

2014

2014 AUSTRALIAN F&A SECTOR OVERVIEW

A REPORT SUPPORTING THE DEVELOPMENT OF WORKING TOGETHER:
THE NATIONAL FISHING AND AQUACULTURE RD&E STRATEGY

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Australian Government

**Fisheries Research and
Development Corporation**

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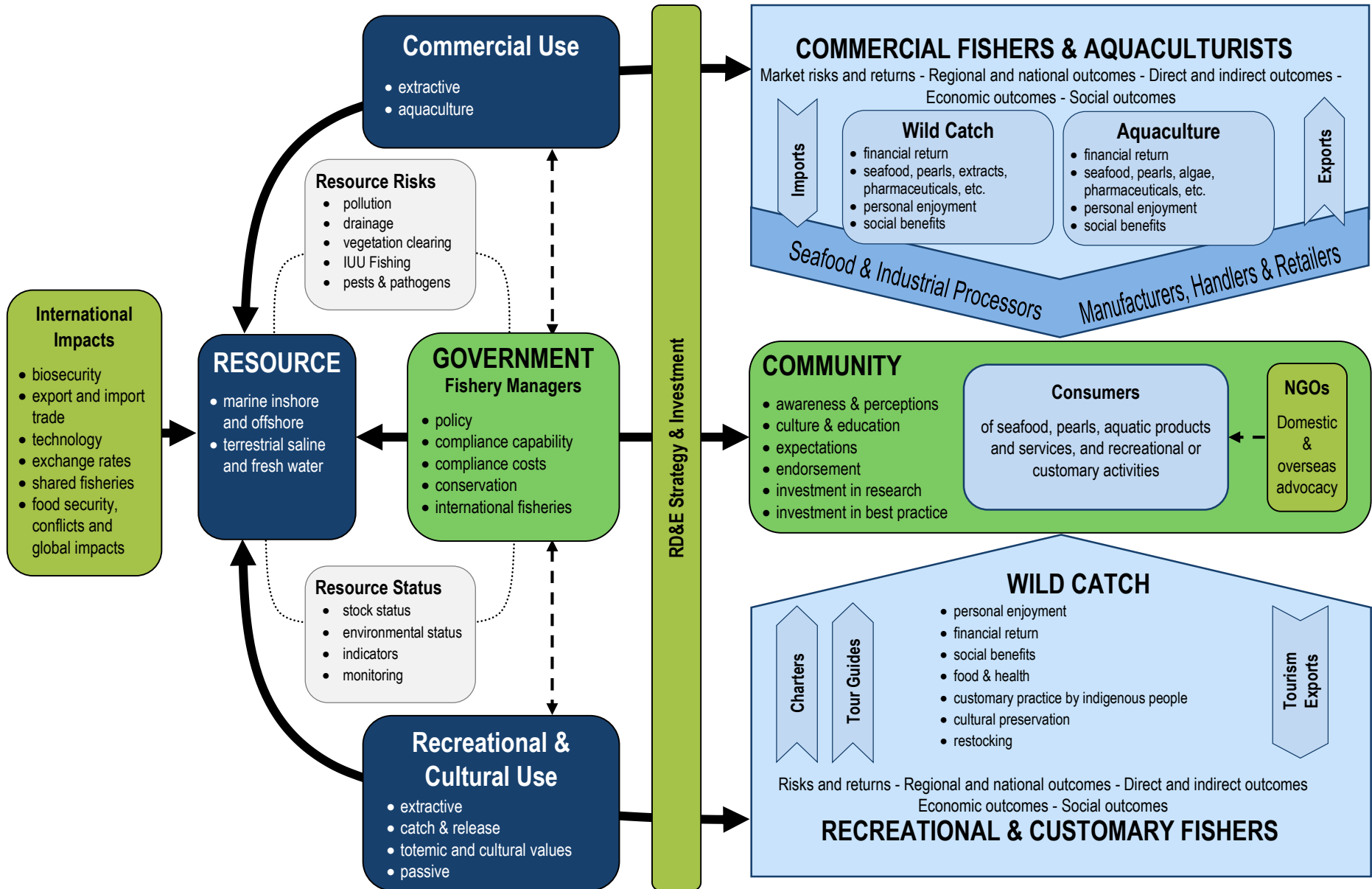
A. HEADLINE STATS

How can we expect to manage F&A efficiently if we don't take the time to measure correctly first? Facts help us tell our story.

1. KEY FISHING & AQUACULTURE (F&A) INDUSTRY STATS 2013

Item	Sector	Measures	Status 2013	Statistical Issues that need attention
1. Resource	Wild Catch	Marine EEZ = 8.15 mil. sq. kms (+ 2 for Antarctic) Coastline = 36,000 kms + >900 estuaries Rivers and significant listed streams = ~1,100 Public lakes, reservoirs, weirs, dams, etc. = ~3,600 Saline aquifers/ground waters = unknown	F&A resource data needs collation	Marine and terrestrial data exists (e.g. Geoscience Aust., state agencies), but has not been mapped for specific F&A use. This is a useful, not critical task. But as Aquaculture expands in both area and yield to dominate our domestic seafood supply and EU markets force more non-tariff barriers (especially environmental) on us we need to better quantify aquaculture's use of public resources. The use of public resources v private resources will be an issue.
	Aquaculture	Area of Water used = unknown Public Aquatic Resource Use versus Private Aquatic Resource Use = % unknown	NAC says this would be good to know	Farmed fish data is currently managed by state and territory jurisdictions but is not harmonised, nor in some instances transparent and available. Aquaculture in Commonwealth waters may also become a reality in the next decade.
2. Licenses and Permits	Wild Catch	Commercial = ~13,100 Recreational = sum of state licenses + anglers Customary = unknown	ABARES + Blueprint project	Most jurisdictions offer F&A data via their public registers for a small fee. More detail can be accessed via agency annual reports (where available) and from sectors and associations. But the lack of harmonised legislation complicates a task that should be much easier. At least one jurisdiction does not support or enable the ready collation and analysis of national data for any F&A Sectors. Need data on Recreational and Customary licenses to be collated.
	Aquaculture	Commercial = ~1,700 licenses and permits Recreational = unknown	ABARES data	
3. Resource Use & Harvest	Wild Catch = 185,000t	Commercial = 152,689 tonnes Recreational = Catch 48,400 t; Retained ~30,000t Customary = ~2,000 tonnes IUU = unknown	Need Recreational, Customary and IUU	The last national survey of recreational and customary fishing was taken in 2002! There is not yet an agreed mechanism to measure the harvest for recreational and customary fisheries – this is a major limitation on managing these sectors.
	Aquaculture = 80,066t	Closed Systems (Ponds, Recirculation) = unknown Semi-open Systems = unknown Open Systems – Cages = unknown	Not essential, but NAC says good to know	The harvest contribution of various aqua production systems is unknown. As the sector becomes the dominant sector for investors, traders and consumers, it will be important to have access to more comprehensive data sets.
4. Resource Status	Wild Catch	Commercial = ABARES Status Reports Recreational = limited data – use SAFS species Customary = limited data	ABARES for Commercial only	FRDC's new Status of Australian Fish Stocks Reports provide timely, direct, harmonised, and critical info. But it needs to include recreational and customary effort, specifically, not just when available ad hoc.
5. Economic Performance	GVP = \$2.4 billion	Commercial wild catch = \$1.38 billion Aquaculture = \$1.03 billion	ABARES	GVP is the economic measure required for commercial fishing and aquaculture by the PIRD Act.
	Economic Contribution	Commercial wild catch = unknown Aquaculture = unknown Recreational = \$2.56 billion (FRDC 2012/214) Customary = unknown IUU Fishing = unknown	Required	National economic impact of F&A is undocumented. Recreational estimates created in 2014, but seafood, customary and IUU are yet to complete. The skills and tools already exist to do this work (e.g. Econsearch), but industry and jurisdictions must give this priority. F&A services are an expanding component – include in the metrics.
	Employment = ~14,373	Commercial wild catch = Total 5,050: 3,475 Fulltime Aquaculture = Total 3,559: 2,342 Fulltime Processing (2011) = 1,783 Fish and seafood wholesaling (2011) = 3,981 Recreational = unknown - ABS est. ~90,000 Customary = unknown	ABARES data available for Commercial. Need data for other sectors	F&A employment data is sectoral or jurisdictionally based, and not yet well managed and collated. F&A related employment in the recreational and customary sectors is particularly deficient. There is a need to agree nationally a joint framework to access and collate F&A employment and productivity data.
	Trade in Edibles = 264,000t; \$2.43 billion	Import Tonnes = 228,391 tonnes: 73% of consumption Import Value = A\$1,427,679,000 Export Tonnes = 35,304 tonnes Export Value = A\$1,002,341,000	ABARES data	ABARES/Customs collect seafood trade data, available to industry and investors. Access to good trade trend data will be important to enable industry to leverage Australia's growing number of Free Trade Agreements and a more competitive A\$ currency. But we also need to add the value of F&A services (science, research, training, equipment, etc.) to the trends.
6. Social Performance	Social Licence	Index or metric to be developed	Required	There are 3 possible indices that could be used: <ul style="list-style-type: none"> FRDC's existing Community Perceptions Surveys; FRDC's existing Performance and Use Study framework across all sectors; FRDC's emerging social assessment tool/performance index (2010/040 and 2011/217). A global social licence to operate index is complicated and unlikely to be available or useful.
	Wild Catch	Commercial = unknown Aquaculture = unknown Recreational = unknown Customary = unknown	Underway	
7. Market Performance	Edible Seafood	Value added after harvest = unknown Domestic per capita consumption of seafood = known	Required ABARES data	Data needs to be developed – need to agree the metrics to be used Data available at ABARES and FAO – need to agree the metrics to be used
	Non-edible	Per capita consumption of non-edibles = unknown	ABARES data	For pearls, algae, etc. Is this data of any use?
	Recreation	F&A's contribution to recreation = unknown	Participation data exists at ARFF	A recreational fishing engagement/participation index would be useful – does it exist?
	Indigenous	F&A's contribution to Custom maintenance = unknown	Non-critical	Very difficult to define this measure and then collate the relevant data
8. R&D Investment	Wild Catch	Fisheries = \$34 million across Commercial, Recreational and Customary Indigenous	Data at FRDC and other agencies	FRDC commissions rolling audits of RD&E research capacity and investment – to date data has been collated in 2008 and 2013. Refer to Fish Article for trends - http://frdc.com.au/knowledge/publications/fish/Pages/22-3_articles/18-New-blends.aspx Improved trend detail and investment analysis will come forward as the dataset evolves and improves.
	Aquaculture	\$36 million across Closed Systems (Ponds, Recirculation), Semi-open Systems, and Open Systems – Cages	Data at FRDC and other agencies	

2. F&A LANDSCAPE 2014



3. EVENTS SHAPING THE RD&E INVESTMENT

There are many relevant projects funded by FRDC and other organisations that have helped shape the F&A Industry. The following table identifies and demonstrates the scope of a selection of FRDC sponsored landmark projects since 1999. (Source: FRDC Project Directory 20May 2014. Also refer to Appendix 2.)

Investment Area	Significant National FRDC Projects
Seafood Consumption	2003/237 Development of a quality index for Australian seafood 2008/779 SCRC Tracking seafood consumption and measuring consumer acceptance of innovation in the Australian seafood industry 2009/721 Eat More Fish – Expanding the Consumption of Seafood Through Retail Channels
Seafood Marketing, Differentiation and Promotion	2004/401 SCRC: A market access guide for seafood exporters: International Residues standards 2004/413 Developing an Australian seafood strategy for export growth - stage 1 2005/233 Developing and implementing a business model for marketing and branding Australian seafood 2010/228 Developing a dynamic regional brand - focus on flavour
Wild fishery access and allocation	2003/039 Dynamic modelling of socio-economic benefits of resource allocation between commercial and recreational use 2010/226 An assessment of the threats to marine biodiversity and their implications for the management of State and Commonwealth fisheries 2011/032 Incorporating the effects of marine spatial closures in risk assessments and fisheries stock assessments 2014/030 Status of key Australian fish stocks reports 2012/202 Operationalising the risk cost catch trade-off 2013/203 Development of an approach to harvest strategy management of internationally managed multi-species fisheries
Recreational Fisheries	1999/158 Implementation of the National Recreational and Indigenous Fishing Survey 2007/227 Recfishing Research: National Strategy for Recreational Fisheries Research, Development and Extension 2010/001 Predicting the impacts of shifting recreational fishing effort towards inshore species 2012/022 Development of methods for obtaining national estimates of the recreational catch of southern bluefin tuna 2012/214 Measuring the economic value of recreational fishing at a national level 2014/402 Planning, developing and coordinating national/regional research, development and extension (RD&E) for Australia's recreational fishing community
Indigenous Fishing and Aquaculture	2003/078 Implementation of the National Recreational and Indigenous Fishing Survey 2003/308 Indigenous Fishing Rights conference 2008/326 People Development Program: FRDC indigenous development scholarships 2010/205 Identifying the key social and economic factors for successful engagement in aquaculture ventures by indigenous communities 2010/401 Shaping advice for Indigenous fishing and aquaculture RD&E within the national strategy 2012/216 Indigenous cultural fishing and fisheries governance
Social issues, data and License to Operate	2003/056 ESD Reporting and Assessment Subprogram: a social assessment handbook for use by Australian fisheries managers in ESD assessment and monitoring 2008/328 Practical implementation of social and economic elements in ecosystem based fisheries and integrated fisheries management frameworks 2009/041 Fisheries Social Sciences Research Coordination Program 2010/040 Developing and testing social objectives for fisheries management 2011/525 Communicating sustainability to build aquaculture's social license to operate 2012/301 Let's Talk Fish: Assisting industry to understand and inform conversations about the sustainability of wild-catch fishing
Performance and Productivity	2006/071 Evaluating the Performance of Australian Marine Capture Fisheries (2009) 2006/068 Co-management: managing Australia's fisheries through partnership and delegation 2010/311 Seafood Directions 2011 - The Productivity Challenge 2013/411 Improving the environmental and economic performance of Australian rocklobster fisheries through collaboration across research, management, harvest, transportation and markets 2014/235 Evaluating the Performance of Australian Marine Capture Fisheries (2014)
Climate change (FRDC, 2011)	2009/073 El Nemo South East: social and economic risk assessment of the fishing and aquaculture sectors in the south eastern Australia region due to climate change 2009/070 El Nemo South East: risk assessment of impacts of climate change for key species in south eastern Australia 2009/056 El Nemo South East: understanding the biophysical implications of climate change — project 1 and 2 2009/053 Tactical Research Fund: spreading the risk — management strategies for multi-method inshore fisheries in a changing climate 2010/023 El Nemo South East: quantitative testing of fisheries management arrangements under climate change using Atlantis

Contents

A. HEADLINE STATS.....	3
1. KEY FISHING & AQUACULTURE (F&A) INDUSTRY STATS 2013	3
2. F&A LANDSCAPE 2014.....	4
3. EVENTS SHAPING THE RD&E INVESTMENT	5
C. ABOUT THIS OVERVIEW REPORT	12
1. PURPOSE	12
a. Objectives	12
b. Study Team.....	12
2. SCOPE AND TERMINOLOGY.....	13
a. Commercial Activity.....	14
b. Recreational Fishing Sector.....	15
c. Indigenous Fishing Sector.....	15
d. Illegal, Unreported and Unregulated Fishing	15
3. F&A BUSINESS ENVIRONMENT.....	15
D. GLOBAL OVERVIEW OF F&A	17
1. FISHING AND AQUACULTURE OFFER MANY BENEFITS.....	17
a. More people means more food	17
b. Health and nutrition.....	19
c. Employment.....	19
d. Productivity.....	19
e. Trade.....	20
f. Prices.....	21
g. Consumers	22
2. FOOD SECURITY.....	22
a. Beware of Trade Implications	23
b. Reduce Food Waste	23
c. Leverage the Efficiency of Fish.....	24
d. Why China Matters to our Planning.....	25
e. Top 10 Seafood Superpowers.....	27
3. USE OF OCEAN RESOURCES.....	29
a. Users.....	29
b. Sustainability.....	29
c. Illegal, Unreported and Unregulated Fishing.....	30
d. Fossil Fuels Use.....	30
4. US AQUACULTURE STRATEGY 2014-19.....	30
5. GLOBAL TRENDS AND ISSUES IN RECREATIONAL FISHING	31
a. Context and trends	31
b. Governance.....	32
c. Social Management.....	33
d. Biological Management.....	33
e. Ethics.....	34
f. Survey Methods and Monitoring.....	34
g. Economic Valuation and Investment.....	34
6. GLOBAL TRENDS AND ISSUES IN CUSTOMARY FISHING	36
7. MEGATRENDS: FOOD - WATER - ENERGY NEXUS	37
a. Climate Change and Impacts.....	37
E. AUSTRALIAN RESOURCE CONTEXT FOR F&A	41
1. ENVIRONMENTAL CAPACITY	41

a. Capacity to Support F&A	41
b. Actions to Enhance Resource Capacity	42
2. RESOURCE USE	42
a. Exclusive Economic Zone	42
b. Dynamic Use Trends	43
c. Key Legislation	43
3. SUSTAINABILITY	44
a. What does it Mean Today?	44
b. Sustainability Assessments	45
c. Marine Reserves	46
d. Community and Public Perceptions	46
4. POTENTIAL YIELD GROWTH TO MEET MARKETS	50
a. What does Yield Growth Mean?	50
b. Wild Catch Yield Growth	51
c. Aquaculture Yield Growth	52
F. FISHERY ACCESS AND MANAGEMENT	55
1. BALANCING BENEFITS AND RISKS	55
a. Social Capacity and License	56
b. Economic Capacity	57
c. National Fisheries Management Goals	58
2. NATURE OF PROPERTY RIGHTS ACROSS SECTORS	58
a. Scope and Scale	58
b. Access and Allocation	59
c. Advantages and Disadvantages	60
d. Fishery Jurisdictions, Species, Employment, and Use	60
3. COMMERCIAL ACTIVITY	63
a. Commercial Fleet	63
b. Commercial Value at the Beach	63
c. Commercial Supply Chain	65
d. Commercial Species – Supply and Use	67
e. Commercial Licensing	71
f. Regulatory Efficiency and Burden	74
g. Business Models and Trends	79
h. Aquaculture Volume Forecasts to 2020	81
4. RECREATIONAL SECTOR	84
a. Primary Issues and Challenges	84
b. Greater Recognition of Recreational fishing	85
c. Technological Improvements	85
d. Maximum Experiential Yield	86
e. Changing Behaviours and the Impact on Fish Stocks	86
f. Resource Sharing	87
g. Property Rights	87
h. Relationship with Other Sectors	88
i. Meeting the Costs of Management	88
j. Impediments to Sustainable Recreational Fishing	89
5. INDIGENOUS FISHERIES	89
a. Scope and Size	89
b. Ranger Program	91
c. National Data and Definition	91
d. Aspirations of Indigenous Fishery Communities	92
e. Fishery and Aquaculture Initiatives	92
f. Social Context	93
g. The Subprogram	93
h. Current Issues in the Literature and Media	94

i. Scorecard on Indigenous Disadvantage	97
6. ANIMAL WELFARE	99
7. CHALLENGES IN MANAGING CLIMATE CHANGE.....	99
G. CREATING PRODUCTS AND SERVICES FOR MARKETS	101
1. SEAFOOD PROCESSING.....	101
a. Prospects.....	101
b. Revenue.....	102
c. Structure	102
d. Value Adding Potential	102
e. Regulation.....	103
f. Technology.....	103
g. Trend in Performance of Sector	103
2. HARVEST SAFETY	104
3. REGIONAL IMPACTS AND MULTIPLIERS	105
4. INDUSTRIAL PRODUCTS AND SERVICES.....	105
5. SEAFOOD CONSUMPTION.....	106
6. RETAIL AND FOOD SERVICE TRENDS	106
a. Certification.....	106
b. GSSI.....	107
c. Australian Food Brand	108
d. Online Marketing.....	108
7. TRADE AND MARKET ACCESS	108
a. Exchange Rates.....	108
b. Free Trade Agreements	109
c. Exports.....	110
d. Imports.....	112
8. HUMAN PRODUCTIVITY, SKILLS AND REGULATION.....	114
a. Critical and Current Issue	114
b. Seafood Skills Status.....	114
c. Vessel Productivity	118
d. Summary of Relevant Literature.....	120
9. RECREATIONAL SECTOR.....	125
a. Size and scope.....	125
b. Recreational Fishing Statistics.....	127
c. Trends since the NRIFS.....	127
10. AUSTRALIAN F&A RESEARCH PERFORMANCE.....	129
a. Issues.....	129
b. Funding the FRDC Performance.....	130
11. IDEAL POLICY FRAMEWORK FOR FISHERIES.....	131
12. PROFITABILITY – SEGMENTS, TRENDS	131
H. SOCIAL TRENDS AND BENEFITS	134
1. SECTOR HOLLOWING.....	134
2. FISHERY BEST USE AND PERFORMANCE	134
3. TRENDS RE NGOS	139
APPENDICES	140
1. METHODOLOGY.....	140
2. KEY PROJECTS IN THE RD&E INVESTMENT.....	141
Bibliography	144

Table of Figures

Figure 1. Australian Fishing and Aquaculture activities.....	13
Figure 2. Australian F&A Sector Harvest (2012, 2007, 2002).....	14
Figure 3. Elements of the F&A Business Environment.....	16
Figure 4. Population Drives Food Demand.....	17
Figure 5. Global Fish Supply and Seafood Consumption.....	18
Figure 6. Aquaculture Supply will soon exceed Wild Catch.....	18
Figure 7. Major Marine Wild Catch Fishers.....	19
Figure 8. Aquaculture Productivity 2012.....	20
Figure 9. Projected Net Exports of Fish by Region.....	21
Figure 10. Forecast Real Fish Price Growth: 2014 to 2030.....	22
Figure 11. The Exploding Asian Middle Class.....	22
Figure 12. Australia's main seafood suppliers 2011-12.....	23
Figure 13. Food Security Risk – Asian Seafood Suppliers.....	23
Figure 14. Global food waste is Large, but Seafood is small.....	23
Figure 15. Aquaculture is relatively efficient and sustainable.....	24
Figure 16. Consumption waste is high in Rich Economies.....	24
Figure 17. Marine Harvest –Salmon efficiency ratings.....	24
Figure 18. Ongoing Urbanisation in China.....	25
Figure 19. Aust. Wild Abalone Price now below 1990 level.....	25
Figure 20. Repositioning of WRL in the China Market.....	26
Figure 21. China is now trading up to new high value species.....	27
Figure 22. Global Seafood Superpowers.....	28
Figure 23. Recreational Fishery Valuation and Data Management in Advanced Economies.....	35
Figure 24. Global Megatrends.....	38
Figure 25. National Climate Change and Fisheries Action Plan.....	40
Figure 26. Australian Fishing Zone.....	41
Figure 27. Jurisdictional GVP's \$Billion (Nominal).....	43
Figure 28. Agreed Status Terminology for classifying individual stocks.....	47
Figure 29. Status of Key Australian Fish Stocks 2012 and 2014.....	47
Figure 30. Community Perceptions of Fishing.....	49
Figure 31. Potential Wild Fisheries offering yield growth.....	51
Figure 32. Australian Aquaculture Species - Where are the Opportunities?.....	54
Figure 33. Headline Social Goals for managing fisheries.....	56
Figure 34. Social Objectives for Fisheries Management.....	56
Figure 35. Major Beneficiaries of Access and Governance.....	59
Figure 36. Pros and Cons for Access and Allocation Models.....	61
Figure 37. Australian Fishery Jurisdictions, Access, Species, Employment, and Use 2012-13.....	62
Figure 38. Commercial Fishing Fleets - Australia and NZ.....	63
Figure 39. Australian Commercial Sector Harvest Trends.....	63
Figure 40. Commercial Wild Catch GVP Trends (Nom. \$'000).....	63
Figure 41. Aquaculture GVP Trends (Nom. \$'000).....	64
Figure 42. Commercial Sector - GVP Trends (Nom. \$'000).....	64
Figure 43. Analysis of Food and Non-Food GVP 2011-12.....	66
Figure 44. Australia's Food Trade by Commodity 2011-12.....	66
Figure 45. Airfreight of fish based foods – Real 2012 values.....	67
Figure 46. Commercial Catch and Trade for Key Species 2012-13.....	68
Figure 47. Headline Trends in Commercial Supply.....	69
Figure 48. 2013 Seafood GVP and China Export Trade.....	69
Figure 49. 2013 Source and Use of Seafood – Tonnes.....	70
Figure 50. 130 Leaders Dominate Commercial Sector.....	71

