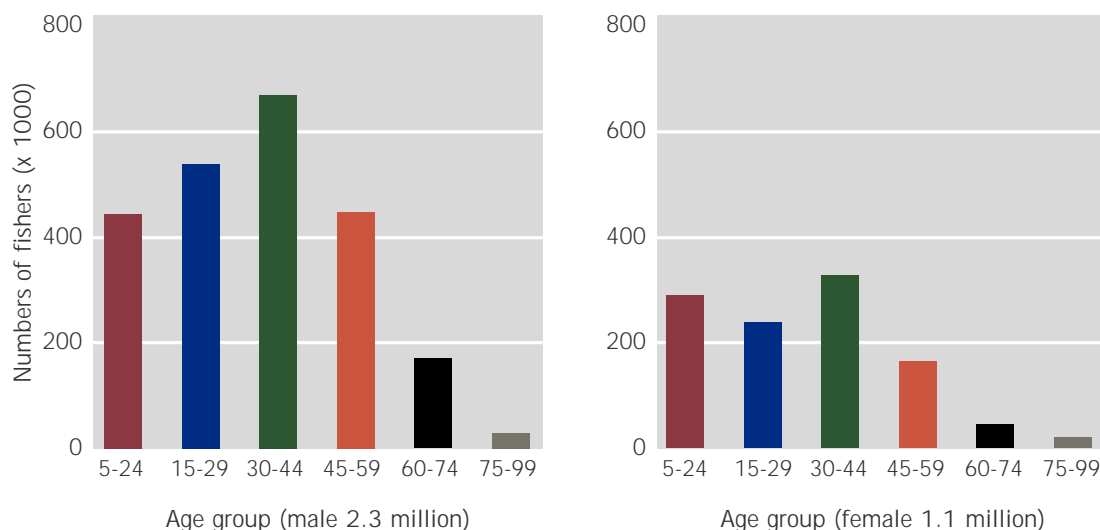


Figure 14: Number of Australian recreational fishers by state

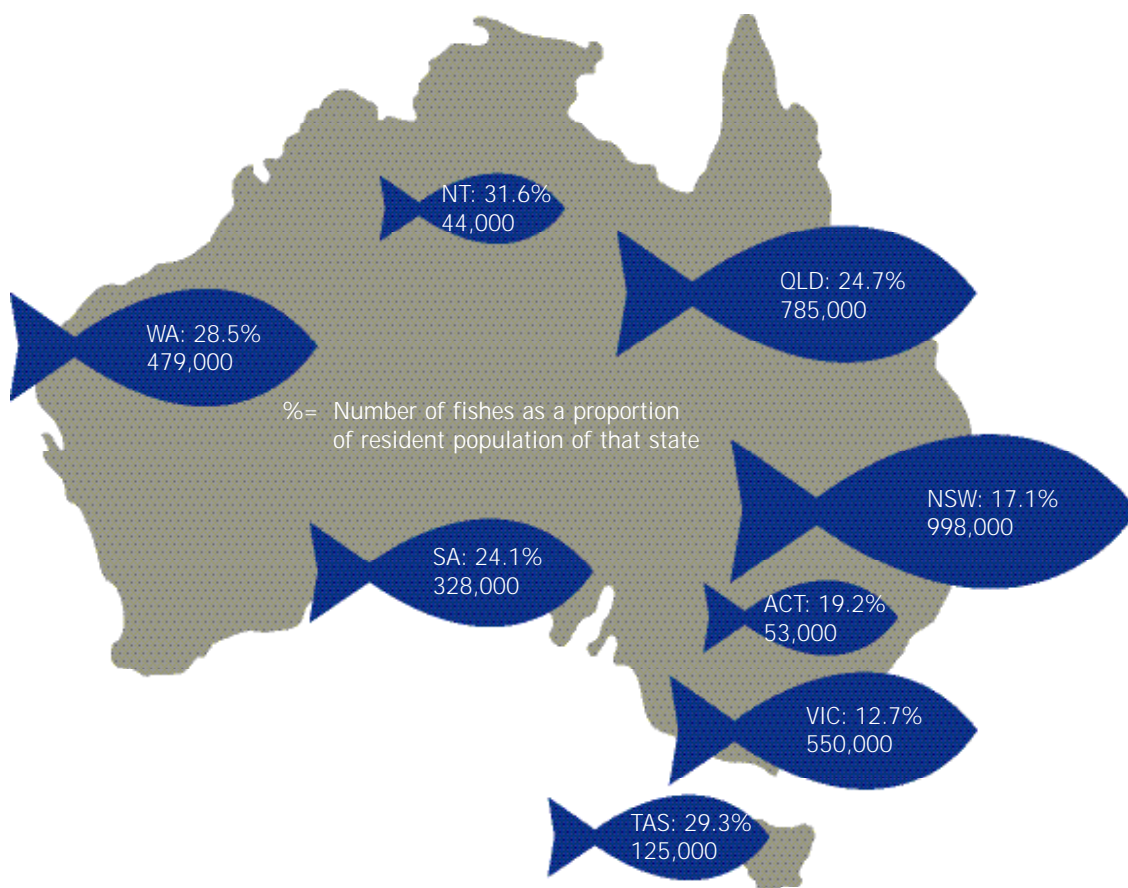
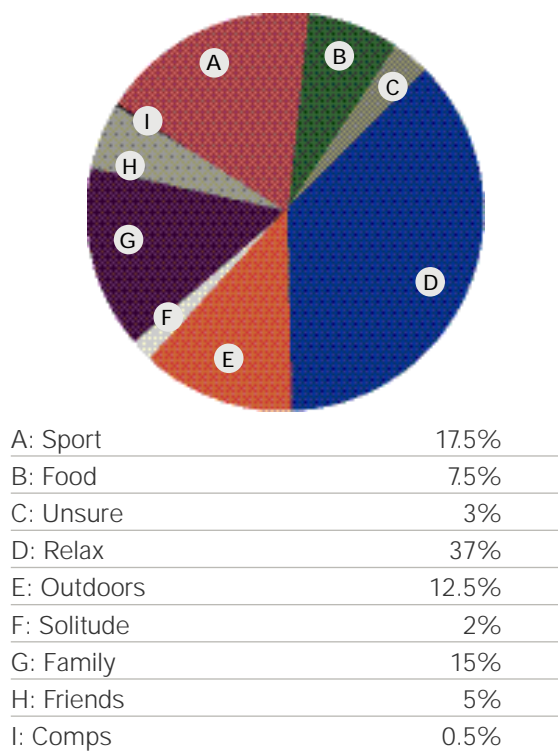


Figure 15: Motivations for recreational fishing







Sponge farming is one opportunity for indigenous aquaculture.

support game fishing, estuarine, coastal and inland fishing and spear-fishing, and there is a diverse boat-hire and service industry. These industries in turn support others. For example, in 1996, of the 3.8 million tourists from overseas, some 12 per cent (450,000) participated in diving activities, 3 per cent (115,000) participated in fishing activities<sup>9</sup> (in 2001, the National Recreational and Indigenous Fishing Survey reported about 4 per cent), and 2 per cent (75,000) in whale-watching.

For most people, the major reason for recreational fishing is “to relax and unwind”, as shown in figure 15. Very few recreational fishers are motivated primarily by the need to catch fish for food.

In addition to their value as sources of food, fisheries resources are valued by the community in many other ways. For example, they have values deriving from people knowing that the environment and the diversity of species are maintained, and that fisheries resources exist. The aquatic environment is increasingly being used by people — particularly tourists — who do not capture the resource but simply enjoy it. Similarly, many people place a very high value on being able to take their children fishing and knowing that the fish will be there

for future generations. Many jobs supporting recreational fishing exist because of these values.

As with commercial wild-catch fishing, some forms of recreational fishing are known to be hazardous, although comprehensive statistics are not available. Improved personal safety equipment is becoming available, but there are many barriers to higher adoption of safety practices.

Competition for resource access between the recreational and commercial sectors has led elements of the one sector to lobby for greater access than the other sector.

### The indigenous sector

Fishing by Aboriginal and Torres Strait Islander people covers the full spectrum of fishing practices: customary, recreational and commercial.

There is a good deal of commonality in the economic, environmental and social factors affecting the three sectors of the fishing industry. Some comments in the discussion of the commercial and recreational sectors therefore apply to the indigenous sector.

<sup>9</sup> McIlgormm, A. and Pepperell, J. ‘A national review of the recreational fishing sector, a report by Dominion Consulting to Agriculture, Fisheries and Forestry — Australia’: AFFA, Canberra, 2000.



Aboriginal and Torres Strait Islander people have developed a close, interdependent relationship with the land, water and living resources of Australia through customary fishing practices over tens of thousands of years. That relationship includes indigenous rights and responsibilities of particular indigenous groups to particular areas of land, water and resources.

Until the 1980s, fisheries management plans concentrated on commercial fisheries and to lesser extent recreational fisheries, with little regard for indigenous fishing. One consequence was perceived or actual restriction of access to what had been Aboriginal subsistence fisheries for tens of thousands of years.

*Indigenous fishing is increasingly being addressed in fisheries management plans.*

Now, some indigenous rights and responsibilities are recognised in Australian common law, and customary fishing is being addressed in fisheries legislation. In some Australian jurisdictions, Aboriginal and Torres Strait Islander fishers are exempt from fisheries regulations when fishing is conducted according to customary laws and traditions. These exemptions typically apply only to customary fishing.

Since the 1992 decision by the High Court of Australia in the Mabo case, which recognised the existence of native title in Australia, there has been increasing

impetus for implementation of indigenous access to fisheries. A 1999 High Court decision confirmed that Aboriginal and Torres Strait Islander people may claim a right under native title to hunt living resources according to local indigenous law. This decision has implications for recognition of indigenous people's rights and interests in fisheries management. A 2001 High Court decision confirmed that native title rights to areas of sea and marine resources continue to exist where Aboriginal and Torres Strait Islander people have retained their traditional relationship with their sea country. Marine native title rights, however, must coexist with other existing rights, which will prevail wherever conflicting rights occur.

Following a landmark conference co-funded by the FRDC in 2003 on indigenous fishing rights, meetings convened by the National Native Title Tribunal developed general indigenous fishing principles to apply within the sustainability limits that currently apply to all other stakeholders. The principles distinguished customary fishing from recreational and commercial fishing, and sought to guide the development of future policy in a way that would avoid litigious approaches. This was agreed to be in the interests of Aboriginal and Torres Strait Islander people having lasting recognition of customary fishing practices and deriving increased opportunities for economic participation in fisheries-related enterprises.



Customary fishing is culturally important in indigenous communities.



### Aboriginal and Torres Strait Islander customary and recreational fishing

Aboriginal and Torres Strait Islander families and individuals may follow customary or recreational fishing practices to pursue subsistence hunting, fishing or gathering. The contribution of subsistence activities to indigenous domestic economies varies between regions, and between families within regions. Whatever the economic contribution or methods used, these activities help to continue the indigenous relationship between indigenous people and their environments, and to strengthen their ties of kinship. There is a wide variation in cultural significance of species: some species are totemic to one community but eaten routinely by another.

This continuing dependence on aquatic resources is most clearly seen in remote northern Aboriginal communities and in the Torres Strait, where daily consumption of seafood can exceed 500 grams per person. This is 10 times the average per capita consumption of seafood for Australia as a whole.

### Aboriginal and Torres Strait Islander commercial fishing

In addition to fishing using customary and recreational methods, Aboriginal and Torres Strait Islander people have been involved in Australia's commercial fisheries for more than 100 years. They have provided crew, divers and skippers for the early *bêche de mer*, trochus and pearl fisheries in northern Australia and have worked with the whaling and coastal net fishing fleets in southern Australia. Some now hold commercial fishing licences, especially in northern Australia. Others have developed their own aquaculture enterprises, sometimes as joint ventures with established companies.

