

FRDC Project 2009/217

RD&E capability audit and assessment for the Australian Fishing and Aquaculture Industry

Final report supporting the development of
Working Together: The National Fishing and
Aquaculture RD&E Strategy

April 2010

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Executive Summary

This report provides an analysis of the research, development and extension (RD&E) effort supporting Australia's fisheries and aquaculture industries in the latter quarter of 2009.

Data was collected through voluntary return, and one-to-one follow-up, of a spreadsheet-based survey tool designed to elicit information regarding:

- value and location of infrastructure and major capital items
- investment against the areas of Legislative¹ Requirements; Fisheries; Aquaculture; and Associated Environment and Ecosystems for the past 5 financial years
- full time equivalent (FTE) capability across 45 areas of expertise at the research scientist and extension professional level.

The project achieved a pleasing level of compliance. It should be noted, however, that data reported here is not complete. Notably, survey compliance from the university sector was not high, even though it is known that the majority of Australia's universities have some level of relevant RD&E capability. That being said, data from those universities with high capability are included in this report.

Infrastructure

Survey recipients were asked to provide a list and location of infrastructure and major capital items for each organisation. Information regarding all vessels was requested, as well as for other items with a capital value of over \$100,000. Respondents were also asked to estimate any additional capacity of specific items.

Reported infrastructure totalled in the order of \$323million. Of this \$138m is located in the Northern region, \$52m in the Southwestern region and \$133m in the Southeastern region².

This high level data-set indicates that infrastructure is largely centred in the Northern and South-eastern regions and is largely fully utilised under current conditions.

This data will be useful when determining efficiencies that may be gained for specific areas of expertise through consolidation and/or centralisation.

Investment

Relevant key research providers provided data of RD&E investment against the areas of Legislative Requirements; Fisheries; Aquaculture; and Associated Environment and Ecosystems for the past 5 financial years (FY2004/05 – 2008/09 inclusive).

When Associated Environment and Ecosystems investment is excluded (to sharpen focus on RD&E with greater direct attribution of benefits to industry), key national research providers

¹ Investment in Legislative Requirements relates to those areas of fisheries management that are mandatory activities of State and Commonwealth fisheries organisations.

² Note that these regions are described within "Working Together: the National Fishing and Aquaculture RD&E Strategy" as proposed regions where natural collaboration could be encouraged to deliver the goals of the Strategy.

reported an average annual investment of \$92m over these years. During this period, total investment increased each year from \$87m in 2004/05 to \$98m in 2008/09.

This represents an increase of about 13%, matching the corresponding CPI increase over the same period.

In each of the years reported, RD&E investment in research to meet legislative requirements (stock assessments) increased, while RD&E investment in strategic Fisheries and Aquaculture research remained relatively static.

The trend increase in investment in RD&E supporting legislative requirements is worth highlighting, as it indicates increased compliance costs during a time when participation in wild fisheries has declined. This trend supports the identified need for a sharpened research focus to deliver more efficient governance and regulatory systems. Reported investment in Associated Environment and Ecosystems increased by about 47% (\$30m to \$44m) during the same period. This indicates an increased focus on research underpinning ecologically-based fisheries management during this period.

Capability

The capability audit has provided new detail regarding the high degree of research activity within the fisheries and aquaculture industries.

When Associated Environment and Ecosystems capability is excluded (to sharpen focus on RD&E with greater direct attribution of benefits to industry), reported Fisheries and Aquaculture RD&E capability totals 607 FTE, with 539 FTE at the research scientist and 68 FTE at the extension professional level .

Of these, about 31% are employed in Australian government agencies, 51% in state agencies and 18% in universities (noting the earlier comment regarding relatively low survey returns from universities).

The majority of reported FTEs (about 23%) were from Queensland, 22% from Tasmania, 15% from WA and 13% from SA. Reported FTEs from the ACT, NSW, Victoria and NT were all <10% of the total.

The distribution of reported RD&E capability between the Aquaculture, Fisheries (Commercial), Fisheries (Indigenous customary) and Fisheries (Recreational) sectors is 32%, 54%, 2% and 12% respectively.

It is worth noting that a call for expressions of interest from small and private RD&E providers brought responses from 27 organisations. Many of these were small consultancies – most of which are headed by skilled personnel. This sector is becoming increasingly important in provision of smaller RD&E projects, with a low reliance on infrastructure.

While noting the above demographics, analysis of reported data suggests that the RD&E capability supporting the fisheries and aquaculture industries is, at present, mostly inadequate. There is an identified need to increase capability in a number of areas in the short to medium term.

When mapped against the thirteen national Strategic Research Themes for aquaculture and fisheries, the following trends outlined below appear.

Strategic Research Themes for which current RD&E capability is inadequate

- Resource access and allocation
 - a near term need to increase capability especially in the area of social research to determine cross-sector issues, including non-extractive user expectations and the economic contribution of recreational and non-extractive user activity
- Growth and profitability
 - a near term need to increase capability in the area of increasing input efficiency of wild capture fisheries and post-harvest value adding
- Biosecurity and aquatic animal health
 - a near term need to increase capability especially in the area of fish veterinary and pathology R&D
- Maximising value from aquatic resources
 - a near term need to increase capability especially in the areas of understanding how value is perceived by non-commercial users and how this value can be increased
- Consumers and markets
 - a near term need to increase capability especially in the areas of consumer trends and needs and promoting to those needs
- Community support
 - a near term need to increase capability especially in the areas of understanding and promoting the health benefits of seafood, and the behaviours, motivations and expectations of all users of living marine resources
- Community resilience and development
 - a near term need to increase capability especially in the areas of understanding community needs and drivers and how the building of true and sustainable social capital can be supported by the fisheries and aquaculture sectors
- People development
 - a near term need to increase capability especially in the area of understanding regional workforce drivers and needs and understanding the leadership gaps and drivers for the aquaculture and fisheries sectors
- Extension and adoption
 - a near term need to increase local and regional capability especially in the area of community understanding of and support for the aquaculture and commercial fishery sectors and an increased industry capacity to identify, commission and take up relevant outputs from R&D.

Strategic Research Themes for which current RD&E capability is adequate

- Habitat and ecosystem protection

- no great drivers for increased capability in the near term. A need may arise to increase research focus in some areas of oceanography and integrated multi-trophic aquaculture.
- Climate change
 - no great drivers for increased capability in the near term
- Ecologically Sustainable Development
 - no great drivers for increased capability in the near term
- Governance & regulatory systems
 - no great drivers for increased capability in the near term. A need may arise to increase research focus in the area of ensuring cost effectiveness of compliance in the face of an increasingly complex Ecologically Based Fisheries Management (EBFM)-focussed, multi-fishery, multi-sector regulatory environment.

An important consideration not tested during this project is that, for areas in which capability is not adequate, there is potential to access capability from other sectors, or through forging new connections with researchers not previously working in the fisheries or aquaculture fields. This possibility has been raised specifically for RD&E requiring social research capability and may well fit for other areas of expertise.

Conclusion

Information gathered during this project strongly suggests that – for the Australian fisheries and aquaculture industries to meet the challenges of the coming years, and to continue to form the bedrock of many of Australia's coastal communities – increased RD&E capability will be required across the entire spectrum of relevant expertise.

Some of this increased capability could be achieved through increased delivery efficiency (e.g. consolidation and/or centralisation of expertise), or accessing capability currently working in other sectors.

This, however, will not be enough.

Additional strategic investment is required, and needs to be targeted to encourage young, keen, skilled RD&E practitioners to enter these industries. New blood is required across the board.

Tertiary education is essential for the future of growth in primary industry, but participation in agriculture at higher education institutions is in decline. According to the Corish Report³, the rate of decline of students entering agricultural science fields is 9 percent in the 5 years to 2000 and a further 6 percent in the 4 years to 2004. It should be noted that that this trend appears consistent with the decline in enrolments in fisheries and aquaculture discipline areas.

The challenge we face is how to build the necessary RD&E capability effectively and efficiently.

³ Corish, P. (2006), Creating our Future: Agriculture and Food Policy for the Next Generation, Department of Agriculture Fisheries and Forestry

Introduction

Task and Objectives

In April 2005, the Australian Primary Industries Ministerial Council (PIMC) endorsed the concept of National research with Regional development and Local extension for Primary Industries in Australia. The concept recognises that basic and strategic research (R) can be provided by a national framework, with regional adaptive development (D) and local extension (E) to improve the uptake of innovation by industry.

Subsequently, in April 2006, the PIMC agreed to a set of principles to facilitate further cooperation between agencies and industry for improving the efficiency and effectiveness of the national RD&E capability. These principles emphasise cooperation, information sharing, maintaining funding, access to capability and reporting.

It was decided that the implementation of the framework would be led by the relevant Research and Development Corporation supported by Primary Industry Standing Committee (PISC) agencies. A meeting of the PISC Research and Development Sub-Committee and the Council of Research and Development Corporation Chairs on 8 July 2008 ratified that the Fisheries Research Development Corporation (FRDC) and PISC agencies of South Australia, Victoria and Tasmania would take the lead in developing a national research, development and extension framework for the fisheries and aquaculture industries.

The framework will be implemented through an assessment of the status of the relevant industries, the completion of an RD&E capability audit, identification of national RD&E priorities and development of a strategy to guide RD&E investment and capability development nationally.

Seven steps are planned for the development of the framework –

1. Sector Overview
2. Current Sector Resource Audit and Analysis
3. Future Strategic RD&E Plan
4. Capability Analysis against the Plan
5. Change Plan
6. Approvals (PIMC)
7. Implementation

This report will contribute to addressing steps 2 and 4.

The objectives for this capability audit are:

1. To audit and assess the existing RD&E capability in the field of fisheries and aquaculture, and their aquatic ecology and biodiversity, within a national context, and including all research providers in this field.
2. To identify the gaps in the current RD&E capability in the fields of fisheries and aquaculture with respect to meeting defined future sector strategic priorities.

Methods

Developing the capability, infrastructure and investment matrix

The survey of RD&E providers in the field of fisheries, aquaculture and related aquatic ecology and biodiversity fields was conducted using a spreadsheet-based capability matrix designed in consultation with the strategy working group.

The survey tool “capability matrix” is a multi-sheet spreadsheet that is too large to present meaningfully in the format of this report. FRDC will hold copies of all survey tools and documentation for reference as required.

The industries, sectors, sub-sectors and fisheries/species and two of the 45 related Areas of expertise included in this survey are shown in a “screen shot” of the left hand columns of the survey tool (Figure 1).