Figure 51. Estimated F&A License Holders 2013.....	72
Figure 52. Leading Commercial Stakeholders Ranked by GVP	72
Figure 53. Regulatory Assessment of Aquaculture	73
Figure 54. Top Entities by Turnover in Commercial Industry (\$mil.).....	82
Figure 55. Forecast Australian Aquaculture Supply 2020.....	83
Figure 56. Recreational Fishery Issues and Challenges	84
Figure 57. Working on Country Ranger Programs	90
Figure 58. Aquaculture Farms with significant Indigenous Involvement	90
Figure 59. Indigenous Fishery Case Study Communities.....	93
Figure 60. 2011 IRG Aspirations and RD&E Priorities	96
Figure 61. 2014 Strategic Areas for Action on Indigenous Disadvantage.....	98
Figure 62. Trends in Australian Seafood Processing.....	103
Figure 63. Economic Impacts from F&A Sectors.....	105
Figure 64. Trade Partner Exchange Rates – last 11 years.....	109
Figure 65. Trade Partner Exchange Rates – last 5 years	109
Figure 66. China Trade Currency Vs TWI	109
Figure 67. Key Seafood Impacts from ChAFTA	110
Figure 68. Seafood Export Tonnes in Decline for last Decade.....	111
Figure 69. Seafood Exports - Real GVP \$'000.....	111
Figure 70. Seafood Export Tonnes to Top 10 Destinations	111
Figure 71. Top 7 Export Destinations – Real GVP Trend	111
Figure 72. Real Average Prices Achieved to Top 7 Markets	112
Figure 73. Export Product Formats - Real GVP \$'000.....	112
Figure 74. Rising Fishery Product Imports Tonnes	112
Figure 75. Edible Seafood Imports - Real Value \$'000.....	113
Figure 76. Inedible Product Imports - Real Value \$'000	113
Figure 77. Edible Seafood Import Tonnes - 5 Top Suppliers	113
Figure 78. Inedible Fish Product Imports - Real Value \$'000.....	114
Figure 79. NCVER STP - Enrollments by Age Group	117
Figure 80. NCVER STP - Enrollments by Jurisdiction	117
Figure 81. NCVER STP - Enrollments by Prior Education.....	117
Figure 82. NCVER STP - Qualifications Completed	117
Figure 83. Current F&A Labour Market Issues	119
Figure 84. DoA Competitiveness Green Paper 2014.....	120
Figure 85. Poor Collaboration and Low R&D Expenditure.....	121
Figure 86. Relative Intangible Investment - % of GDP.....	121
Figure 87. Productivity Commission and Responses re RD&E.....	123
Figure 88. Proportion of RD&E Investment by RDCs	125
Figure 89. Map of Recreational Fishing Locations.....	126
Figure 90. Recreational Harvest (NRIFS)	127
Figure 91. Recreational Catch and Release.....	127
Figure 92. Proposed Sustainable Wild Fisheries Management Framework.....	133
Figure 93. 2014 Performance and Use - Headline Results.....	135
Figure 94. High Level Ratings by Sector	136
Figure 95. High Level Performance Trends.....	137
Figure 96. Expert Ratings of Performance 2014	137
Figure 97. Performance & Use Priorities for Action 2014.....	138
Figure 98. Actions To Reduce the Performance Gap - 2009 and 2014.....	138

Glossary

AANZ	ASEAN – Australia, New Zealand Free Trade Agreement
ACIAR	Australian Centre for International Agricultural Research
ASCRC	Australian Seafood Cooperative Research Centre
ASEAN	Association of South East Asian Nations
ASX	Australian Stock Exchange
CITES	Convention on the International Trade in Endangered Species
COAG	Council of Australian Governments
CoOL	Country of Origin Labelling
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EPBC	Environmental Protection and Biodiversity Conservation Act
FCR	Feed Conversion Ratio
FIRB	Foreign Investment Review Board
FRDC	Fisheries Research and Development Corporation
FT	Full time employment
GBRMPA	Great Barrier Reef Marine Park Authority
GHG	Greenhouse Gases
Kcal	kilo calories
MMT	Million Metric Tonnes
MEY	Maximum Economic Yield
MPA	Marine Protected Areas
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
NCVER	National Centre for Vocational and Education Research
NMSP	National Marine Science Plan
NOAA	USA Nation Oceans and Atmospheric Administration
NRIFS	National Recreational and Indigenous Fishing Survey
PT	Part time employment
QAIF	Queensland Aquaculture Industry Federation
RDC	Rural Research and Development Corporation
SME	Small and Medium Enterprise
TAC/C	Total Allowable Catch/Commercial Catch
TACL	Tasmanian Abalone Council Ltd
TFK	Traditional Fishing Knowledge
TWI	Trade Weighted Index
UNCLOS	United Nations Convention on the Law of the Sea

C. ABOUT THIS OVERVIEW REPORT

1. PURPOSE

This report presents a strategic review and analysis of the business environment for the fishing and aquaculture industry in Australia. The review has been undertaken to provide baseline data and analysis to support FRDC and industry planning activities, in particular for the National Fishing and Aquaculture (F&A) Research Development and Extension (RD&E) Strategy for the period 2015-2020.

Fishing and aquaculture (F&A) in Australia broadly includes any activity concerned with taking, culturing, processing, preserving, storing, transporting, marketing or selling fish or fish products. This review covers the four main F&A sectors, across all Australian jurisdictions:

1. Commercial wild catch fishers, (the term “Commercial fishing” is increasingly used to define wild catch only),
2. Aquaculture producers,
3. Recreational fishers and associated commercial enterprises, and
4. Indigenous customary fishers.

The commercial wild catch fishers, aquaculture producers and post-harvest enterprises collectively are referred to as the seafood industry, although non-food items such as pearls are included among its products.

Aboriginal and Torres Strait Islander people are involved in the commercial and recreational sectors in addition to fishing in continuance of their ancient customs.

Over time the evolution of these four sectors prompts change in their respective definitions. This trend continues, as evidenced by new technologies and related investments in ranching and reseeded of wild fisheries in Australian waters. It also serves to illustrate how the fishing and aquaculture industry is the most complex of all primary industries. These changes throw up challenges for legislators and fishery managers, but also for RD&E investors.

a. Objectives

The objectives for the review and analysis are:

1. To assess and analyse the current business and operating environments for the four major sectors of F&A
2. To develop scenario forecasts for the future business and operating environments for F&A – including opportunities and threats; and
3. Based on the forecasted scenarios, identify the R D & E strategies

b. Study Team

This report has been compiled by Ridge Partners, a Brisbane based firm, in response to the national RD&E strategy working group’s Terms of Reference. Project Leader Ewan Colquhoun has been supported by the following industry experts to variously design the methodology, comment on issues and drafts, collate and analyse data; and compile this report and related presentations to industry stakeholders. The team included:

Kelly Buchanan, Prof. Colin Buxton, Dr Matt Flood, Dr Caleb Gardner, Matt Barwick, Dr Chris Calogeras, Ian Curnow, Dr Alistair Hobday, Pheroze Jungalwalla, Prof. George Kailis, Matt West, Hamish Allen, Gus Dannoun, Sam Gordon, Jayne Gallagher, Sam Guthrie, Hari Dimitri, Dr Kate Brooks, Bo Carne, Dr Sarah Jennings, and Dr Ian Poiner. Project and communications support was provided by FRDC staff including Josh Fielding, Peter Horvat and Jo Ruscoe.

Information used in the report has been drawn from verifiable sources wherever possible, and supplemented by expert consultation and team advice. A first draft of this report was tested with a broad range of stakeholders at a workshop held in Adelaide in July 2014.

2. SCOPE AND TERMINOLOGY

This review considers the global fishing and aquaculture industry context as a basis for more detailed discussion of the Australian fishing, aquaculture and the seafood industry.

The previous page identifies the four main areas of activity – commercial wild catch fishing, aquaculture, recreational fishing, and Indigenous customary fishing. One additional

activity area (illegal, unreported and unregulated fishing) is also recognised, but is not a legal industry activity.

Figure 1 illustrates the various activities undertaken within the F&A industry.

FIGURE 1. AUSTRALIAN FISHING AND AQUACULTURE ACTIVITIES

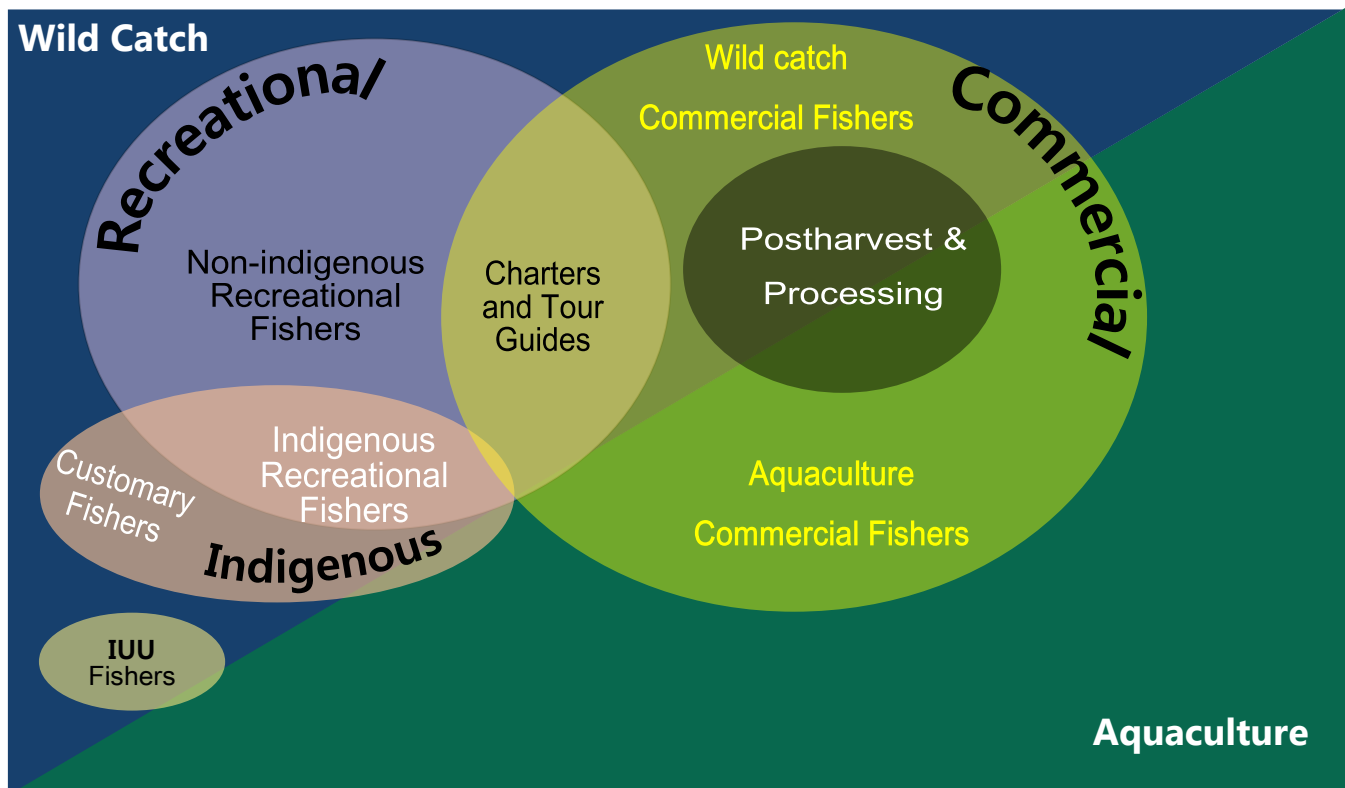


Figure 2 comprises four quadrants representing the spatial location and broad transition of fishing and aquaculture activities by the four sectors (wild catch Commercial, Recreational, Customary and Aquaculture) over the last decade.

The coloured areas are representative of the relative harvest volumes for each sector or resource user group.

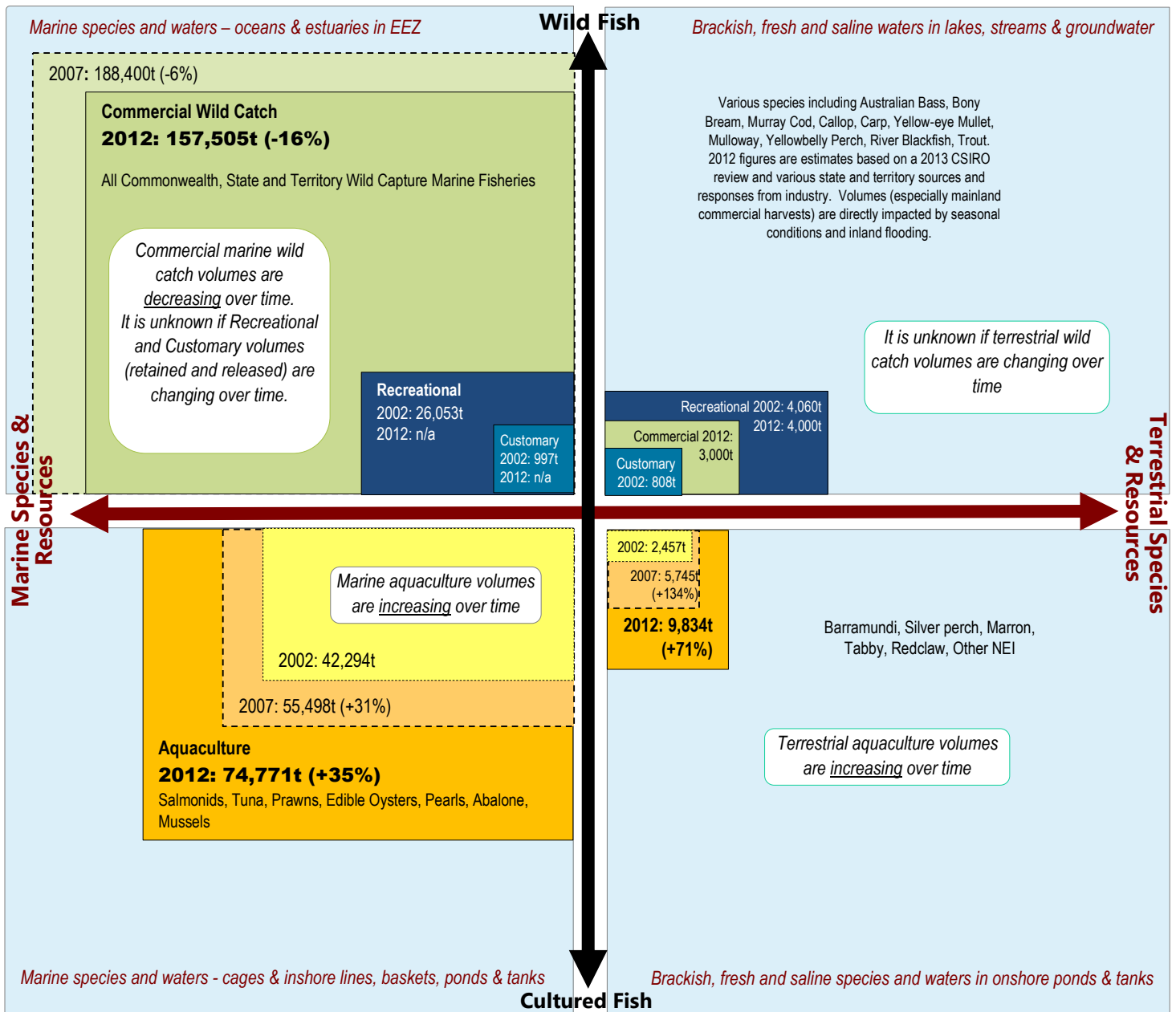
Their known harvest volume data has been sourced where possible, from available marine and terrestrial sources.

But the diagram is deficient as it does not illustrate the important supply chain impacts, socio-economic impacts

and other intangible values (e.g. workplace enjoyment, recreational benefits, cultural or community values, and resource legacies).

Stakeholders need to invest more effort to appropriately quantify and illustrate these supply chain and intangible components as they are increasingly important to securing a long term social licence to operate for all Users.

FIGURE 2. AUSTRALIAN F&A SECTOR HARVEST (2012, 2007, 2002)



a. Commercial Activity

Commercial fishers and farmers undertake activities directed to a financial return from the sale of either seafood, or non-edible aquatic products including pearls, algae, kelp sponges, etc. This activity occurs in two sectors:

- Wild catch fishers utilising limited entry marine, estuarine and inland fresh and saline waters; and
- Aquaculture farmers utilising limited entry production systems in three categories:

- Semi-Open Systems where there is control of host movement but no control of water flow e.g. net or pen culture
- Semi-Closed Systems where there is control of host movement and some control of water flow e.g. pond culture, race culture.
- Closed Systems where there is good control of both host movement and water flow e.g. recirculation aquaculture, aquaria.

In addition to profit, participants in both sectors gain a level of personal and professional satisfaction from their participation in the sector. Commercial activity is managed within Australian jurisdictions (by federal, state, or territory governments), or is undertaken in open ocean waters outside the Australian Fishing Zone. Collectively these fishers and producers and downstream (i.e. from the beach, farm gate or pond) enterprises in the industry value chain are called the Seafood Industry.

b. Recreational Fishing Sector

Recreational fishers undertake activities that create personal enjoyment and recreation from fishing, utilising wild catch marine, estuarine and inland fresh and saline waters. Fish tour and charter operators and fishing guides who provide commercial services to recreational fishers are managed by agencies as part of their recreational fisheries. Fishout activity utilises ponds containing cultured species for recreational fishing and can be an important activity for those that don't traditionally go recreational fishing.

All Australian recreational fisheries (including game, sports and spear) are managed by state and territory jurisdictions – there are no federally managed recreational fisheries. At present, fisheries management arrangements limit the rights of individual fishers, not the number of fishers active in the sector or total harvest. Fisher entry (via licensing of fishers or vessels, or via spatial or temporal closures of waters) and fisher take (via bag limits, fish size or other specifications) are the tools used for management of this sector. Recreational catch may be released live, or retained for personal use only (e.g. as food) – sale of recreational catch is illegal in Australia.

c. Indigenous Fishing Sector

Indigenous fishers comprise Aboriginal and Torres Strait Islander peoples. They participate variously in all F&A Industry activity in Australia:

- Customary activities where they observe cultural norms and practice traditional fishing crafts for food and other benefits in support of their Indigenous communities and cultural life;
- Commercial activities (including fishing, charter or fishing guide businesses) for commercial gain in wild catch fisheries in marine, estuarine, or inland waters,

- Aquaculture activities for commercial gain, or for providing food or recreation for their community,
- Recreational activities in pursuit of leisure and social wellbeing.

It is important to distinguish between "Indigenous people" and "customary activities" to ensure a more comprehensive understanding by all stakeholders of the economic, social and cultural development and RD&E investment opportunities for Australia's fisheries. This is especially the case across northern Australia where there are many more and larger, remote coastal Indigenous communities. Australia's Indigenous communities are increasingly seeking opportunities to develop their fishery resources and related capacity to achieve a number of outcomes, including to improve diets and nutrition, retain young people in communities, engage women and men in local employment, develop local trade and business skills, demonstrate their cultural heritage to a growing international tourism industry, collaborate in investments with other remote communities, and improve health and reduce substance abuse. Clarification of the importance of both "Indigenous peoples" and "customary activities" updates our lexicon to keep pace with what is actually happening in 2014 along the development pathways that Indigenous people are now advancing.

In the context of Australian fishing and aquaculture, "customary fishing" is an activity unique to Aboriginal and Torres Strait Islander people. As Indigenous people become increasingly active across all fishery activities, fishery management terminology and legislation is being reviewed to incorporate and support management of their rights and sustainability of their fisheries.

d. Illegal, Unreported and Unregulated Fishing

A further fishing activity (not included in Figures 1 or 2) involves illegal, unreported and unregulated (IUU) catch. While collecting meaningful data on this activity is difficult for obvious reasons, industry advice suggests the take of IUU fishers is as high as 10% of harvest tonnage in some fisheries, with an estimated national take equivalent to 1% of commercial harvest tonnage.

3. F&A BUSINESS ENVIRONMENT

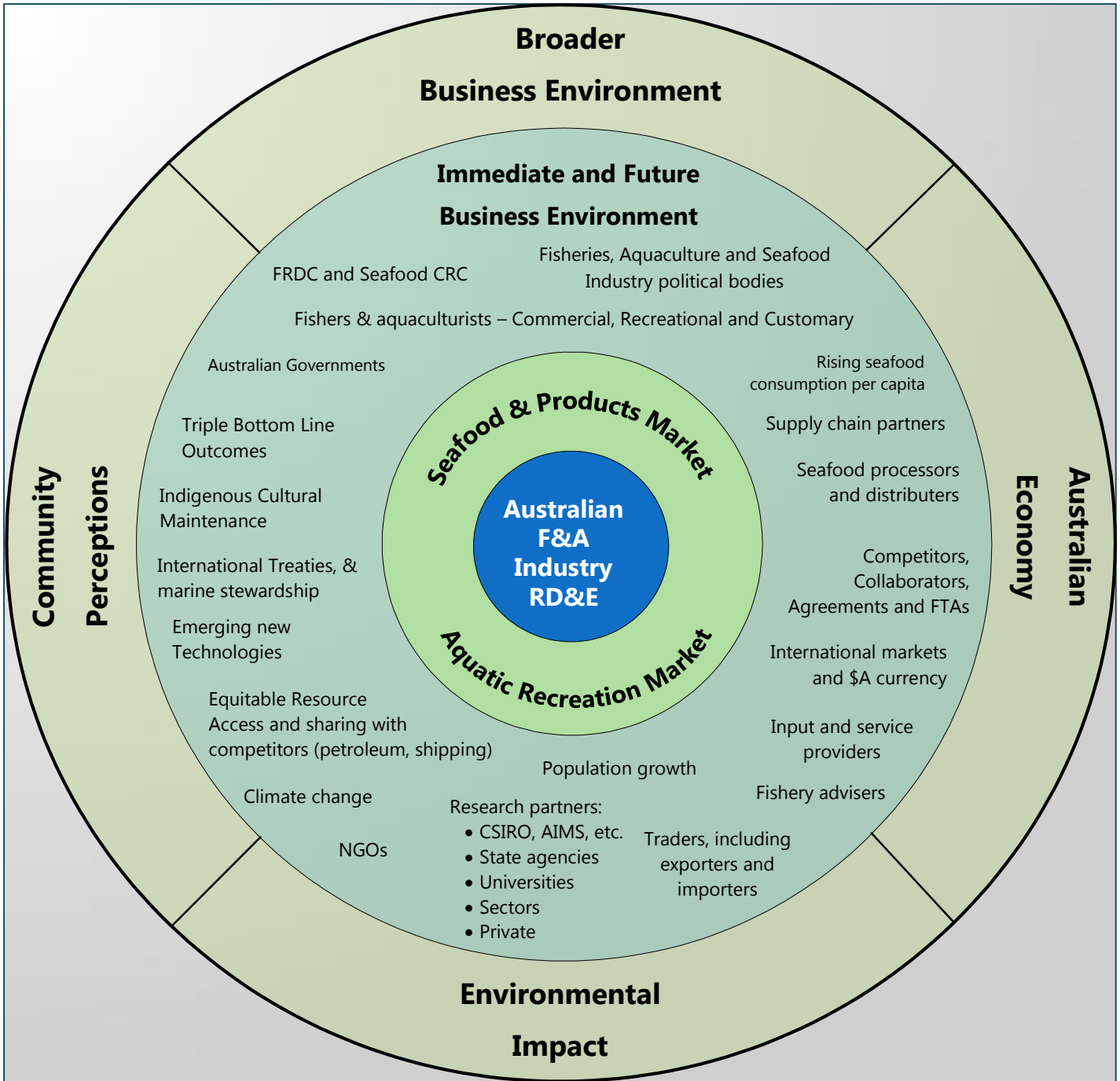
The central purpose of this report is to overview the various sectors of the fishing and aquaculture industry and consider their development and RD&E investment

scenarios in the current and future business environment, 5-10 years ahead.

Figure 3 illustrates the business elements influencing the assumptions for future scenarios. Many impacts on

fishers and aquaculturists, and their chain partners, arise from non-commercial origins (e.g. community perceptions). These are the elements considered in more detail in this Sector Overview report.

FIGURE 3. ELEMENTS OF THE F&A BUSINESS ENVIRONMENT



D. GLOBAL OVERVIEW OF F&A

Fishing and aquaculture provide 16% of the world's animal protein consumption (World Bank, 2013, p. vii). The industry also provides many nutritional, social, cultural and economic benefits important in human nutrition, human health, food security, wellbeing and livelihoods.

These are summarised in this chapter in a format designed to inform Australian stakeholders and planners.