In some jurisdictions, certain commercial fisheries (notably trochus) are reserved for indigenous fishers. In others, special licensing provisions encourage greater indigenous participation in commercial fishing.

Above: Indigenous people share a close relationship with their environment.



## THE STRATEGIC CHALLENGES FOR THE NEXT 20 YEARS

This chapter is based on an analysis of the likely changes in the FRDC's business environment during the next 20 years. Five strategic challenges relating to the fishing industry and the natural resources on which it depends have been derived from the analysis.



STRATEGIC CHALLENGES



# THE STRATEGIC CHALLENGES FOR THE NEXT 20 YEARS

## THE FUTURE IS NOW ...

Consumer preferences and modern technology will increasingly turn food supply chains into demand chains.

Rising concerns about food safety and a healthy diet are leading consumers to demand more information about food products. Some consumers are also concerned about other factors, such as the environment and animal ethics.

*Responses to precision in buying will lead to supply chains being transformed into demand chains.*

Technology can now satisfy this need for information instantly.

In Japan, a system is being tested in the fruit and vegetable section of a large supermarket chain that allows buyers to purchase produce knowing who grew it, where it was grown, when it was harvested, and what insecticides and fertilisers were used. Soon, fish will be bar-coded before being sent to market. Using their mobile telephones, customers will be able to scan the code and read the name of the fisher, the enterprise to which the boat belongs, the time and place of the catch, and details of subsequent handling.

At the checkout, the same bar-code will trigger the supermarket's ordering system, placing an instant, demand-driven order for specific new product.

Similar initiatives are being trialled in other countries, including Australia, using radio frequencies.

The implications of such precision in buying are huge. Among them is the potential to focus on demand rather than supply in whole-of-chain management systems.

Responses to precision in buying will lead to supply chains being transformed into demand chains.

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## Why we must take a 20-year view

A century ago, the combined impact of humans on the global environment was small compared to the natural resource base. This is no longer the case. Globally, economic decision-making is not equipped to deal with the relentless long-term impacts of population growth on water, land, air, biological diversity and other natural resources and processes.

Given the increasing speed with which the human population is closing the gap between under-utilisation and over-exploitation of the resource

base, the timeframe for decision-making and action must be shortened. Short-term plans are likely to produce mediocre results in relation to long-term needs. Strategic planning must be based on time periods that are as long as is possible to predict, albeit with declining certainty.

Timeframes for decision-making and action must be shortened — but must also be based on planning that take the very long-term view.

The following discussion looks at the main factors of importance in a 20-year timeframe. It focuses on matters that will be central to



achieving economic, environmental and social sustainability while meeting and increasing seafood demand. These issues are for the most part relevant to all three sectors of the fishing industry, albeit to varying degrees and in some matters indirectly. Most of the issues faced are either urgent now, or are emerging, and in the long term will become equally or more significant than present issues.

### The background to future sustainability

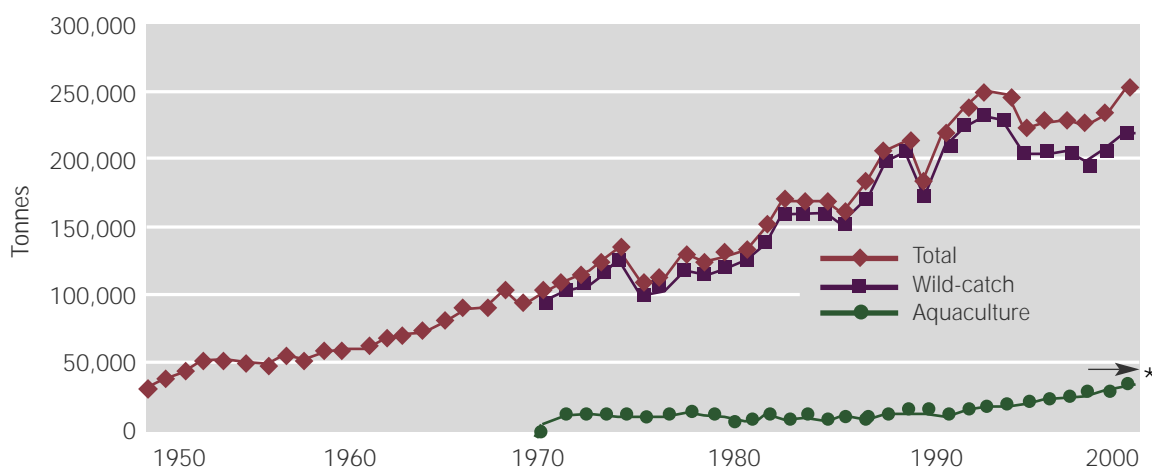
Current total world production of fisheries product is reported at almost 130 million tonnes. A little more than 90 million tonnes of this total comes from wild-catch fisheries and more than 30 million from aquaculture. In its 2002 report, *The state of world fisheries and aquaculture*, the Food and Agriculture Organization of the United Nations identified four trends in production and consumption up to 2030, as follows:

- World production, total consumption, food demand and per capita food consumption will increase over the next three decades; however, the rate of these increases will slow over time.
- World wild-catch production is projected to stagnate, while world aquaculture production is projected to increase, albeit at a slower rate than in the past.
- In developed countries, consumption patterns will reflect demand for — and depend on imports of — high-cost, high-value species.
- In developing countries, trade flows will reflect the exportation of high-cost, high-value species and the importation of low-cost, low-value species.

[www.fao.org/documents/show\\_cdr.asp?url\\_file=/docrep/005/y7300e/y7300e00.htm](http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/005/y7300e/y7300e00.htm)

Australia's total commercial production (figure 16) has closely followed world trends, with a levelling of wild-catch fisheries production since the early 1990s. Aquaculture production has continued to grow to about 30 per cent of total commercial production in 2004.<sup>10</sup>

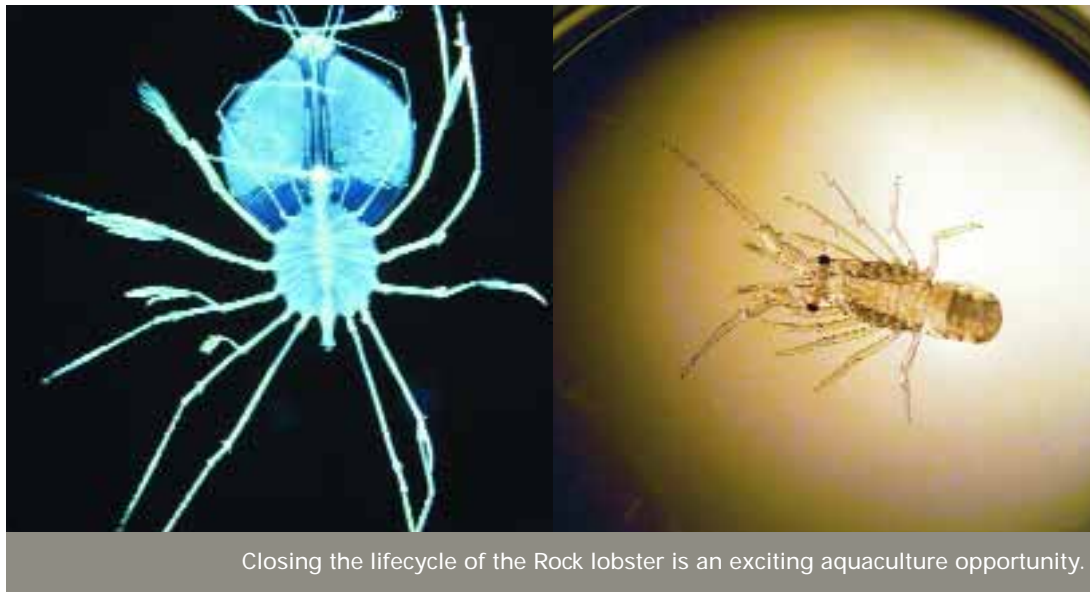
Figure 16: Wild-catch and aquaculture production, 1950-2004



"\*" Shows nominal gross additional catch by recreational fishers. No historical data is available, but the current estimate is about 30,000 tonnes per year. From this figure it is necessary to deduct surviving fish that have been caught and released. The average national release rate has been surveyed at 44 per cent of numbers of fish caught. However, it is extremely difficult to translate "numbers caught" to "tonnage caught" because of large variations in factors such as size, location, gear used, time of year etc. Moreover, only limited data is available on the survival of fish once released into the wild, and it is known to vary greatly (indicatively between 40 and 95 per cent, depending on species, with an average survival rate in the range 75–85 per cent having been suggested). Catch data for indigenous fishing is not available.

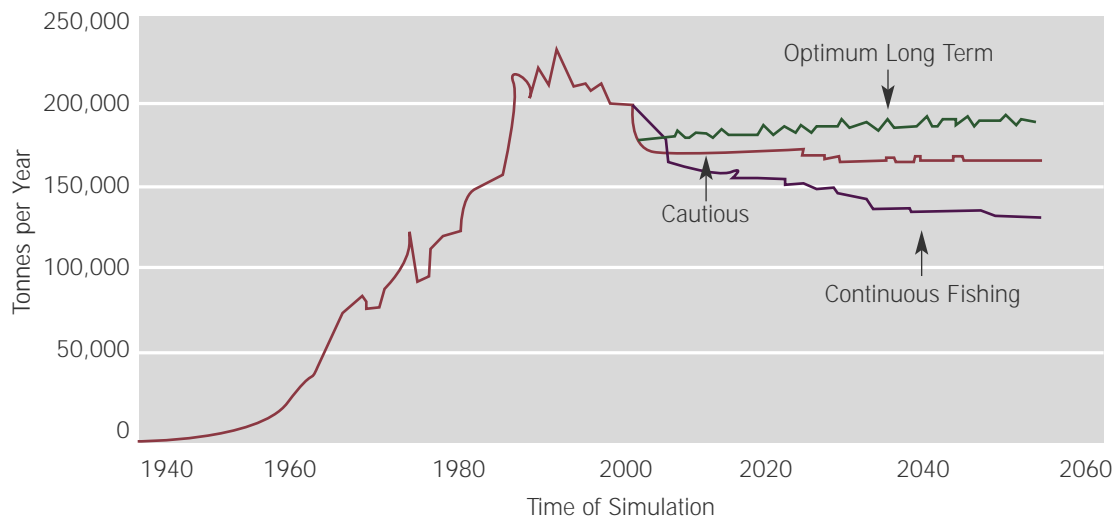
FRDC project 1999/158, national Recreational and Indigenous Fishing Survey, p.86

<sup>10</sup> For technical reasons this figure and related information on pages 64 and 65 exclude the recent increase in pilchard catch in South Australia.



🐟 FRDC project 1999/160. “Fish Futures 2020 project” is the short title for FRDC project 1999/160, ‘Assessing Australia’s future resource requirements to the year 2020 and beyond: strategic options for fisheries’, conducted by the University of Canberra (Bob Kearney, Barney Foran, Franz Poldy and Don Lowe). A summary published in 2003, Modelling Australia’s fisheries to 2050: policy and management implications, is available from [www.frdc.com.au/bookshop/index.htm](http://www.frdc.com.au/bookshop/index.htm)

Figure 17: Total catch from commercial wild-catch fishing: historical and future



Against this background of stable wild-catch fisheries production and modest aquaculture production, great increases in demand have taken place. These increases were driven by growth in population and wealth and, more recently, by increased awareness of the health benefits of seafood and by improved product quality resulting from better handling and processing techniques.

### Supply factors

The Fish Futures 2020 project posed three fisheries management scenarios — “cautious”, “optimum long-term” and “continuous fishing”. Fisheries production was predicted to decline in all three scenarios from levels experienced over the previous two decades (about 271,000 tonnes per year from





Consumer preferences will dictate the market for seafood in the future.