			CAPABILITY AREA		Fisheries & Aquaculture	
			FIELD / AREA OF EXPERTISE (Version 2 terminology)		Taxonomy	Fisheries Biology / Ecology
INDUSTRY (FTEs)	SECTOR (FTEs)	SUB-SECTOR (Importance)	FISHERY / SPECIES (Importance)			
Fisheries						
	Commercial / Wild-catch					
		Finfish				
			Antarctic/sub-Antarctic			
			Demersal			
			Pelagic			
			Reef			
			Estuarine			
			Inland/Freshwater			
			Other			
		Crustacea				
			Rock Lobster			
			Prawns			
			Crab			
			Krill			
			Other			
		Molluscs				
			Abalone			
			Scallops			
			Cephalopods			
			Other			
		Other				
			Seaweed			
			Other			
	Recreational / Charter					
			Marine			
			Freshwater			
			Other			
	Customary / Indigenous					
			Marine			
			Freshwater			
			Other			
Aquaculture						
	Commercial					
		Finfish				
			Salmonids			
			Tuna			
			Yellowtail Kingfish			
			Barramundi			
			Native freshwater			
			Eel			
			Other			
		Crustacea				
			Prawns			
			Rock Lobster			
			Yabbies / Redclaw / Murren			
			Other			
		Molluscs				
			Abalone			
			Pearl oysters			
			Edible Oysters			
			Mussels			
			Other			
		Other				
			Algal Production			
			Seaweeds			
			Microalgae			
			Other			

There are 45 Areas of Expertise in the matrix (see Table 1)

Figure 1. “Screen shot” showing the Industries, Sectors, Sub-sectors and Fisheries/Species, and two of the 45 Areas of Expertise included in this survey

The related Capability Areas and Areas of Expertise which were mapped against the nominated Industries, Sectors, Sub-sectors and Fisheries/Species are listed in Table 1.

Table 1. Capability Areas and Areas of Expertise used in the capability audit matrix

Capability Area	Area of Expertise
Fisheries & Aquaculture	Taxonomy
	Fisheries Biology / Ecology
	Ageing
	Data management/programming
	Stakeholder surveys / logbooks
	Fish Surveys
	Biometrics/ Statistics
	Fisheries Modelling
	Fisheries Assessment
Aquaculture	Hatchery/ nursery
	Grow-out/ production
	Broodstock management
	Feed & Nutrition
	Aquatic Animal Health
	Genetics & genomics
	Aquaculture systems & polyculture
Environment and Ecosystems	Environmental impacts (incl. bycatch & wildlife interactions)
	Oceanography
	Hydrology
	Chemistry/ Biogeochemistry
	Habitat mapping
	Benthic Ecology (incl.habitat mapping & assessment)
	Pelagic ecology
	Freshwater Ecology
	Ecosystem modelling
Fisheries & aquaculture technicians	Technical Expertise*
Gear & engineering	Gear technology
	Observational technology
	Aquatic engineering
Social Research	Anthropology
	Demography
	Educational Research
	Indigenous studies
	Sociology
Economic Research	Resources allocation
	Economic surveying
	Economic assessment
	Economic modelling
	Productivity & Market analysis (incl. Supply chain)
	Market access & trade
	Commercialisation
Post -harvest	Seafood Processing
	Seafood safety
Governance & Management	Governance & Management
Communication /Extension Professionals	Communication / Extension

* Technical Expertise FTE information was requested for specialist technicians, but is not reported against in this report.

Detailed instructions on how to fill in each section of the audit spreadsheet and capability matrix were drafted and approved by the working group.

A characteristic of the fishing and aquaculture industry is its high reliance on RD&E relating to the public nature of the resource that it utilises. It should, therefore, be noted that the RD&E capabilities supporting the Australian fishing and aquaculture industry cover probably the broadest range of any of Australia's primary industries.

Disciplines range from tactical research supporting State and the Commonwealth jurisdictional fisheries management responsibilities, to strategic research with a high attribution of direct benefit to the aquaculture and fishing industry, to strategic research that supports environmental and ecosystem management with a low attribution of direct benefit to these industries (Figure 2).

Figure 2. The spread of RD&E capabilities supporting Australian aquaculture and fisheries

Tactical research supporting State and the Commonwealth jurisdictional management responsibilities	Strategic research with a high attribution of direct benefit to industry	Strategic research supporting aquatic environment and ecosystem management with a low attribution of direct benefit to industry
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All three areas shown in Figure 2 are recognised and have been included in this survey. It is for this reason that the actual survey matrix, which contains some 45 Areas of Expertise (Table 1), is too large to be included in this report. The main focus of this report is on the central grouping in Figure 2 – the strategic activities with a high attribution of direct benefit to the Australian fishing and aquaculture industry, acknowledging that the boundaries between these areas are fuzzy, and not easy to define. While data pertaining to the entire spectrum is reported and assessed to some degree, data relating to capability in the jurisdictional and environmental groups are outside the direct scope of the National Fishing and Aquaculture RD&E Strategy.

Capability

The capability matrix was designed to allow research providers to record RD&E capability, as research Full Time Equivalents (FTE), against the list of suggested Areas of Expertise at the Industry (i.e. Fisheries or Aquaculture) or Sector (i.e. Aquaculture – Commercial; Fisheries - Commercial Wild-catch; Fisheries - Recreational; and Fisheries - Indigenous customary) Levels.

The Steering Committee spent considerable time discussing the best way to capture equivalent RD&E capability from the different research providers. The decision was made to seek data at the research scientist, specialist technician and extension professional level. This wording was used to allow pragmatic differentiation of internal classifications between, for example, universities and CSIRO.

In addition, the matrix allowed research providers to rank the level of alignment of this capability to their organisation's strategic/operating plan at the Sub-Sector Level (i.e. Finfish; Crustacea; Mollusc; or Other) or the Fishery/Species Level (e.g. Demersal; Reef; Rock Lobster; Abalone; Salmonid; Edible Oyster; etc.). Following stakeholder feedback, minor version changes of the

capability matrix were undertaken during the course of the project, primarily a review of the listed field/area(s) of expertise.

In order to cross-check the capability information provided, the audit spreadsheet containing the capability matrix included a section where organisations could record the name of research staff, their FTE, position and level of appointment. However, this information was confidential and only used by the research team.

Infrastructure

In addition to human capability, a section where organisations could record major infrastructure and capital items was included within the spreadsheet. Information about the type, value, additional available usage and location of capital items was sought.

Institutions were requested to provide details of infrastructure and major capital items for their organisation, including the physical location of each item.

For vessels, institutions were requested to list all vessels within each of four size categories (> 50 m; 20 – 50 m; 10 – 20 m; 5 -10 m; < 5 m). Other than vessels, only items with a capital value of over \$100,000 were requested to be listed.

A list of suggested items was provided. However, institutions were instructed that these were only suggested items and were encouraged to add other items as relevant to their institution.

Where feasible, institutions were requested to estimate the current spare capacity of listed items (For example, for an aquarium facility that is currently used at 80% capacity, it would be recorded that this item has 20% additional capacity).

Investment

The Steering Committee determined that R&D investment for key agencies should be surveyed. A survey tool allowing key agencies to record investment against the areas of Legislative⁴ Requirements; Fisheries; Aquaculture; and Associated Environment and Ecosystems for the past 5 financial years was designed and distributed to relevant agencies.

⁴ Investment in Legislative Requirements relates to those areas of fisheries management that are mandatory activities of State and Commonwealth fisheries organisations.

Identifying participants

National capability was assessed through direct contact with major RD&E providers, including universities, state and national research agencies, industry bodies and through expressions of interest from other public and private providers and enterprises following national advertisement. An initial list of institutions and government research providers was developed with the Steering Committee. The list included suggested key contacts, which were generally the Head (or their nominated proxy) of research organisations or programs.

Key organisations within the initial list to be surveyed for investment data were also selected by the Steering Committee.

Contacting participants

Engagement of key personnel for each organisation was through initial contact by the FRDC via e-mail and an attached letter. The purpose of the initial contact was to notify organisations of the survey and to introduce the service provider contracted to conduct the capability survey and assessment.

Following the initial FRDC contact, key contacts for each organisation were contacted via e-mail. This e-mail requested that organisations populate each section of the survey spreadsheet (i.e. Capability matrix; Staff details; and Infrastructure and Capital). The e-mail included the following attachments: the survey spreadsheet; the detailed instructions; and a copy of the initial FRDC introductory letter.

Contact of organisations was phased over several weeks. Key organisations that were to be surveyed for investment were in the first round of organisations contacted. Following initial e-mail contact, telephone follow-up was attempted to determine whether they required any assistance in providing the capability survey information.

Following a review of investment information received, a number of additional organisations not initially identified as being required to provide investment information were requested to provide this information.

Inviting wider participation

To ensure a wide coverage of research providers – in particular non-government research providers – the Steering Committee placed an advertisement in the tenders section of The Weekend Australian newspaper. The advertisement indicated that the audit and assessment of RD&E capability was being undertaken and invited research providers to participate in the capability audit. Research providers were directed to register their interest by e-mail.

Those researcher providers who registered their interest in participating in the capability audit were contacted by e-mail and requested to populate each section of the audit spreadsheet (i.e. Capability matrix; Staff details; and Infrastructure and Capital). The e-mail included the audit spreadsheet and detailed instructions as attachments.

Analysing current RD&E Capability data

Data⁵ returned by research providers was analysed to provide aggregated capability information against the following criteria:

- FTE against sector:
 - Aquaculture - Commercial
 - Fisheries - Commercial Wild-catch
 - Fisheries – Indigenous Customary
 - Fisheries - Recreational
- FTE against state / territory⁶
- FTE against major institution type
 - National
 - State and territory government
 - University

In this report, FTE data for the above is presented in two formats: with and without FTE data reported against “Environment and Ecosystems”.

Analysing future RD&E capability needs

Aggregated FTE data for the Areas of Capability, as listed in the capability matrix questionnaire, were mapped against the following information:

- Aquaculture and Fisheries Strategic Research Themes (as provided by FRDC)
- comments and assumptions for current and future capability requirements (derived from the DRAFT Australian Fishing Industry: Sector Overview; Ridge Partners 2009)

This information was used to assess the current adequacy of RD&E capacity against the nominated Areas of Capability, as well as possible requirements in the short (1-5 year) and medium (5-10 year) term.

The initial assessment made by the project team was tested through review and input by relevant agency heads and other nominated experts. In some cases it was not possible to reconcile all input. For example, one respondent suggested that current RD&E capability focussing on Climate Change was adequate, with another suggesting it was inadequate.