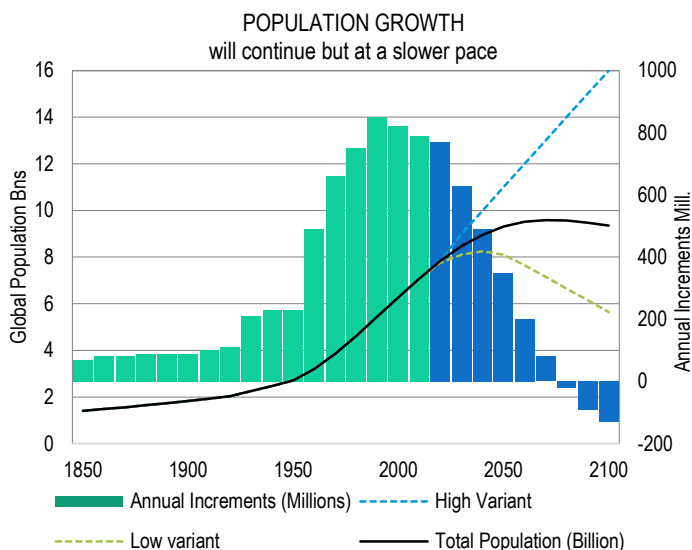
1. FISHING AND AQUACULTURE OFFER MANY BENEFITS

Fish as food – seafood – provides protein and a range of other nutrients, particularly essential fats, minerals and vitamins. Fish is also both a traditional food and offers a cultural activity for many global communities. More broadly, fishing activity also creates unique opportunities for recreational activity, some of which are now driving new approaches, for example specific human mental health outcomes in advanced economies.

a. More people means more food

In 2012, the world gained its seven billionth person. As population growth continues, the demand for fish and fish products is expected to increase, driven by two factors: global population growth, and rising consumption/head.

FIGURE 4. POPULATION DRIVES FOOD DEMAND



Key Points: GLOBAL OVERVIEW OF F&A

Global population and middle class income growth drives resource demand. An extra billion consumers by 2030 (to 8.3 Bn) will add 25 MMT to seafood demand. Fishery products are one of the most globally traded human food commodities (FAO, 2014 Feb), and seafood is the most consumed by volume.

With a majority of wild resources fully fished, most new seafood supply will come from farms. Productivity must double in the next 15 years. Food waste is high in advanced economies, but seafood waste is low.

Farmed seafood is very efficient and sustainable - better than beef and pork, and on par with chicken. And it has huge untapped potential in marine technologies, genetics, nutrition, etc.

Competition among global resource users (mining, food, recreation, conservation) is rising. This food-water-energy nexus is occurring at a time when biosecurity risks are high and climate change impacts are rising.

China dominates global seafood production and trade, and will do so to 2030. It produces 62% of aquaculture supply today. By 2030 China will account for 37% of fish production, and 38% of global seafood consumption, and dominate inbound tourism demand with implications for Australian recreational fisheries.

Efficient trade in seafood and services is critical for our open economy, especially with emerging middle class cities across China/Asia where consumers want branded safe seafood. We must also monitor food insecurity triggers in our supply partners, especially Vietnam, and Indonesia.

The 2014 global population of 7.2 billion is forecast to rise nearly to 9 billion by 2050. Average per capita food fish consumption today is around 17.5 kg/year, forecast to rise modestly to 18.2 kg/year by 2030 (World Bank, 2013, p. 45). The latest Rabobank report (Rabobank, 2014 Oct) notes that seafood is the world's most consumed animal protein, with consumption up 26% over the last 15 years, driven by population and dietary preferences for seafood.

FIGURE 5. GLOBAL FISH SUPPLY AND SEAFOOD CONSUMPTION

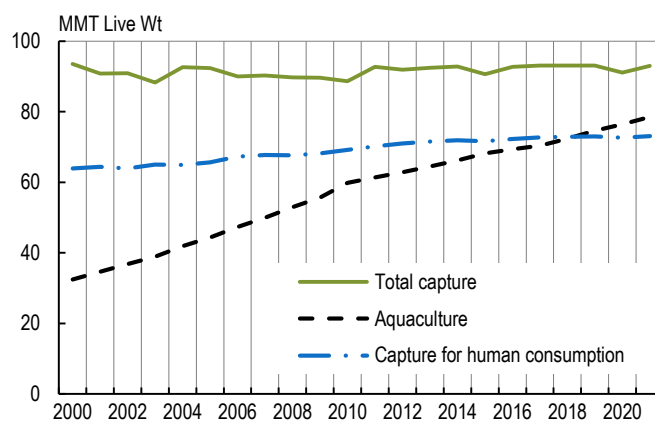
'000 Tonnes	Fish Supply		Consumption	
	2008	2030	2006	2030#
Capture	89,443	93,229	64,533	58,159
Aquaculture	52,843	93,612	47,164	93,612
Global Total	142,285	186,842	111,697	151,771
By Region / Country:				
Europe and Central Asia	14,564	15,796	18.5	18.2
Latin America and Caribbean	17,427	21,829	9.4	7.5
China	49,224	68,950	26.6	41.0
North America	6,064	6,472	24.3	26.4
Japan	4,912	4,702	59.2	62.2
South East Asia	20,009	29,092	27.9	29.6
India	7,589	12,731	5.0	6.6
Notes: #2030 per capita consumption estimate for China is the World Bank Base Case. The study found that China's consumption under various scenarios could range from 40.7 kg to 64.6 kg.				
Sources: (World Bank, 2013), Tables 1, 3.1 and 3.7				

The striking observation in Figure 5 is the forecast massive demand growth for seafood in China and South East Asia, and the flat line/decline trends for Europe and Central Asia, and Latin America and Caribbean. India is the big sleeper at a current low base line – while per capita demand is forecast to rise by 32% over the 24 year period, the actual Indian demand will increase 67% over a very large and increasing population.

In 2010 commercial fishing and aquaculture supplied the world with 168.5 MMT (WWF, 2013), making it a leading globally traded protein. According to the World Bank, 57% of wild marine fish stocks are exploited to their full potential, and another 30% are overexploited and likely to decline (WRI, 2014, p. 2). For many global wild catch fisheries Maximum Sustainable Yield (MSY) has been reached and/or surpassed due to vastly increased capacity and effort.

Globally, the wild fish catch peaked in the 1990s, has since modestly declined, and will need to decline further for at least some temporary period if fisheries are to recover enough to produce present catch levels sustainably. The United National Environmental Program (WRI, 2014 June, p. 8) suggests that this temporary effort decline needs to be in the order of 50% of today's levels for the wild resource recovery process to be achievable long term. Figure 6 illustrates the trends in supply.

FIGURE 6. AQUACULTURE SUPPLY WILL SOON EXCEED WILD CATCH



The top 15 wild catch countries comprised 57% of the global wild catch harvest in 2012, per Figure 7 (FAO, 2014, p. 10). Notably 10 of these top 15 countries are based in Asia. The very large growth of wild catch volumes in emerging economies (Indonesia, Vietnam and Myanmar), suggests long term environmental risks and food security issues.

Aquaculture is very diverse, occurring in nearly every country in the world and across more than 500 species. Aquaculture is the only seafood source predicted to be able to meet projected growth in global seafood demand. The sector is currently the fastest growing food production systems in the world, and is forecast to expand by a third to 80 MMT by 2021. Aquaculture growth in the coming decade will slow to around 2.4% p.a. from the high 5.8% p.a. rate in the last decade. In its recently released study (World Bank, 2014) the FAO predicts that aquaculture will provide 62% of fish for human consumption by 2030.

The major challenges for sustainable expansion of global aquaculture are to double production (yield per ha of water), while slowing or halting sector demands for land based sites, better utilise the stream of fish wastes for reuse into aquaculture feeds, overcome rising food

insecurity (especially in developing economies), preserving the natural aquatic environment, and to do this without damage to wild catch fisheries, or disease outbreaks.

FIGURE 7. MAJOR MARINE WILD CATCH FISHERS

MM Tonnes	2012	% of Total	Growth 2003-12
Global Total	79.71		0%
1. China	13.87	17%	13.6%
2. Indonesia	5.42	6.8%	27.0%
3. USA	5.11	6.4%	4.0%
4. Peru	4.81	6.0%	-20.6%
5. Russian Federation	4.07	5.1%	31.6%
6. Japan	3.61	4.5%	-21.9
7. India	3.40	4.3%	15.1%
8. Chile	2.58	3.2%	-28.8
9. Viet Nam	2.42	3.0%	46.8%
10. Myanmar	2.33	2.9%	121.4
11. Norway	2.15	2.7%	-15.6
12. Philippines	2.13	2.7%	4.6
13. South Korea	1.66	2.1%	0.7%
14. Thailand	1.61	2.0%	-39.2%
15. Malaysia	1.47	1.8%	
Top 15 Countries	56.64	71%	3.3%

b. Health and nutrition

Seafood accounts for 17% of the global population's intake of animal protein- with much higher rates in some large emerging markets (e.g. Indonesia 54%, Cambodia 60%).

Seafood, particularly oily fish (e.g. Anchovies, Sardines, Mackerel, Herring, Atlantic salmon, Trout and Swordfish) are the richest source of long-chain omega-3 fatty acids, eicosapentaenoic (EPA) and docosahexaenoic (DHA). These are the major building blocks of our neural system (Black Dog Institute, 2014). EPA and DHA reduce the risk of human coronary heart diseases (CHD) by up to 36% (FAO, 2014 Feb). Increasing medical evidence that DHA plays a central role in preventing mental illnesses is particularly important as the economic cost of brain disorders across developed economies is now greater than the combined cost related to CHD and cancer.

A 2010 study (FAO/WHO, 2011) concluded that "the consumption of any amount of fish has a positive impact on health. In particular, pregnant women and nursing mothers should ensure they eat enough fish."

To sum up, across advanced and emerging economies evidence is now showing that seafood offers two nutritional benefits – its unique nutritional values in a healthy diet, and also as a cost effective replacement for less healthy foods. Wild and sustainably farmed fish are also a good alternative to other meat products. (FAO, 2014 Feb).

c. Employment

About 56 million people (FAO, 2014 Feb) are directly employed in fishing and aquaculture – and growing at a rate faster than both employment in traditional agriculture and global population growth. Almost 19 million of these jobs were on-farm at aquaculture sites, 96% of which were located in Asia. Many more people are employed in downstream seafood handling, processing and distribution, where women represent half of those involved.

Across these workers and their families, fishing and aquaculture supports the livelihoods of some 660 to 880 million people, or 12% of world population.

d. Productivity

The global literature agrees that wild fisheries must be better managed for multiple uses across commercial, recreational and customary/artisanal fishers. Productivity gains are possible in some fisheries, on a case by case basis, but only where sustainability is preserved at a capped or reduced extraction rate.

The literature also agrees that aquaculture productivity must double by 2030 if the various global risks identified in the preceding discussion are to be overcome. Six drivers have been identified for fish farm productivity (WRI, 2014 June)

- Increase investment in technology innovation and transfer via breeding and genetics, disease control,

Sustainable wild catch and aquaculture fisheries have a big role to play in human food supply, physical and mental health, and social and cultural wellbeing.

One big global take-home message is clear for commercial fisheries: the future viability of Australian fisheries is increasingly driven by factors beyond the current planning controls of our industry.

Our costs are set locally but our revenues (price + A\$) are set in global markets. Therefore margins, investment returns and incentives can be very unpredictable year to year.

Norwegian salmon farmers are world leaders in aquaculture. In the last 30 years they have made great sustainability gains:

- Reduction in fishmeal/fish oil in salmon diets from 45%/25% in 1995, to 25%/15% by 2010, by replacing fish-based inputs with soybean meal, canola oil, and other plant-based ingredients
- 98% reduction in use of antibiotics from 1987 - 2004
- Reduced fish escapes by 82% to 100,000 in 2004 – 2008

Over 30 years the productivity gains have enabled costs and export prices to fall ~75% and still remain viable. Several factors are at the core of these gains in productivity and sustainability:

- Technological improvements stimulated by high levels of public and private investment, especially in vaccines, feed formulation, FCR's, biosecurity
- Industry consolidation and vertical integration – 80% of salmon now comes from 22 firms; was 70 firms in 1997
- Government investment in spatial and temporal planning and monitoring of sites and environmental impacts
- Public policy has enabled a specific Norwegian Aquaculture Act (2006) to optimise zonal planning and reduce impacts with wild salmon fisheries.

(WRI, 2014 June, p. 46)

nutrition/feeds/feed management, and low-impact production systems,

- Use spatial planning/zoning to guide aquaculture growth,
- Shift incentives (both government and private) to motivate investment in productivity and environmental outcomes,
- Leverage information technologies to drive productivity and environmental outcomes,
- Shift fish consumption toward low-trophic aquaculture fish species including Tilapia, Catfish, Carp, and bivalve molluscs in order to optimise efficient use of available resources and reduce pressure on fisheries,
- Ensure investment in intangibles assets and capacity is aligned to support sustainable growth.

Figure 8 suggests, based on one key measure, there is a wide range of productivity outcomes across aquaculture.

FIGURE 8. AQUACULTURE PRODUCTIVITY 2012

Regional Producers	Employment	Tonnes /Employee
1. Nth America	9,000	59.3
2. Oceania	6,000	32.7
3. Europe	103,000	27.8
4. Latin America	269,000	9.7
5. Africa	298,000	5.1
6. Asia	18,175,000	3.2
7. World Aqua	18,861,000	3.5
8. Australia wild	6,990	19.3
9. Australia Aqua	3,642	21.9

On this assessment Australia is only an average performer – certainly not performing as well as our Oceania partner New Zealand (WRI, 2014 June, p. 12) AND RIDGE PARTNERS ANALYSIS.

The Feed Conversion Ratio (FCR) is the core productivity variable for aquaculture. The pressure is on aquaculture to improve efficiency of fishmeal use, reflecting the increasing competition for fishmeal on global animal feed markets between aquaculture and livestock producers.

The forecast growth in aquaculture will drive global fishmeal demand and feed prices – this implies that only feed-efficient and high-valued aquaculture products will be profitable with fishmeal feed inputs. The use of global fishmeal by aquaculture grew from nil in 1960 to 10% in 1980, and to 73% in 2010. (China's use of fishmeal demand rose from 20kg to 45kg/unit output in the decade to 2009). The global share held by swine/pig and poultry producers has fallen sharply. The World Bank study forecasts global average aquaculture FCRs will fall from ~1.6 in 2014 to ~1.2 by 2030.

e. Trade

Rising demand for seafood drives global seafood trade. Fishery products are one of the most traded foods, with 40% of total fish production entering international trade with a yearly export value of more than US\$130 billion. The world's largest seafood trade influencer is China (production, imports and exports) with the largest importers being the USA and Japan (each importing ~US\$25 billion), Spain (US\$11 billion), China, (US\$9 billion) and UK (US\$5 billion).

The ongoing rise in branded global seafood trade is increasing the need for industrial fish processors to

separate high value fish parts from waste streams (heads, viscera, bones etc., comprise 30-70% wet harvest weight). Importantly as aquaculture supply for human consumption passes wild catch volume for human consumption (expected in 2015-20), it is the unsustainable use of wild pelagic “trash” fisheries and the availability of alternative aquaculture feeds (e.g. fish meal from waste, and soy beans) that are the critical drivers for aquaculture productivity and sustainability.

As aquaculture has grown over the last 20 years, there has been a substantial increase in seafood trade, in intraregional trade (e.g. within ASEAN), and in the diversification of seafood products and product forms. This is all in response to increasing global consumer demand. Aquaculture is contributing to a growing share of international trade in seafood commodities, with high-value species (Salmon, Sea bass, Sea bream, Shrimp, bivalves and other molluscs) and also relatively low-value species (Tilapia, Catfish /Pangasius, Carps) product forms to respond to consumer needs.

Figure 9 highlights a number of forecast trends relevant for Australian planners through to 2030:

- From a very low base in 2006, India will fast become a significant seafood exporter by 2030,
- South East Asia, already the largest net exporter of seafood, will increase its export dominance,
- North America will increase its imports of seafood by 87% over the next 20 years,
- As the largest net exporter in 2006, China retained more of its production for its domestic market in 2010, but is forecast to become a top 3 global exporter again by 2030.

Seafood trade provides an important source of income for many countries, particularly developing countries, which have a 50% share in value and 60% share in quantity (live weight) of all exported fish and fishery products.

f. Prices

Global price trends (FAO, 2014, p. 48) since 1990, confirm that:

- Real long term prices for wild catch and aquaculture products are trending down or flat, as is the case with most global food commodities,

FIGURE 9. PROJECTED NET EXPORTS OF FISH BY REGION

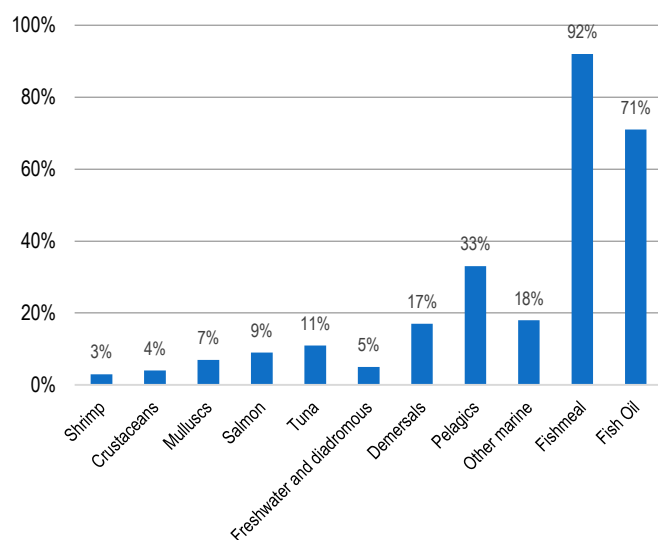
Trade Tonnes	2006	2010	2030	% Change 2010-30
Global Total	12,258	12,677	17,756	40.1%
Europe and Central Asia	-4,166	-4,145	-4,602	11.0%
North America	-2,405	-2,911	-5,464	87.7%
Latin America	2,520	2,018	3,678	82.3%
China	4,288	2,002	3,567	78.1%
Japan	-3,570	-4,239	-3,953	-6.8%
South East Asia	2,741	5,372	7,735	44.0%
India	596	623	2,232	258.1%

Notes: A positive number indicates NET EXPORTS; a negative number indicates NET IMPORTS (shaded cells). Sources: (World Bank, 2013) Table 3.9

- Real aquaculture prices are lower than real wild catch prices. This divergence is due to cost structure differences on the supply side – higher energy prices on fishing vessel operations than on farmed ones, and wild catch supply lower than demand for certain species. Aquaculture has benefited to a greater degree from cost reductions through productivity gains and economies of scale. But looming aquafeed scarcity is pushing costs up and encouraging substitute ingredients (e.g. soy bean based feeds). Aquaculture production also responds to price changes with a time lag related to the restocking and production cycle.

Forecast commodity prices to 2030 (World Bank, 2014, p. 47) show modest real price gains for fish, but very large gains for fish meal and oil ingredient (Figure 10) inputs to the expanding aquaculture sector.

FIGURE 10. FORECAST REAL FISH PRICE GROWTH: 2014 TO 2030



g. Consumers

Middle class (in a GDP per capita range of US\$6,000-30,000 p.a. in 2012) expansion is the driver for much of global change, including for fishing and aquaculture (NIC, 2012, p. 10).

FIGURE 11. THE EXPLODING ASIAN MIDDLE CLASS

Region	2009		2020		2030	
	Pop'n	Share	Pop'n	Share	Pop'n	Share
Population in millions						
North America	338	18%	333	10%	322	7%
Europe	664	36%	703	22%	680	14%
Central and South America	181	10%	251	8%	313	6%
Asia Pacific	525	28%	1,740	54%	3,228	66%
Sub-Saharan Africa	32	2%	57	2%	107	2%
Middle East and North Africa	105	6%	165	5%	234	5%
Global Total	1,845	100%	3,249	100%	4,884	100%

Figure 11 forecasts there will be an increase in the global middle class from the current 1 billion, to a possible 3 billion by 2030.

Surprisingly, global forecasters predict the middleclass will emerge in India ahead of China. The Asia Pacific Region

will dominate growth in both population and share of consumer purchasing power.

In large existing markets there is also growth in seafood demand. Recent research in the US Market (Nielsen Perishables Group, 2014 Nov) highlighted that over one-third of US householders purchased prepared seafood in the last 12 months, at an average of 3.1 trips per year. Prepared seafood increased dollar sales 5.3%, keeping pace with total seafood growth, which increased 5.8% compared to the prior year. The top-selling prepared seafood variety was prepared fish, which made up 35% of prepared seafood and increased dollar sales 11.6% compared to the prior year. Prepared crustaceans was the next largest sub-category of prepared fish, making up nearly one-third of prepared seafood and increasing dollar sales 1.6%.

2. FOOD SECURITY

The FAO stated in 2012 that the livelihoods of 12% of the world's population depend directly or indirectly on fishing and aquaculture. The industry gives an important contribution to food security and nutrition, as the primary source of protein for 17% of the world's population and nearly a quarter in low-income food-deficit countries.

Security¹ of food supply is not a direct threat to Australia – the Commonwealth Department of Agriculture noting in a recent White Paper that only 2-5% of the Australian population is currently affected by food insecurity. Across all human foods Australia currently produce around 150% of domestic food demand – current food exports would supply around 60 million people (ACBC, 2014). (Dept of Agriculture, 2014)

However, indirectly there are good reasons to maintain our awareness of the food availability and quality concerns of our near neighbours, many of whom are our key suppliers of imported seafood. The big driver that we must plan for is the rapidly expanding Asian middle classes (ACBC, 2014, p. 4). This is clearly an opportunity for Australian seafood suppliers, but there is also a significant threat to Australia that Asian suppliers will shift policy to retain their production to meet their local demand.

¹ According to the FAO, "food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their

dietary needs and food preferences for an active and healthy life." This depends on 4 criteria: Availability, Access, Utilisation and Stability.

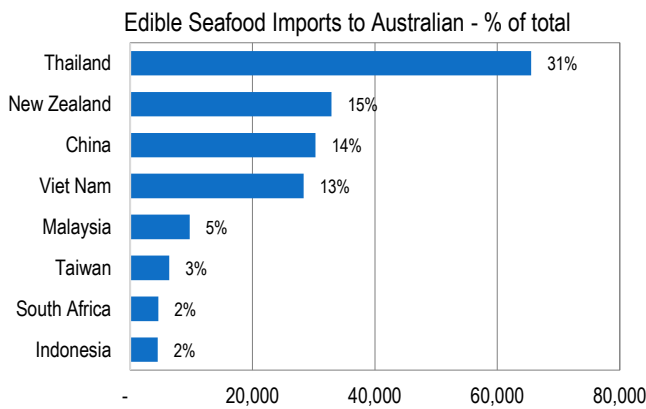
a. Beware of Trade Implications

In 2012 Australia imported 214,000 tonnes of edible seafood products, valued at \$1.37 billion (ABARES Fish Stats, 2013).

As Figure 12 confirms, more than 2/3 of all Australia’s edible seafood imports came from just six large Asian suppliers. Generally, seafood comprises a higher percentage of protein in-take for the poor compared with the rich, making the poor more dependent on fish for food security.

Australia became a net seafood importer in 2004-5 and it is expected that imports will service rising seafood demand and continue to outstrip domestic supply (particularly for lower unit priced value added product).

FIGURE 12. AUSTRALIA’S MAIN SEAFOOD SUPPLIERS 2011-12



Based on expected population increases in our Asia Pacific region, more fish will be needed to feed a growing population, exclusive of any increased per capita fish consumption, due to rising incomes and increasing urbanisation. As noted above world per capita fish consumption is expected to rise especially in East Asia – growth of 16% by 2021 for Oceania and Asia including China (WWF, 2013, p. 31).

There are substantial food security risks facing our largest seafood suppliers; Thailand, China and Vietnam (Figure 13). Each country has a very high reliance on seafood in its domestic food diet. As food riots in ASEAN countries showed in 2007-8, hungry people are angry people and so sudden policy changes resulting from food scarcity could mean seafood supplies are suddenly no longer available for export to Australia, at least at prices we have become accustomed to.