1980–2000) to about 170,000 tonnes per year, then stabilise at that level, as shown in figure 17.

Aquaculture, inversely, has considerable potential. The Fish Futures 2020 project incorporated a simple projection of aquaculture production to double by 2020 and to double again by 2050, which is consistent with recent trends in aquaculture growth.

Notwithstanding the assumptions behind this model, the underlying truth — that Australian wild-catch has peaked, and will either plateau or decline during the next 20 years — has significant bearing on how industry and managers adapt to ensure the industry is sustainable and profitable. The trends predicted for Australia may or may not be mirrored by their competitors overseas. Differing levels of acceptable impacts, harvesting strategies and aquaculture practices mean that supply conditions overseas will have different environmental, economic and social drivers.

### Demand factors

In 1999, the world's population reached 6 billion: four times the population of a century before. By 2020, world population is expected to be more than 7 billion. This larger population will increase demand for seafood and put more pressure on natural resources. However, most of the increase in demand will be in developing countries — and for low-value seafood that can be supplied in bulk. Australia is generally poorly equipped to meet this demand.

In countries where Australia's fish is sold, some populations will be steady or will decline. Growth in demand in these countries is likely to be closely linked to rising disposable incomes than population, particularly for high-value seafood species and fisheries products. The growing affluent middle classes in South-east Asian countries — who are presently few in relation to their national populations but many in relation to Australia's population — will provide a significant opportunity for Australian seafood supply. In turn, these consumers will compete for access to higher-quality seafood, inducing a level of competition that will result in increased demand for Australian seafood. Supply to affluent consumers will therefore continue to be limited, giving rise to higher prices.

In Australia, the main driver of demand for seafood will probably result from increasing affluence (with more people eating out) and from social factors (such as increased awareness of the health benefits of seafood).

By 2050, Australia could be home to 20, 25 or 32 million people — depending mainly on rates of immigration, but also on birth and death rates. The Fish Futures 2020 project assumed a population of 25 million and predicted a possible increase in seafood consumption to 23 kg by 2050<sup>11</sup>.

11 25 million was considered to be the most likely population in a recent comparison of population options conducted by CSIRO Resource Futures for the Australian Government (Foran and Poldy 2002).

**table 2: Predicted shortfall in meeting domestic demand for seafood, 2020 and 2050**  
*—Figures are in tonnes of live weight of commercially caught fish.*

Year →	2000	2020		2050		
Consumption → per person	At 11.33 kg per person	At 14.7 kg per person	At 17.25 kg per person	At 14.7 kg per person	At 17.25 kg per person	At 23 kg per person
1. Domestic demand (note 1)	442,000	661,500	776,000	735,000	862,500	1,150,000
2. Wild-catch production ("cautious" scenario) (note 2)	198,000	170,000		165,000		
3. Aquaculture production	34,000	66,000		130,000		
4. Seafood exports (note 3)	70,000	70,000		70,000		
5. Required seafood imports (= shortfall) (note 4)	280,000	495,000	610,000	510,000	637,500	925,000

Notes:

1. Assumes 50 per cent recovery of edible seafood from live weight.
2. Amounts in the table do not include recreational and indigenous catch, which for simplicity is presumed to be constant.
3. Seafood exports need to be included in the table but the Fish Futures 2020 project and the FRDC do not have any basis for predicting what future amounts might be. Present-day values have therefore been continued, indicatively.
4. As with exports, the Fish Futures 2020 project was unable to predict imports. The amounts in this row are calculated in each column by adding the amounts in rows 2, 3 and 4 and subtracting their sum from the amounts in row 1. The nature of imports — for example, canned and highly processed product — make it difficult to translate the figures for shortfall in live weight (row 5) into weight of imported product. However, a 50 per cent recovery of seafood is assumed.

Using this population projection, the “cautious” fisheries management scenario and three seafood consumption scenarios<sup>12</sup>, the FRDC has estimated a likely supply–demand scenario as shown in table 2.

It is particularly difficult to predict future imports of seafood. Much will depend on the ability of international wild-catch and aquaculture production to reach and maintain a sustainable level to address the deficit in supply and Australian consumers’ capacity to pay for seafood.

The commercial sector will continue to concentrate on meeting the demands of the premium-quality end of world markets. As a result, Australians may eat higher proportions of imported seafood (non-premium, low-value) than at present. Global factors will affect the demand — hence the price — for Australian seafood exports and imports.

Less quantifiable is the demand originating from non-commercial fishing, because data is still poor. If Australia were to implement the predicted 20–30 per cent level of marine and freshwater parks that conservationists are seeking, then a significant drop in wild-catch production would result, given that it would be necessary to ensure that fishing effort were sustainable in areas outside those parks. Such a development would also affect the areas available for aquaculture production.

The FRDC expects that in 2020, despite Australia’s higher population, the number of recreational fishers will not exceed the present figure of 3.4 million. Currently participation rates are declining slightly, largely as a consequence of Australians — including retired people — increasingly being “time-poor”. It is reasonable to assume that

<sup>12</sup> Based on the Fish Futures 2020 project and FRDC-funded seafood consumption studies (FRDC projects 1998/345 and 1999/342, Ruella and Associates).

recreational fishing will continue to place considerable demand on fish stocks, especially since there are indications that catch rates by more involved recreational fishers are increasing.<sup>13</sup>

Similarly, demand from fishing by Aboriginal and Torres Strait Islander people is expected to continue, although at present the extent of that demand is not well understood.

*In essence, in future humans will require more fish to satisfy both the demand for seafood to eat and the needs of recreational and indigenous fishers. Investment in R&D will need to lead to increased, and more sustainable, production — as reflected in the title of this plan, 'Investing for Tomorrow's Fish'.*

### The five strategic challenges

The FRDC and its stakeholders have analysed the foregoing demand and supply factors in the fishing industry business environment (described on pages 21–52) and their likely effects during the next 20 years. This analysis has resulted in the following five strategic challenges being identified:

#### 1. Natural resources sustainability

Maintain and improve the management and use of aquatic natural resources to ensure their sustainability.

#### 2. Resource access and resource allocation

Optimise resource access, resource allocation and opportunities for each sector of the fishing industry, within a rights-based framework.

#### 3. Response to demand; profitability

Respond to, and take advantage of, increased demand for seafood and for recreational and customary fishing experiences.

#### 4. People development

Develop people who will help the fishing industry to meet its future needs.

#### 5. Community and consumer support

Increase community and consumer support for the benefits of the three main sectors of the fishing industry.

The dimensions of the challenges vary, as indicated by the number and scope of the factors of significance nominated in the following discussion.

### Converting the challenges to action: future directions for the FRDC

Demand for FRDC investment in R&D is growing strongly because of increasing acknowledgement by stakeholders of the five strategic challenges.

Translating these demands into R&D investments is challenging because fisheries and aquaculture managers and industry often have different views on R&D priorities, and because existing research capacities need to be complemented with a growing need for expertise in economic, social and other scientific disciplines to ensure a more multi-disciplinary approach.

Demand for investment in fisheries R&D is growing strongly.

Competing pressures for public sector funds limit investment in R&D by federal, state and territory governments. It is likely that governments will do no more than maintain current levels of investment in R&D, resulting in increasing demands being placed on the FRDC. Consequently, the FRDC needs to expand its revenue base to maximise investment in fisheries R&D by:

- providing increased incentives for industry sectors to contribute to the FRDC above the limit to which the Australian Government will provide matching contributions;
- providing a mix of arrangements to facilitate contribution, such as levies (compulsory and voluntary) underpinned by legislation or memoranda of understanding;
- fostering better partnerships with research providers to ensure improved utilisation of available funding resources and to meet beneficiary needs;
- expanding the definition of gross value of production to recognise the economic value of

<sup>13</sup> FRDC project 1999/158, 'National Recreational and Indigenous Fishing Survey'.

the natural resources used by the recreational and indigenous sectors;

- providing increased incentives for other users of fisheries resources to contribute to the FRDC; and
- assuming a more commercial approach to the sale of knowledge, processes and technology.

Faced with limits to government funding, the FRDC is vigorously pursuing new sources of cost-effective R&D investment.

Further, the FRDC needs to continue to develop flexible approaches to ensure that the most cost-effective investments are made on behalf of stakeholders. Therefore, although the competitive annual R&D cycle will remain the primary avenue for FRDC investment for the foreseeable future, the Corporation will need to employ other avenues, including by:

- commissioning research providers to undertake specific R&D;
- requesting tenders for specific R&D; and
- supporting the formation of joint venture entities and other collaborative arrangements, including for effective commercialisation.

In making decisions about the FRDC's R&D investment portfolio, it is very important to strike the right balance in satisfying the varying needs of stakeholders, especially the needs of stakeholders who contribute substantially to the Corporation's revenue base. Such a balance would be helped by being able to distinguish clearly between private benefit and public good. In practice, as described in the panel above, in fisheries R&D the distinction is blurred.

## OTHER FACTORS

### **A distinguishing feature of fisheries R&D — public good and private benefit are inextricably linked**

In fisheries research relating to the commercial wild-catch sector, public good and private benefit are inextricably linked, from catching to marketing. In the recreational and indigenous sectors, any private benefit is likely to be derived only indirectly — mainly by enterprises that support the sectors' activities.

The large public good component in most fisheries R&D flows from the fact that the Australian Government's stewardship role in relation to fisheries resources is exercised on behalf of the Australian community. The commercial sector of the fishing industry targets renewable, though limited, resources; and it shares the resources and its operating environment with other users to a greater degree than other primary industries. The proportion of public good flowing from fisheries research is high,

and the private benefits derived are inseparable from the public good component. Compared with land-based resources, knowledge of fisheries resources is poor, and acquiring such knowledge is slow and expensive. In the interests of the community, these characteristics direct most fisheries R&D towards the public good.

Although the public good component is more obvious in the FRDC's Natural Resources Sustainability program, the Industry Development program also aims to achieve the public-good objective of relieving pressure (directly or indirectly) on wild fisheries resources. At the same time, the Industry Development program helps to meet a growing demand for seafood (for example, through aquaculture) and for lifestyle benefits through recreational fishing. It also satisfies cultural needs through indigenous fishing of Aboriginal and Torres Strait Islander people. Other public good benefits, such as increased employment, also derive from this program.





In addition to achieving this balance, the FRDC needs to ensure that its R&D investment is of direct relevance, within a five-year period, to the fishery, industry sector, or state / territory in which funds were collected.<sup>14</sup> Also as a consequence of its focus on the needs of end-users, a high proportion of activity is tactical R&D — both short-term and long-term — although strategic research is also funded.

### *A key need is to tap into wider sources of funding for fisheries R&D.*

The FRDC not only needs to balance its investments in R&D; it needs to provide sufficient resources to maintain capabilities for effective management of projects. For that reason, the FRDC invests a significant proportion of funds in project development, knowledge transfer and post-project evaluation.

Increased levels of accountability to the Australian Government for achievement of outcomes requires increased effort in identifying and measuring the FRDC's planned outcomes, both as an accountability measure and as a response to the Government's emphasis on R&D to create innovation and, in turn, economic growth.

In seeking to get the most out of innovation, the FRDC places continual emphasis on effective use of

existing knowledge when that is appropriate, as distinct from developing new knowledge.

An important strategic consideration is that Australia's investment in R&D (all R&D, not just fisheries) generates about 2 per cent of the world's R&D knowledge. Making use of knowledge from the other 98 per cent is essential.

Development of systems for managing knowledge is increasing (for example, more outputs of fisheries R&D are being delivered via the Internet very soon after discovery) and the time-lag between discovery, and adoption is decreasing accordingly. The FRDC is continuing to make maximum use of this development.