The FRDC RD&E Strategy details 13 Strategic Research Themes. Given that these encompass direction of research in this area, Areas of Expertise from the Capability Matrix were mapped against these Themes. Information from the Australian Industry Sector Overview (2009) was used to project future capability needs and potential gaps.

An analysis of the current and future capability needs of the Australian fisheries and aquaculture industries against each Strategic Research Theme was made using information provided in the associated Ridge Partners report, Australian Fishing Industry Sector Overview (2009).

⁵ This draft report presents data received by 20 February 2010.

⁶ CSIRO Marine data was reported as a national aggregate. In this report we used a proportional split of CSIRO Marine FTE of 70% TAS, 25% QLD, 5% WA.

Results

Table 2 shows those organisations which provided capability, infrastructure and investment information for this survey. Results presented in this report are drawn from these responses.

Table 2. Respondents to capability, infrastructure and investment survey

Institution type	Institution	Investment data
Aust Gov Funder	AFMA	Y
	DAFF - FRRF fund	Y
	FRDC	Y
	Seafood CRC	Y
	Reef and Rainforest Research Centre	Y
Aust Gov Research	Australian Antarctic Division	
	Australian Bureau of Agricultural and Resource Economics	Y
	CSIRO Marine	Y
	Bureau of Rural Science	Y
	CSIRO Livestock - AAHL	Y
	Australian Institute of Marine Science	Y
State Funder	DPIPWE - Tasmania	Y
	PIRSA aquaculture and fisheries	
State Research	Arthur Rylah Institute	
	Department of Fisheries WA	Y
	DPI VIC	Y
	NT Fisheries - Department of Resources	Y
	Industry and Investment NSW - DPI NSW	Y
	QLD DEEDI - Fisheries	Y
	SARDI	Y
University	Curtin University	Y
	Deakin University	
	Edith Cowan University	
	Flinders University	
	James Cook University – Aquaculture	Y
	James Cook University – FFRC	Y
	Macquarie University	
	Murdoch University	
	University of Adelaide	
	University of Tasmania	Y
	University of Melbourne	
	University of Newcastle	
	University of Queensland	
	University of Sunshine Coast	
	University of Wollongong	
Education Facility	Marine Discovery Centres	
	OceanWatch Australia	
	WA Maritime Training Centre	
Museum	QLD Museum	
Private	Biospherics	
	Cawthron Institute - NZ*	
	Chris Calogeros	
	Kate Brooks	
	Bunya Creek Farm	
	Tasmanian Seafoods Pty Ltd	
Total	45 institutions	21 institutions
* NZ data not included in audit report		

Capability⁷

Full Time Equivalent (FTE) Capability – Sectoral analysis

When associated environment and ecosystems investment is included for those organisations that reported capability at the sector level or provided a proportional allocation of FTE (n=721) between sectors, capability was reported to be allocated at 32% Aquaculture - Commercial, 54% Fisheries – Commercial Wild-catch, 11% Fisheries - Recreational and 2% Fisheries - Indigenous Customary (Figure 3).

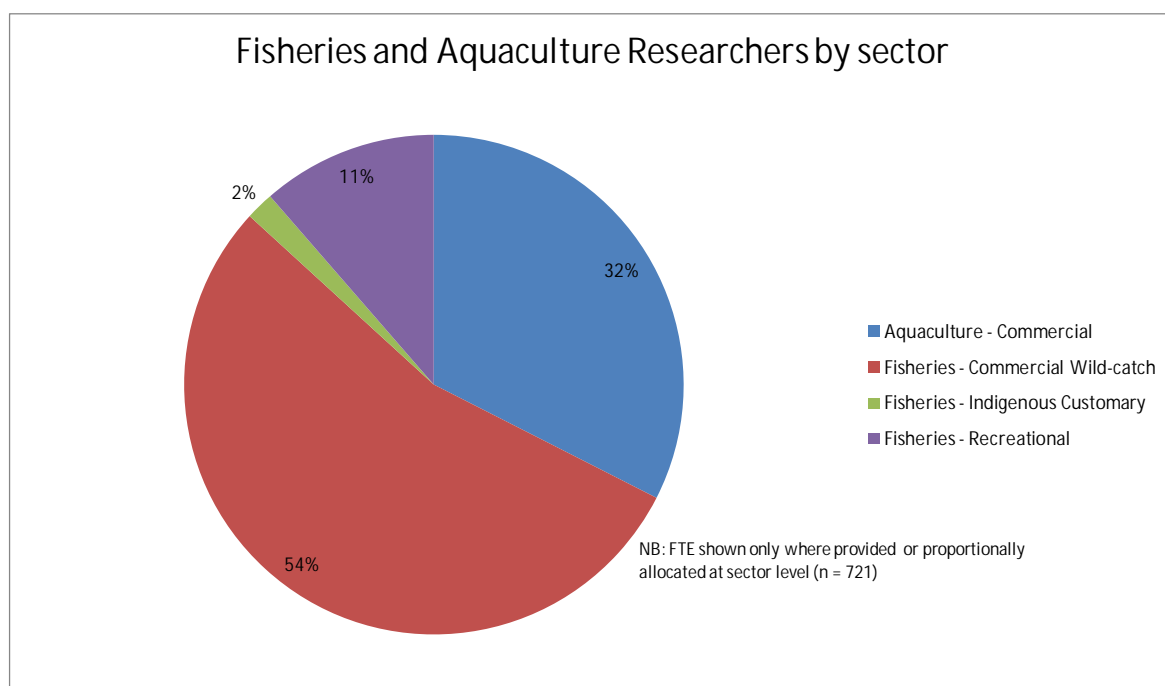


Figure 3. Current proportion of Fisheries and Aquaculture researchers by sector (including Environment and Ecosystems fields of research)

When associated environment and ecosystems investment is excluded for those organisations that reported capability at the sector level or provided a proportional allocation of FTE (n=516) between sectors, capability was reported to be allocated at about 32% Aquaculture - Commercial, 54% Fisheries – Commercial Wild-catch, 12% Fisheries - Recreational and 2% Fisheries - Indigenous Customary (Figure 4).

⁷ It should be noted that data relating to capability in the Environment and Ecosystems fields of research are outside the direct scope of the National Fishing and Aquaculture RD&E Strategy. In this report, data is provided to show RD&E capability both including and excluding Environment and Ecosystems fields of research.

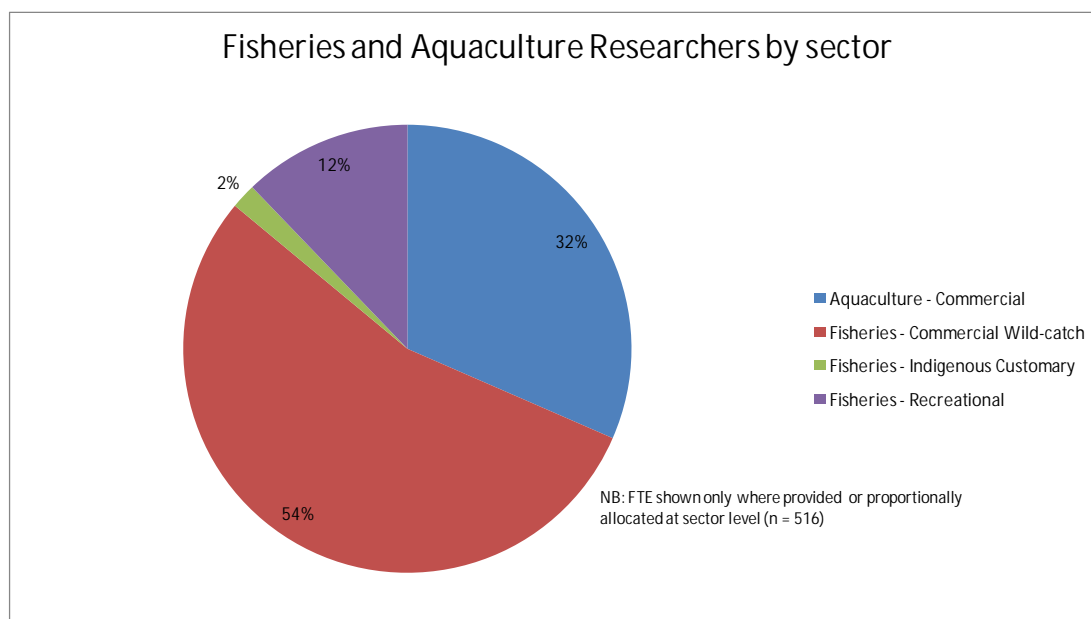


Figure 4. Current proportion of Fisheries and Aquaculture researchers by sector (excluding Environment and Ecosystems fields of research)

Full Time Equivalent (FTE) Capability – Regional analysis

With the inclusion of Environment and Ecosystems fields of research, there were 884 FTE researchers reported nationally (Figure 5 and Figure 6). Figure 5 presents the same data as Figure 6, except that Figure 6 indicates the attributed FTE split for CSIRO staff assuming a split of 70% TAS, 25% QLD and 5% WA.