FIGURE 13. FOOD SECURITY RISK – ASIAN SEAFOOD SUPPLIERS

Country	Food Security Score out of 100	Global Rank of 109 Countries	% of Protein from Seafood
Thailand	60	49	38%
China	62	42	Estimate 41%
Vietnam	49	67	32%
Malaysia	68	34	34%
Indonesia	47	72	40%
Philippines	49	65	45%
Myanmar	38	86	68%

Source: Global Food Security Index Oct2014 www.foodsecurityindex.eiu.com

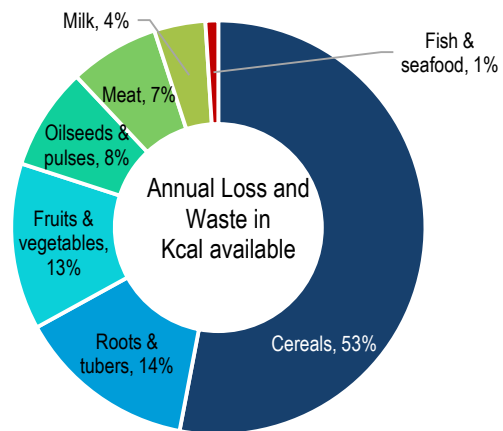
b. Reduce Food Waste

The FAO forecasts that per capita direct calorie consumption will increase 55% from 2006 to 2050 (WRI, 2014, p. 18). Between the beach/farm and the fork, roughly a quarter of food calories are lost or wasted (WRI, 2014, p. 3). In advanced economies the figure is even higher at ~50% wasted). If global food waste was a country it would rank:

- #3 as an emitter of greenhouse gases, behind China and the USA,
- #1 as a user of blue water for consumption in agriculture (IASS, 2013).

But because there is massive reliance on seafood to feed the world’s poor, there is very little wasted seafood on average, compared to other human food sources. Figure 14 highlights the source of this waste in human food supply (WRI, 2014, p. 29).

FIGURE 14. GLOBAL FOOD WASTE IS LARGE, BUT SEAFOOD IS SMALL



North America and Oceania have the highest per capita food loss and waste, due primarily to waste at the consumption point.

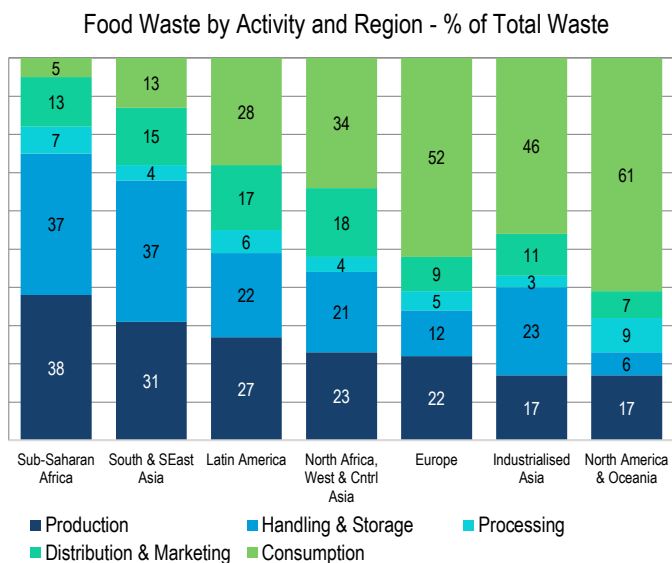
As regions get richer, the percentage of production and storage losses decline and that of consumer waste increases (as a percent of kilocalories lost or wasted). However, the world average of food waste is very lumpy, and as an advanced country, Australia wastes an estimated 7.5 MMT of food annually (economic value of \$8 billion) predominantly at the consumer and retail levels. (FUTURE DIRECTIONS INTERNATIONAL, 2014)

FIGURE 15. AQUACULTURE IS RELATIVELY EFFICIENT AND SUSTAINABLE

WRI 2012	Prod'n	Farm Gate Price	Fresh water Consumption	Climate – GHG Intensity
	MMT	\$US/kg 2013	M³/kg edible protein	CO2e/t. edible protein
1. Carps	25.4	1.45	61	47
2. Molluscs	15.2	1.06	0	11
3. Shrimp	4.8	4.57	4.4	162
4. Tilapia	4.5	1.70	16	41
5. Catfish	3.9	1.57	52	135
6. Salmonids	3.2	4.73	0	10
Aquaculture	66.7	2.07	40	67
7. Pork	109	1.54	57	58
8. Chicken	93	1.43	34	42
9. Beef	63	2.70	113	337

Source: (WRI, 2014)

FIGURE 16. CONSUMPTION WASTE IS HIGH IN RICH ECONOMIES



c. Leverage the Efficiency of Fish

As incomes rise consumers switch to protein intensive foods – comprising meat, milk, fish and eggs. In 2009, sixty years after the start of its “Westernisation” Japan’s per capita meat consumption finally exceeded seafood consumption (Gadda T., 2009 Sept). Will China also take 60 years for its consumers to balance meat and seafood proteins? Leading US thinkers believe China’s middle class will emerge much more rapidly than experienced in Japan or South Korea.

Similar nutritional and demographic shifts are underway in large population economies (India, Indonesia) and other emerging Asian markets. The FAO (WRI, 2014, p. 41) projects that by 2050, most of the world’s people will consume (per capita) more beef than Europeans did in 2006; and Chinese people will eat as much beef as Americans.

The underlying efficiency (feed in v’s meat out) of meat production (see Figure 17) is a big driver for this shift, but there are implications for ecosystems, climate, water, energy (“the resource nexus”) and demand for seafood.

On average farmed fish are as efficient at converting feed inputs to food outputs as chicken, and better than pork and beef. Aquaculture is an efficient, and environmentally desirable source of animal protein, if produced sustainably.

A similar comparison undertaken by global aquaculture major, Marine Harvest (Marine Harvest, 2014) for the global Atlantic salmon industry reinforces these seafood efficiencies:

FIGURE 17. MARINE HARVEST –SALMON EFFICIENCY RATINGS

	Beef	Chicken	Pork	Salmon
Feed conversion	4-10	2.2	3	1.2
Energy retention	27%	10%	14%	27%
Protein retention	15%	21%	18%	24%
Edible yield	41%	46%	52%	68%
Edible meat per 100kg fed	4-10 kg	21 kg	17 kg	57 kg
Carbon footprint kg CO2/kg edible meat	30 kg	3.4 kg	5.9 kg	2.9 kg
Water consumption kL	15.4	4.3	6.0	1.4
Price comparison Apr 2014 retail price of Salmon /competitor				
UK	0.9	1.5	1.8	
USA	1.1	2.3	2.0	
Belgium	1.3	1.7	1.9	
Japan	0.7	4.4	1.2	

But there are impacts (e.g. fish escapes, disease, contamination, loss of biodiversity, loss of small pelagic fisheries) and challenges (e.g. feeding the Muslim poor in ASEAN who cannot eat pork and have no grain for poultry or beef), many of which we are now seeing as a result of the last two decades of high growth in Asian aquaculture.

Asia accounted for 88% of global aquaculture production by volume in 2011 (World Bank, 2013, p. 1).

d. Why China Matters to our Planning

Why is China important to Australian industry planning?

The answer is clearly relevant to our seafood sector as we produce, export and import seafood. But China is and will also impact both recreational fishing (via tourism (CRC for Sustainable Tourism, 2004)) and Indigenous fishing (for example via export of trepang/beche de mer and unique Indigenous species).

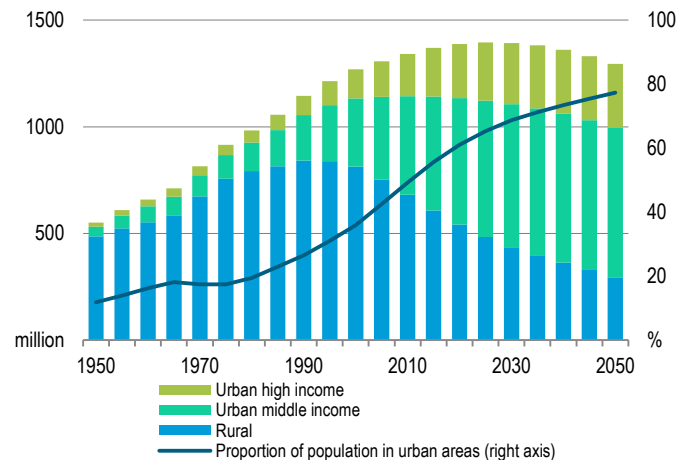
A fundamental reason for factoring in a sound long term trading relationship between Australia and China is that China has the lowest per capita average of resources of any country in the world and Australia has the highest (ACBC, 2014). This offers many compelling opportunities for new and more sophisticated strategic competitive advantages for Australian food and seafood producers.

There are three drivers for China’s increased food demand:

- Population growth, to around 1.38 billion by 2050,
- Urbanisation, to continue to rise rapidly toward 80% by 2050 (ABARES, 2014) (Figure 18), and
- Income growth,

and their impact on consumers’ food choices.

FIGURE 18. ONGOING URBANISATION IN CHINA

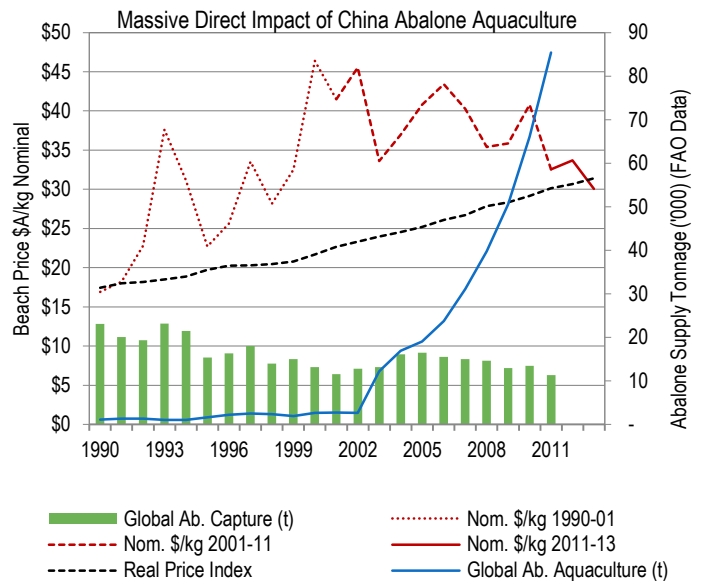


These changes underway in China are having and will continue to have major direct impacts on Australian seafood investors and producers, including in F&A.

A case-study look at China’s long term impact on two of Australia’s large seafood products is instructive regarding our need to engage and better plan our development.

Wild catch abalone have faced a massive increase in global abalone aquaculture (90% from China) since 2002 (TACL, AND RIDGE PARTNERS 2014). The dramatic rise in aquaculture volume has forced a steep reversal and decline in real beach prices for Australian wild abalone, to now be below 1990 real prices.

FIGURE 19. AUST. WILD ABALONE PRICE NOW BELOW 1990 LEVEL

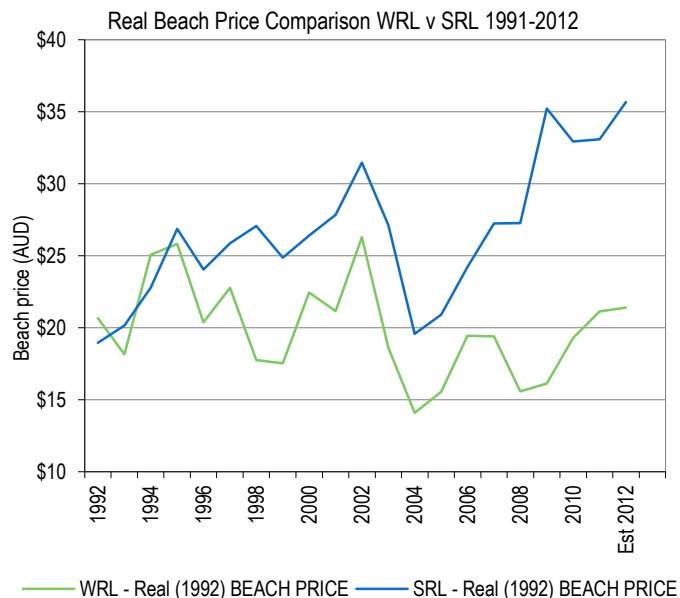


For the Western Rock Lobster fishery, (WRL, a leading, MSC accredited, Australian fishery and seafood exporter) the rise of the Chinese consumer market since 2009 has coincided with the decline in puerulus settlement and 50% fall in the fishery’s harvest volume. In response, WRL fishers and managers cut their TACC by ~45% to ~5,600 tonnes p.a. and now focus on supplying live product to a premium just-in-time Chinese consumer market (WRL RD&E PLAN 2014-23).

WRL prices had been sliding relative to Southern Rock Lobster (SRL) prices in real terms for some time (Figure 20). But industry advice in 2014 confirms WRL beach prices have risen sharply and are now back up on a par with SRL price trends.

In both the abalone and rock lobster cases the sector had the leadership and adequate resources to respond to both challenge and opportunity, and benefit from the China impact. However this is less likely to be the outcome for smaller Australian fisheries that face strong import competition from large low cost Chinese and other Asian aquaculture suppliers.

FIGURE 20. REPOSITIONING OF WRL IN THE CHINA MARKET



The simple fact is that China is and will continue to set both the baseline production cost and globally traded price for seafood, for the next 15-20 years. As an open economy with a floating exchange rate, and with a rising demand for health seafood, Australia cannot avoid the collateral impacts of Chinese policy decisions on both our seafood sector, and F&A industry. The most recent example – the impact of China’s 2013 corruption crackdown and ban on expensive banquets was a direct cause of the recent steep fall in export sales of Australian abalone and trepang to China (Ge, 2014).

China’s global influence will be leveraged both via wild catch and aquaculture. Some key points about China:

- Supplies 62% of global aquaculture (World Bank, 2013, p. 3), Asia produces around 88%,
- In 2030, will account for 37% of total fish production (17% of wild catch and 57% of aquaculture), and 38% of global seafood consumption,

- Share in the global fish production grew from 7% in 1961 to 35% in 2011.
- Consumes 34% of global food fish supply, but it is still a net exporter of food fish.
- From 1990-2009, per capita seafood consumption rose from 11kg to 31kg.

Population, demographic and consumption trends bring dramatic social and economic change and added welfare costs. For example, the obese in poor countries are typically wealthy, and rates of obesity typically grow with a country’s wealth until annual incomes reach roughly US\$5,000 per person – China reached a level of US\$6,500 p.a. in 2013 (WORLD BANK), and there will be 3.1 billion middle class consumers in China and across Asia by 2030 (ACBC, 2014, p. 2). Welfare investment needs will escalate rapidly in China to 2030.

If Australia is going to optimise its wild fisheries and aquaculture resources, we must address what is going to unfold in China over the next 2-3 decades. Drawing from Rabobank research (Rabobank, 2012 Oct), Figure 21 identifies 3 subgroups in the emerging high value species and markets. Our focus must be on their *Domestic Champions*, and selected species of the *Domestic Winners*.

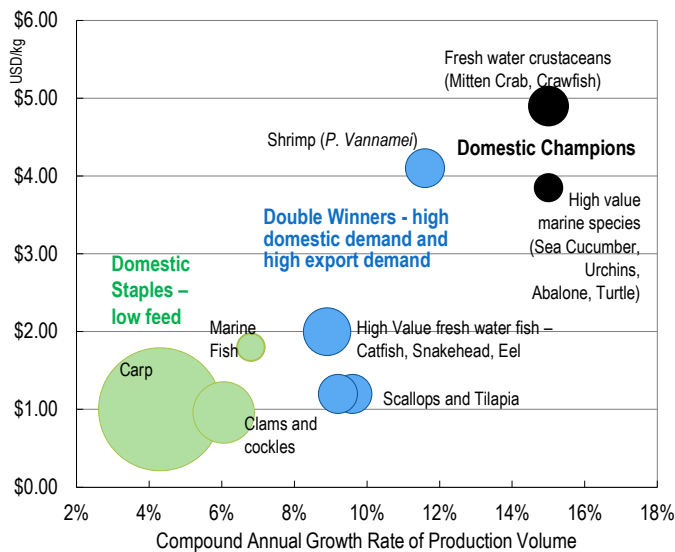
It is important to note that ~45% of China’s domestic seafood comes from freshwater aquaculture, mainly as carp varieties. The driver for the progression to higher value and more marine based species is common across Asia, but particularly marked in China.

At the World Economic Forum in Sept. 2013, Chinese Premier Li Keqiang said “In the next 5 years China will send 400 million tourists abroad.” (KPMG, 2014)

In 2013, 6.5 million Chinese tourists arrived in Australia, up 5.5% on 2012. Chinese tourists are the key source of growth in tourism visitor expenditure, spending A\$4.7Bn in 2013, more than double the figure in 2008.

In July 2014 Chinese visitors to Canada had increased 246% over the decade. CAL World Travel director Alice Lin, based in Vancouver, said more young Chinese (20-44 years old) are travelling to Canada seeking new experiences including special tours, such as fishing and whale watching. (Xinhua News, 2014)

FIGURE 21. CHINA IS NOW TRADING UP TO NEW HIGH VALUE SPECIES



Putting aside the Western focus on the health aspects of omega 3, seafood is considered healthy across Asia. In addition, certain species, such as abalone, shrimp, sea cucumber (trepang/beche de mer), scallops and large carnivorous marine fish (e.g. Grouper and Sea bass), are regarded in Chinese culture as prestigious. In contrast to terrestrial proteins (e.g. beef and pork), the large variety of seafood provides a spectrum of prestige levels for Chinese consumers to aspire to, and switch to, as wealth increases.

Australia's relative competitiveness has been falling in most seafood export markets over the last few years due to the high A\$. New Zealand in particular (on the back of its 2008 Free Trade Agreement) has been far more successful as an exporter to China than Australia has.

Australia and China are now signatories to a Free Trade Agreement (FTA). Prime Minister Abbott and the Chinese leadership have expressed a determination to accelerate the implementation. Past Minister for Trade, Dr Craig Emerson noted at a recent Australia China Food Summit that "if" Australia were to secure a deal comparable with that between New Zealand and China, the big beneficiaries would include the Australian dairy, beef, sheep meat, wine and seafood industries. (ACBC, 2014) The devil will be in the detail – as it turns out, tariffs will fall to zero over 4 years.

e. Top 10 Seafood Superpowers

Seafood International (Seafood International, 2014) is a global publication for seafood marketing professionals. In

November 2014 it published a list of 10 seafood producers and their core capabilities. Figure 22 summarises the data.

However caution is required. This list comes from one source, albeit one that is very credible in the industry. Headline findings drawn from a large private unpublished research study by the US Soy Bean Export Council (US Soy Bean Export Council, 2014) across Asian / ASEAN aquaculture suggests this ranking is far more complicated than presented here.

For example in the case of Indonesia, there are very complex social and overlapping fishery and seafood issues and challenges, including:

- Rapid population growth to 250 million is a real concern for food security, compounded by the lack of infrastructure / logistics capacity across the 17,000 islands in this country as geographically large as Australia,
- Domestic wild catch fisheries, a traditional stable source of food, are overfished, and under survival pressure, and from the environmental movement,
- For the world's largest Muslim country, pork is not a dietary option as it is in China and elsewhere in developing Asia, and there is little land suitable for broad-acre grain or beef production,
- While aquaculture is well established (especially in corporate hands) and considered the gap filler for domestic food demand, it is very low-tech and inefficient across the thousands of small-holder remote poor communities, with little prospect of innovation or investment, or environmental sustainability (especially in eastern provinces),
- Rising affluence is driving a dietary preference switch away from traditional foods of rice, grains, tempeh, goat, mutton, chicken, and fruit and vegetables, to increasingly include dairy, beef and seafood, to meet the convenience needs of an emerging middle class consumer.

FIGURE 22. GLOBAL SEAFOOD SUPERPOWERS

Ranking	Core Capabilities
1. China	<p>Largest producer, processor and exporter of seafood</p> <p>Dramatic growth in domestic market – now 3rd largest importer.</p> <p>Growing domestic consumption of species not available from its waters.</p> <p>Record seafood trade: exports \$19.6 billion and imports at \$8 billion</p> <p>8,000 to 10,000 seafood processing plants, combined are >24 MMT</p> <p>Of global supply (130 MMT), China alone produced roughly 44 MMT.</p>
2. Indonesia	<p>Importance to its domestic economy and to global seafood trade</p> <p>Produced 15.2 MMT of seafood (2012): wild catch -5.8 MMT; aqua 9.4.</p> <p>Ranked second in marine wild catch fisheries in 2012 (e.g. tuna, shrimp)</p> <p>Fishery exports reached \$3.9 billion in 2012.</p> <p>Avg. annual growth 10.7% shrimp farming in last three year</p>
3. India	<p>Eleven-fold increase in fish production since 1950 to 9.06 MMT</p> <p>Aquaculture is one-third of total production – 4.43 MMT, (carp 4.1 MMT)</p> <p>Almost 100% of finfish consumed domestically, while shrimp (0.27MMT) and freshwater prawns are mainly exported.</p> <p>EU is 2nd largest market with 22.1%, then USA (21.2%), Japan (10.6%), China (7.6%) and the Middle East (5.9%).</p> <p>Over 14.5 million people depend on fishing for their livelihoods.</p>
4. Japan	<p>Largely supplied for domestic consumption – ranked 6th in marine wild catch fishing, at 3.6 MMT in 2012</p> <p>Marine fishery and aquaculture production of 4.73 MMT in 2013.</p> <p>Seafood consumption declining, young people prefer beef or chicken.</p> <p>A rich and long fishing tradition</p> <p>“Delight of a Fish-Rich Country” project launched by government to stimulate consumption.</p> <p>Ability to influence global markets on the international seafood stage.</p>
5. USA	<p>In 2012, landed 4.48 MMT valued at \$5.5 billion. In 2013 Alaska Pollock (1.36 MMT), Pacific salmon and menhaden were basis for fish sticks and other breaded fish portions sold throughout the world.</p> <p>Large wild salmon production, ex Alaska – 2012 harvest of 484,927 MMT sold in global markets.</p>
6. Russia	<p>Global Pollock and salmon production are basis for large wild catch marine fisheries > 4 MMT.</p> <p>Supply of Alaska Pollock 1.54 MMT in 2013</p> <p>Bulk of catch is consumed in Russia.</p>
7. Peru	<p>86% of catch for local consumption; 14% fishmeal and fish oil export.</p> <p>Largest fish meal and fish oil supplier – rising demand in aquaculture</p> <p>In 2009, caught 5.9 MMT -57% of global catch of anchovies.</p> <p>Variable harvest of anchovy is major risk for global fish prices – as fish meal/oil buyers must find alternatives on human consumption markets.</p>
8. Vietnam	<p>Pioneered aquaculture system for Pangasius.</p> <p>In 2012, supplied 75% of global Pangasius production (1.6 MMT)</p> <p>Large shrimp production – both white shrimp and black tigers – 548,000 MMT, placing it in the top 3 in global shrimp production.</p>
9. Norway	<p>World-leader (1.16 MMT) in farmed Atlantic salmon in 2013.</p> <p>Farmed trout production of 72,497 MT. Plus 2 MMT of pelagic and groundfish.</p> <p>Salmon exported to markets worldwide, with Russia, France and Poland accounting for nearly 40% of exports.</p>
10. Egypt	<p>Africa’s largest aquaculture industry – aquaculture (tilapia) is currently the largest single source (65%) of fish supply</p> <p>Greater than 99% of supply comes from family farms</p> <p>Egypt is the world’s second largest farmer of tilapia behind China</p>
Others	Chile, Canada

3. USE OF OCEAN RESOURCES

a. Users

Oceans cover ~70% of the globe, and are the major untapped resource to support forecast peak global population of 9 billion in 2050. But currently only 6.5% of protein for human consumption is produced from ocean sources (Marine Harvest, 2014). This suggests that competition for access to and use of marine waters will increase markedly in the future.

The OECD (OECD, 2014) considered the trends and implications for use of the oceans, identifying established and emerging ocean-based industries including:

- Shipping and ship building,
- Off-shore wind, tidal and wave energy,
- Mining for oil, gas and seabed minerals,
- Marine aquaculture,
- Marine biotechnology,
- Ocean-related tourism and leisure activities,
- Ocean monitoring, control and surveillance.

Constraints to growth in marine aquaculture include scarcity of suitable water, limited sites for new operations, crowded multiple-user coastal areas, limited carrying capacity of the environment for nutrients and pollution, and more stringent environmental regulations.

The OECD oceans study found that most of the future expansion in aquaculture production capacity will occur out in the ocean. The increasing move off-shore is to escape the constraints of coastal waters, including degradation of coastal waters and habitats, endangered biodiversity due to escapees, lower resistance to economically costly fish diseases, and invasive species.