Management of intellectual property is becoming more challenging. The FRDC accepts that it must be increasingly accountable for its investment of public funds, and at the same time protect the commercial interests of its commercial partners.

Access to comprehensive, sound information and data is a prerequisite for developing policy, law and procedures in support of sustainable fisheries and aquaculture management. Cost-effective technology that can access all sources of information and data will ensure its comprehensiveness. A need also exists for improved storage methods to ensure that

<sup>14</sup> This practice also complies with a ministerial direction issued under section 143(1) of the PIERD Act.

information and data remains available for future use.

Unlike previous FRDC R&D plans, this plan not only identifies the challenges and the broad R&D framework for the FRDC's investment; for the first time it also includes specific priorities that need to be addressed in the next five years. To ensure the FRDC makes a significant difference in these priority areas, it will be important that the Corporation focuses its investment on targeted outputs to ensure that funds are not spread too thinly to provide worthwhile benefit to the industry.

### The FRDC's management response

Given the foregoing, the FRDC seeks to maximise Australia's investment in fisheries R&D by:

- providing leadership in fisheries R&D;
- investing in high-priority R&D that has the potential to deliver the highest benefits;
- making R&D results widely known, and facilitating their adoption and (if appropriate) commercialisation;
- expanding the FRDC revenue base to increase investment in fisheries R&D; and

- developing and maintaining effective, efficient, open and accountable management procedures and systems.

*By assuming a strong national leadership role in fisheries R&D, the FRDC is obtaining better results for its stakeholders' investments.*

These factors constitute the strategies of Program 4 (Management and Accountability), which focus the FRDC's management and accountability activities on continually improving the Corporation's services and corporate governance. This program, as with the three R&D programs, is derived from an object specified in section 3 of the PIERD Act. Its relationship to the other programs is shown in figure 19 (page 85).

Unlike the three R&D programs, Program 4 is not detailed in this plan. Rather, each year in its annual operational plan the Corporation forecasts its revenue and expenditure break-downs and the activities to be undertaken against the foregoing strategies. Subsequently, achievement is reported in the annual report.



Genetic improvements in oysters will result in a consistently better product and a more resilient industry.



## THE FRDC'S R&D PROGRAMS

This chapter describes how the FRDC integrates the five strategic challenges with legislative, government and industry R&D priorities into an R&D framework for the purposes of efficient, effective investment and reporting.



R&D PROGRAMS



# THE FRDC'S R&D PROGRAMS

## PROGRAM 1: NATURAL RESOURCES SUSTAINABILITY

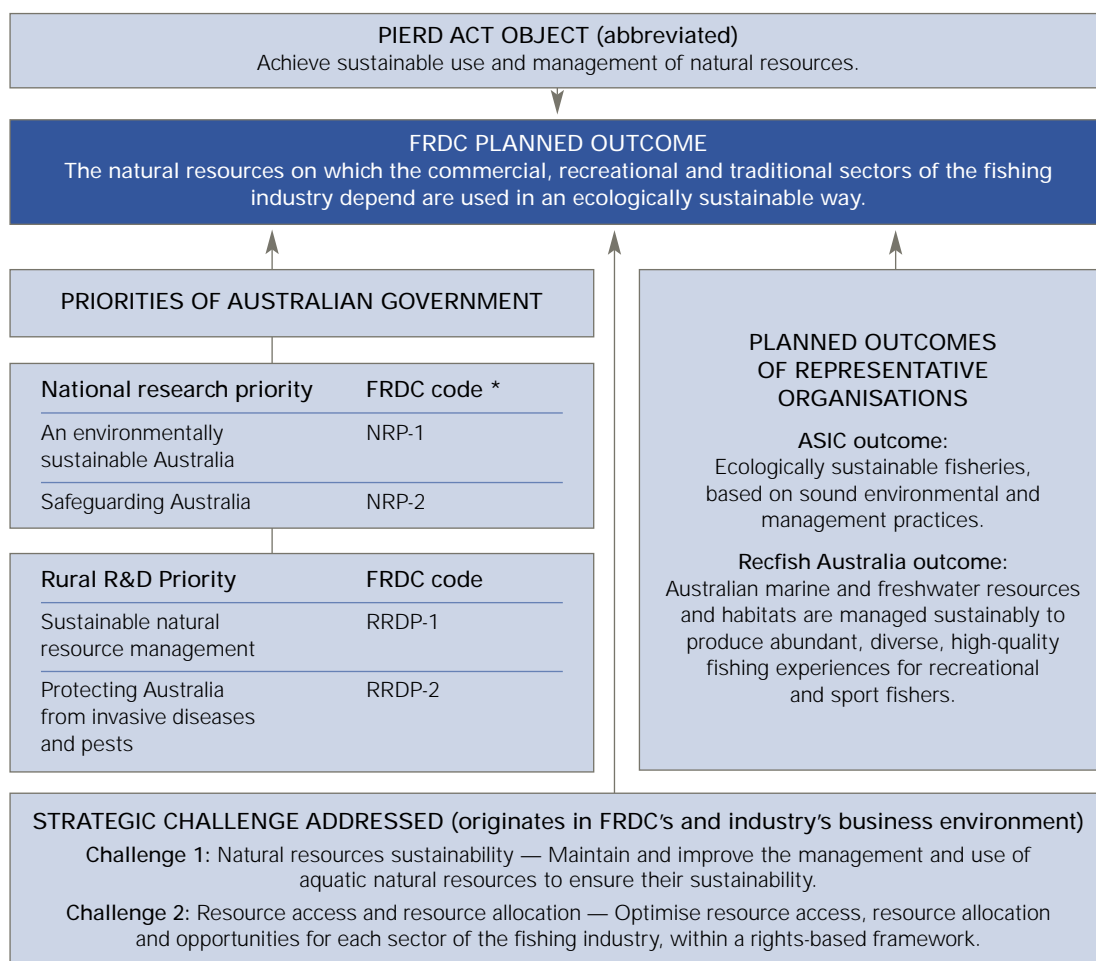
Legislative source: PIERD Act s. 3, Object b: Achieving the sustainable use and sustainable management of natural resources.

Expenditure for this R&D program at the time this plan was published: 60 per cent of total R&D expenditure.

In this program, the FRDC invests in R&D that addresses the first and second of the five strategic challenges in working towards its planned outcome for natural resources sustainability.

The program addresses the following Australian Government priorities:

Figure 18: Strategic elements on which Program 1 is based



\* The Corporation has set up these codes to refer to and report on the various Australian Government priorities, which in their original form are not numbered.



## Strategic challenges addressed by this program

### Challenge 1 — Natural resources sustainability

#### **Maintain and improve the management and use of aquatic natural resources to ensure their sustainability.**

Addressing overfished stocks and overfishing are key management challenges. The community requires the utilisation of fisheries and aquaculture resources to be not only ecologically sustainable, but also economically and socially sustainable. This is a prerequisite for sectors wanting access to aquatic resources. The community's focus has changed from single-issue sustainability measures to taking into account broader environmental interactions and being consistent with other uses of the environment. To change community attitudes about what is an acceptable change will require ongoing adaptation by industry. Evolving environmental legislation is requiring greater assessment and accountability on a broad range of environmental criteria. The health of the aquatic habitats and aquatic animals needs to be protected and maintained. Where environmental damage has occurred, methods need to be developed to restore it.

Management is evolving from regulation and compliance to more inclusive self-management, accredited systems, and incentive instruments that meet the reporting and assessment needs of ecologically sustainable development.

#### **Action by all sectors**

	National research priority	Rural R&D priority
Develop and implement management frameworks that facilitate co-management, market focus, independent accreditation and cost efficiency.	NRP-1	RRDP-1
Measure and mitigate the interactions of fishing and non-fishing activities on the aquatic environment, fish stocks and health.	NRP-2	RRDP-2
Meet the regulatory requirements of natural resource environmental legislation (e.g. EPBC) and improve fisheries environmental management performance.	NRP-1	RRDP-1
Develop spatially explicit management models that are appropriate for fish stocks and integrate them into a broader natural resource framework.	NRP-1	RRDP-1
Develop tools to assist in broader-scale assessments of the impacts of the fishing industry.	NRP-1	RRDP-1
Incorporate a broader ecosystem and habitat role in fisheries management, underpinned by risk management processes that also address natural resources management factors, including global climate change and variability.	NRP-1	RRDP-1
Develop appropriate standards of environmental performance reporting.	NRP-1	RRDP-1
Develop and implement environmental management systems, including assessment of the benefits of different environmental certification processes.	NRP-1	RRDP-1

Develop processes for internationally recognised eco-labelling.	NRP-1	RRDP-1
Develop methods to protect Australia from exotic pathogens and pests.	NRP-2	RRDP-2
Address illegal fishing by innovative, cost-effective compliance technologies and tools.	NRP-1	RRDP-1
Develop methods to minimise animal welfare issues.	NRP-2	RRDP-2
<b>Action by commercial sector</b>		
Develop management frameworks that incorporate economic targets.	NRP-1	RRDP-1
<b>Action by recreational sector</b>		
Develop cost-effective methods for determining recreational catch and effort and incorporate them into alternative methods for managing the sector.	NRP-1	RRDP-1
Improve the environmental performance of catch-and-release practices.	NRP-1	RRDP-1
<b>Action by indigenous sector</b>		
Define, measure and quantify indigenous catch and incorporate catch data into the fisheries management framework.	NRP-1	RRDP-1
Develop autonomous, improved indigenous management that achieves sustainability (includes improved understanding of indigenous catch and realisation of catch).	NRP-1	RRDP-1

## REFERENCE POINT FOR THIS CHALLENGE

In the next two decades, fisheries and aquaculture managers will come under increasing scrutiny from a wider range of stakeholders. Inevitably, they and industry alike will have to work towards proving the sustainability of natural resources on which the industry depends. This will come at a cost that will have to be borne by consumers through governments, which exercise stewardship on behalf the Australian people, and the fishing industry, which derives its income from these natural resources.

Significant drivers of Challenge 1 are as follows:

- More prescriptive domestic legislation that imposes higher environmental standards on wild-catch and aquaculture will undoubtedly ensue, with further development of regional management plans for multiple use bio-regions within the EEZ.
- Stocks considered to be overfished will be recovered by implementing appropriate management measures.
- Fisheries managers and the fishing industry will need to work together to reduce fishing effort to sustainable levels in some wild-catch fisheries. Reduction will be based on environmental, economic and social considerations.



- The wild-catch and aquaculture sectors will be expected to contribute increasingly to costs of management, including research. Cost-effective management regimes that do not unduly reduce profitability will be needed. In the wild-catch sector, this may lead to lower risk and lower levels of harvest.
- In pursuing ecosystem-based fisheries management, fisheries and aquaculture managers will need to concentrate increasingly on whole ecosystems and to make risk-based management decisions in the absence of scientific certainty. This will result in development of new models that will integrate targeted species harvests and other habitat requirements. Nevertheless, single species assessments will still form the basis of fisheries management for the near future.
- Effective strategies will need to achieve a transition in effort levels that will result in sustainable, profitable industries.
- To maximise efficiency, responsibility for fisheries management will need to be shared between government agencies and industry, including through improved decision-making. Options will vary from full government involvement (e.g. in small, data-poor fisheries) to self-management with third-party auditing (e.g. in large, data-rich fisheries).
- Spatial management, including the declaration of marine protected areas, will be used increasingly to protect aquatic ecosystems.
- Environmental certification will be routinely required for major commercial fisheries and aquaculture sites, management agencies and commercial enterprises.
- Policy and strategies will need to address illegal, unregulated and unreported fishing and trading.
- Aquaculture managers and aquaculturists will need to improve husbandry practices to reduce effects on marine and freshwater ecosystems.
- All sectors of the fishing industry will need to respond to pressure that will be applied to reduce effects such as greenhouse gas emissions.
- The fishing industry, particularly sport fishers and catch-and-release fishers, will need to respond to pressure initiated by animal welfare activists.
- Managers and operators of land-based activities will need to understand the impacts of their activities on rivers, coastal floodplains and coastal waters, and will need to develop management options for addressing them — e.g., the effects of water flow.
- Fisheries and aquaculture managers and industry will need to understand the impacts of climate change on production systems and incorporate suitable responses into their management and business strategies.
- Fisheries and aquaculture managers and industry will need to understand the impacts of aquatic pests and pathogens on production systems, and will need to develop preventative measures and emergency response plans.