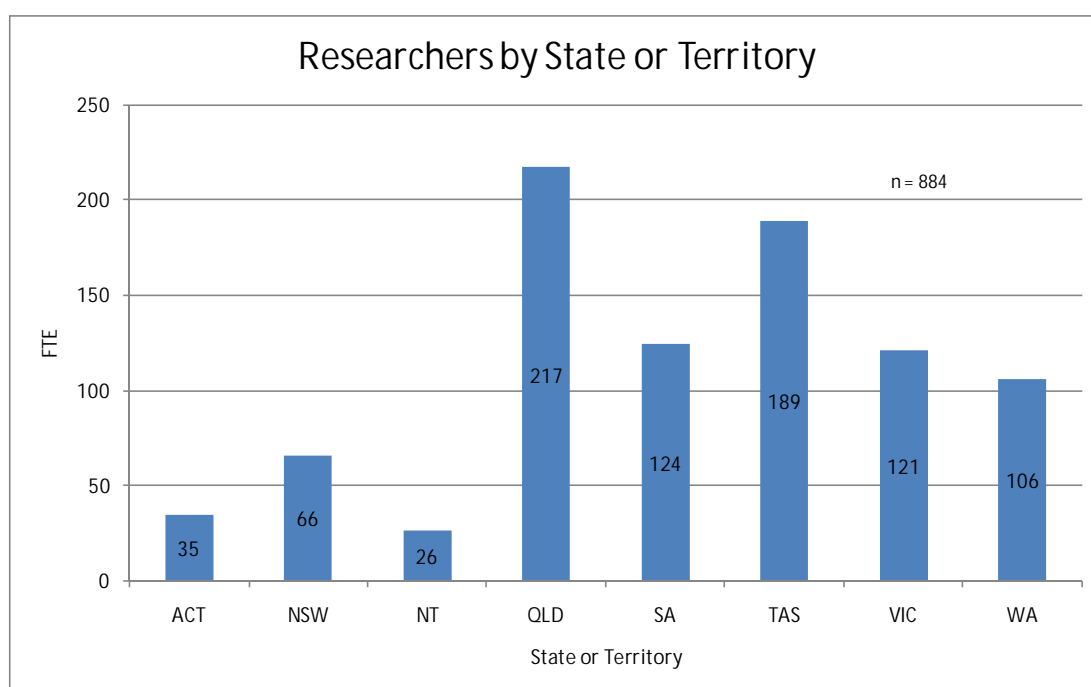


Figure 5. National Fisheries and Aquaculture Researchers by State or Territory (including Environment and Ecosystem fields of research)

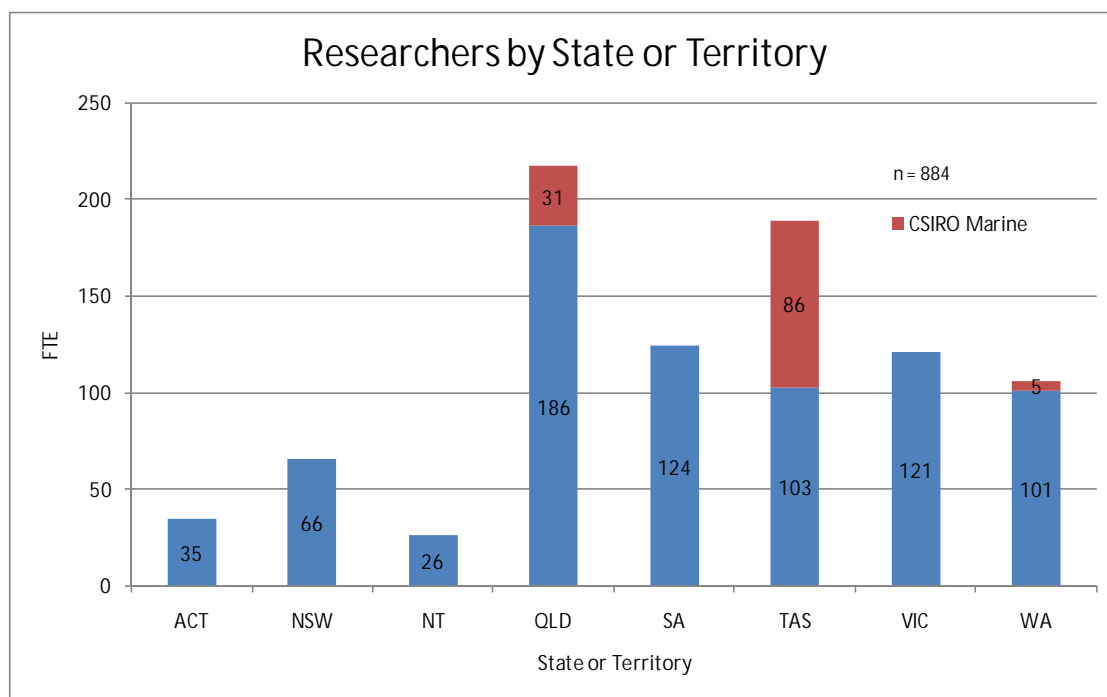


Figure 6. National Fisheries and Aquaculture Researchers by State or Territory (including Environment and Ecosystem fields of research)

Excluding researchers in the Environment and Ecosystem type fields of research, there were 607 FTE researchers reported nationally (Figure 7 and Figure 8). Figure 7 presents the same data as Figure 8, except that Figure 8 shows the same attributed FTE split for CSIRO staff as for Figure 6.

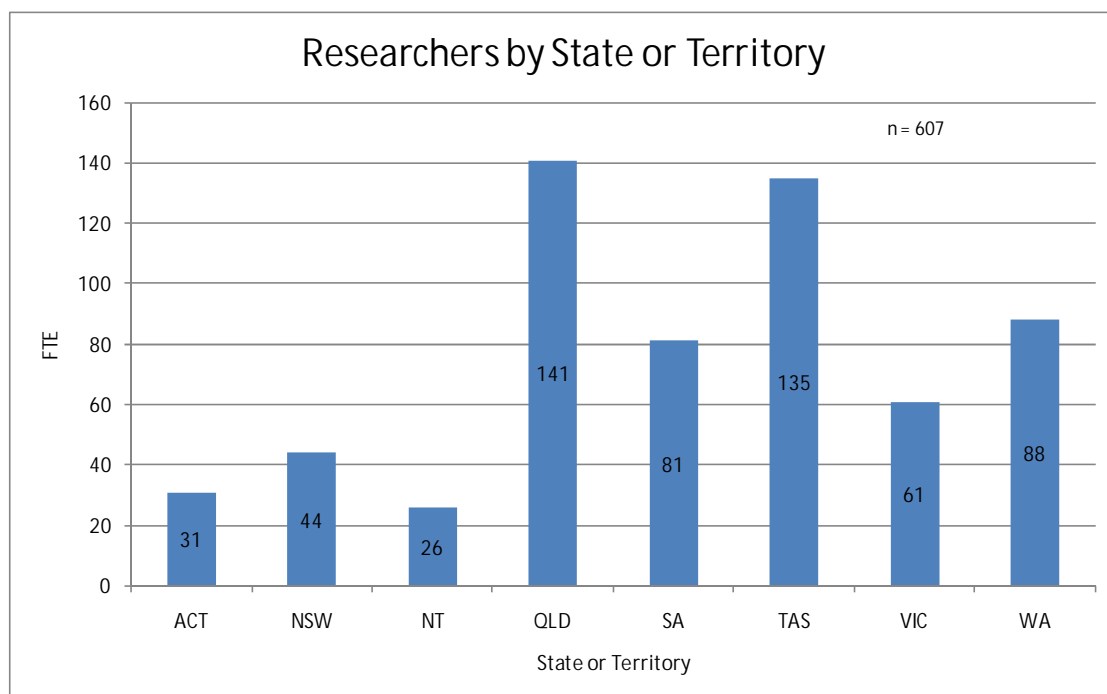


Figure 7. National Fisheries and Aquaculture Researchers by State or Territory (excluding Environment and Ecosystems fields of research)

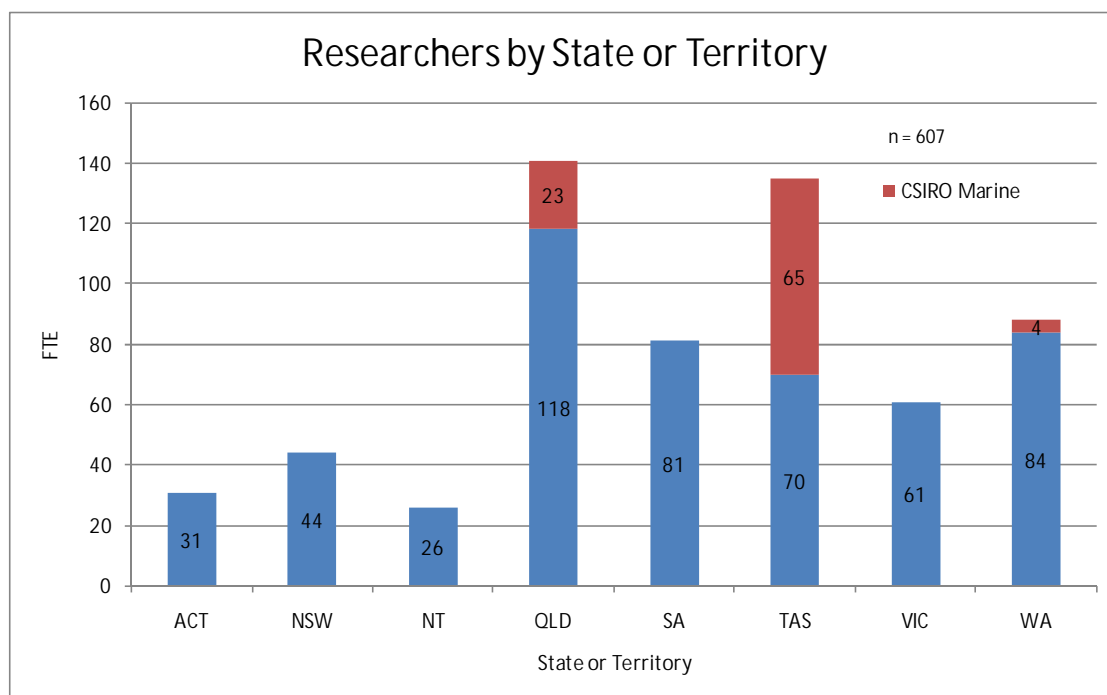


Figure 8. National Fisheries and Aquaculture Researchers by State or Territory (excluding Environment and Ecosystems fields of research)

Full Time Equivalent (FTE) Capability – Major Institutions

With the inclusion of Environment and Ecosystems fields of research, there were 823 FTE RD&E researchers reported nationally for major institutions (those with ≥ 5 reported FTE) (Figure 9). Of these, 262 were with Australian government agencies, 389 with State agencies and 172 with Universities.