Algal biofuels are considered a promising prospect. The Marine Board of the European Science Foundation (2010) predicts algal tonnage yields per hectare per year higher than biofuel systems from terrestrial crops. It also cautioned that "cost-competitive, high volume algae biofuel production is still some way off and will require much more research, development and demonstration".

b. Sustainability

A 2014 global conference and report (Swedish Agency for Marine and Water Management, 2014) assessed the global trends in fisheries governance. The conference considered the following issues to be most important for fishery sustainability:

- The EU's new Common Fisheries Policy will integrate international aspects of fisheries management into Basic Regulation,
- The challenges of protecting biodiversity, both within EEZ and in international waters,
- The future role of the fishing sector for food security and economic development in a growing blue economy,
- Global developments within regional fisheries management organizations, and UNCLOS developments,
- How biodiversity in the protection of national and international waters relates to fisheries management,
- How fisheries can contribute to global food security,
- As the largest seafood importer, the members of the EU must pay more attention to the long-term sustainability of fish stocks in and beyond EU waters, and to ensure the EU's share of trade,
- Need for transparency in resource allocation and in sharing information about subsidies,
- The legal and biological definitions of fishing rights according to UNCLOS and now embedded in the EU policy, are essential for good governance,
- Assessing MSY will become increasingly important,
- Consumers are more vocal about their demands, which can alter the behaviour of producers of goods and services. Consumers who demand supplies of fish and fish products from sustainable fish stocks, may have a positive influence on fisheries management and may improve sustainability in the long run,
- Continue the battle against illegal, unreported and unregulated (IUU) fishing,

In addition to marine technologies, offshore "biotechnologies" offer solutions to a raft of major global challenges such as sustainable food supplies, human health, energy security and environmental remediation. Current investment of \$2.8Bn will grow to \$4.6Bn by 2017. OECD 2014

- Sectoral integration, for example for the implementation of UNCLOS and the Biodiversity Convention, - but no consensus was reached,
- The performance of Regional Fishery Management Organisation has been variable and some have been largely ineffective in promoting sustainable fishing. The conference explored the performance of RFMOs and ways to improve their efficiency.

c. Illegal, Unreported and Unregulated Fishing

In September 2011, and July 2012 the European Commission signed agreements with the USA and Japan, respectively to limit IUU fishing (OECD, 2013, p. 26). Joint action by the three economies, the largest importers in the global seafood trade, will ensure that products in all three markets are caught legally.

The statement recognises that IUU fishing is not only a threat to stock sustainability but also deprives honest fishers and communities of up to US\$ 23 billion worth of products annually. The agreements commit each economy to exchange information, promote management measures that eliminate IUU fishing, encourage other countries to ratify similar agreements, and promote sustainable use of fisheries resources while preserving marine biodiversity.

d. Fossil Fuels Use

Globally the fuel consumption of fishing vessels is estimated to be 1.2% of world oil use, and fuel represents a large share of variable costs in most wild catch fisheries. Fuel tax concessions in fisheries are a common policy tool used to reduce the cost of fuel for fishing fleets.

The OECD agreed at its Pittsburgh USA meeting (2009) to “phase out and rationalise over the medium term inefficient fossil fuel subsidies (OECD, 2013, p. 46).

Average end-use fuel price has been quite volatile in the last decade. On top of this volatility average real fuel prices paid by industry doubled from 1999 to 2011, and continual increases are anticipated (OECD, 2014, p. 52).

4. US AQUACULTURE STRATEGY 2014-19

The US is one of the three largest seafood markets in the world. US planners see aquaculture as an increasingly integral source of safe, sustainable seafood for consumers worldwide as wild catch fishery supplies remain flat.

The US Government (NSTC, 2014) has identified what they describe as a “framework for coordination and collaboration across agencies.” Nine strategic goals for its new high-level aquaculture plan include:

1. Advance understanding of the interactions of aquaculture and the environment,
2. Employ genetics to increase productivity and protect natural populations,
3. Counter disease in aquatic organisms and improve biosecurity,
4. Improve production efficiency and well-being,
5. Improve nutrition and develop novel feeds,
6. Increase supply of nutritious, safe, high-quality seafood and aquatic products,
7. Improve performance of production systems,
8. Create a skilled workforce and enhance technology transfer,
9. Develop and use socioeconomic and business research to advance domestic aquaculture.

These aspirational goals mirror the approaches for most advanced western economies (including Australia), in that they are built on a strategic platform that recognises:

- The rising domestic consumer demand for sustainable and prepared seafood products,
- The increasing role of aquaculture as the primary global source of sustainable and nutritious human food and industrial products,
- The need for better science to enable the triple bottom line development of the sector, and
- The need to motivate private investment in both science and aquaculture business development.

In 2011, U.S. consumer seafood expenditures were \$57 billion in food service and \$27.6 billion in retail sales for home consumption. The top 10 species consumed represent about 90% of total U.S. seafood consumption; six species are farmed or a mix of farmed and wild sources, including Shrimp, Salmon, and Tilapia.

U.S. aquaculture is a minor producer, at only 5% of domestic seafood supply. Like Australia, the US depends on imports to meet seafood demand. Around 90% (by value) of seafood consumption is imported, driving a seafood trade deficit of \$11 billion in 2012. Around 50% of imported seafood is from farms and 50% from wild catch fishing. Compared with other US commercial industries (manufacturing, agriculture, wild fishing) aquaculture is small and emergent, with annual farm gate sales for private domestic aquaculture of ~US\$1.3 billion 2010 (similar to Australia in 2012).

The Plan sees strategic advantage in leveraging the nation's bountiful freshwater and marine natural resources, plentiful feed grains, world class aquaculture research infrastructures, and scientists, pioneers, and entrepreneurs to drive innovation.

One capacity the US has that Australia lacks is a large cohort of international corporations in food, technology, and services that are already established in overseas markets and able to leverage and project their sales of knowledge intensive products and services to aquaculture investors, especially in aquaculture in China, Asia, ASEAN and South and Central America. Large US multinational producers (e.g. Merck, Cargill) in the grains, soybean, dairy, life science /agvet chemical and aquaculture genetics sectors are already investing directly into these trade/aid export initiatives.

The Plan also recognises the need and opportunity for aquaculture to support recreational fishing and fisheries restoration. This includes support for private and public salmon hatcheries that supply commercial and recreational fishing.

The plan is designed for use as an agency/public sector document. While the goals appear to be appropriate, its main shortcoming seems to be its lack of specifics on the how, who and when these goals will be met. It is an aspirational document from a top level national technology and science council – the linkage to real investors is not apparent.

5. GLOBAL TRENDS AND ISSUES IN RECREATIONAL FISHING

a. Context and trends

Recreational fishing is undertaken in 76% of the world's exclusive economic zones (FAO Recreational Fisheries, 2012).

Recreational fishing activity increases with economic development of societies because people can afford to spend time fishing for leisure rather than fishing to secure nutrient input or survival. Globally the trend for wild fishery stock use is for a staged societal shift from subsistence fishing to commercial fishing, and then to exclusive recreational fishing (especially in inland fisheries), and finally later a decline in all extractive uses, as social attitudes change with increased urbanisation and affluence. (ARLINGHAUS, 2006). In Australia, the relatively strong community endorsement for creation of largest networks of MPAs is evidence of the mature stage of this transition.

As recreational fishing participation increases with economic development, many of today's fisheries are in "pervasively anthropogenically altered habitats and ecosystems (FAO Recreational Fisheries, 2012, p. 5)" affected by a range of impacts unrelated to fishing. This includes multiuse patterns, history of habitat change in conjunction with coastal zone management, flood control, damming, channeling, pollution, water abstraction, commercial overfishing, etc. Further, recreational fisheries struggle to attract sociocultural policy attention making it difficult to attract funding for the development and management of recreational fisheries resources. However in less-developed countries, subsistence and commercial fisheries dominate and strongly influence the management and development of recreational fisheries.

On average, across countries with reliable statistics, the participation rate in recreational fishing by the total population in a given country is 10.6% +/- 6.1%. Extrapolation suggests around 140 million recreational fishers in a combined North America-Europe-Oceania zone, with around 700 million worldwide.

The demarcation between recreational fisheries and subsistence fisheries is sometimes impossible and meaningless, because many recreational fishers, even in wealthy countries, have strong subsistence-like incentives to harvest fish.

There are few literature sources that specifically consider and document hunting and fishing tourism – one local source was the CRC for Sustainable Tourism, until its closure in 2010. A 2006 report by the CRC (*Rivers, Stream, Lakes and Estuaries: hot spots for cool recreation and tourism in Australia, 2006*) is somewhat negative regarding the net benefits of recreational fisheries but does reveal broad national survey data (n=140, across protected area managers, local councils, general and river tour operators) that confirms “hunting and fishing” are quite attractive activities for tourists.

An earlier CRC report (*CRC FOR SUSTAINABLE TOURISM, 2004, pp. 57-75*) is a little dated, but notes a problem we all face when trying to disaggregate or access good recreational fishing data:

“One feature of the tourism industry is the indistinct boundaries between its subcategories; many tourists like to mix hunting and fishing, and the overlap between fishing categories is even more fluid, as freshwater fishing for example includes spear fishing, and charter-boat fishing may take place in marine or freshwater environments”.

The report concluded that the way was open for the development of a significant tourism industry built on the consumptive (including recreational) use of wildlife. This is not only a challenge, but also an opportunity for the tourism industry to engage in the development of guidelines and to contribute to its own destiny through dialogue with regulators, stakeholders, and the local communities. The authors recommended a triple bottom line approach that would enable the wildlife tourism industry to:

- Establish guidelines for ecological sustainability of the industry, including development of an accreditation system and identification of local community benefits,
- Develop and improve current destinations, through accreditation of operators and engaging in conservation initiatives aiming at sustainable wildlife use, habitat conservation, and community participation
- Engage in R & D for wildlife management, and benefits from fishing/hunting tourism through coordination with hunting and fishing organisations and researchers.

These opportunities take on new meaning when we consider that 709,000 (up 14.5% on prior year) Chinese

tourists visited Australian in 2013 and spent \$4.8 billion. (TOURISM AUSTRALIA, 2015)

What are the issues in the global recreational fishery? The 5th World Recreational Fishing Conference in 2011 (American Fisheries Society, 2011) is the latest global update on issues and trends in the sector. From this and related sources a number of issues are identified:

b. Governance

Property rights are considered central to the long term viability of recreational fisheries (as per other sectors). Of interest are design principles (evident in Germany, US) that are emerging for crafting sound resource management institutions for resources accessed in common:

1. Need for clearly defined boundaries: that embody license and permit systems, monitoring of permits /licenses, identification of water boundaries, effort limitation on particular waters, and recognition of emotional link to a fishing “place”,
2. Need for equivalence between benefits and costs: that values user investment into a fishery and rewards this with exclusive benefits - free riders are to be excluded. Mechanisms are needed to enable trade in access rights between users and overcome rivalry in consumption.
3. Need for collective choice arrangements: users should be involved in establishing local rules, to encourage their commitment to these rules. Science-educated staff should be involved in rule development and management.
4. Need for monitoring: processes should have scientific support, that promotes/ensures scientific data quality, together with local knowledge, and user involvement,
5. Need for graduated sanctions: that enable enforcement among users, promote peer pressure for rule compliance, and reinforce the perception of severity levels for offences,
6. Need for conflict resolution mechanisms: balanced by effective and adequate communications with users, to ensure speedy conflict resolution, and that can readily tap external support.
7. Need to recognise rights of users: to organise and seek reference to external advice,
8. Need to understand the network landscape: including nested enterprises and their tiered ability

to deal with local issues, and relative political power that exists on regional and state and national levels.

US Marine recreational fishing communities generally support an ecosystem-based management approach inherent in the MPA (Marine Protected Area) movement, but views with great skepticism the arbitrary application of no-take zones as manifestation of protectionist conservation. The US recreational fishing community supports sustainable-use conservation.

c. Social Management

Web based consultation across North American anglers, fishery managers and researchers identified common and divergent views. Shared views were found regarding:

- Perceived impact of commercial fishing contributing to fish stock declines,
- Perceived importance of using gear that minimizes stress and injury to individual fish when released,
- Belief that conflicts among stakeholders is growing as is the global anti-fishing movement based on animal rights thinking.

Divergent views included:

- Researchers are more concerned than anglers and managers re potential for anglers to contribute to declining fish stock,
- Anglers were also less content with their involvement in the fisheries management process than were responding managers and researchers,
- Anglers have a greater desire for more human dimensions research on understanding angler attitudes and behavior than was evident for responding managers and researchers.

Inclusion in Management

Many US marine recreational fishery stakeholders feel frustrated by a lack of inclusion in management decisions. A "FishSmart" model has been proposed to overcome this gap where recreational anglers are directly involved in research to quantify the value of best practices (e.g. in catch and release) and reinforce the notion among anglers that best practice behaviors facilitate conservation and sustainable exploitation. A model for "citizen science" and the principles of experiential education includes immersion, involvement, ownership and legacy (i.e. networking, follow up).

Social Capital

The development of social capital (per a NZ case study) in recreational fisheries was highlighted, with three main drivers identified:

- Trust is built up over time and can be influenced by status of individuals or organisations and their record of doing what they say they will do,
- Cooperation arising from a common understanding of issues and the potential for mutual benefit from participation in decision making,
- Social networks are a causal factor in social capital and can be looked at in terms of strong linkages within groups of like-minded individuals (bonding social capital), strong links across similar groups or social networks (bridging social capital), and connections or engagement across disparate groups or networks (linking social capital).

Recreational Only Fishing Areas

The use of ROFA's (Recreational-only fishing areas, where commercial fishing is excluded, leaving sole fishing access to recreational fishers) was considered (based on a case study area from Cardwell to Ayr in Qld). The study suggests that the ROFAs are not currently providing the expected benefits for fishers and adding more ROFAs would be unlikely to reduce conflict between commercial and recreational fishers. The effectiveness of the ROFAs may be improved if recreational fishers are better informed about their location.

d. Biological Management

Hooking Mortality in Fresh Water

A German case study in fresh water species found that barbless hooks and artificial baits improved catch and release survival while doing so in warmer waters increased hooking mortality. A US study supports better alignment

US Recreational Fishing 2006

- 40 m licensed anglers
- \$46 Bn in retail sales
- \$115 Bn economic impact
- 828,000 sector employees
- Private, recreation-based aquaculture contributes the western states contributes \$1.9 Bn p.a. and 26,229 full-time jobs.

(NSTC, 2014)

of fish target size with catch and release behaviour in order to reduce overall recreational hooking mortality.

Ecological Damage due to Seabirds

The explosion in Greater Cormorants across Europe is considered to be a central cause for ecological damage to fish populations and economic and sociocultural damage to fishing. Rearing of fish in farms and stocking of juveniles in natural waters are often unsuccessful because of cormorant predation.

Climate Change Impacts

The uncertain impacts of climate change on Central Queensland riverine related flood events and recreational fisheries was assessed as a significant risk to fishery performance.

e. Ethics

Are fish sentient and are there grounds for a recreational fishing cruelty charge? European researchers identified five ethical challenges for global Recreational Fishing:

- Animal welfare and the opportunity to improve the treatment of fish caught,
- Wilderness centred perspectives and ways to increase sector sustainability,
- Animal liberation, including the scientific data that suggests fish do not feel pain,
- Animal rights, and the ability for animals / fish to emotionally conceptualise "life",
- Angler rights and motivations.

The paper finds that the recreational fishing sector is most at risk from the last three challenges.

A Finnish paper calls for clarification of the ambiguous terminology of catch-and-release fishing and for the development of new policy institutions where different views and values could be governed.

An Australian paper (sponsored by the FRDC), described the development of an environmental standard (NEATFish) for fishing tournaments. Benefits claimed include reduced insurance premiums for tournaments, increased recognition by sponsors, and greater acceptance within the broader community. The standard is currently being considered for use by several organisations, including marine park authorities.

f. Survey Methods and Monitoring

US, NZ, German, Czech, and Australian studies and alternate survey approaches were cited to highlight:

- The advancing sophistication of survey and engagement processes,
- The increased accuracy of these advanced approaches in guiding fishery users and managers,
- The need to directly engage charter operators on economic terms to optimise their responses,
- The need for direct involvement of fishers in data collection programs, to promote greater support for sustainable management arrangements,
- Potential cost effectiveness gains of diary surveys over creel surveys,
- Refinements to methodologies that reveal fishing pressure insights in marine recreational fisheries.

g. Economic Valuation and Investment

The FAO (FAO Recreational Fisheries, 2012) has identified the difficulties that recreational fisheries have in attracting social policy support, and in leveraging this into funding and investment, both public and private.

This economic valuation matter is a particular issue constraining the sector's development in many advanced economies. Economists and politicians recognise the significant social role that recreational fishing plays in community welfare and its economic contribution to their economies. But typically the sector lacks the organisational and data management capacity, and financial heft to describe its value proposition and put its investment case professionally and in economic terms.

A current project (FRDC 2012-214) has found that many advanced economies are looking for methods that will adequately assess the economic value (from both financial transactions and social wellbeing dividends). In Australia the economic value of the recreational fishing industry (from financial transactions alone) is in the order of \$2.5 billion, just less than the Australian golf sector.

Figure 23 summarises the latest reviews and approaches to sector valuation in advanced economies. The *revealed travel cost method* is increasingly chosen globally as the best market based indicator of sector economic value.

FIGURE 23. RECREATIONAL FISHERY VALUATION AND DATA MANAGEMENT IN ADVANCED ECONOMIES

	Agency	Approach to Recreational Data Management	What data is collected	Key Findings
Canada	<ul style="list-style-type: none"> Department of Fisheries and Oceans Canada, with support from Provincial and Territory agencies (Fisheries and Oceans Canada, 2010) 	<ul style="list-style-type: none"> A consistent national Travel Cost approach Survey conducted every 5 years since 1975; 2010 survey was the 8th. Target population of all individuals in provincial and territorial fishing license databases. In 2010 questionnaires were mailed out to almost 102,000 households within Canada and in other countries to obtain information on recreational fishing activities. Sample design based on license databases in each jurisdiction. Sample sizes were determined from the reliability estimates for days fished for each stratum, per 2005 Survey results. Specific adjustments undertaken by individual provinces. Northwest Territories survey was conducted by DFO headquarters using samples provided by the jurisdiction. 	<p>The 2010 survey collected information on:</p> <ul style="list-style-type: none"> Angler profile (age, sex, residence, etc.), Recreational fishing activities, including fishing effort by region, Number of fish caught and retained, and Harvest by species and by fishery management/economic region. Various questions focusing on aquatic invasive species, Trip information for non-resident anglers, Expenditures including major purchases or investments attributable to fishing activities, package deals purchased, and direct expenditures related to fishing trip activities. Each province/territory also asked supplementary questions on recreational fishing activities and programs in their respective jurisdictions. 	<p>2010 Recreational anglers:</p> <ul style="list-style-type: none"> Licensed 3.6 million: Active 3.3 million (males 77%) Average days fished per angler 13.2 days Fish caught/kept 193/63 million (21 fish kept/angler) <p>Fishing Trip Expenses: C\$2.5 billion (\$766/active angler) Transport \$281; Food and Lodging \$240; Package deals \$120; Fishing Services/Other \$125</p> <p>Fishing Investment Expenditure: C\$5.8 billion</p> <ul style="list-style-type: none"> Wholly attributable \$2.95 billion (\$898/active angler) Boating equipment \$343; Special vehicles \$189; Camping equipment \$111; Land and Building \$152; Fishing equipment \$77, Other \$26. Partially attributable \$2.87 billion <p>Total Expenditure by: Residents %95; Non-resident Canadians 3%, Other 2%</p>
USA	<ul style="list-style-type: none"> Dept of Commerce, with NOAA and NMFS (National Marine Fisheries Service) (DOC, 2008) Magnuson-Stevens Fishery Conservation Act 	<ul style="list-style-type: none"> Some states do not use saltwater angler's licenses. So surveys aggregate state and regional Travel Cost data into a Marine Recreational Information Program (MRIP) National Marine Fisheries Service has surveyed marine catch, effort and participation since 1998; last in 2011 (Nat'l Survey of Economic Contributions to Saltwater Angling - 15 million anglers across 23 states). MRIP consists of three independent and complementary surveys of catch, effort, participation, and fishing modes (shore, private boat, rental boat, charter boat). <ul style="list-style-type: none"> a trip intercept survey of ~6000 fishing pressure sites an economic data intercept survey 42,000 mail surveys of investments and demographic data States contribute additional data from licenses etc. 	<ul style="list-style-type: none"> 2006 survey - Direct + Indirect data and expenditures - state, county, residence zip code, hours fished, main area fished, target species, party makeup, gear used, license data, days fished in last 2 and 12 months, length and weight of fish, species retained and released, disposition of catch, angler, overnight trip information (days, lodging, purpose), trip expenditures, fishing ability, boat ownership, durable investment spend, Induced Expenditure Data – state/region/nation income, taxes, value added, input-output analyses, and state level multipliers for angler expenditures and employment impacts Key Pt: An independent periodic review of survey methodology recommended a registry of national marine fishers and changes to the sampling frame. (US National Academy of Sciences, 2006) 	<p>2006 Recreational <u>saltwater</u> anglers: (Gentner & Steinback, 2008)</p> <ul style="list-style-type: none"> Licensed 24.7m Avg. days fished per angler 5.2 days <p>Fishing Trip Expenses: US\$5.8 billion (\$235/saltwater angler) Transport \$48; Food \$47; Lodging \$39; Tackle \$18; Bait \$14; Rent, etc. \$69</p> <p>Fishing Investment Expenditure: US\$25.6 billion (\$1036/angler) Boats \$279; Special vehicles \$215; Home purchases and Mt'ce \$205; Fishing equipment \$121; Camping equipment \$9, Other \$207</p> <p>Total Expenditure: State residents %83, Nonresidents 17% Employment: 533,813 jobs supported.</p> <p>The ongoing US MRIP is considered by a number of Australian recreational fishery researchers to be an international reporting benchmark for recreational fisheries. Also see (Steinback, Gentner, & Castle, 2004)</p>
France	<ul style="list-style-type: none"> IFREMER (IFREMER, 2008) 	<ul style="list-style-type: none"> Between 2006 and 2008, Ifremer (French Research Institute for Exploration of the Sea) implemented the first national survey of French recreational fisheries. Based on the Travel Cost approach, the survey aimed to assess the number of fishers and effort, landings, the diversity of practices and species, and economic contributions. The method involved a telephone survey of sample (15,085) of national households, followed by detailed on-site interviews of catch, trip expenditure etc. The study found 2.45 million recreational fishers (5.1% of population - 82% males) with an average of 13 fishing trips per year. The study divided the costs in to three items: average direct trip expenditure 28€, average investment costs per fisher 87€, and average annual cost per boat 1,701€. A license is not required for recreational fishing in France. 		
UK	<ul style="list-style-type: none"> DEFRA s (DEFRA, 2012) with CEFAS, MMO and IFCAs 	<ul style="list-style-type: none"> England's Dep't of Environment, Food and Rural Affairs (DEFRA) will conduct its most comprehensive survey of recreational fishing during 2012. The survey, <i>Sea Angling 2012</i>, will find out how many people enjoy the sport, how much fish they catch within six nautical miles of the coast, what is returned alive, and how important the sport is to the country's economy. European legislation requires EU Members to collect and report data on recreational catches of certain species – including bass, cod and sharks – to give a clearer picture of stock impacts. <i>Sea Angling 2012</i> will be carried out by DEFRA affiliates – MMO (Marine Management Organisation), CEFAS (Centre for Environment, Fisheries and Aquaculture Science), and the new local IFCAs (Inshore Fisheries and Conservation Authorities). The survey will give sea anglers input to the new IFCAs as policies develop for managing sustainable fishing. The valuation techniques used are unknown. 		
NZ	<ul style="list-style-type: none"> MAF (MAF, 2012), NIWA & BOMR 	<ul style="list-style-type: none"> In 2011/12 summer, NZ's Ministry of Agriculture and Fisheries (MAF), National Institute of Water and Atmospheric (NIWA) Research and Blue Water Marine Research (BOMR) undertook marine boat ramp surveys, aerial surveys and diary surveys with about 7000 fishers on when, where and how they fish, along with their total catch to better understand and manage recreational fisheries. . The valuation techniques to be used with this data have not been advised. The full results of the research program are expected to be released in June 2013. 		
Ireland	<ul style="list-style-type: none"> Inland Fisheries Ireland (IFI, 2012) 	<ul style="list-style-type: none"> IFI has appointed Tourism Development International (an independent company) to undertake a Socio-Economic Survey of Recreational Angling in Ireland. The survey will establish the current volume and value of domestic and overseas recreational angling in Ireland. The Survey will consult sea anglers and inform IFI and its tourism partners and also enable improved strategic planning and decision making in respect of product development and marketing. The survey comprises two parts, a household survey and a survey of recreational anglers which will commence in April 2012. Anglers will be met at fishing locations throughout Ireland and invited to participate there and then, or later by phone or on-line. The valuation techniques to be used with this data have not been advised. 		

6. GLOBAL TRENDS AND ISSUES IN CUSTOMARY FISHING

There is uncertainty regarding the term “customary fishing”, which is not widely used in the global wild catch fisheries management lexicon. In advanced countries where there are substantial ongoing linkages between Indigenous communities and fisheries resources (Australia, US, Canada, NZ), a range of words are used to describe fishing activity by Indigenous people – customary fishing, aboriginal fishing, first nations peoples’ fishing, Indigenous fishing, and Maori customary fishing. The most commonly used global name is “traditional fisheries”.