*“Challenges [for the Australian Government] arise from the emergence of Australia’s Oceans Policy, the EPBC Act and the need ... to take account of the take by recreational and traditional sectors when managing commercial fisheries.”*  
*— A conclusion of Looking to the future: a review of Commonwealth fisheries policy, 2003*

- Ecosystem-based fisheries management will require greater understanding of the impacts of recreational and indigenous fishing, and will need to develop new, cost-effective arrangements for managing them. Indigenous fishers will need to respond to pressure to reduce the catch of protected species.
- Fisheries management will be integrated increasingly into the wider regional and international framework, with environmental instruments remaining as a significant source of change.

## Challenge 2 — Resource access and resource allocation

### **Optimise resource access, resource allocation and opportunities for each sector of the fishing industry, within a rights-based framework.**

The value that the community places on the use of aquatic resource is changing with aquatic and coastal development, increasing wealth and leisure time. Processes that are adaptive to changing values and that facilitate evolution of the sectors are therefore important. A significant part of the management challenge is to develop adjustment mechanisms to address over-capacity in relation to both the available catch and the economic viability of fisheries.

#### **Action by all sectors**

	National research priority	Rural R&D priority
Develop data and methods to examine economic, social and ecological impacts of planning policies regarding resource allocation.	NRP-1	RRDP-1
Develop processes to integrate fisheries management into coastal management.	NRP-1	RRDP-1
Develop processes to inform and define inter-sector resource allocation.	NRP-1	RRDP-1
Develop a better research-based process for defining marine protected areas.	NRP-1	RRDP-1
Determine the types of environmental, social and economic benefits that arise from different closure systems, and their effectiveness in achieving multiple natural resource management objectives.	NRP-1	RRDP-1
Develop methods for adjustment that addresses re-allocation between sectors.	NRP-1	RRDP-1

#### **Action by commercial sector**

Develop decision support tools for aquaculture planning.	NRP-1	RRDP-1
Develop processes to determine optimum economic and environmental access.	NRP-1	RRDP-1
Develop mechanisms and policies to manage changing resource access between different commercial enterprises.	NRP-1	RRDP-1
Develop processes for allocation between commercial enterprises.	NRP-1	RRDP-1

#### **Action by recreational sector**

Develop methods to determine allocation between different recreational activities.	NRP-1	RRDP-1
Develop opportunities for partnerships with resource owners to gain access.	NRP-1	RRDP-1

#### **Action by indigenous sector**

Define the nature of the fishing activity and its resource needs.	NRP-1	RRDP-1
Develop opportunities for the indigenous sector to increase its participation.	NRP-1	RRDP-1

## REFERENCE POINT FOR THIS CHALLENGE

In the next two decades, fisheries and aquaculture managers will come under increasing scrutiny from a wider range of stakeholders. Inevitably, they and industry alike will have to work towards providing the sustainability of natural resources on which the industry depends. This will come at a cost that will have to be borne by consumers through governments, which exercise stewardship on behalf of the Australian people, and the fishing industry, which derives its income from these natural resources.

The demand for natural resources will require more innovative management to ensure sectors achieve equitable access that maximises the benefit to the Australian community. Managers and industry will need to develop mechanisms to adjust allocation based on changing demand, and appropriate environmental, economic and social benefits to Australia.

Significant drivers of Challenge 2 are as follows:

- Allocation of fisheries resources will move away from formulas based on historic catch to ones that seek to maximise economic and social returns to both the community and the industry sector. This will require agreement between industry sectors and governments on how such returns are to be valued.
- In allocating wild-catch fisheries resources, it will be necessary to include the economic and social returns to the community and to show the environmental benefits of prohibiting or limiting access to specific areas. The areas will not be declared solely on the basis of science. The fishing industry will need to take a leadership role in working within structures such as the National Representative System of Marine Protected Areas to ensure that such areas are created in a way that supports sustainable development of the industry.
- The demand for better fishing experiences by the recreational sector, and in particular the tourism component, will require greater emphasis on maintaining and utilising fish stocks. Catch-and-release practices and stocking programs will become very important to this sector's ability to attract participants and deliver good fishing experiences.



Equitable resource allocation – a fisheries management challenge.

## PROGRAM 2: INDUSTRY DEVELOPMENT

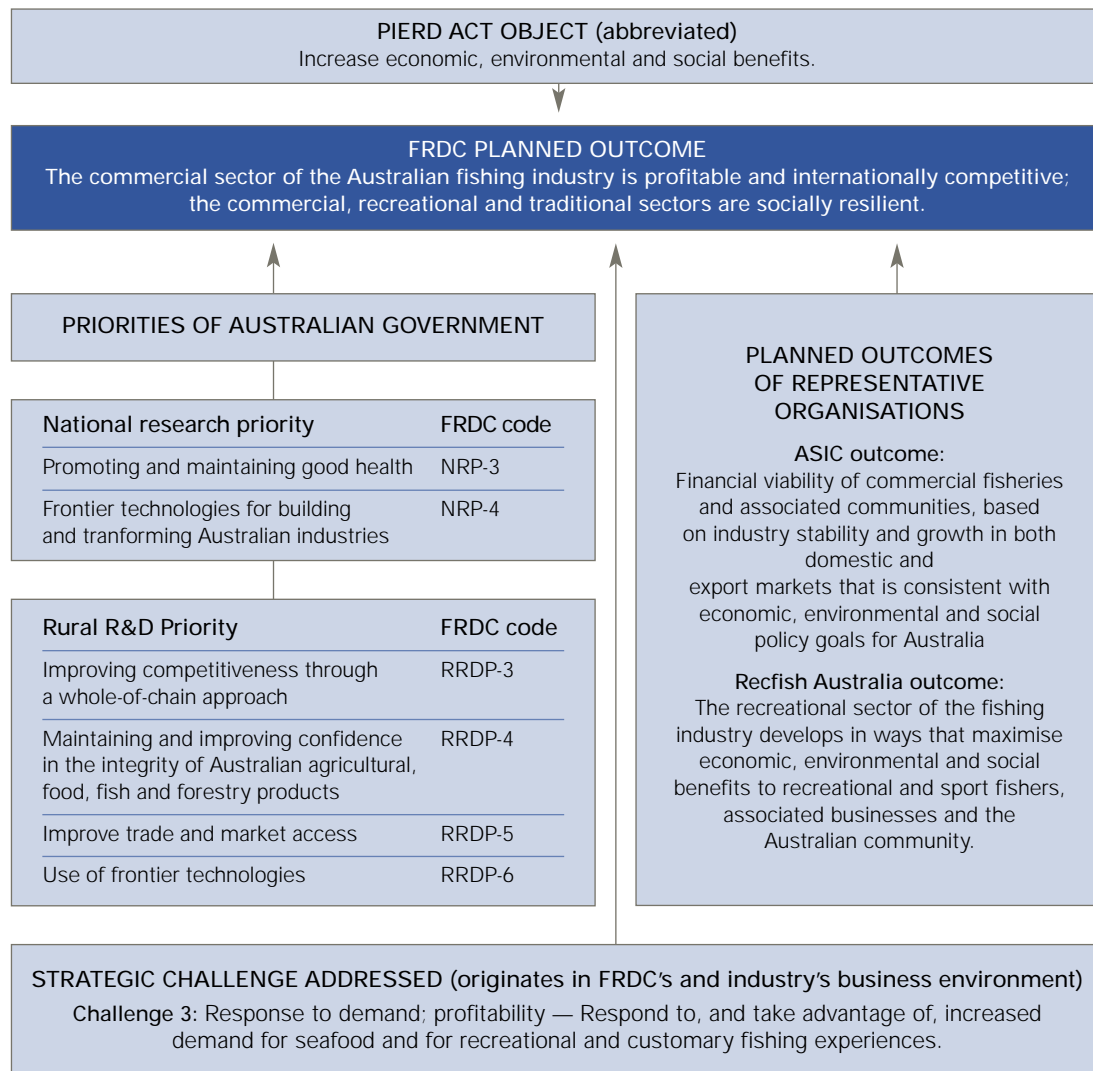
Legislative source: PIERD Acts.3, Object a: Increasing the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries.

Expenditure for this R&D program at the time this plan was published: 35 per cent of total R&D expenditure.

In this program, the FRDC invests in R&D that addresses the third of the five strategic challenges in working towards its planned outcome for industry development.

The program addresses the following Australian Government priorities:

Figure 19: Strategic elements on which Program 2 is based





## Strategic challenge addressed by this program

### Challenge 3 — Response to demand; profitability

**Respond to, and take advantage of, increased demand for seafood and for recreational and customary fishing experiences.**

Demand for high-quality seafood is predicted to outstrip supply in both domestic and export markets; and similarly demand for high-quality fishing experiences will outstrip supply. All three sectors have a challenge to ensure their use of the aquatic resource meets the demands of their customers and stakeholders. There is a need to increase the catch (or in some fisheries the value of the catch), the business profitability and international competitiveness, and to take advantage of future opportunities.

#### Action by all sectors

	National research priority	Rural R&D priority
Increase the profitability of the businesses supporting the three main sectors of the fishing industry.	NRP-3	RRDP-4
Develop capacity to produce more fish for consumption or for fishing experiences.	NRP-3	RRDP-4

#### Action by commercial sector

Increase trade and market access.	NRP-3	RRDP-5
Develop systems to increase market intelligence.	NRP-3	RRDP-5
Ensure that seafood is safe and of high quality.	NRP-3	RRDP-4
Develop a competitive, market-based aquaculture industry.	NRP-3	RRDP-3
Develop innovative processes for value-adding through product development.	NRP-3	RRDP-3
Develop efficient, market-based supply chains that add value to product.	NRP-3	RRDP-4
Take advantage of opportunities to develop fisheries that harvest straddling stocks.	NRP-3	RRDP-3
Encourage innovation in frontier technologies to increase production and develop supply chains.	NRP-3	RRDP-6
Develop technologies and processes to underpin industrial-scale inland saline aquaculture.	NRP-4	RRDP-6

#### Action by recreational sector

Increase the quality and enjoyment of recreational fishing experiences	NRP-3	—
Take advantage of expanding fishing tourism opportunities.	NRP-3	—
Improve fishing practices to increase survival of released fish.	NRP-3	—

**Action by indigenous sector**

Increase the quality and value derived from commercial, recreational and customary fishing by Aboriginal and Torres Strait Islander fishers.

NRP-3

—

**REFERENCE POINT FOR THIS CHALLENGE**

Given the likelihood of stable wild-catch production, and a doubling in seafood demand by 2050 (at the mid-range of predictions on page 58) to meet demand domestic aquaculture production and imports, combined, would need to at least treble.

To avoid a significant deficit in seafood production, Australia will need to work to develop a national approach to aquaculture production systems and species that will contribute significantly to meeting the foregoing production targets. In addition, it will be necessary to ensure the maximum utilisation of wild-catch fish and by-products, and of waste derived from fishing and aquaculture.

Profitability and competitiveness of the commercial sector will not be achieved solely through the marketing and production of safe, high-quality seafood. The low production costs of overseas competitors will enable imported seafood to be sold on the Australian market at lower prices than for seafood produced in Australia — particularly aquaculture products. The industry cannot simply rely on the consumer to favour Australian product.