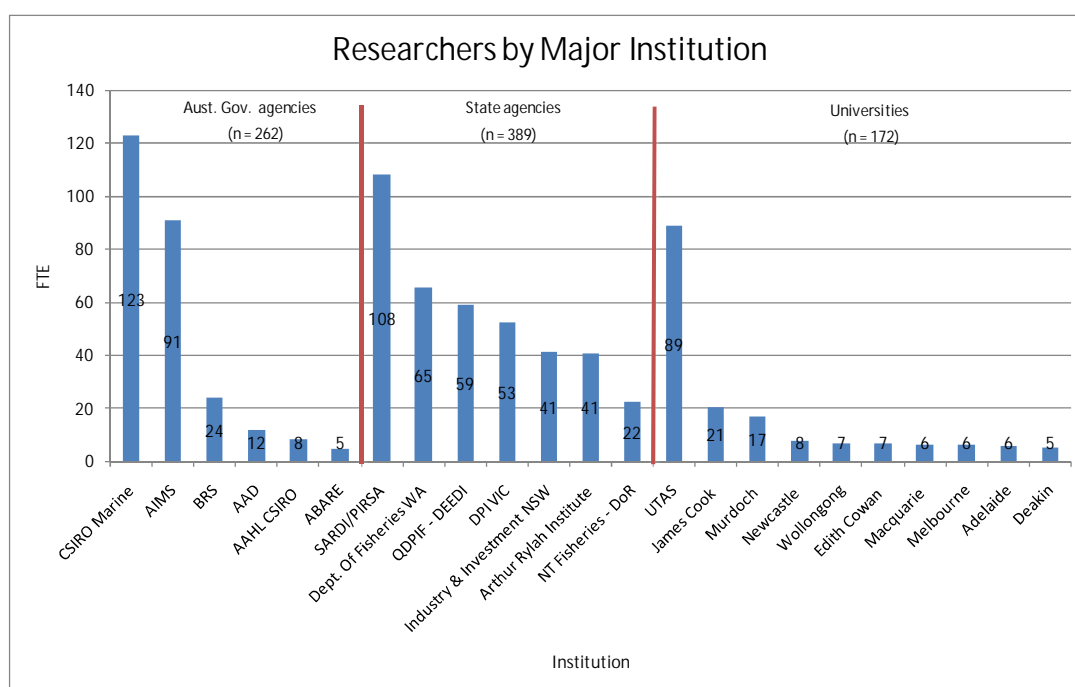


Figure 9. National Fisheries and Aquaculture Researchers by major institutions (≥ 5 FTE) (including Environment and Ecosystem fields of research)

Excluding researchers in the Environment and Ecosystem type fields of research, there were 531 FTE RD&E researchers reported nationally for major institutions (those with ≥ 5 reported FTE) (Figure 10). Of these, 161 were with Australian government agencies, 272 with State agencies and 98 with Universities.

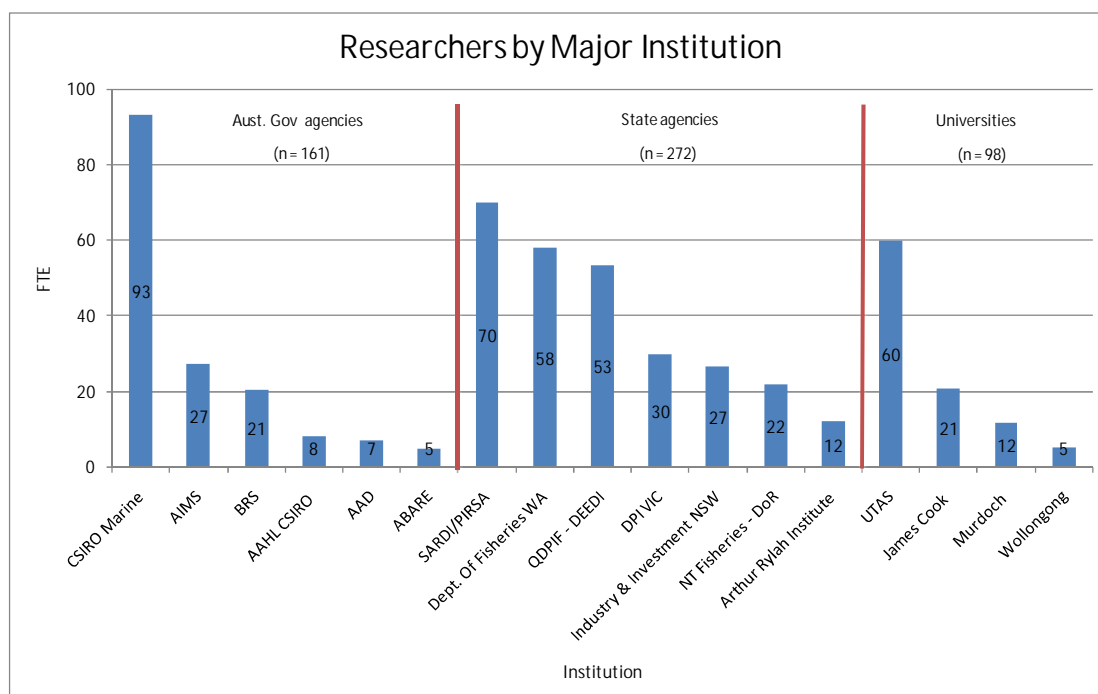


Figure 10. National Fisheries and Aquaculture Researchers by major institutions (≥ 5 FTE) (excluding Environment and Ecosystem fields of research)

Infrastructure

Of those institutions that responded to the survey, 28 provided information on infrastructure and capital items. For those items valued at more than \$100,000 per item plus all vessels - and where a capital value was provided - the total value of infrastructure was about \$306m.

Infrastructure items were broadly categorised based on the information provided by each institution. The total value for each item category and total number of items within each category is listed in Table 3, and have been grouped into the Northern, Southwestern and Southeastern regions (Figure 11) currently being considered as potential collaborative regions as part of the National Fishing and Aquaculture RD&E Strategy. The range of estimated additional capacity (minimum and maximum values reported across all institutions for each category) is shown.

Reported infrastructure data indicates a total estimated capital value of about \$300 million, distributed across the Northern, Southwestern and Southeastern regions at values of about \$138m, \$52m and \$133m respectively.

Most items were reported to be at or near maximum capacity, although some were reported to be currently underutilised.

Table 3. Estimated capital value for infrastructure valued at more than \$100,000 per item, plus all vessels

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

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

Note: All SARDI infrastructure is attributed within the Southeastern region

⁸ No value was provided for this item

⁹ The capital value for the vessel Aurora Australis, which is chartered by the Australian Antarctic Division, is not included in this list

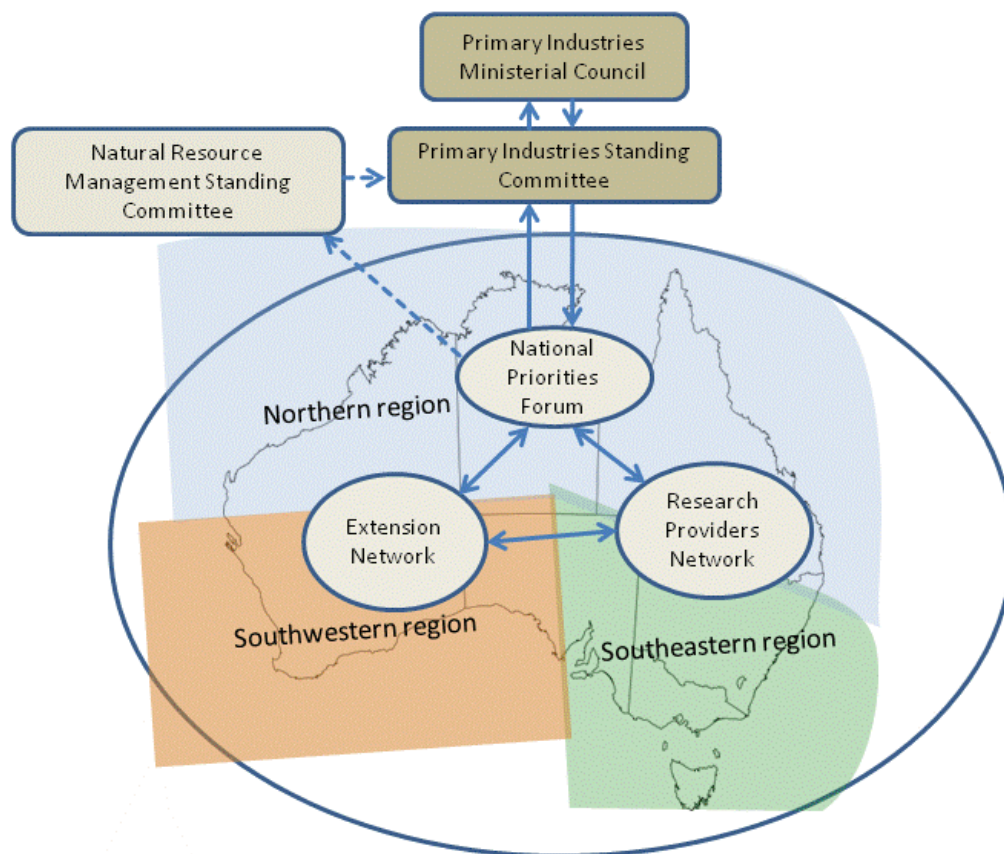


Figure 11: Potential collaborative regions identified. The lines are for demonstration and would not reflect the pragmatic approach to regional RD&E. (source: Working Together: The National RD&E Strategy for Fishing and Aquaculture, 2010)

Investment

When associated environment and ecosystems investment is included, key national research providers (Table 2) reported an average annual investment of \$129m for the financial years 2004/05 to 2008/09. During this period, total investment increased in each year from \$117m in 2004/05 to \$142m in 2008/09. In each of the years reported, investment increased within each of the areas of Legislative Requirements and Associated Environment and Ecosystems, with investment in Fisheries and Aquaculture being relatively static (Figure 12).

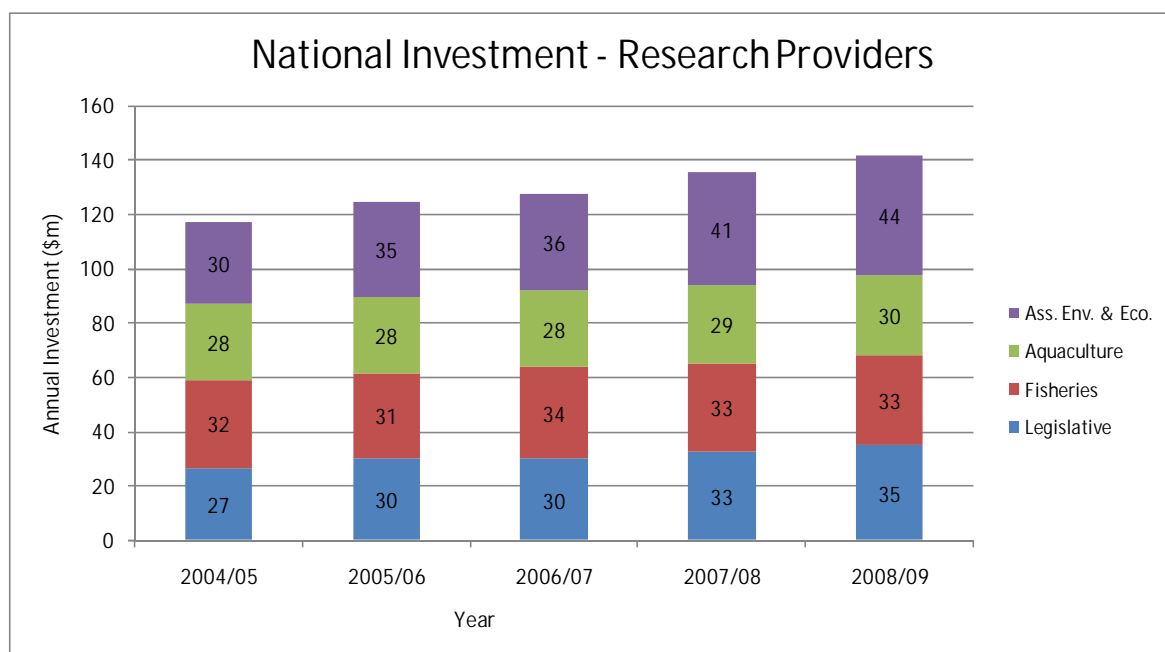


Figure 12. Key national research provider investment, 2004/05 - 08/09 (including Environment and Ecosystems fields of research)

When associated environment and ecosystems investment is excluded, key national research providers reported an average annual investment of \$92m for the financial years 2004/05 to 2008/09. During this period, total investment increased in each year from \$87m in 2004/05 to \$98m in 2008/09.