Confusion arises elsewhere however, because of common usage. In less developed economies the traditional motivation for and method of fishing is often synonymous with subsistence or artisanal fishing activity. The FAO tries to address this on their website (<http://www.fao.org/fishery/topic/12306/en>)

- Small scale fisheries: labour-intensive fisheries using relatively small crafts (if any) and little capital and equipment per person-on-board. Most often family-owned. May be commercial or for subsistence. Often equated with artisanal fisheries.
- Artisanal fisheries: typically traditional fisheries involving fishing households working close to shore, mainly for local consumption. In practice, the definition varies between countries. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export.
- Subsistence fisheries: a fishery where the catch is shared and consumed directly by the families of the fishers rather than being bought by intermediaries. Pure subsistence fisheries are rare, as part of the products are often sold or exchanged/bartered for other goods or services.
- Traditional fisheries: fisheries established long ago, usually by specific communities that have developed customary patterns of rules and operations. Traditional fisheries reflect cultural traits and attitudes and may be strongly influenced by religious practices or social customs. Knowledge is transmitted between generations by word of mouth. They are usually small-scale and/or artisanal.

What are the trends? In advanced economies there is a clear trend to:

- Recognise customary rights to wild fishery resources,
- Identify the nature of these fishing rights,
- Develop legal and legislative tools to access these rights, and
- Allocate resource access and use elements in relation to these rights.

Perhaps the most advanced economy in management of customary fisheries is New Zealand, where a detailed Information Manual (NZ Ministry of Fisheries, 2009) has been published. This 70 page how-to document:

- Defines the elements of customary fishing - sale, barter, trade, Marae use, personal use, family use and Koha, under non-commercial and commercial headings,
- Summarises the history of rights development, and the key legislative structures and tools in the current fisheries management framework,
- Describes the intent, aspirations, obligations and outcomes of the use of fishery resources in a customary manner,
- Provides a fisher-friendly Q&A Section for the basic day-to-day matters confronting customary usage of the fishery resource, and
- Identifies where new policy guidance is required to achieve better management and user outcomes.

7. MEGATRENDS: FOOD - WATER - ENERGY NEXUS

The essential discussion regarding so called Megatrends has been left to last in this chapter,.... because it integrates

the global issues and tries to make F&A sense of the compound future impacts Australia will face.

Megatrends are important to Australian planners for fisheries and aquaculture. But not all megatrends will have equal impact on the F&A industry.

Food security, access and performance for domestic and export consumers is the trend that is most able to benefit from an investment by the FRDC.

The Corporation's investment in climate, biodiversity, water and energy are via contributions to a collaborative national strategy.

While much of this discussion is well beyond our F&A needs, it is worth a minute to summarise views from a number of global think tanks regarding the compound interaction of five global elements – climate, biodiversity, food security, water and energy. These elements all directly impact the way fishing and aquaculture currently operate and will

compete for resource access and use, with other industries through to 2030. Together these elements and their forecast compound impacts are referred to universally as “the Nexus” that will greatly influence human food, health and geopolitical outcomes through to 2030. Building an understanding of the Nexus (it is claimed) will help identify and manage trade-offs that will be required to drive cost effective planning and investment in global and national solutions. The summary of these nexus issues is illustrated in Figure 24.

a. Climate Change and Impacts

There are many global and Australian reports regarding the status and options available to improve resilience to

climate change, including for the F&A Industry. A short list of up-to-date sources has been identified below.

National Climate and Fisheries Action Plan

In 2010 the Commonwealth Dept. of Agriculture established a National Climate Change and Fisheries Action Plan (DoA, 2010). The Plan is summarised in Figure 25.

Within a COAG framework the National Climate Change Adaptation Research Facility has been established by the Australian Government to coordinate and lead the Australian research community to generate the biophysical, social and economic information needed to adapt to climate change.

The scope of the plan includes both the wild catch (commercial, recreational and Indigenous) and aquaculture sectors.

The major focus of the plan is on improving the capacity of Australian fisheries sectors to operate under changing climatic conditions (i.e. adaptation).

National Marine Science Plan

A draft summary paper (NMSP, 2014) developed in 2014 as an input to the NMSP notes that:

“While the presence of long-term warming and an anthropogenic cause are clearly observed, well understood and widely accepted within the scientific community the science required to deal with climate variability and change and manage future risks to Australia still constitutes a significant scientific challenge. Climate impacts are experienced on global to local scales and often manifest via extremes, so our science must be able to inform at these scales.”

FIGURE 24. GLOBAL MEGATRENDS

By 2030:	1. CLIMATE	2. BIODIVERSITY	3. FOOD SECURITY	4. WATER	5. ENERGY		
Driver	Carbon	Species	Calories	Fresh Access	Access		
Global Objectives	Reduce outputs to agreed targets	Preserve species and diversity	Increase food availability 35% to meet global population and consumption patterns of an expanding middle class	Increase fresh water availability 40% to meet global population and consumption patterns of an expanding middle class	Increase energy availability 50% to meet global population and consumption patterns of an expanding middle class		
Where /How FRDC is Engaged	Participant in the National Marine Science Plan	Participant in the National Marine Science Plan	Participant in the National Marine Science Plan A range of strategies to ensure seafood supply is accessible, and contains nutritional health benefits, at acceptable costs	Not relevant for most marine fisheries, but significant uncontrolled seasonal impacts on near-shore wild catch fisheries (e.g. prawns) and inland freshwater and saline water fisheries	Direct impact on wild fishers and fish farmers via fuel usage and input cost.		
Global Nexus	<p>Complex interrelationships and increasing competition for resources between global elements.</p> <p>There will be as much scope for negative tradeoffs as there is the potential for positive synergies</p> <p><i>Big Question:</i> How will Fishing and Aquaculture outcompete other resource users and protein suppliers over the next 30 years?</p>						
Global Tectonic Shifts that are Expected	Growth of the global middle class	Wider access to lethal and disruptive technologies	Definitive shift of economic power from the West to the East and South	Unprecedented and widespread aging	Urbanisation - will climb from 50% to 60%	Food and Water scarcity and pressure	US Energy Independence
SOURCES: (GLOBAL TRENDS 2030: ALTERNATIVE WORLDS, 2012); (MULLER, 2014 MAY); (FAO, 2014 MAY); (GERMAN GOVERNMENT, 2013 NOV)							

World Bank

The latest World Bank climate report (World Bank, 2014 May, p. 14) suggests there is “increasing global focus on climate change policy and several economies are planning, implementing and refining domestic mitigation actions”. The two largest greenhouse gas (GHG) emitters (USA and China) have established carbon pricing instruments.

Around 40 national and over 20 sub-national jurisdictions are putting a price on carbon. Collectively these carbon pricing initiatives cover around 12% of annual global GHG emissions.

Risky Business: Economic Risks of Climate Change in the USA

This report (Risky Business Project, 2014 June) takes a standard (and refreshing) commercial risk-management approach to climate change risks. It details the costs of inaction in ways that are easy to grasp in dollars and cents. Co-chairs of the project were Michael Bloomberg (ex. Mayor of New York) and Henry Paulsen (ex. Sec. of the Treasury), both respected US economic sustainability thought leaders.

The report says “It is our hope that it becomes standard practice for the American business and investment community to factor climate change into its decision-making process. We are already seeing this response from the agricultural and national security sectors; we are starting to see it from the bond markets and utilities as well. But business still tends to respond only to the extent that these risks intersect with core short term financial and planning decisions.

The study finds that early and ongoing action will avoid most of the worst impacts of climate change on US businesses and the US economy – but change in business and public policy practices is required from today (June 2014).

The study is data rich and of real value to Australian F&A planners as it details a region-by-region approach to impacts and solutions. Direct brief mention is made of impacts on seafood, in the regional case of Alaska.

CSIRO

A 2012 Report (FRDC, CSIRO, & NATIONAL CLIMATE CHANGE ADAPTATION RESEARCH FACIL., 2012) summarised current knowledge of marine climate change impacts, noting that research at that time indicated that:

- Re Tropical Fish: some species have a greater capacity to acclimate to rising temperatures than

previously thought; however the extent of this capacity is unknown,

- Re Temperate Fish: southward range extensions are evident for many coastal temperate fishes,
- Re Pelagic Fish: distributions may be expanding south.

More recent modelling by the CSIRO (Fisheries in a future ocean: impacts of climate change, 2014) has highlighted changes in a range of variables that will influence global and Australian fisheries, including, temperature, ocean currents, winds, nutrient supply, rainfall, ocean chemistry, and extreme weather conditions.

Long term changes in ocean temperatures and nutrient availability will affect the range and productivity of fishing grounds, aquaculture and all tiers of marine biodiversity, with economic and social consequences.

The agency suggests that by 2030 the changes will be manifest as impacts of changing climate and ocean conditions, including:

- Regional shifts in wild fish stocks, which will also require Fisheries Managers to distinguish climate change impacts from other impacts,
- Changes in spawning times,
- Contraction of suitable habitat for aquaculture reliant on cool water conditions,
- Habitat change due to species invasions,
- Higher intensity extreme weather events affecting onshore and coastal aquaculture,
- Southward movement of benthic and demersal fish species prominently in the east and south-east,
- Some populations may decline,
- Continued decreases in the zonal west winds are likely to lead to continued depletions and potential collapses of demersal fish stocks,
- Changes in temperature, current patterns, and primary and secondary production may affect larval fish health and transport thereby influencing recruitment potential,
- Climate change impacts will potentially combine with fishery impacts to exacerbate further depletion of groundfish stocks.

FIGURE 25. NATIONAL CLIMATE CHANGE AND FISHERIES ACTION PLAN

Sector / Use Impacted	Environmental Variable	Potential Effect on Fishery	Objective of Plan	Desired Outcome
Wild catch fisheries for Commercial, Recreational and Customary Users, and Aquaculture farms	Ocean currents, winds and nutrients	Changes to oceanic and inshore productivity (e.g. due to altered upwellings) and food webs. Changes to recruitment patterns of marine organisms, including those affected by fishing. Changes in the abundance of wild catch species and availability and composition of fish meal. Altered flushing rates around sea cages affecting dispersal of waste.	The plan's objective is to guide activities to inform and support adaptation responses to climate change, and to help fishers reduce the intensity of greenhouse gas emissions. Strategies that support socio-economic and biological resilience are identified in the Action Plan. These strategies are grouped within the focus areas of: 1. Improving the adaptive capacity of the fisheries sectors • Improving the resilience of fishing operations to climate change • Improving understanding and awareness of climate change impacts on fisheries • Facilitating ongoing assessment and monitoring of climate change impacts at suitable scales • Management and policy frameworks that are informed, agile and consistent. 2. Mitigation—reducing emissions intensity • Fishers understand and reduce greenhouse gas emissions.	Fisheries sectors that are: <ul style="list-style-type: none"> • Ecologically sustainable • Social and cultural resilience in fishing activities • Profitable and competitive within a changing climate. Fishers have the capacity and knowledge to respond to climate change and make educated, risk-based decisions. Fishers who: <ul style="list-style-type: none"> • Are able to respond to fluctuating operating environments • Look for and capture opportunities that may arise from climate change (for example, commercial operators will benefit from being entrepreneurial and innovative) • Work cooperatively to address climate change challenges. Flexible and adaptive regulatory and management frameworks that: <ul style="list-style-type: none"> • Can deal with uncertainty • Accommodate fisher adaptation to climate change • Support long-term biological, economic, social and cultural sustainability • Promote an understanding of appropriate responses to climate change • Involve government and fisheries sector partnerships that provide for ongoing cooperation.
	Ocean acidification	Changes in pH could be detrimental to some marine organisms, including: <ul style="list-style-type: none"> • Reduced growth of calcifying phytoplankton and effects on the moulting process • Physiological stress in other marine organisms • Altered food-web structure • Possible vulnerability of sensitive life history stages (e.g. larvae). 		
	Rainfall patterns and more frequent, extreme storm events	Altered catchment flows and subsequent changes to estuarine and inshore productivity. Changes to the timing and extent of spawning of estuarine and inshore species. Flooding following storm events may affect fish survival in inshore habitats. Competition for water resources in some areas may impact on inland fishing and aquaculture. Changes to levels of catchment-sourced pollutants and nutrients entering waterways. Possible infrastructure, stock and property loss associated with storms. Habitat damage, particularly in the tropics, from more frequent storms and cyclones.		
	Sea-level rise and increased wave activity	Altered inshore habitats and nursery areas for fish, dugongs* and invertebrates. Possible loss of rocky shore macroalgal habitat, and dependent species. Possible changes to the availability of suitable aquaculture sites		
	Water temperature	Southward shift in the distribution of many species, particularly off south-eastern mainland Australia. Changes in phenology, such as the timing of spawning, migrations and other life-history events. Altered recruitment and dispersal patterns. Changes to growth and reproductive rates. Altered disease and parasite susceptibility and physiological stress. Possible increased incursions of pest species as a result of ecosystem disturbance. Changes in habitats, communities and mosaics, including poleward shifts in aquatic plants and fauna. Loss or distribution shift of habitat-forming organisms may alter fish communities and catches. Increased oceanic stratification, limiting the recirculation of nutrients to surface waters. Increased incidence of algal blooms. Decreased oxygen availability as a result of higher water temperatures. Enhanced or suppressed feed-conversion ratios in aquaculture systems. Possible altered sex ratio of marine turtles and range shift in suitable nesting beaches (Dugongs, turtles) Changes in availability of traditional target species, including new opportunities. Increase in the range and/or availability of warm water species (e.g. pelagic gamefish species).		

E. AUSTRALIAN RESOURCE CONTEXT FOR F&A

1. ENVIRONMENTAL CAPACITY

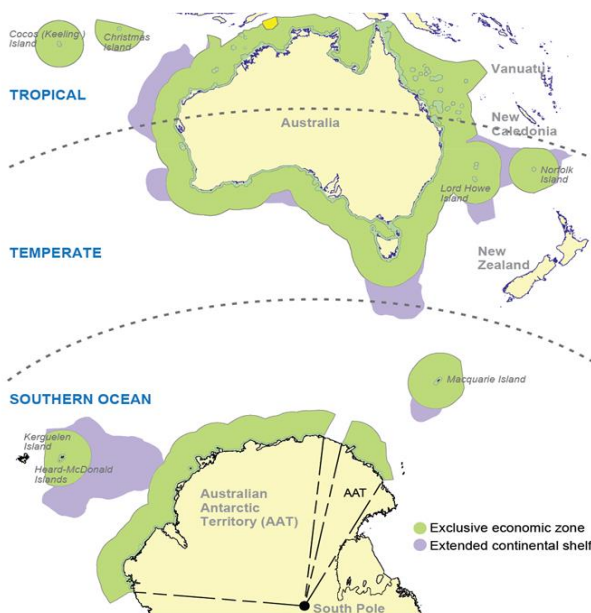
Australia has the third largest marine territory in the World. Our diverse marine seascapes, stretching from the tropics to Antarctica, reflect unique biodiversity values and deliver a valuable flow of ecosystems goods and services. These values are under pressure everywhere but especially on the continental shelf where marine ecosystems face multiple pressures from human development and changing ocean climate (Dittmann & Doherty, 2014 Nov).

a. Capacity to Support F&A

Australia is a maritime nation - over 80% of its 23 million population live within 50 km of the coast - and citizens have sovereign rights over the world's third largest fishing zone.

This marine territory covers 8,148,250 square kilometers² – but, because of a lack of nutrient-rich currents (and so relatively low productivity), Australia ranks only 52nd in the world in terms of volume of fish landed.

FIGURE 26. AUSTRALIAN FISHING ZONE



Key Points: AUSTRALIAN RESOURCE CONTEXT

Our large EEZ offers great potential for seafood expansion, by harvesting to the sustainable TACC, and expanding farming.

Modern consumers want guilt-free seafood. Their risk aversion and media influence are manifest in the increasing NGO collaboration around harvesting, supply, retail and food service. Our fishers and managers are too slow to hear this message and accept it as fact, and to respond with change in the way we do things - in harvest, supply, and in getting the data and telling the world we are among the top 3 fishery managers.

The proportion of Australians who believe the industry is “sustainable” has increased since 2011 (up 5% from 37%) - opinions are changing, but only slowly. More work to do!

The community is more confident about sustainability in aquaculture (76%, down 2% from 2011) and recreational fishing (69% up 2%), than wild catch seafood (30%, up 3%). We need to engage the community in ‘telling the story’ of the journey to sustainability. More than one in two adults (56%) believe our sustainability is ahead of other countries.

Yield growth is possible under existing TACCs but must be viable long-term, against imported commodities. We need to find ways to convert up to \$0.5Bn in uncaught wild catch yield into branded economic and social (employment, recreation) outcomes. Our wild fisheries have real long term global niche potential but we need more investment, and management guided by clear economics.

We farm many key global commodity species. But we will only get/stay ahead with RD&E that becomes branded innovation.

² Geoscience Australia, www.ga.gov.au/education/geoscience-basics/dimensions/oceans-and-seas.html

Marine, estuarine and terrestrial ecosystems provide habitat for a diverse range of species – about 4,500 finfish species, and perhaps tens of thousands of invertebrate species.

Australian marine and terrestrial waters are nutrient poor by global standards, due to the dominance of the two southern polar flowing currents of warm tropical waters. Consequently our marine fisheries rank 52nd in global tonnage terms (0.2% of tonnage landed), but are relatively high in value (2% of landed value). The low production capabilities of these marine fisheries offer little opportunity to increase tonnage.

The extensive length of our continental coastline (36,000 klms, rank 7th) spanning 35° of latitude creates great diversity in habitat, and species, providing potential for selected aquaculture. Our shorelines include coral reefs temperate rocky and sandy shores, more than 900 estuaries, 10,000 sandy beaches, and 8,000 diverse islands (NMSP, 2014). This visible and bathymetric variability creates habitat for molluscs and crustaceans, where Australian is established as a significant producer of wild catch species, including rock lobster, pearl oysters, abalone and prawns.

Fish habitat on remote sovereign Australian islands (Macquarie, McDonald, Heard, Norfolk, Cocos and Christmas Islands) are variously impacted by these oceanic circulation patterns. Waters in north eastern Australia are dominated by the world's largest coral reef systems. Inland waters are diverse, ranging from temperate highland lakes in Tasmania to highly seasonal flood-event rivers in Tropical Australia.

b. Actions to Enhance Resource Capacity

The Australian Marine Science Plan is a work-in-progress, the latest step being a symposium in Canberra on 25-26 November 2014. The plan will bring together diverse themes that impact all marine and coastal resource users, including fishing and aquaculture. The themes include:

- Sovereignty, security and natural hazards,
- Energy security,
- Food security,
- Biodiversity conservation and ecosystem health,
- Dealing with climate change,
- Optimal resource allocation,
- Urban coastal environments, and
- Infrastructure.

The FRDC is an active participant in the NMSP process.

2. RESOURCE USE

The FRDC has noted (2010) that the fishing industry makes a “large, unique contribution to the wellbeing and economy of Australians”. Stepping back and considering the scope and scale of the potential uses, the Corporation should also be saying that fishing is the most expansive and dynamic source of healthy and sustainable food, economic wealth, and enjoyment for the next generation of Australians.

a. Exclusive Economic Zone

Australia's Exclusive Economic Zone (EEZ) generally extends 200 nautical miles seaward from coastal baselines, ranging from tropical to Antarctic waters and enclosing a diverse range of marine environments, communities and fisheries.

Australia abides by a range of international instruments concerning fisheries. The *United Nations Convention on the Law of the Sea, 1982* (UNCLOS) sets out detailed rules in relation to Australia's and other State's sovereign rights in the EEZ, including in relation to fisheries. Key supporting instruments are the non-legally binding Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries, and International Plans of Action (IPOA) to:

- Prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing,
- Reduce fishing (over) capacity,
- Reduce the incidental catch of seabirds,
- Conserve and manage sharks.

The Commonwealth has jurisdiction for fisheries that lie between 3 - 200 nautical miles of the coastline – although in practice most are in fact controlled by the States and Northern Territory as the ports and logistics are within their remit. Where a fishery spans two or more jurisdictions, administrative boundaries are usually developed under an Offshore Constitutional Settlement (OCS), an arrangement by which management responsibility for the fishery is handed to one jurisdiction. The OCS framework was established in 1979.

b. Dynamic Use Trends

The fishery and aquaculture sectors described at the start of this report identify the uses and users and their respective benefit streams. Over time, usage changes – in response to economic, social and environmental needs and dynamics.

Resource use is and must be dynamic - trading and sharing the resource between sectors and users to optimise the net triple-bottom-line benefits to Australians. For example,

- In some traditional commercial waters, Recreational Fishing is now more economically attractive than traditional commercial use;
- Indigenous people are increasingly owners of rights in all sectors – customary, recreational, commercial wild catch fisheries, and a small number of aquaculture ventures,
- In the next few decades we will see significant aquaculture investment from Asia enter Australia seeking real estate - fresh marine and aquatic farm sites for fish or industrial uses such as algae for biofuels. This will drive the development of aquaculture into waters outside the 3 nautical mile (nm) limit that is currently managed by the Commonwealth.

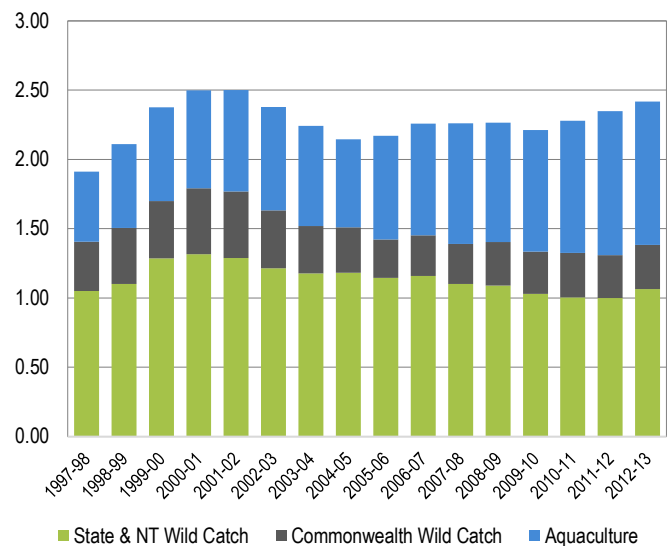
Since the beginning of the century, the total annual volume of Australian fisheries production has increased by 4% (~2,582 tonnes). But the industry's value has been in decline since 2000–01, the annual real GVP has fallen by 47 % or \$1.04 billion.

Figure 27 presents trends in nominal jurisdictional GVPs.

Why the decline in value? The figure confirms a nominal average annual increase in aquaculture GVP of 5.7% over the 15 year period. At an average inflation rate of say 3% p.a. this is effectively real GVP growth of ~2.7%. However the figure also confirms that wild catch in state and NT, and Commonwealth fisheries is declining in nominal terms – the 15 year averages are (0.3%) and (0.5%) respectively. These both indicate an average real value decline in the order of 3-4% p.a.

As illustrated in the figure, and noted by David Borthwick, in his 2012 review of the management of Commonwealth Fisheries (Borthwick, 2012), most of the decline in value occurred between 2000–05.

FIGURE 27. JURISDICTIONAL GVP'S \$BILLION (NOMINAL)



In recent years the rate of nominal wild catch decline in GVP has slowed, with the real GVP decreasing by only 10% since 2004-05. This steadying reflects, in part, the exit of non-competitive fishers as a result of structural adjustment. Since then more stringent management arrangements have helped to ensure both better biological sustainability of target stocks and improved individual and fisheries economic performances.

In Commonwealth fisheries there has been a decline in value of 40-50%. ABARES notes (ABARES, 2013 Aug) that data and anecdotal information from industry suggests that the quota market is seeing ongoing industry consolidation.

In the effort-managed state fisheries, effort creep and jurisdictions buying out fishing concessions (e.g. QLD, NSW) continues. The clear forces driving restructuring in Australian fisheries are uncertain, as is the impact on public interest, levels of efficiency, reduction in competition, whether management structures impact industry consolidation, and whether it should be encouraged in the public interest

c. Key Legislation

Jurisdictions maintain their respective Fishery Acts/Fishery Management Acts which cover all sectoral users accessing their aquatic (marine, brackish and freshwater) resources. Their purpose is to ensure fishery resources within the remit are beneficially used, and used competitively, profitably and sustainably.

Some states (e.g. SA and TAS) have also established specific aquaculture acts/legislation to facilitate growth and streamline management in this sector. QLD's competition authority is currently in a process to assess the benefits of an aquaculture act. Beyond these instruments, jurisdictions variously maintain supporting and enabling fishery/seafood legislation as necessary (e.g. for food safety and human health, or environmental protection).