Significant drivers of Challenge 3 are as follows:

- The post-harvest sector will need to ensure that its activities add value and not just cost. Supply chain efficiency will need to improve and, for example, eliminate unnecessary handling and improve traceability. Technologies such as electronic trading will encourage improvement.
- In improving supply chain efficiencies to ensure it remains competitive, the fishing industry needs to address production costs such as fuel costs.
- Increasingly, the drivers for aquaculture investment will be demand for seafood, consumer preferences, and the need to generate wealth. Farmers will need to concentrate on a variety of production systems, including offshore and inland systems.
- The regulatory environment for all sectors, spanning many jurisdictions, will need to be improved to make investment more attractive. The costs of obtaining regulatory decisions must be dramatically reduced, and the certainty of approvals increased.
- To increase production and reduce costs, innovative frontier technologies need to be developed — including smart packaging, efficient fishing technology (e.g. hydrodynamic otter board designs), biotechnology, novel chemicals (e.g. nutraceuticals), hatchery systems, utilisation of grain ingredients in aquaculture feeds, and breeding programs.
- The likelihood of discovery of new fisheries within Australia's EEZ is limited. Opportunities to expand and utilise straddling stocks and high-seas fisheries will be increasingly investigated under the auspices of regional fisheries management organisations established under the United Nations Fish Stocks Agreement.
- Fisheries managers and industry will need to develop strategies that provide incentives for retaining both fish of lower value and non-commercial species, to produce products that make better use of these resources.

- Industry will need to develop and expand on its seafood promotion capabilities to deal with the competition that seafood will face on the domestic and international market from other foods, particularly with respect to quality and price.
- Eco-labelling will form part of the industry's short to medium-term promotion strategies. Maintaining worldwide recognition of Australia's seafood as "premium brand" will rely on continuing to build a reputation for clean seas, sound environmental management and quality assurance.

*"Everyone in the fishing industry knows that Australian seafood is the cleanest and greenest in the world. Now we need domestic and overseas consumers to heed this message as well."*

*— Senator Ian Macdonald, Australian Government Minister for Fisheries, Forestry and Conservation*

- It will be necessary to ensure that Australian seafood has a strong negotiation position within the demand chain to respond to market aggregation by supermarket chains. Industry must be able

to respond to demand for some species that can best meet supermarkets' specifications — such as "ready-to-eat meal solutions" and attractive cuts such as Atlantic salmon.

- The Australian Government and industry will continue to engage importing countries to ensure that Australian exports are not impeded by tariff and non-tariff barriers.
- Seafood producers will need to make themselves better informed about ever-changing consumer preferences.
- Businesses dependent on the recreational sector will need to develop and promote the economic and social value of recreational fishing.
- Traditional supply chains will become "demand chains" as consumers' preferences drive real-time production responses.
- Industry will need to respond to consumers' concerns about food safety and their growing interest in all the characteristics of the products they buy. Truth in labelling, including use of correct fish names, will become more important, as will product traceability mechanisms.
- The cost of dumping seafood waste as landfill and the penalties for otherwise discarding it at sea or flushing it down drains will induce businesses to investigate commercial opportunities for adding value to such waste.



The western rock lobster fishery was the first Marine Stewardship Council certified fishery in the world.

## MARKET AGGREGATION AND THE FUTURE

“The huge aggregation of purchasing power by bigger and bigger supermarket chains in the northern hemisphere poses serious threats to the producer nations which are now — on the whole — of southern location. The danger is that, although the southern producers should be price leaders because of northern scarcity, they are at risk of becoming dependent price-taking peasants in their own southern seas.

“The producer response to market aggregation has been to increase the level of integration, a process by which the catching and processing sector has sought to capture an increasing percentage of the dollar cost of sale by managing a greater proportion of the value chain. This has been associated with — even enhanced by — a huge focus on quality, better technology and a targeting of the high-value end of the market. All this has, in turn, required substantial further investments in new vessels, gear, onshore processing and distribution technology.

“... The real challenge is for the major southern producers and their governments to recognise their commonality of regional interest and to develop effective cooperative strategies to combat the price pressure of the aggregating markets of the northern hemisphere. This is a political challenge as much as it is a commercial and economic one. My prediction is that they will fail to meet this challenge and will allow the seafood industry's taste for competitive throat-cutting to contain us all at the peasant-producer end of the commodity cycle.”

— Sir Tipene O'Regan, architect of New Zealand's Treaty fisheries settlements and founding chairman of both the Treaty of Waitangi Fisheries Commission and the Sealord Group, in his opening keynote address at the Seafood Directions 2001 conference



The aquaculture industry is ideally placed to deliver market driven product.



## PROGRAM 3: PEOPLE DEVELOPMENT

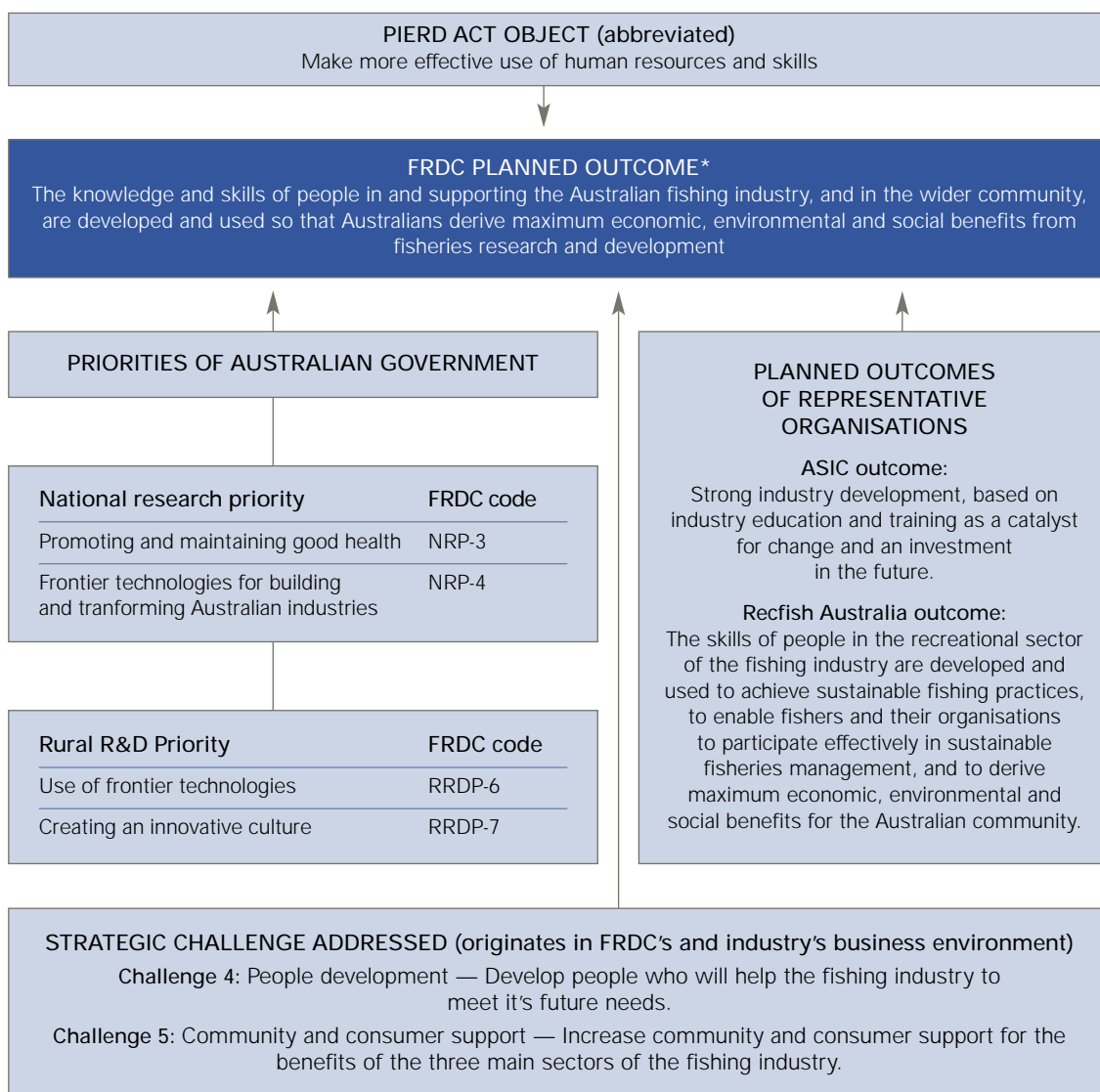
Legislative source: PIERD Acts.3, Object c: Making more effective use of the resources and skills of the community in general and the scientific community in particular.

Expenditure for this R&D program at the time this plan was published: 5 per cent of total R&D expenditure.

In this program, the FRDC invests in R&D that addresses the final two of the five strategic challenges in working towards its planned outcome for people development.

The program addresses the following Australian Government priorities:

Figure 20: Strategic elements on which Program 3 is based



\* Projects funded under Program 3 primarily address the FRDC's planned outcome for people development. However, this outcome is also addressed, as a secondary but very important element, by projects within Programs 1 and 2.

## Strategic challenges addressed by this program

### Challenge 4 — People development

#### Develop people who will help the fishing industry to meet its future needs.

The commercial, recreational and customary sectors of the fishing industry need to be driven increasingly by a culture that is market-focused and places high value on learning, innovation and professionalism.

Action by all sectors

	National research priority	Rural R&D priority
Provide knowledge that helps to develop a market-based culture in the industry.	NRP-4	RRDP-7
Develop mechanisms for better adoption of R&D results by industry.	NRP-4	RRDP-7
Enhance industry leadership for all sectors through appropriate needs-based training.	NRP-4	RRDP-7
Enhance opportunities for information and technology transfer within and between sectors.	NRP-4	RRDP-7
Promote an environment of business best practice through skills-based training.	NRP-4	RRDP-7
Develop knowledge to assist with policies that provide incentives for the retention, training and career development of skilled people.	NRP-4	RRDP-7
Develop industry champions to bridge the gap between Australian-based knowledge and that developed overseas.	NRP-4	RRDP-7
Foster an environment that encourages innovation and its adoption to assist the development of the industry.	NRP-4	RRDP-7
Enhance the scientific skill base to include novel scientific methods that have benefit for the industry.	NRP-4	RRDP-7

## REFERENCE POINT FOR THIS CHALLENGE

To ensure that the fishing industry meets its strategic challenges and reaches its potential to deliver economic, environmental and social benefits, there is a need to develop the capabilities of the people to whom the industry entrusts its future and to improve communication between them.

Significant drivers of Challenge 4 are as follows:

- The operational environment of the fishing industry is very complex. To be effective, leaders must have knowledge of industry organisation, planning and policy development, advocacy, and political and government processes. They must also be intimately aware of community and consumer beliefs and attitudes. If industry is to make a prosperous, sustainable future for itself there will need to be an increase the number and quality of its leaders. Succession planning and personal development opportunities must also be provided to maximise the benefits to be derived from those leaders.

*"It is not the strongest species that survive, nor the most intelligent, but the ones most responsive to change."*  
— Charles Darwin

- Managing Australia's fisheries is an increasingly complex task. The turnover of fisheries management staff in state and federal agencies is high. If sustainable wild-catch and aquaculture is to be well managed, a planned approach to managers' career development will need to be taken. The result will be skills appropriate to the changing

situation and higher career satisfaction among the managers.