This represents an increase of about 13%, matching the corresponding CPI increase over the same period.

In each of the years reported, investment increased for Legislative Requirements, and remained relatively static for Fisheries and Aquaculture (Figure 13).

In addition to the key research provider organisations that were requested to provide investment information, key national research funding agencies were also requested to provide investment information. These research funding agencies were the:

- Australian Fisheries Management Authority
- Department of Agriculture Forestry and Fisheries (FRRF fund)
- Fisheries Research Development Corporation

- Reef and Rainforest Research Centre
- Seafood Cooperative Research Centre¹⁰

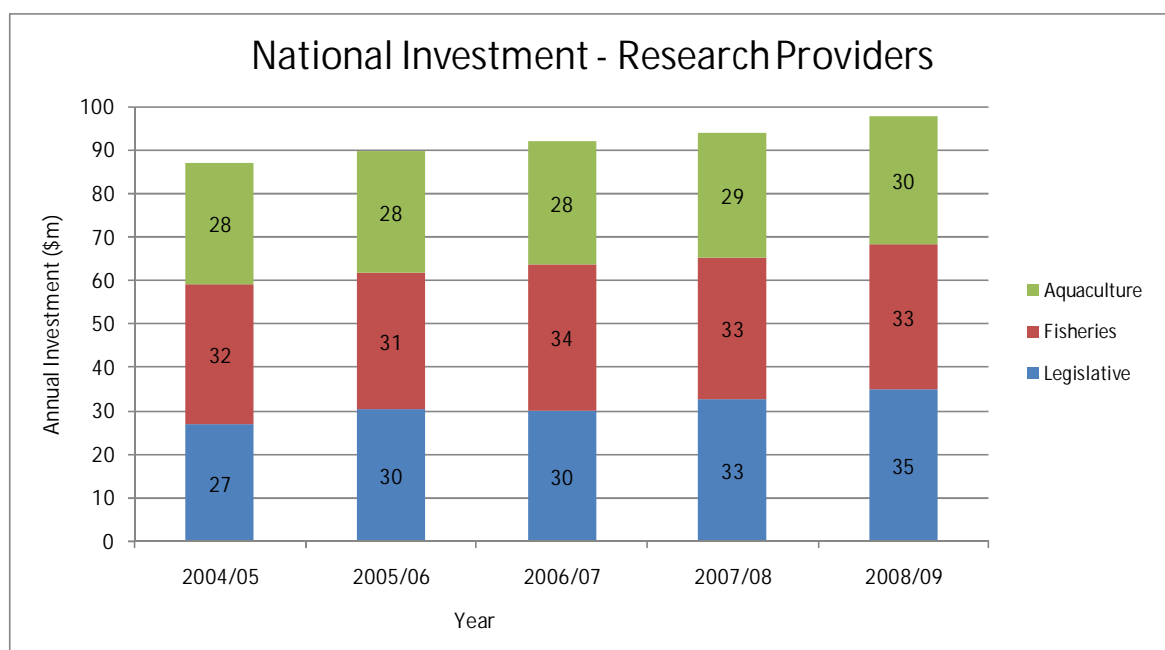


Figure 13. Key national researcher provider investment, 2004/05 - 08/09 (excluding Environment and Ecosystems fields of research)

When associated environment and ecosystems investment is included, key national research funding agencies reported an average annual investment of \$35m for the financial years 2004/05 to 2008/09. During this period, investment continually decreased from \$37m in 2004/05 to \$31m in 2007/08, and then rose sharply in 2008/09 to a high of \$39m (Figure 14).

¹⁰ Seafood CRC formed in 2007

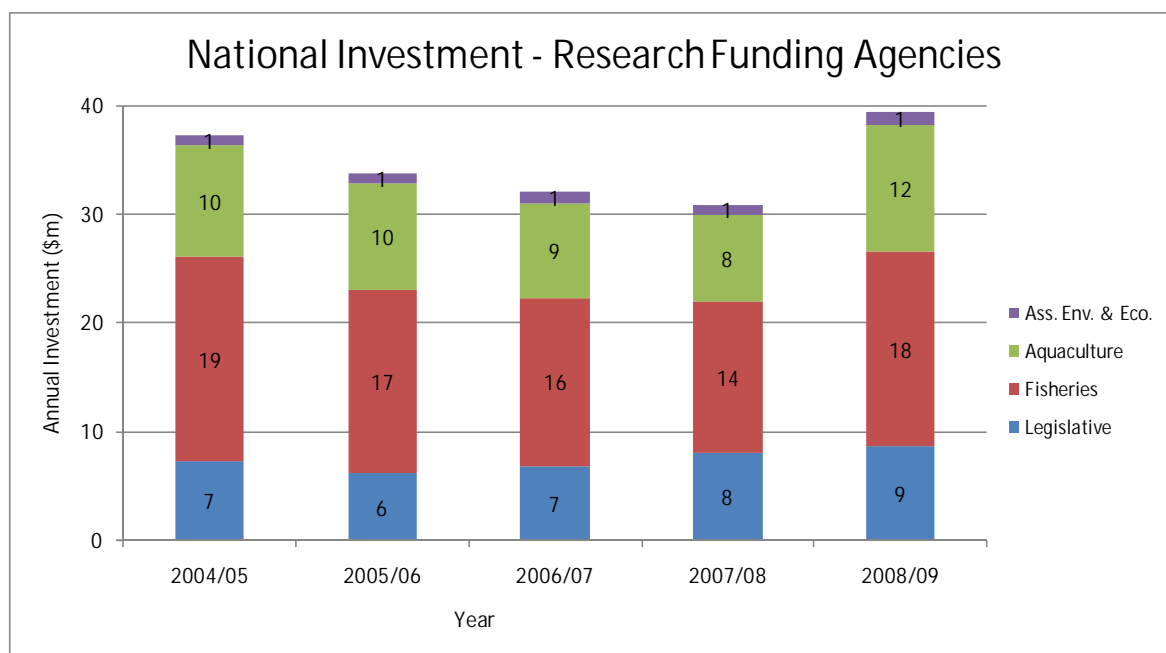


Figure 14. Key national funding agency investment, 2004/05 - 08/09 (including Environment and Ecosystems fields of research)

During this period, the Associated Environment and Ecosystems component of investment represented a minor part of national research funding at about \$1m per year (Figure 14). Without the Associated Environment and Ecosystems component, average annual investment for this period was \$34m (Figure 15).

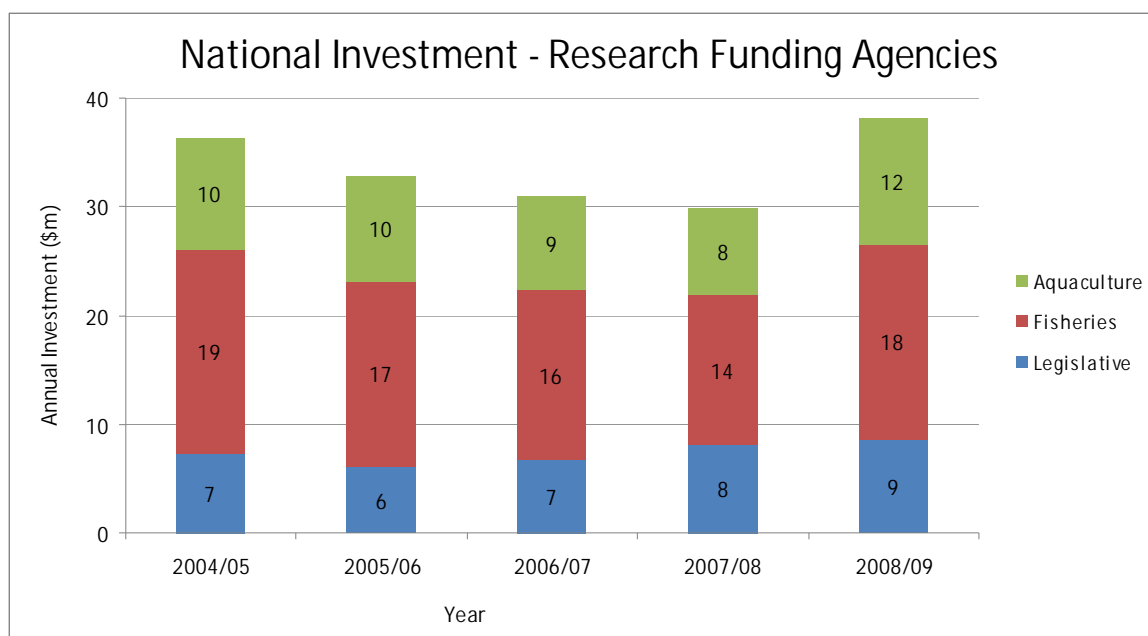


Figure 15. Key national funding agency investment, 2004/05 - 08/09 (excluding Environment and Ecosystems fields of research)

Fisheries and Aquaculture RD&E capability assessment and gap analysis

Mapping (FTE) Capability data against Strategic Research Themes

A table mapping Area of Expertise capability data against Strategic Research Themes is provided in Appendix 1. The major assumptions allowing this work to be done are the current proportion of effort within each Area of Expertise, which the Steering Committee estimated could be allocated against each Strategic Research Theme.