State and Territory fishery legislation is subservient to national legislation, including the Commonwealth's EPBC Act. The EPBC Act bears directly on Commonwealth, State and the Northern Territory fisheries management in three ways:

- Assessing matters of national environmental significance,
- Avoiding impact on listed threatened species, listed migratory species, cetaceans and members of listed marine species,
- Monitoring and precluding international movement of wildlife specimens; as it relates to fisheries, the commercial export of Australian native species or species listed under the *Convention on the International Trade in Endangered Species (CITES)*.

3. SUSTAINABILITY

a. What does it Mean Today?

The triple bottom line has been with us for a decade and the word "sustainability" has been in the common lexicon of fishers, farmers, the public and the media for at least that long.

But today we still find that "sustainability" is used (and abused) and means different things to different audiences. A baseline problem is that, in the large and diverse F&A industry a lack of data and knowledge is often interpreted by third parties as a lack of sustainability.

The issues of sustainability fall broadly into four categories:

1. Food safety,
2. Environmental sustainability;
3. Labour welfare (e.g. child exploitation and trafficking), and
4. Animal welfare.

The media (including current shows such as *What's the Catch* on SBS television) has taken increasing interest in these issues over the last decade, often without clear understanding of the facts or drivers – this has enabled activist manipulation – with both positive and negative impacts on consumers' information and choice, and on the political stage. On the other side, fishers and seafood product producers, processors and manufacturers have been poorly prepared and too muted in their advice to consumers regarding the source, sustainability and credence of their food offer.

The net result is that, while Western consumers increasingly value the lifestyle and nutritional attributes of seafood (taste, ease of preparation, health giving omega 3s), they are concerned for the "sustainability" aspects of seafood and fishery products, and lack confidence in their ability to choose seafood based on their own judgments. Consumers want guilt-free seafood! (Consumer jitters are not unique to seafood – caged poultry, beef growth promotants, permeate free dairy milk, and sow breeding stalls are all supermarket and media hot topics in 2014).

This seafood trust vacuum has encouraged the rise of independent standard and certification bodies (e.g. Marine Stewardship Council (MSC), Global Aquaculture Alliance, and Global Reporting Initiative) and about 90 others which offer standards, and mechanisms for independent assessment against those standards, for the issues mentioned above.

Also on the rise is the corporate/commercial branding of "sustainable seafood", by Australian firms, including:

- In aquaculture businesses - Tassal Ltd (Tassal Ltd, 2013),
- In wild catch businesses - Austral Fisheries (*Sustainable Seafood and Prawns at www.austral-fisheries.com.au*) in wild catch Prawns and Patagonian toothfish), and
- In fisheries (e.g. MSC certified Western Rock Lobster, and multiple species in the SA Lakes and Coorong Fishery).

These branded consumer touch-points are also flowing across into social media such as Facebook and YouTube.

The impact across the board has been to raise both the standard of seafood offered, and the compliance procedures in fishery management production and

March 29, 2010

Woolworths Supermarkets has today announced a three point action plan for palm oil sourcing and labelling for private label food products.

Following long standing efforts to minimise the use of palm oil, and consultation with WWF, Woolworths is now stepping up its commitment as follows:

1. Moving to RSPO (Roundtable on Sustainable Palm Oil) certified sustainable palm oil by 2015 for all private label products
2. On pack labelling of palm oil and derivatives
3. Applying to become the first Australian retail member of the RSPO – a global not for profit organisation set up to advance the use of certified palm oil and establish consistent standards.

2010-11-20 2010-11-20

processing to deliver that offer. This impact is also now crossing over to include seafood inputs such as fish meal and fish oil.

Global supermarkets are the major players between suppliers and consumers. In the last 5 years most large global (and Australian) chains have made significant public commitments to reaching targets relative to each of the 4 issues, and to thru-chain integrity. Large chains have considerable power over seafood suppliers, and their demands for compliance are now significantly increasing upstream production costs.

Of recent interest are the direct collaborations that are now emerging between sustainability

promote sustainable seafood choices. The partnership involves a multi-million dollar investment over three years, with Woolworths becoming the principal supporter of Taronga's Great Southern Oceans precinct, which provides a unique experience of Australia's marine wildlife and highlights its conservation needs."

The F&A industry (especially wild catch fishing) is far more complex in species and structure and unique in its product offers, when compared to terrestrial food production systems that are visible and more easily converted to credible metrics for consumers and the media. But it is also clear that most seafood producers are much less prepared to deal with the sustainability issue, and also less inclined to invest in the preferred solutions to manage the risks. The 10 large species-fisheries that produce the bulk of Australian seafood are typically driven by corporate fishers who are taking action to address these challenges and branding accordingly. The balance of fisheries that draw from inshore waters and service the domestic markets only, are yet to frame a response and some are defaulting on the benchmarks set by their regulators (i.e. agencies responsible for fishery management, human health and the environment).

The bottom line is the increasing demand for Australian seafood and the community's growing concern for it to be sustainably caught or produced, is the F&A Industry's problem to solve. It is still a work-in-progress, but it is not certain that industry is gaining on the fast moving expectations of consumers and the media.

b. Sustainability Assessments

For wild catch fisheries the biological sustainability of fish stocks is the primary indicator of fishery sustainability. A 2012 development initiative (FRDC 2011/513, 2013) contributed to by all eight Australian jurisdictions has subsequently delivered the inaugural edition of the *Status of Key Australian Fish Stock Reports 2012*. The latest version has just been published in Dec 2014 (FRDC, 2014 Dec).

National Framework

Traditionally, fishery status reporting has been undertaken separately within each jurisdiction for commercial wild-catch fisheries. These jurisdictional reports use differing terminology and reference points to classify fish stocks. However the national reporting framework has resolved this problem via standardised terminology and reference points for stock status classifications.

/environmental NGOs and the supermarkets.

In 2015, Australia's big two supermarket chains will only sell fresh fish that's been independently certified as



sustainable, and they're also promising a 3rd party tick of approval for some frozen and canned fish (ABC, 2014). As an example, Woolworths has established formal



collaborations with the Sustainable Fisheries Partnership, an NGO to "to carry out the scientific assessment of the sustainability of our seafood products and provide advice on the management of specific issues." In addition Woolworths has also partnered with the Taronga Conservation Society Australia so "together we support and

The Status of key Australian Fish Stocks reports are national reports on the status of Australian wild caught fish stocks. In the inaugural 2012 edition, 49 wild caught species (or, in some cases, species complexes) were considered. Many of the species included comprised multiple stocks, with a total of 150 stocks assessed across the 49 species in 2012. In the 2014 report, the number of wild caught species has increased to 68, comprised of 238 separate stocks. These species and stocks contributed around 85% of the annual catch and 90% of the value of Australian wild catch fisheries in 2012–13.

Classification has been undertaken at three levels as presented in Figures 28 and 29 below. Figure 29 compares the status in 2012 and 2014. Biological classifications are presented (wherever possible), for a biological stock that spans the waters of more than one jurisdiction. This recognises the reality that biological boundaries of fish stocks rather than manmade boundaries of management units (i.e. fisheries) or jurisdictions (i.e. the marine borders of the Commonwealth, states or the NT).

2014 Status for All Stocks

The 2014 national report shows a worsening status for key Australian fisheries, with overfished stocks rising from 2 to 11. This represents an increase from 3.5% to 4.9 % of the total tonnage harvested that is now classified as overfished. Of concern are the number of abalone fisheries now classified as overfished – abalone is a leading national export species that is undertaking significant market development strategies in China.

2013-14 Status of Commonwealth Managed Stocks

The latest Status Report 2013-14 for Commonwealth Managed Stocks was published in October 2014 (ABARES, 2014), with only headline changes captured in this Sector Overview. The report notes:

The status of six solely Australian Government–managed fish stocks changed in 2013. Three of these changes reflect increased uncertainty around fishing mortality status, while the other three changes represent increased certainty around both fishing mortality and biomass status. Although 2013 was the first year that no solely Australian Government–managed stocks were subject to overfishing since 2006, the increased uncertainty around the fishing mortality status of Blue-eye trevalla, Eastern gem fish and School shark is of some concern."

c. Marine Reserves

The Australian Government is committed to the development of marine reserves through the marine bioregional planning process to support the conservation and sustainable use of Australia's marine environment.

The marine reserves policy integrates a variety of different zoning arrangements, including multiple-use zones allowing continuation of commercial and recreational fishing activities that are compatible with habitat protection.

Future management of domestic fisheries will need to consider the role of newly declared marine reserves in stock management.

Spatial management measures are a recognised tool for fisheries stock management. However, in most cases, the new marine reserves are not designed to address species protection requirements and, in the absence of continued fishing, it may be problematic to gather data on their potential role in fisheries management (ABARES, 2013 Aug).

d. Community and Public Perceptions

For the purposes of this Overview, sustainability is defined as "the industry having the necessary practices and policies in place that ensure the future of fish species and the marine environment while at the same time providing sufficient supply of fish for commercial and recreational fishing needs."

In 2011 the FRDC undertook a survey to understand community perceptions of the sustainability of the fishing industry in Australia. The survey found that just over one in three people believe the industry is sustainable, with one in four believing the industry to be unsustainable, and the remainder are were unsure. When fisheries sectors were considered, aquaculture was deemed much more sustainable than commercial wild catch fishing. Another survey that year found that 87% of commercial fishers were concerned about public perceptions of the fishing industry.

Two years later in October 2103 the FRDC commissioned another survey (FRDC - Intuitive Solutions project, 2013) that updated industry on the community's perceptions of the sustainability of the fishing industry in Australia. Based on an online survey of 1,025 respondents aged 18 years and over, the key findings are presented below in Figure 30.

It is of interest that recent fishery management reviews in Commonwealth Fisheries (Barthwick, 2012) and NSW Fisheries (Independent Review of NSW Commercial Fisheries Policy, Management and Administration, 2012 March), have both independently recommended a number of changes to the manner of public consultation in relation to fisheries management plans including more extensive and more substantive consultation on the plans. These recommendations include consultation regarding the community's perceptions on sustainability or practice and related policy settings.

The industry and government will need to adapt to recognise shifts in public perceptions and community attitudes and values before issues develop. It is important

that community expectations about Australia's approach to managing our fisheries resources, and how this relates to developing acceptance of the fishing industry, are better understood. As noted in Figure 30, around 85% of people are not aware that governments manage fisheries, hence their expectation that MPAs are the only management tool.

Understanding public demand for policy changes could involve understanding how the community is informed about fisheries – looking at how this demand for policy change is influenced by the domestic and international media and how the evidence base is communicated.

FIGURE 28. AGREED STATUS TERMINOLOGY FOR CLASSIFYING INDIVIDUAL STOCKS

	Terminology	Description	Expected Management Response
	Sustainably fished	Stocks for which the biomass (or biomass proxy) is above recruitment overfished and for which fishing pressure is not high enough to move stocks to a recruitment overfished state	Appropriate management is in place
↑	Transitional / Recovering	Recovering stock – stocks for which biomass is overfished but management measures are in place to promote stock recovery and recovery is occurring	Appropriate management is in place and stock is recovering
↓	Transitional / Depleting	Deteriorating stock – a stock that is not yet overfished but for which fishing pressure is too high and moving the stock in the direction of becoming overfished	Management needs to be put in place to reduce fishing pressure and ensure biomass does not deplete to an overfished state
	Overfished	Stocks that are overfished and for which current management is not adequate to recover the stock; or adequate management measures have been put in place but these have not yet resulted in measurable improvements	Management needs to be put in place to recover this stock; if adequate management measures are already in place, more time may be required for them to take effect
	Environmentally limited	Spawning stock biomass has been reduced to the point where average recruitment levels are significantly reduced, primarily as a result of substantial environmental changes or disease outbreaks (that is, the stock is not recruitment overfished).	Appropriate management is in place.
	Undefined	Not enough information exists to determine stock status	Management needs to identify data required to remove stock from this category and put in place measures to obtain these data

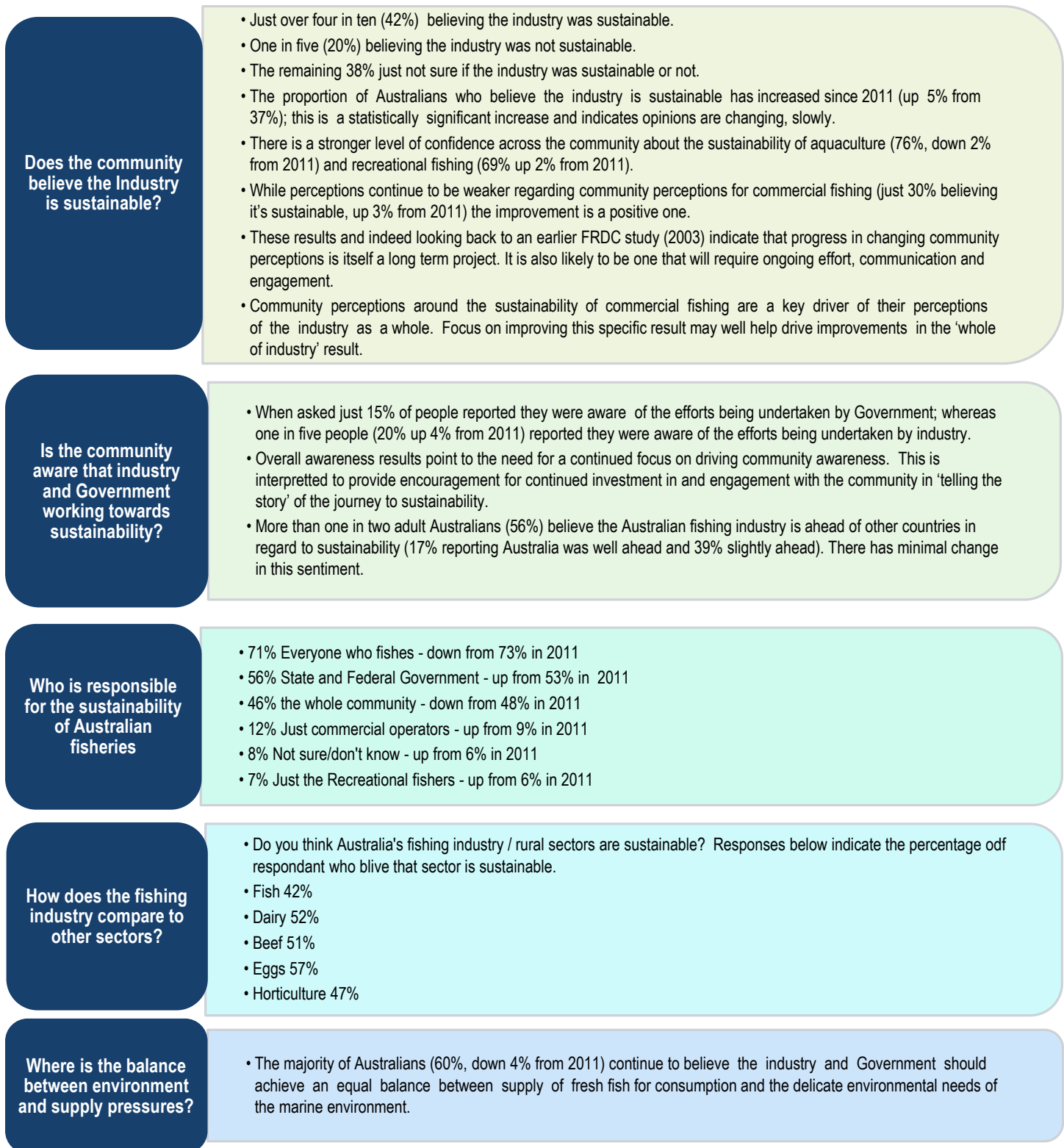
FIGURE 29. STATUS OF KEY AUSTRALIAN FISH STOCKS 2012 AND 2014

2012	Stock status	Number of Stocks				Catch		Species Considered
		Biological Stock (B)	Management Unit (M)	Jurisdiction (J)	Total Stocks	'000t	% of Total	
	Sustainable	53	35	10	98	110	90.6%	98 stocks
↑	Transitional / Recovering	5	2	1	8	0.9	0.7%	<ul style="list-style-type: none"> Black Lip Abalone - NSW (J) Blue Swimmer Crab - WA - Cockburn Sound (M) Western King Prawn - SA - West Coast Prawn (M) Dusky Shark - SA/WA/Comm. - SW Australia (B) Sandbar Shark - WA (B) Snapper - WA - Shark Bay Oceanic (B), and Shark Bay inshore Freycinet Estuary (B), and West Coast (B)
↓	Transitional / Depleting	3	0	0	3	0.8	0.7%	<ul style="list-style-type: none"> Snapper - SA - both South and North Spencer Gulf (B) Bigeye Tuna - Comm. - Pacific Ocean (B)
	Overfished	2	0	0	2	4.3	3.5%	<ul style="list-style-type: none"> School Shark - all jurisdictions - Southern Australia (B) Southern Bluefin Tuna - Comm. - Global stocks (B)
	Undefined	18	8	13	39	5.4	4.5%	39 stocks
	Total	81	45	24	150	121	100	

The 2014 report national stock status classification framework introduces the new environmentally limited category, noted above. The Status of key Australian fish stocks reports Advisory Group included this additional category to describe stocks depleted below the limit reference point by environmental factors rather than fishing.

2014		Number of Stocks				Catch		Species Considered
	Stock status	Biological Stock (B)	Management Unit (M)	Jurisdiction (J)	Total Stocks	'000t	% of Total	Cited Species - jurisdiction - stocks or fishery (Status Assessment Unit)
	Sustainable	68	48	13	129	122.3	87.5%	
↑	Transitional / Recovering	4	3	0	7	1.2	0.9%	<ul style="list-style-type: none"> • Blacklip Abalone - TAS EZ (M) • Blacklip Abalone - NSW (M) • Blue Swimmer Crab – Gulf St Vincent SA (B) • Dusky Shark – Comm., SA, WA (B) • Sandbar Shark – NT, WA (B) • Snapper - Shark Bay Freycinet Estuary (B) and West Coast (M) WA
↓	Transitional / Depleting	5	13	1	19	3.0	2.1%	<ul style="list-style-type: none"> • Blacklip Abalone - SA CZ & WZ (M) • Blacklip Abalone - VIC EZ (M) • Blacklip Abalone - TAS WZ, CWZ and NZ (M) • Greenlip Abalone - SA CZ (M) • Pale Octopus - TAS (J) • Giant Crab – TAS, VIC, SA, WA (B) • Western King Prawn – Gulf St Vincent SA (M) • Banded Morwong – TAS (M) • Southern Garfish – Nth Spencer Gulf and Nth Gulf St Vincent SA (B) • Snapper – South East (M) SA, Southern Gulf St Vincent (M) SA, Southern Spencer Gulf (M) SA, Northern Spencer Gulf (M) SA, • King George Whiting – Gulf St Vincent and Spencer Gulf SA (B)
	Overfished	4	4	3	11	6.9	4.9%	<ul style="list-style-type: none"> • Blacklip Abalone - VIC CZ & WZ (M) • Greenlip Abalone - VIC CZ & WZ (M) • School Shark -all jurisdictions – Southern Australia (B) • Black Jewfish – NT (J) • Eastern Gemfish – (B) Comm., NSW • Mulloway – NSW (J) • Golden Snapper – NT (J) • Bigeye Tuna – Pacific Ocean (B) Comm. • Southern Bluefin Tuna - Comm. - Global stocks (B)
	Environmentally limited	0	4	0	4	0	0%	<ul style="list-style-type: none"> • Saucer Scallop - Shark Bay Scallop Managed Fishery WA (M) • Saucer Scallop - Abrolhos Is. Midwest Trawl Managed Fishery WA (M) • Blue Swimmer Crab - Shark Bay WA (M) • Blue Swimmer Crab - Cockburn Sound (Crab) Managed Fishery (M)
	Undefined	21	17	30	68	6.4	4.6%	
	Total	102	89	47	238	139.7	100	

FIGURE 30. COMMUNITY PERCEPTIONS OF FISHING



4. POTENTIAL YIELD GROWTH TO MEET MARKETS

a. What does Yield Growth Mean?

At first glance Australia's fisheries have considerable upside capacity available to meet existing market demand and potential growth in demand. This is evident in both the wild catch commercial fisheries and in aquaculture.

But a better question needs to be asked – is yield growth both environmentally sustainable and worth doing financially?

The Harvest Strategy/TACC/MSY thresholds set jointly by industry and fishery managers will determine the sustainability for both quota limited and effort limited fisheries.

The other part of the question to do with investment viability, is more complex. The simple fact is that all yield from a fishery is not viable yield – prices, and costs that determine fishery or farm viability are dynamic and fluctuate every day, and probably every minute. As an openly trading economy our local and global A\$ revenues are set by overseas competitors (in line with overseas marginal production costs). In many cases (and always in a commodity product) the only thing we can do to influence our profit margin is to manage fishery access, harvest and production/processing costs. So, the fact that yield upside exists does not mean that it is worth chasing.

If markets here or overseas, raise their demand for Australian produced seafood and fishery products, fishers and farmers will be motivated to invest and increase supply, for a given price. (This is going to happen as the middle class grows in China.) But will our fishers/farmers be better off to supply more products at the same price and margin per sale, or supply at a different level and margin per sale? The answers will vary considerably depending on whether the species comes from a limited entry wild harvest fishery, or a seafood "aquaculture factory".

The real life example of the wild catch Western Rock Lobster (WRL) Fishery illustrates the point. From a long standing annual wild harvest of around 11,000 tonnes, the WRL fishery TACC was reduced in 2012 to around 6,500 tonnes, largely in response to unplanned falls in puerulus settlement. Industry leaders and managers restructured the fishery over the last 2 years and switched to just-in-time supply chain improvements that maximise supply of

live lobster yielding a higher sales margin per unit. Even with less volume, the fishing businesses remaining in the WRL are now more profitable and better placed to differentiate their offer to targeted consumers and optimise the value of their catch. It must be noted that this fishery currently has few readily available spiny lobster competitors and global aquaculture has not yet delivered a competitive product.

One of the challenges is that the Australian F&A industry is not adequately structured nor large enough to compete in global commodity markets. Distances are big, fisheries are relatively small and there are many jurisdictional overlays and inefficiencies. At around the same GVP value but in a much smaller space, the single-jurisdiction New Zealand industry has developed a more comprehensive seafood processing chain using lower value species and is therefore able to focus on a few wild and farmed species (e.g. Hoki, Green mussels) where corporatised supply chains are very efficient and export focused. It also helps to have a relatively large free-trade market like Australia just next door.

Australian producers must guard against being trapped in the commodity end of the seafood supply business. In an openly traded and wealthy consumer market economy such as Australia there is nowhere to hide – there will

According to the CSIRO Australia is a world leader in using fisheries economics to improve the long-term profitability and viability of the industry. Dr Sean Pascoe says (July 2014) many experts across global fisheries are talking about pushing MEY to the forefront of fisheries management, but Australian fisheries are the only group already doing it.

Leading fisheries such as the Northern Prawn have become champions of economic data cause and collection and analysis of data. The use of economic modelling data has totally changed the focus for the fishery to healthier more viable outcomes.

The next step in the development of these indicators is to integrate environmental and social indicators into the economic framework.

FRDC Project 2013/412 and FISH Magazine Vol. 22, 3 Sept 2014

always be readily available, good quality, substitute products at very competitive commodity-driven prices.

Barramundi and prawns demonstrate the problem – we must differentiate before we drive yield growth.

Due to their lower cost bases, Thailand and other SE Asian suppliers can produce and deliver Barramundi (referred to as Sea bass everywhere else) and prawn commodity products to us much cheaper than we can produce them locally. Australian suppliers (both wild catch and farmed) have the capacity to increase yield, but it is not viable to do so at the same landed price as imported competing product. Both sectors are (correctly) now investing to rebrand/reposition and differentiate their products to find and offer discerning local consumers a more environmentally sustainable and attractive value proposition that promises a better meal experience, even if you have to pay more for the sustainable production system.

This strategy may also work to service overseas customers if the A\$ remains competitive. Large producer Cone Bay Barramundi (Marine Produce Australia Ltd) in WA plans to significantly expand the scale of the farmed Barramundi sector, and a current ambitious proposal by listed company Commodities Group Ltd (Commodities Group - Seafarm, 2014 July) plans to develop greenfield prawn export farms that will triple the size of the \$60 million Australian prawn farming sector by 2020.

One irony is that an increasing share of imported Barramundi comes from fingerlings that were bred in Australian hatcheries. So they carry Aussie Barramundi passports when they come back as imports. Perhaps our yield gains should be driven not by end user fish products, but also by bigger picture thinking and investment, including genetic capacity which we can capture as a long term competitive advantage. Reference to Australia's more mature pork, chicken and beef industries suggests this is exactly where we should be thinking and investing. Opportunity for more sophisticated collaborative service trade options may be revealed in the three new Free Trade Agreements being launched. If we can't compete selling commodity food, let's sell ideas and innovations that enhance the food system.