- Industry must develop a "knowledge and innovation culture" and actively support the development of vocational competence that will meet future demands. For example, it is no longer sufficient for fishers, managers and scientists to simply know about fish; they need to be able to draw on knowledge of the environmental, economic and social drivers of their industry.
- The fishing industry is mainly regional in nature, remote in its areas of operation and subject to working time constraints. These characteristics are not conducive to developing vocational skills through formal methods of training. The industry will need to develop innovative ways to overcome the many consequences of isolation. The recreational and indigenous sectors face comparable challenges in developing their members.
- Commercial sector enterprises will need to adopt best-practice principles for the conduct of their businesses, including occupational health and safety training and improved administration. Increasingly, enterprises will put principles into practice through quality management systems.
- The commercial sector needs to diversify its range of skills to compete in future markets.

## Challenge 5 — Community and consumer support

**Increase community and consumer support for the benefits of the three main sectors of the fishing industry.**

The Australian community and consumers need to be better informed about seafood in the interests of their health. The community also needs to be more aware of factors relating to the fishing industry — in particular the economic, environmental and social benefits arising from the industry — and more aware of the significance of the fishing experiences which people enjoy. From such understanding comes informed support, which among other things enables better decision-making through political processes.

The health benefits of seafood and the lifestyle benefits from recreational and customary fishing need to be identified and communicated to the community. The ways in which the industry supports communities in rural and regional Australia also needs to be better understood.

## Action by all sectors

	National research priority	Rural R&D priority
Promote public education, especially via the interface between the industry and consumers.	NRP-4	RRDP-7
Increase understanding of the health benefits of eating seafood.	NRP-3	RRDP-7
Address animal welfare and bio-security issues.	NRP-4	RRDP-7
Develop productive relationships with interest groups and other partners.	NRP-4	RRDP-7
Educate the community about fisheries and aquaculture management and its contribution to rural Australia.	NRP-4	RRDP-7
Communicate the benefits of government and industry investment in R&D.	NRP-4	RRDP-7

## REFERENCE POINT FOR THIS CHALLENGE

As with Challenge 4, the community's knowledge of, and involvement with, the industry must be developed if the fishing industry is to capitalise on its potential.

Significant drivers of Challenge 5 are as follows:

- The community is having a greater say in the use and management of the natural resources on which the fishing industry depends. Industry will need to engage community representatives to ensure that both parties have a good understanding of the basis for each others' viewpoints. It is likely that future industry access to fisheries and aquaculture resources will depend heavily on such understanding.
- Consumer education will continue to be important in developing markets. An important part of education will be to develop information that imparts the health benefits of seafood. A particularly important element is to address the national priority to reduce obesity among Australians.
- The community interacts with the fishing industry in many ways. For example, many human activities adversely affect fisheries habitats. The fishing industry will need to mobilise community resources to achieve outcomes that are beneficial for the environment, the community and the industry itself. This can be effected through community involvement in R&D, rehabilitation of habitats, and broader decision-making for natural resources management.
- Investment in Australian fisheries research has been large, but much of the findings has not been adequately communicated and extended to the community. The need to justify investment in R&D will be of particular significance in the light of demands for more accountability for spending of public and industry funds.





## HOW THE FRDC PLANS, INVESTS IN AND MANAGES R&D

This chapter is an overview of how the FRDC plans, invests in and manages R&D. To apply for R&D funding, please refer to the Corporation's website ([www.frdc.com.au](http://www.frdc.com.au)).



PLANNING, INVESTMENT AND MANAGEMENT

# HOW THE FRDC PLANS, INVESTS IN AND MANAGES R&D

The following is a broad description of how the FRDC manages its planning and investment activities so that:

- timings for key events specified by the PIERD Act and the CAC Act are met,
- the FRDC Board can evaluate most R&D applications competitively at the one time, and
- other agencies that have a role in R&D can plan their activities accordingly.

The annual cycle for these activities is depicted in figure 21.

For more information on this topic, see [www.frdc.com.au](http://www.frdc.com.au) and the FRDC's R&D News (key dates for each year are in each April edition).

Development of fisheries and aquaculture priorities is a bottom-up process in which beneficiaries and

end-users determine the priorities for relevant jurisdictions, industries and enterprises. The FRABs then assess the priorities for R&D funding applications in their jurisdictions, rank the applications and refer them to the FRDC Board. The essence of this process is that those who co-invest in FRDC-funded R&D determine the priorities for investment in partnership with the Corporation.

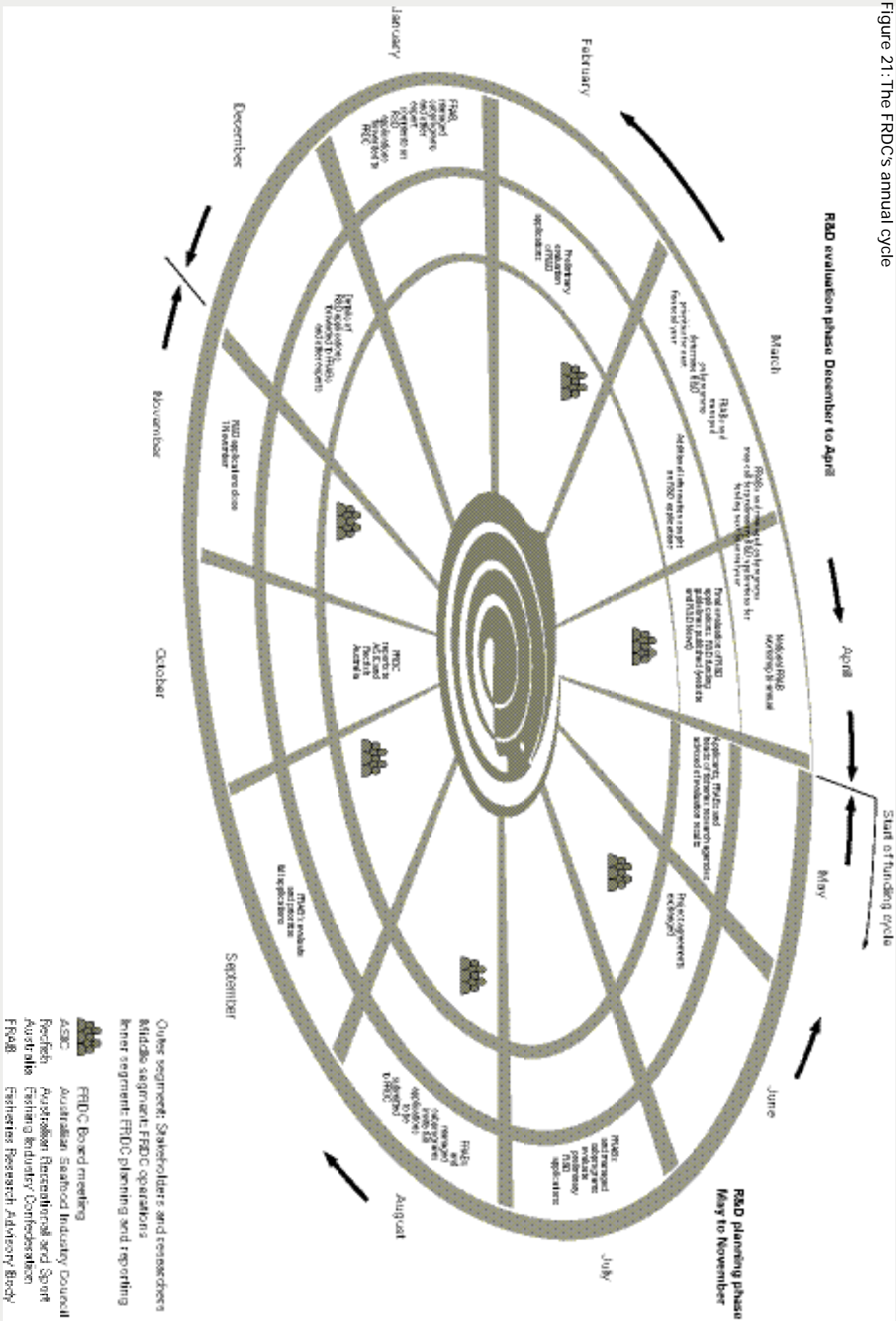
## R&D planning

Since good planning is fundamental to maximising investment in R&D, the FRDC continually reviews its R&D planning processes. To this end the FRDC also encourages the Fisheries Research Advisory Bodies (FRABs) to undertake planning for R&D in consultation with governments, industry, other stakeholders and research providers. These plans help to develop and maintain a strong focus for strategic directions and to avoid duplication of R&D.



Fisheries Research Advisory Bodies will continue assist the FRDC set future priorities

Figure 21: The FRDCs annual cycle





## ROLE OF THE FISHERIES RESEARCH ADVISORY BODIES

The FRDC supports a network of FRABs covering Commonwealth, state and Northern Territory fisheries.

The FRABs have an extremely important role in maximising the efficiency of the FRDC's planning and investment process. Their role is to:

- develop strategic plans for R&D that take into account other strategic plans, and subsequently maintain strategic directions and are responsive to changing circumstances;
- identify R&D priorities in consultation with management advisory committees and other bodies;
- invite R&D applications to address those priorities;
- encourage collaboration between researchers, and between researchers, fisheries and aquaculture managers and fishing industry interests;
- identify appropriate investment sources (including the FRDC);
- advise the FRDC on the priority and appropriateness of applications attributing benefit to their related fisheries or industry sectors; and
- assist the FRDC with communication and extension of R&D results.

The FRDC meets some of the costs of operating the FRABs. However, the FRDC is not the sole beneficiary of their outputs: other beneficiaries include fisheries management agencies, other research funding agencies, research providers and industry. Some FRABs are responsible for advising the respective ministers on fisheries R&D matters.

The FRABs represent all sectors of the fishing industry, fisheries managers and researchers; most also include environmental and other community interests.

## SEAFOOD SERVICES AUSTRALIA

Seafood Services Australia Ltd (SSA) is a not-for-profit company set up in 2001 by the FRDC and the Australian Seafood Industry Council. SSA's mission is to be a catalyst for sustainable development of the seafood industry. To achieve this, the company works with stakeholders to help the seafood industry to continually improve industry practices and to add value throughout the seafood supply chain.

Through being a non-government entity, the company has been able to lever significant external funding and other resources in support of its industry development initiatives.

Increasingly sophisticated global markets impel the industry to have prompt, efficient access to the best knowledge, processes and technology if it is to remain globally competitive. SSA therefore aims to be proactive in providing an Australia-wide service for people who catch, farm, process, transport, buy, sell, prepare or handle seafood. Its priority business includes:

- seafood products, processes and supply chains;
- systems and standards for the safety and quality of seafood;
- systems and standards for environmental management;
- trade and market development; and
- occupational health and safety.

To help to ensure that the plans drive the development of R&D applications, the FRDC's website has a list of plans produced by FRABs and other entities.

The FRDC's formal planning processes are augmented by conferences, workshops and meetings relating to fisheries resources and the fishing industry, and by steering committees' advice about managed subprograms and specific projects.

The FRDC does not normally determine priorities for R&D at state, regional or fishery level. That task is carried out by the FRABs, managed subprograms and other priority-setting structures. However, to ensure a balanced portfolio and to comply with directions from the Australian Government and the FRDC's representative organisations, the Corporation determines the balance between projects funded within the R&D programs. Accordingly, each year, the Corporation reviews its strategic assessment of the business environment, including through consultation with its representative organisations. The review may highlight actual or potential changes to the business environment that prompt the FRDC to adjust the balance — or to address gaps — in the R&D portfolio.

## R&D investment

### Avenues of investment

There are four avenues through which the FRDC invests in R&D:

- via an annual competitive cycle (the avenue for most of the FRDC's R&D investment);
- by commissioning a research provider, requesting tenders or forming a joint venture entity;
- through Seafood Services Australia Limited; and
- via the Seafood Industry Development Fund (for applications less than \$30,000).

### Annual competitive cycle

Because the total R&D funding requested from the FRDC each year exceeds the funds available, it is necessary to evaluate R&D applications at the same time and to approve those which address the highest priorities. For this reason, R&D

applications must normally be submitted by 1 November each year.