For example, the committee determined that the proportional spread of current RD&E effort within the Area of Expertise "Taxonomy" is currently 10% against "Biosecurity and health", and 30% each against "Habitat protection", "Climate change" and "Ecologically sustainable development".

Multiplying this weighting by the total FTE capability reported against "Taxonomy" (8.6 FTE) it is possible to calculate a nominal spread of Taxonomy FTE across the Strategic Research Themes. In this case, the weighted FTE for "Biosecurity and health", "Habitat protection", "Climate change" and "Ecologically sustainable Development" are 0.9, 2.6, 2.6 and 2.6 respectively.

This process therefore allowed the data collated from returned capability matrices to be grouped against Strategic Research Themes, in turn allowing an estimation to be made of the total FTE currently focussing on each Strategic Research Theme.

For example, it was determined that the "Biosecurity and health" Strategic Research Theme was supported in the main by the following Areas of Capability: Taxonomy, Fisheries biology / ecology, Aquatic animal health. The weighted reported FTE for each of these gives a total reported FTE of 30.0 against "Biosecurity and health".

Assessing current and future capability requirements

Data provided in Appendix 1 were mapped against the findings of the related (draft) Ridge Partners study - Australian Fishing Industry Sector Overview (2009) as a means of assessing whether current RD&E capability against each Strategic Research Theme is currently "Adequate" or "Inadequate", and whether an increase in RD&E capacity will be required in the short (1-5yr) or medium (5-10yr) term (Table 4).

This analysis has been developed with input from relevant agency heads and other nominated experts. The collected thoughts from responses to this request were used to update this analysis. In some cases, it was not possible to reconcile all input. For example, one respondent suggested that current RD&E capability focussing on Climate Change was adequate, with another suggesting it was inadequate.

This discrepancy in perception of the relative adequacy of RD&E capacity in specific areas highlights a challenge facing a national overview such as this, in that it is likely that the RD&E capability of some disciplines sections of a Strategic Research Theme will not fit the overall trend for that Strategic Research Theme. In other words, even if the current capability for an overall SRT is deemed "Adequate", there may be some disciplines within the Strategic Research Theme that are inadequately resourced. Such discrepancies will need to be addressed during discussions regarding specific Strategic Research Themes.

This analysis indicates that the following Strategic Research Themes are currently under-resourced and will require moderate increases in RD&E capability to meet projected short and/or medium term increases in demand.

- Biosecurity and aquatic animal health
- Resource access and allocation
- Growth and profitability
- Maximising value from aquatic resources
- Consumers and Markets
- Community support
- Community resilience and development
- People development
- Extension and adoption

The following Strategic Research Themes appear to be adequately resourced to meet current needs and will require slight to moderate increases in RD&E capability within the next 5 years.

- Habitat and ecosystem protection
- Climate change
- Ecologically sustainable development
- Governance and regulatory systems

Projected changes in demand indicate that, of these, only Governance and regulatory systems will require a slight increase in RD&E capacity in the shorter term.

Table 4. Current and future fisheries and aquaculture RD&E capability analysis

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



			Capability assessment		
Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Now	1 - 5 y	5 – 10 y
Resource access and allocation	23.3	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Stakeholder Surveys / Logbooks; Biometrics / Statistics; Fisheries Assessment; Resources Allocation; Economic Surveying; Economic Assessment; Economic Modelling; Social Surveying/assessment and modelling. <p>Priority research topics</p> <ul style="list-style-type: none"> Developing and implementing methods for defining access rights and allocating shares [ALL sectors] Identifying competing values and negotiating acceptable outcomes [ALL sectors] Developing systems and models to underpin aquaculture planning and development, including for data poor environments and systems and where interactions with fisheries are likely to occur [ALL sectors] Developing and applying methods for valuing the resource for all sectors [ALL sectors] Developing and applying adjustment and re-allocation mechanisms between sectors [ALL sectors] 	Inadequate	↑↑	→



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Growth and profitability	143.4	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Hatchery / Nursery; Growout / Production; Broodstock Management; Feed and Nutrition; Genetics and Genomics; Aquaculture Systems and Polyculture; Gear Technology; Aquatic Engineering; Economic Surveying; Economic Assessment; Economic Modelling; Social (Impact) Assessments; Social Surveying; Commercialisation; Seafood Processing; Seafood Safety. <p>Priority research topics</p> <ul style="list-style-type: none"> Developing improved business models, and building business modelling skills [Aqua, Com] Identifying supportive communities/environments for new business endeavours [Aqua, Com] Developing new business opportunities and new products, including non-seafood products such as bio-actives and bio-fuels [Aqua, Com] Domestication technologies for aquaculture species, particularly breeding genetics for disease resistance and growth, climate change and market attributes [Aqua] Supporting operational efficiencies [Aqua, Com] <ul style="list-style-type: none"> Fuel efficiency Hull design Anti-foulant technologies Reducing fresh water use in the processing sector Gear technologies to reduce costs Technological development for cost-effective compliance 	Inadequate	↑	→



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Maximising value from aquatic resources	3.6	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Indigenous Studies; Sociology; Economic Surveying; Economic Assessment; Economic Modelling. <p>Priority research topics</p> <ul style="list-style-type: none"> Enhancing fisheries through improved productivity of natural systems [Com, Rec, Cust] Enhancing the recreational fishing experience through stock enhancement and the application of structures to enhance recruitment, including artificial reefs and snags [Rec] Understanding the environmental interactions of stock enhancement technologies [All sectors] Understanding and enhancing personal, domestic and non-commercial communal (including social, cultural, religious, spiritual and ceremonial purposes) fishing activities in Aboriginal and Torres Strait Islander communities [Cust] 	Inadequate	↑↑	→
Consumers and markets	8.5	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Productivity and Market Analysis; Market Access and Trade; Seafood Processing; Seafood Safety. <p>Priority research topics</p> <ul style="list-style-type: none"> Developing knowledge of consumer trends and needs [Aqua, Com] Maximising trade and market access opportunities [Aqua, Com] Understanding and responding to the needs of the consumer, including credence values, chain of custody and food safety [Aqua, Com] Improving supply chain efficiencies [Aqua, Com] Introducing consumers to new products [Aqua, Com, Cust] 	Inadequate	↑↑	→



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Community support	2.4	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Anthropology; Indigenous Studies; Sociology; Seafood Safety. <p>Priority research topics</p> <ul style="list-style-type: none"> Understanding and promoting health benefits of seafood [Aqua, Com] Understanding and responding to consumers beliefs regarding the sustainability of the Australian fisheries resource [Aqua, Com] Responding to community concerns regarding public health associated with seafood [Aqua, Com] Understanding and communicating the interactions between recreational and customary fishing and biosecurity, the environment and other aquatic environment users and managing those effects where necessary [All sectors] Understanding the behaviours, motivations and expectations of fishers and aquaculturalists [All sectors] Understanding and communicating the benefits and value of recreational and customary fishing lifestyles to the community [Rec, Cust] To understand and communicate the benefits and value of fishers and fishing (commercial, recreational and customary) in the community, family and at the individual levels [Com, Rec, Cust] 	Inadequate	↑↑	→



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Community resilience and development	1.3	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Anthropology; Demography; Indigenous Studies; Sociology. <p>Priority research topics</p> <ul style="list-style-type: none"> Developing pathways to regional employment and community development (this is relevant to all of Recreation, Wild Catch, and Indigenous sectors) [Com, Rec, Cust] To value, communicate and develop opportunities based around fishing heritage and emerging technologies and industries[Com, Rec, Cust] R&D to support planning for recovery from biosecurity emergencies, natural disasters or other emergencies [ALL sectors] Understanding the capacity of society to accept and incorporate greater levels of fishing and aquaculture activity, and how to assess and increase this carrying capacity [ALL sectors] Understanding the nature and resilience of industry (social, demographic, economic and attitudinal) [Aqua, Com] Understanding and predicting behavioural responses to management approaches [All sectors] Building social capital between industry and community [ALL sectors] 	Inadequate	↑↑	→



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
People development ¹¹	2.2	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Anthropology; Educational Research; Demography; Indigenous Studies; Sociology. <p>Priority research topics</p> <ul style="list-style-type: none"> Understanding and meeting regional workforce needs, including attraction and retention of required technical, managerial, professional, semi-skilled and scientific capability [Aqua, Com] Improving workplace health and safety [Aqua, Com] Developing the leadership skills across all stakeholder groups [All sectors] Developing business and business modelling capability [Aqua, Com] Building stakeholder capacity to move toward co-management of fisheries [Com, Rec, Cust] Building skills and networks that support knowledge transfer and R&D adoption [All sectors] Building understanding between stakeholders, including researchers, managers, fishers and NGOs [All sectors] Identifying and understanding factors that drive responsiveness or adoption of new practices and innovation and how these can be influenced [Aqua, Com] 	Inadequate	↑↑	→

¹¹ Education and Training Providers were not included in this RD&E survey



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Extension and adoption	60.1	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> ▪ Educational Research; Demography; Indigenous Studies; Sociology; Communication / Extension. <p>Priority research topics</p> <ul style="list-style-type: none"> ▪ Identify perceived value of Research and new technology to industry sectors [ALL sectors] ▪ Communicating accessible key messages about the fishing and aquaculture industry to the community [ALL sectors] ▪ Capture and transfer knowledge from domestic and international sources to industry and managers [ALL sectors] ▪ Demonstrate the value and link between R&D and profitability and sustainability [ALL sectors] ▪ Understand and design appropriate communication and adoption and engagement systems for all sectors [ALL sectors] ▪ Develop industry capacity to undertake adoption and extension [Aqua, Com] ▪ Evaluate the impacts and value of the adoption and extension program to continually improve performance [Aqua, Com] 	Inadequate	↑	→



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Habitat and ecosystem protection	112.0	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Taxonomy; Fisheries Biology / Ecology; Data Management / Programming; Stakeholder Surveys / Logbooks; Fish Surveys; Biometrics / Statistics; Fisheries Modelling; Aquatic Animal Health; Environmental impacts (incl. bycatch); Oceanography; Hydrology; Chemistry / Biogeochemistry; Habitat Mapping; Benthic Ecology; Freshwater Ecology; Ecosystem Modelling; Gear Technology; Observational Technology. <p>Priority research topics</p> <ul style="list-style-type: none"> Understanding key food webs that support fisheries production and resilient aquatic ecosystems [ALL sectors] Mitigating impacts of fishing on threatened, endangered and protected species [Com] Reducing by-catch and discards, and better utilisation of previously discarded catch [Com] Replacing /optimising the use of fish meal in aquaculture diets [Aqua] Designing improved and standardised environmental monitoring and management systems and technologies [Aqua] Mitigating human catchment and coastal activities on aquatic habitats, including habitat rehabilitation and improved land management practices [ALL sectors] 	Adequate	→	→



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Climate change	102.1	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Taxonomy; Fisheries Biology / Ecology; Data Management / Programming; Stakeholder Surveys / Logbooks; Fish Surveys; Biometrics / Statistics; Fisheries Modelling; Aquatic Animal Health; Biosecurity; Environmental impacts (incl. bycatch); Oceanography; Hydrology; Chemistry / Biogeochemistry; Habitat Mapping; Benthic Ecology; Freshwater Ecology; Ecosystem Modelling; Social Impact and Assessment; Observational Technology. <p>Priority research topics</p> <ul style="list-style-type: none"> Understanding risk, opportunities and impacts of climate change on fisheries and aquaculture [ALL sectors] Understanding the sensitivity and impacts of climate change on ecosystems, fish stocks and fishing communities [ALL sectors] Understanding the adaptive capacity of stakeholders – both management and industry [ALL sectors] Developing tools to assist fisheries and aquaculture businesses and management to adapt to climate change [Aqua, Com] Understanding and reducing the carbon foot print of industry [Aqua, Com] 	Adequate	→	→



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Ecologically Sustainable Development	220.0	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Taxonomy; Fisheries Biology / Ecology; Data Management / Programming; Stakeholder Surveys / Logbooks; Fish Surveys; Biometrics / Statistics; Fisheries Modelling; Environmental impacts (incl. bycatch); Oceanography; Hydrology; Chemistry / Biogeochemistry; Habitat Mapping; Benthic Ecology; Freshwater Ecology; Ecosystem Modelling; Observational Technology; Economic Surveying; Economic Assessment; Social Assessment; Economic Modelling. <p>Priority research topics</p> <ul style="list-style-type: none"> Developing and implementing efficient and effective data collection and monitoring processes (e.g. electronic log books, fishery dependent data, remote observation systems) [Com] Developing technologies and models to underpin harvest strategy development, delivery and evaluation; including for data poor fisheries [Com] Integrating social, environmental and economic considerations into fisheries management strategies [ALL sectors] Developing performance indicators - including social, ecological and economic [ALL sectors] Understanding the influence of oceanographic and ecological factors on fisheries e.g. recruitment of fish stocks [Com, Rec, Cust] Developing technologies and processes to better understand the impacts of aquaculture systems and to quantify carrying capacity [Aqua] Developing practical tools for EBFM, and incorporating them into fisheries management plans [Com, Rec, Cust] Implementation of environmental management systems, eco-labels and other schemes to foster user-stewardship of the resource [Aqua, Com] 	Adequate	→	→



Strategic Research Theme (SRT)	Current FTE (Appendix 1)	Trends & future sector requirements and priority research topics (i.e. defined future sector strategic priorities) (based on information provided in Appendix 1, the related Ridge Partners Sector Overview & draft Fisheries & Aquaculture RD & E Strategy)	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Governance & regulatory systems	54.0	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> Fisheries Assessment; Ecosystem Modelling; Economic Surveying; Economic Assessment; Social Surveying and Assessments; Economic Modelling; Governance and Management; Fisheries Law; International Governance and Management. <p>Priority research topics</p> <ul style="list-style-type: none"> Developing delegation and accountability governance models [ALL sectors] Developing tools and techniques to support flexible, adaptive and more responsive fisheries management [Com] R&D to support the development of formal arrangements for responding to disasters and biosecurity emergencies [ALL sectors] Integrating monitoring and reporting systems so as to reduce costs and complexity [Aqua, Com] Developing efficient multi-fishery and multi-sector management arrangements in Australia's bioregions [Com, Rec, Cust] Involving communities in fisheries management at the local and regional level (e.g. monitoring, decision making and implementation) [Com, Rec, Cust] Developing and implementing cost effective compliance systems, including targeting and performance assessment (incentives/disincentives and education) [ALL sectors] 	Adequate	↑	→

**Key: Sector abbreviations: Aqua - Aquaculture; Com - Fisheries Commercial; Rec - Fisheries Recreational; Cust - Fisheries Indigenous Customary
 Capability assessment: → no capability change required; ↑ slight increase in capability required; ↑↑ moderate increase in capability required



Appendices

Appendix 1: Area of Expertise (AoE; Table 1) mapped against industry Strategic Research Theme

(The twin columns under each Strategic Research Theme represent the assumed proportional (%) spread of effort of each Area of Expertise against that Strategic Research Theme and the consequent assumed FTE, based on the total reported FTE for that AoE.)

		Strategic Research Theme																									
Area of Expertise	Total reported FTE	Biosecurity and aquatic animal health		Habitat and ecosystem protection		Climate change		Ecologically Sustainable Development		Governance & regulatory systems		Resource access and allocation		Growth and profitability		Maximising value from aquatic resources		Consumers and markets		Community support		Community resilience and development		People development		Extension and Adoption	
		%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE
Taxonomy	9.3	10	0.9	30	2.8	30	2.8	30	2.8																		
Fisheries Biology / Ecology	72.9	10	7.3	30	21.9	30	21.9	30	21.9																		
Ageing	7.2							100	7.2																		
Data management /programming	33.0			5	1.7	25	8.3	70	23.1																		
Stakeholder surveys / logbooks	12.3			10	1.2	10	1.2	55	6.7			25	3.1														

		Strategic Research Theme																									
Area of Expertise	Total reported FTE	Biosecurity and aquatic animal health		Habitat and ecosystem protection		Climate change		Ecologically Sustainable Development		Governance & regulatory systems		Resource access and allocation		Growth and profitability		Maximising value from aquatic resources		Consumers and markets		Community support		Community resilience and development		People development		Extension and Adoption	
		%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE
Fish Surveys	9.1			15	1.4	15	1.4	70	6.4																		
Biometrics / Statistics	24.3			10	2.4	10	2.4	70	17.0			10	2.4														
Fisheries Modelling	38.1			15	5.7	15	5.7	70	26.7																		
Fisheries Assessment	63.1							30	18.9	50	31.6	20	12.6														
Hatchery / nursery	30.4													100	30.4												
Grow-out/ production	15.3													100	15.3												
Broodstock management	7.0													100	7.0												
Feed & Nutrition	29.1													100	29.1												
Aquatic Animal Health	36.2	80	28.9	10	3.6									10	3.6												
Genetics & genomics	42.6							10	4.3					90	38.3												
Aquaculture systems & polyculture	18.4													100	18.5												

		Strategic Research Theme																																																			
Area of Expertise	Total reported FTE	Biosecurity and aquatic animal health				Habitat and ecosystem protection				Climate change				Ecologically Sustainable Development				Governance & regulatory systems				Resource access and allocation				Growth and profitability				Maximising value from aquatic resources				Consumers and markets				Community support				Community resilience and development				People development				Extension and Adoption			
		%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE																
Environment al impacts (inc. Bycatch & wildlife interactions)	53.3			70	37.3	20	10.7	10	5.3																																												
Oceano-graphy	32.1			25	8.0	50	16.1	25	8.0																																												
Hydrology	1.3			25	0.3	50	0.7	25	0.3																																												
Chemistry / Biogeo-chemistry	25.5			25	6.4	50	12.8	25	6.4																																												
Habitat mapping	11.6			20	2.3	20	2.3	60	7.0																																												
Benthic Ecology (incl. mapping & assess)	73.2			20	14.6	20	14.6	60	43.9																																												
Pelagic ecology	19.0			20	3.8	20	3.8	60	11.4																																												
Freshwater Ecology	28.7			20	5.7	20	5.7	60	17.2																																												

		Strategic Research Theme																									
Area of Expertise	Total reported FTE	Biosecurity and aquatic animal health		Habitat and ecosystem protection		Climate change		Ecologically Sustainable Development		Governance & regulatory systems		Resource access and allocation		Growth and profitability		Maximising value from aquatic resources		Consumers and markets		Community support		Community resilience and development		People development		Extension and Adoption	
		%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE
Ecosystem modelling	29.0			20	5.8	20	5.8	50	14.5	10	2.9																
Gear technology	15.8			50	7.9									50	7.9												
Observ'l technology	9.0			34	3.1	33	3.0	33	3.0																		
Aquatic engineering	0.5													100	0.5												
Anthro-pology	0.0																			40	0.0	60	0.0				
Demo-graphy	0.9																					15	0.1	85	0.6		
Educational Research	2.7																							20	0.5	80	2.1
Indigenous studies (incl. Culture)	1.2															20	0.2			35	0.4	20	0.2	20	0.2	5	0.1
Sociology	5.6															20	1.1			35	2.0	20	1.1	20	1.1	5	0.3
Resources allocation	3.3											100	3.3														
Economic surveying	2.3							20	0.5	10	0.2	40	0.9	10	0.2	20	0.5										

Area of Expertise	Total reported FTE	Strategic Research Theme																									
		Biosecurity and aquatic animal health		Habitat and ecosystem protection		Climate change		Ecologically Sustainable Development		Governance & regulatory systems		Resource access and allocation		Growth and profitability		Maximising value from aquatic resources		Consumers and markets		Community support		Community resilience and development		People development		Extension and Adoption	
		%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE
Economic assessment	5.8							20	1.2	10	0.6	40	2.3	10	0.6	20	1.2										
Economic modelling	7.1							20	1.4	10	0.7	40	2.9	10	0.7	20	1.4										
Prod & Mkt analysis	2.3																	100	2.3								
Market access & trade	3.5																	100	3.5								
Commer- cialisation	1.6													50	0.8											50	0.8
Seafood Processing	6.3													80	5.0			20	1.3								
Seafood safety	3.5													20	0.7			70	2.5	10	0.4						
Gov & Mgmnt	19.0									100	19.0																
Fisheries Law	0.9									100	0.9																
Int'l Gov & Mgmnt	1.8									100	1.8																

		Strategic Research Theme																									
Area of Expertise	Total reported FTE	Biosecurity and aquatic animal health		Habitat and ecosystem protection		Climate change		Ecologically Sustainable Development		Governance & regulatory systems		Resource access and allocation		Growth and profitability		Maximising value from aquatic resources		Consumers and markets		Community support		Community resilience and development		People development		Extension and Adoption	
		%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%	FTE
Communi- cation / Extension	69.1																									100	69.1
TOTAL FTE	884	37.1		136.0		119.1		225.0		57.6		27.4		158.7		4.4		9.5		2.7		1.5		2.6		72.4	