### Funding through Seafood Services Australia

Seafood Services Australia Limited (SSA) is funded by the FRDC to conduct short-term, market-focused R&D projects.

These R&D projects normally involve a commercial partner who contributes equally with the FRDC. The FRDC contribution to projects has an upper limit that the FRDC Board determines from time to time. SSA R&D applications are received throughout the year and are evaluated by an advisory committee.

For more information about R&D funding via SSA, visit [www.seafoodservices.com.au](http://www.seafoodservices.com.au) or telephone 1300 130 321.

### Co-investment

Through a range of formal and informal collaborative arrangements most of the research projects funded by the FRDC contain a high level of co-investment from the research provider and other sources. This effectively more than doubles the research investment managed by the FRDC.

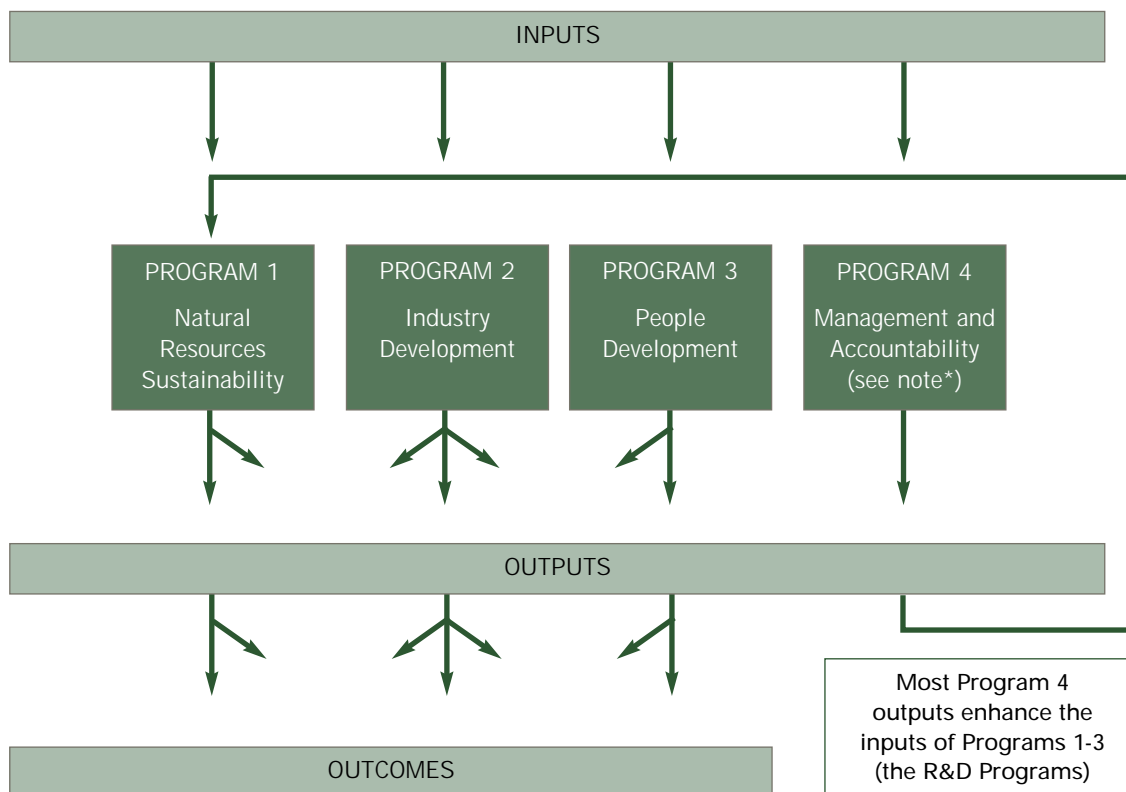
*The FRDC's efforts are focused on the actual impacts of fisheries R&D on the Australian economy, environment and society.*

### The R&D investment model

The FRDC's investment model is focused on:

- delivering outputs (that is, goods and services — mainly knowledge, processes and technology);
- that the FRDC and its R&D partners produce for external organisations or individuals; and
- that help to achieve its planned outcomes (the results, impacts or consequences of actions by the FRDC and its R&D partners on the fishing industry and Australia's economic, environmental and social resources).

Figure 22: The FRDC's four programs: inputs, outputs and outcomes



Inputs are resources — in the form of people, expertise, materials, energy, facilities and funds — that the FRDC and its R&D partners use in activities to produce outputs.

Outputs are the goods and services (mainly knowledge, processes and technology) that the FRDC and its R&D partners produce for external organisations or individuals.

Outcomes are the results, impacts or consequences of actions by the FRDC and its R&D partners on the fishing industry and Australia's economic, environmental and social resources.

\* The Management and Accountability Program's outputs enhance the inputs of the three R&D programs rather than contribute directly to outcomes in their own right. This program is the vehicle for continually improving the effectiveness and efficiency of the ways in which the FRDC plans, invests in and manages fisheries R&D. It is an important element in the FRDC's achievement of high standards of corporate governance.

The concepts of outcomes and outputs, as used in the Australian Government's outcome-output accountability framework, are shown in the FRDC context in figure 22.

### Achievement of outcomes through R&D outputs

As distinct from its obligation to invest in the most beneficial R&D, the FRDC has an obligation to foster the most effective and efficient transformation of outputs from that R&D into outcomes.

The FRDC's business environment is different from those of other rural R&D corporations and R&D investors. For example there is, uniquely, a very high component of public good in most fisheries R&D, as discussed on page 62. And there is another distinction: although the processes by which R&D outputs are taken up and applied to achieve natural resources outcomes are more diffuse than in most other R&D fields, in fisheries R&D they are even more diffuse.

The links between outcomes and the R&D inputs and outputs that achieve them are far from direct

and linear: they are many and complex. In general, outcomes result when outputs are implemented by the fishing industry, fisheries managers and other end-users of R&D. These contributing outputs come from many sources, including R&D project outputs of previous years. Further, when there are several projects proceeding in a particular area of R&D, many project outputs become inputs to related projects. Such inter-relatedness becomes most apparent when the FRDC and its R&D partners communicate and extend R&D results to potential beneficiaries, both before and after projects are completed.

Despite the FRDC's focus on planned outcomes and the high degree of FRDC influence over outputs from R&D projects, the Corporation's investment in R&D is not, of itself, sufficient to ensure that the planned outcomes are achieved. The Corporation is increasing the demands it makes on end-users to commit themselves to using R&D outputs. Quicker, more efficient adoption and commercialisation of R&D outputs has been enabled by new communication technologies and greater involvement of stakeholders throughout the innovation chain, commencing at the planning stage. End-users are frequently taking up appropriate R&D findings while a project is in progress, rather than after the final report is produced.

The FRDC has an R&D subprogram dedicated to developing an ESD reporting and assessment framework incorporating performance indicators for fisheries so that the industry can meet its obligations under the Environment Protection and Biodiversity Conservation Act 1999. The Corporation is also using these indicators to measure the outcomes achieved through investment that is directed to sustainability of natural resources.

The FRDC's achievements against its planned outcomes, together with expenditure targets, are forecast in the Corporation's annual operational plans and reported in annual reports.

The FRDC is working with all other rural R&D corporations to identify ways to measure non-market benefits of R&D

*Likewise when we look back in time from the vantage point of [knowledge] pool-derived innovations or contributions to quality of life, the mixing of streams makes it difficult if not impossible to quantify the contributions of the various sources.*

*— S.E. Cozzens, 'The knowledge pool: Measurement challenges in evaluating fundamental research programs'. Evaluation and program planning, 20(1).*

### Criteria for evaluating prospective R&D

In evaluating prospective R&D, the FRDC has regard to advice from its representative bodies, the FRABs, the Australian Fisheries Management Forum, industry bodies, managed subprogram steering committees and other stakeholders and scientific experts. The FRDC's criteria for evaluating its investment are as follows:

#### Attractiveness:

- Is the application relevant to the FRDC's R&D programs?
- Are the need and planned outcomes well-defined and relevant to R&D priorities that are documented in strategic plans for R&D produced by FRABs and/or other entities?
- Is the application a priority of the appropriate FRAB(s), industry sector(s), fisheries management agency / agencies and other potential beneficiaries? Does the application demonstrate the support of users and beneficiaries and a commitment to utilise the outputs?
- Does the application describe the scope and pathway by which the nation will capture the benefits of the research?
- Is the applicant, potential beneficiary or other entity making an appropriate financial contribution to the project?



*Quicker, more efficient adoption and commercialisation of R&D outputs has been enabled by new communication technologies and greater involvement of stakeholders.*

- Will the planned outcomes, if achieved, provide a high benefit-cost ratio or a sound return on investment or value for money?
- Is there an appropriate level of collaboration between researchers, and between researchers, fisheries managers and fishing industry interests?
- Is the application innovative? Does it add value to previous R&D?

#### **Feasibility:**

- Are the planned project outputs well described, and is the strategy for extending the outputs sufficient to achieve the planned outcomes?
- Are the objectives clearly specified, and are they consistent with planned project outputs?
- Are the methods well described, and are they consistent with the project's stated objectives?
- Does the applicant have the capacity and commitment to produce the planned outputs?
- Are the principal investigator and other researchers to be engaged on the project competent? Have they performed well in the past?
- Is there a strategy for managing data arising from the project so that it will be easily accessible by others in future?

## **MANAGED SUBPROGRAMS**

The FRDC forms a managed subprogram when it becomes evident that a planned R&D outcome could be achieved more successfully if a number of related projects were managed more intensively by employing higher levels of coordination, integration and communication than for individual projects. This generally occurs when the FRDC has a high level of investment concentrated on a fishery, species or some other theme. Subprograms may be managed by FRDC staff where the appropriate skills are available, or may be outsourced.

The role of managed subprograms is to:

- develop strategic plans for R&D that take into account other strategic plans, and subsequently maintain strategic directions and are responsive to changing circumstances;
- in consultation with management advisory committees and other bodies, identify R&D priorities to maximise investment in that field, avoid duplication and achieve the greatest potential return;
- invite R&D applications to address those priorities;
- maximise collaboration between researchers, fisheries and aquaculture managers and fishing industry interests;
- attract other R&D investment and influence the way in which other entities apply their investments in that field;
- standardise on the best scientific methods;
- communicate regularly with potential beneficiaries; and
- influence the adoption of R&D results.

The subprogram leader normally reports to a steering committee, which in turn is advised by a scientific committee.

- Will the research have an impact on endangered, rare or sensitive ecosystems?
- Will the research require some sort of external approval because of its impact on ecosystems or animal welfare?
- FRDC staff also conduct on-site audits of financial management, risk management and compliance with the conditions in project agreements.
- The FRDC uses a range of external information sources to monitor projects between reporting periods — including conferences; workshops; and meetings of management advisory committees, FRABs, managed subprograms and other parties involved in research. This information may prompt intervention when projects are not meeting their reporting schedule or other agreed performance indicators.

## R&D management

The FRDC manages R&D projects through a range of mechanisms.

- The FRDC quality management system is the framework that allows the FRDC to manage R&D effectively and efficiently.
- The FRDC's project management information system — which integrates technical, financial and administrative data — monitors the status of projects and informs FRDC staff when key project milestones are not met.
- FRDC staff — assisted when necessary by external advisers — technically evaluate milestone reports to ensure that agreed requirements are met.

To improve its management service within a defined area of research, the FRDC also uses managed subprograms.

The FRDC's project management relies heavily on close cooperation and communication between the Corporation, project administrators, principal investigators and potential end-users of project outputs. Of these people, potential end-users are critical to achieving effective R&D outcomes.



Research and development will continue to be important to all levels of the fishing industry.

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