That said, and assuming that yield growth is the preferred pathway to increased returns, there are options to increase

Australian fishery and aquaculture yield, if there is a viable customer ready to fund those additional sales.

b. Wild Catch Yield Growth

Where is wild catch yield growth possible? This effectively means...Where can we see available sustainable TACC that is un-harvested?

Figure 31 illustrates some of the un-harvested quota fishery potential in Commonwealth, WA and TAS fisheries in 2011-12, used as examples. Data are best estimates from available reports.

FIGURE 31. POTENTIAL WILD FISHERIES OFFERING YIELD GROWTH

Fishery	2011-12 TACC tonnes	2011-12 Harvest tonnes	Unharvested Yield %
Commonwealth Fisheries	83,715	28,555	66%
Bass Strait Scallop	2,360	484	79%
Eastern Tuna and Billfish	7,522	3,939	48%
South East Scale and Shark	19,870	13,287	33%
Southern Bluefin Tuna	4,509	4,543	-1%
Western Tuna and Billfish	10,125	415	96%
WA Fisheries	32,585	16,280	23%
Western Rock Lobster	6,938	6,647	4%
Pearl Oysters (units)	754,800	685,888	9%
Shark Bay prawn	2,330	1,592	32%
Abalone	209	202	3%
Australian salmon	2,800	117	96%
TAS Fisheries	Insufficient data to assess all fisheries		
Abalone	2,366	2,363	0%
Giant crab	52	44	15%
Rock lobster	1,104	1,104	0%
Banded Morwong (units)	29,825	25,386	15%

One other thing is apparent; there are three significant Tuna fisheries in the figure above– Southern Bluefin Tuna, Eastern Tuna and Billfish, and Western Tuna and Billfish. The ranching/aquaculture SBT fishery is fully fished for a specific high-value export market, while the two large wild catch Tuna fisheries are unfished commodity sources with 75% of their aggregate TACC unharvested. Contrast this with the fact that Australia's largest imported seafood product by volume (~43,000 tonnes) and value is canned Tuna from Thailand. Clearly Australians prefer to buy their Tuna canned from an overseas resource rather than catch /

lease it from their own wild resource, for many complex reasons as also noted by Ruello (A study of the Composition, Value and Utilisation of Imported Seafood in Australia, 2011, p. 39).

Yield gains in aquaculture may be more readily achievable by use of technology, than from wild catch fisheries. Each fishery needs assessment on market and economic grounds before any investment is placed to increase yield.

The previous figure shows (on the fisheries listed) that around 50-70% of the Commonwealth fishery TACC was uncaught in 2011-12. Rough numbers suggest this equates to a commercial GVP yield foregone of around \$200 million p.a. across Commonwealth fisheries that deliver an annual GVP of \$310 million. Including downstream and flow-on economic impacts through processing and logistics chains, this becomes a pretty significant loss of fishery economic potential. It is noted that the estimated forgone value of this uncaught Tuna TACC will be offset by the economic value of these fish should they be caught by a sport or recreational fisher.

The figure also makes it is clear that the TACC's are fully fished for species with strong markets – Southern Bluefin Tuna (aquaculture ranching), Western Rock Lobster (wild catch), Pearl Oysters (aquaculture ranching), and abalone (wild catch).

c. Aquaculture Yield Growth

Aquaculture is a different business model – it is a food factory, similar in many ways to other mainstream grain, dairy, beef, sugar food production factories.

How much can Australian aquaculture expand in the next 10-20 years?

The right of license access to the sustainable aquatic resource (i.e. the site) is currently the main limiting factor, closely followed by access to capital, and shortage of skills. With an extensive coastline in Australia there are many large opportunities for aquaculture yield growth subject to environmental sustainability, and multi-use bargaining with other fishery sectors and resource industries, etc.

It is the lack of appropriate supporting legislation to drive these preapproved and de-risked aquaculture zones across

jurisdictions that is the first line constraint to aquaculture development and yield gains.

In terrestrially produced foods from species developed and intensively bred for hundreds of years, there are now a relatively few species that provide the great bulk of global products for human consumption – goat, pork, chicken, beef³. In global seafood we are some way behind in culturing species but certainly going in the same direction – a limited number of top species.

Key Global Species

Figure 32 lists the largest commercial species in global aquaculture in 2012. Australia has existing or pending production (shaded lines) in 11 of these species. Research has been undertaken variously across a further seven to ten species.

This figure also highlights the dominance of major global aquaculture producers by species (especially China and ASEAN countries), and the critical intersection of their competitive advantages in the development of Australian FTAs.

Emerging Local Opportunities

There are a small number of attractive species in addition to those identified in the global aquaculture leaders table.

One expansion example (noted earlier in discussion) is the current commercial proposal on-foot by listed firm Commodities Group Ltd regarding new greenfield prawn development – Project Sea Dragon. (Commodities Group - Seafarm, 2014 July, p. 38). The company has recently (2014) completed transactions to purchase a ~15% share of existing active prawn farms, and established market and consumer brands. The project summary includes:

- Large-scale, integrated, land-based aquaculture projects in northern Australia producing world class volumes of Black Tiger Prawns –a high quality/high value seafood commodity –for export markets,
- 10,000 hectare growout farm supported by feed mill, hatchery and broodstock facility, power station, processing plant, storage/export facilities,

³ A compelling and informative non-fiction summary of the reasons why these species dominate our 21st century foods, is presented in a Pulitzer Prize winning publication by Professor Jared Diamond, UCLA (Diamond, 1997).

- Development scaled in 3 stages, with ~\$1.45 billion capital expenditure in total,
- Total production (at Stage 3) of 120,000 tonnes (120M kgs) per annum,
- ~\$1.2 –1.8 billion revenue per annum,
- Stage 1 forecasts production of 5,500 tonnes in 3 years from a 1,000ha growout facility, based on imported feed and ~ \$150 million in capital expenditure, with a forecast IRR return >40%.
- Stage 1 alone (should it eventuate) will double the size of the current farmed prawn sector, and increase this 20 fold by 2025!

Another small but emerging aquaculture product is farmed abalone, a sector now relatively tightly held by 5 leading farm entities across the four southern states (WA, SA, VIC, TAS). Their collaborative proposal backed by significant corporate investment and expansion capacity is to double aggregate farmed abalone GVP to more than \$50 million within the next 5 years. Their preferred niche market includes mainland China but also the global overseas Chinese diaspora.

A third emergent aquaculture species in Australia is Yellowtail Kingfish. The species is currently in pilot/early stage production in:

- WA – trial growout of fingerlings near Geraldton, a project supported by Marine Fishfarmers Assn and Indian Ocean Fresh Pty Ltd
- SA – Clean Seas Tuna at Port Lincoln
- NSW - a five year experimental site off the coast of Port Stephens to farm yellowtail kingfish, and to be run by NSW DPI with a commercial partner in conjunction with an adjacent commercial site.

The potential aquaculture production increase in the next decade is considered later in this report.

FIGURE 32. AUSTRALIAN AQUACULTURE SPECIES - WHERE ARE THE OPPORTUNITIES?

2012 World FAO (descending order by volume)	Global Production MMT	Australian Production MMT	Status in Australia	Est. Global US\$/kg 2013	Major Producers (descending order in MMT)	Existing Free Trade Agreement with Australia	Pending Likely FTA
1. Carp	19.3	Nil	Wild catch/feral	\$1.32	China 17.2, Bangladesh 0.42, India 0.41, Indonesia 0.40, Vietnam 0.10	China, Indonesia, Vietnam	India
2. Edible Oyster	4.74	0.016	Seafood sector	\$0.82	China 3.95, South Korea 0.285, Japan 0.161, USA 0.132, France 0.083	China, USA, South Korea, Japan	
3. Tilapia	4.51	Nil	Aquarium trade/feral	\$1.70	China 1.6, Egypt 0.8, Indonesia 0.7, Brazil 0.3, Philippines 0.3, Thailand 0.2	China, Indonesia, Philippines; Thailand	
4. Shrimp/Prawn	4.35	0.004	Seafood sector	\$4.49	China 1.7, Thailand 0.6, Vietnam 0.5, Indonesia 0.4, India 0.3, Ecuador 0.3	China, Thailand, Vietnam, Indonesia	India
5. Catfish (incl. Pangasius)	3.90	Nil	In farm dams	\$1.57	Vietnam 1.3, Indonesia 0.9, Bangladesh 0.3, Nigeria 0.3, India 0.09	Vietnam, Indonesia,	India
6. Salmon	2.25	0.044	Seafood sector	\$4.89	Norway 1.2, Chile 0.56, UK 0.16, Canada 0.11, Faroe Is. 0.08	Chile	
7. Mussel	1.83	0.0004	Seafood sector	\$1.12	China 0.764, Chile 0.246, Spain 0.204, Thailand 0.107, France 0.075	China, Chile, Thailand	
8. Scallop	1.64	Nil	Trials in Qld	\$1.74	China 1.42 Japan 0.184, Peru 0.025	China, Japan	Peru
9. Crab	1.00	Negligible	Seafood sector	\$5.88	China 0.96, Philippines 0.016, Indonesia 0.014, Vietnam 0.013	China, Philippines, Indonesia, Vietnam	
10. Milkfish	0.94	Nil		\$1.81	Indonesia 0.52, Philippines 0.43, Taiwan 0.07, Singapore 0.002	Indonesia, Philippines, Singapore	Taiwan
11. Eels	0.56	Negligible	Minor sector	\$3.93	China 0.53, Japan 0.17, Taiwan 0.02	China, Japan	Taiwan
12. Sea Bass/Barramundi	0.36	0.005	Seafood sector	\$4.25	China 0.125, Turkey 0.066, Greece 0.042, Taiwan 0.026, Malaysia 0.020, Thailand 0.017	China, Malaysia, Thailand	Taiwan
13. Amberjack	0.17	Nil		\$9.18	Japan 0.16, China 0.013	Japan, China	
14. Mullet	0.15	Nil		\$3.23	Egypt 0.13, Indonesia 0.007, South Korea 0.006	Indonesia, South Korea	
15. Gourami	0.13	Nil		\$2.55	Indonesia 0.085, Thailand 0.038, Cambodia 0.008	Indonesia, Thailand, Cambodia	
16. Grouper	0.12	Nil	ACIAR 2014 in Qld	\$5.31	China 0.073, Taiwan 0.022, Indonesia 0.012, Malaysia 0.006	China, Indonesia, Malaysia	Taiwan
17. Pompano	0.11	Nil		\$4.01	China 0.12, Singapore 0.005, Dominican Republic 0.001	China, Singapore	
18. Abalone	0.10	0.0006	Seafood sector	\$7.83	China 0.091, South Korea 0.007, South Africa 0.001	China, South Korea	
19. Cobia	0.042	Negligible	ASCRC Review 2014 in QLD	\$1.60	China 0.038, Vietnam 0.002, Taiwan 0.001	China, Vietnam	Taiwan
20. Tuna	0.017	0.007	Seafood sector	\$7.79	Japan 0.01, Australia 0.007, Mexico 0.002, Spain 0.001	Japan	Mexico
21. Snapper	0.007	Nil		\$6.48	Malaysia 0.007, Taiwan 0.003	Malaysia	Taiwan
22. Aquatic Plants (Kelp/Undaria)	23.8	Negligible	TAS kelp /SA trial 2013	\$0.27	China 12.8, Indonesia 6.5, Philippines 1.8, South Korea 1.0	China, Indonesia, Philippines, South Korea	
23. Marine Algae	unknown	unknown	Trials in WA	n/a	OECD 2014 – "global market for marine biotech products and services will double by 2020 to USD 5 billion"		

F. FISHERY ACCESS AND MANAGEMENT

1. BALANCING BENEFITS AND RISKS

The public and private use of Australian fisheries involves social, health, welfare and economic activities that create benefits for all Australians.

Ensuring broad access to and use of F&A resources is important. A broad approach will optimise the generational flows of benefits from a sustainable triple-bottom-line enjoyed by today's Australians and as legacy assets for future Australians.

The stock market is ever-slowly being dominated by the soft value of intangible human-induced assets (process inventions, scientific discoveries, patents, brands, software, resource and access rights, FTA market access rights, etc.). However the intangible values of our marine and fishery assets are largely untapped, and often unvalued (as distinct from undervalued). Is this a problem with our F&A science, or management or our business models and their markets?

This does not mean that fish as food is near its use-by-date, far from it. Rather, fish and aquatic products and related services in new formats will find new food /pharmaceutical /bioenergy /ecotourism /waste management markets, and aquatic resources in as yet unforeseen or unproven ways.

The challenge for fishers, farmers and managers is to optimise the productivity and performance of today's allocations and uses, while attracting and motivating the innovators and investors to sustain the resource and create future benefits for Australians. No one accepts that plunder of the resource, overfishing and unsustainable environmental degradation are acceptable, but neither is there a case for excessive application of ESD principles to transform all fishery resources into zoos or museums.

Risk is at the heart of all F&A choices and outcomes. We need efficient ways to collate information and knowledge as the first step, then to assess risks (both internal and external, for controllable and uncontrollable variables), before applying targeted and efficient RD&E to minimise and de-risk investment failure, in pursuit of democratically set goals.

Key Points: FISHERY ACCESS & MANAGEMENT

User rights to access and use aquatic resources are jurisdictionally complex, and add to regulatory risk and cost burden. Communities are demanding users meet objective performance criteria in order to retain their Social License to Operate (SLTO). As a result conflicts between users and with communities will increase, unless clear principles and processes are established.

RD&E must support fishers and managers to respond, by refining access and use rights, collating better data, and building industry bodies with capacity to promote the SLTO.

Across its 15,400 license holders Seafood is becoming two businesses with differing needs:

- 8-10 large high-value species fisheries are increasingly corporatised, with an export focus, strong supply chains and access to capital, and capacity to invest in marketing and R&D. 500 of these firms land ~50% of all wild catch value, and >95% of all farmed value.
- 20-30 smaller fisheries (mostly wild catch) serve great seafood but only to domestic consumers who face import options, are SME dominated, have limited capital, low RD&E, and low levels of collaboration in consumer marketing.

Recreational capacity is too slow to build, and lack of licenses limits investment. Young people are not going fishing, but older folk are more engaged. RD&E should shift away from stock abundance to fisher experiential outcomes and community wellbeing.

Indigenous people are increasingly active in all sectors, but need to build capacity to control their economic outcomes. Customary rights are not yet clear for fish communities.

a. Social Capacity and License

A recent report (FRDC 2010-040, 2014) has identified, tested and reviewed a range of social objectives and indicators relevant to all fishery communities (including Indigenous and non-Indigenous) at the national level.

The report identifies three goals relevant to the access and allocation of all Australian fisheries. (Figure 33).

FIGURE 33. HEADLINE SOCIAL GOALS FOR MANAGING FISHERIES



The report recommends 23 social objectives (Figure 34) be adopted to implement this social wellbeing framework to assess and support the social wellbeing, aspirations and capacity of Australian fishery communities for all Australian fisheries.

Social Licence to Operate

In the five years since the last Sector Overview, this topic has become centre-of-the-plate for all sectors of the F&A industry. (Refer to Chapter H for a more comprehensive discussion of Fishery Performance and Use assessments and related social licence issues.)

The impact on fishers and fishery managers has been large, direct and growing, especially media analysis (e.g. the super trawler event in the small pelagic fishery, and more recently in the management of shark fisheries) that has been exhaustive and often inaccurate. The National Aquaculture Council has also placed Social Licence to Operate at the top of its strategic priorities.

The definition of Social Licence to Operate is evolving but has been defined as *the provision of the privilege to operate with minimal formalised restrictions, procured and maintained through generating public trust by doing what's 'right'*. The provision of a Social Licence to Operate is one outcome of good Corporate Social Responsibility (CSR) practices.

FIGURE 34. SOCIAL OBJECTIVES FOR FISHERIES MANAGEMENT

Industry	Indigenous	Local/Regional
<ul style="list-style-type: none"> • Provide flexible opportunities to ensure fishers can maintain or enhance their livelihood • Maximise cultural, recreational and lifestyle benefits for those who participate in fishing activities • Ensure appropriate mechanisms (e.g. skills) exist for fisher involvement in development of fisheries management advice • Improve the ability of fishers to participate effectively in fisheries management advisory processes • Industry stakeholders have a high level of trust in management of fisheries • Maximise stewardship of fisheries resources. • Ensure transparent decision-making process by fisheries agencies • Ensure equitable treatment and access for fishers • Ensure access to infrastructure needed for successful operation of fishing activities • Ensure fisheries information is available in a timely and publicly accessible manner 	<ul style="list-style-type: none"> • Fisheries management actions support the maintenance of cultural and heritage values • Ensure access to 'Country' to enable continuation of cultural fishing activities • Provide opportunities for communities to participate in fisheries management decision making processes • Optimise access to income earning opportunities for community members related to the management of fisheries • Make fisheries collected data available in a timely and publicly accessible manner • Communities associated with 'Country' aquatic resources have a high level of trust in the management of fisheries • Ensure collaborative inputs by communities, regional and industry sectors on the benefits each sector offers to fisheries management 	<ul style="list-style-type: none"> • Positively influence fisheries related socio-economic benefits for regional communities, within the constraints of ecological sustainability. • Facilitate and support the cohesion and connectedness of fishers with their regional communities through fisheries management. • Maximise community trust in fisheries agencies to manage fisheries. • Ensure fisheries management contributes to the maintenance of cultural and heritage values related to fishing activities. • To facilitate capacity building (through skills and knowledge development) for community members to enhance stewardship of fisheries resources. • Ensure fisheries information is available in a timely and publicly accessible manner.

An FRDC sponsored workshop in March 2014 (FRDC 2008-328.18, 2014 Mar) identified policies, governance arrangements, and resources to operationalise the integration of social and economic fishery management aspects, under four heading:

- Recognise that in the current Australian context, community expectations and scrutiny of fisheries management is increasing and that this is occurring against the backdrop of fisheries management and science resources becoming increasingly constrained,

- Develop or refine existing fisheries management strategies to create better integration of ecological sustainability with economic and social objectives,
- Undertake case studies (or 'proof of concept') that match method/approach with need and data in a variety of situations, to establish the additional resources and processes required. The results of the Social Audit Project (FRDC 2010-040) should be applied/tested more broadly to provide a proof of concept.
- Investigate the need for any necessary changes in governance arrangements that are required to build increased participation and transparency into decision making processes to assure fisheries stakeholders and the wider community of the integrity of relationships and fisheries management systems.

The industry views recorded at the workshop identified thirteen matters where current Social Licence to Operate approaches "are not working", including:

1. Need to demonstrate the value of the Australian fishing industry to the Australian economy,
2. Need to identify the benefits versus the potential additional costs to fishers of implementing social and economic objectives,
3. Need to identify and use language that can easily be understood,
4. Industry's ambivalence or lack of 'political will' to engage with explicit social and economic dimensions of fisheries management,
5. Little to no explicit consideration of social and economic objectives in management plans and decision making, but this is not necessarily seen as a concern by the industry,
6. Commercial fishers acknowledge that seafood is a community owned resource, but one which is often regarded as 'locally' owned by those communities, rather than the whole of Australian community. This creates a tension in identifying which 'community' fishers should engage with.
7. Data generally used to account for economic and/or social concerns are only GVP based, and need to be broadened,
8. Need for clear and standardised decision rules that industry can rely on,
9. Total Allowable Catch (TAC) is currently seen by commercial fishers as a proxy for (implicit) social objectives in regard to the amount harvested and the time when fishing can be undertaken to maximise price for catch,
10. Clear and simple language and communication strategies are critical to engage fishers, in regard to the purpose and benefits of social and economic objectives and what these mean,
11. Gaining and maintaining a 'social licence to operate' is top of mind for the majority of commercial fishers, as it has an impact on management and public perception – they want to know the connection between social and economic objectives and indicators, and obtaining a 'social licence to operate',
12. There is a conflict between sectors (commercial, recreational and customary) regarding their relative contributions toward management costs,
13. Social and economic data were perceived to be relatively easy to collect; but the challenge lies in the change required in the management culture to utilise and act upon these data.

b. Economic Capacity

Each of the four F&A sectors – wild commercial, aquaculture, recreational, and customary - involves activities by stakeholders who are economically and financially motivated to access and use fisheries resources.

Wild catch commercial fishers seek "financial return" on their risk capital (both fixed assets and operating margins) from consumers, as do aquaculturists. Recreational and sports fishers spend around \$2.5 billion annually on gear, equipment, charters and advice to achieve their "welfare return". By its nature the customary fishing sector has limited motivation for direct commercial returns, but there is increasing evidence of and public policy support for Indigenous fisher communities' investments in commercial fishing and aquaculture activities as a way to fund the maintenance of their traditions and employ their young people.

But there are significantly different financial risk profiles for investors in each of the wild catch and aquaculture activities, regardless of their sector affiliation. In wild catch fisheries, vessels, boats, marine and aquatic equipment is a depreciating asset exposed to some of the harshest asset

management conditions known. A vessel's productivity and value is directly related to its capacity to provide a stable and secure harvest platform to accommodate all the latest technology, software, professional fishers, and harvest innovation at sea. These assets must be committed for some years in advance (often based on debt rather than equity finance), with uncertain knowledge of the future access to the resource, or the harvest yield from the resource subject to TACC or effort regime, or the landed price of the future fish harvested.

On the other hand aquaculturists (like other terrestrial farmers) have a stable and known production and harvest location and can leverage and mitigate (to a greater degree) climatic and resource opportunities and risks. They also have the benefit of being able to control genetics and nutrition, while facing significant productivity issues in herd/stock management, disease and predation. A key advantage is that they can tune production to meet a known market time and need with greater certainty, and can standardise the size and format of the fish/seafood product to be landed and processed. It is no surprise then that aquaculture average costs for a fish is typically less than the wild catch average cost for the same fish species. Overall, aquaculturists can better manage risk for their production unit and for their customer. Theoretically this enables better finance access, and turnover of capital as profit.

c. National Fisheries Management Goals

The Australian Fisheries Management Forum (AFMF) comprises heads or CEOs of the Commonwealth, state and territory agencies responsible for fisheries. The role of the body is to:

- Facilitate communication and cooperation on fisheries matters between jurisdictions,
- Develop and promote best practice policy principles for fisheries management,
- Promote implementation and adoption of best practice fisheries management; and
- Strategically address the range and complexity of cross jurisdictional fisheries responsibilities and issues through improved communication and collaboration.

AFMF has established national goals (AFMF, 2013) for the F&A Industry. An author's comment re the status of progress to the goal is included for each:

- Australia's fishing and aquaculture sectors are managed, and acknowledged, to be ecologically sustainable, *(we are in the top 3 in the world but it is not widely known here or overseas).*
- Secure access to fishing and aquaculture resources, *(most commercial fisheries have clear and secure access, but this is still a work in progress for recreational and Indigenous fishers),*
- Profitable and viable fishing and aquaculture industries, *(this is very big unknown as we do not collect the data, nor provide economic guidance to our fishery managers in most jurisdictions to pursue it),*
- Supporting the health of habitats upon which fishing and aquaculture rely, *(our fishery habitat management systems are generally world's best, but there is room for improvement).*

2. NATURE OF PROPERTY RIGHTS ACROSS SECTORS

a. Scope and Scale

Wild fishery resource access, allocation and sharing are increasingly important issues:

- Economically, to beneficially use the resource for the current and future good of the community,
- Socially, to optimise the recreational, social (including medical) and cultural wellbeing derived now from current use, and tomorrow as an intergenerational legacy value, and
- Environmentally, for the sustainability of the natural environment and related fishery resources.

While access has long been a commercial fishery issue, the growing economic and voting power of recreational /charter fishers, here and overseas, is driving new issues around fishery access and allocation, and therefore property rights.

Looking more broadly across all marine resource users, the National Marine Science Planning Committee (NMSP, 2014) is currently (Nov 2014) guiding the development of their Plan. In one of the input papers to its work, it notes that "Profound uncertainty, lack of succinct property rights and the contested values of key stakeholders make the allocation of marine resources a wicked problem."

The paper also identifies the broad range of beneficiaries and users of R&D into resource access and allocation as per Figure 35.

FIGURE 35. MAJOR BENEFICIARIES OF ACCESS AND GOVERNANCE

Non-Government	Government
Individual industries and sectors: <ul style="list-style-type: none"> • Fisheries (commercial, recreational, Indigenous), aquaculture • Offshore oil and gas • Seabed mining • Renewable energy • Ports and shipping • Tourism 	Local governments and NRM regions: <ul style="list-style-type: none"> • Management of coasts and estuaries • Complimentary management of land resources, especially regulation of water resources and agricultural practices.
Public interest groups: <ul style="list-style-type: none"> • National and International NGOs • Indigenous groups • Regional and local community-based conservation groups • Other public interest groups • The general public - future generations 	State and Territory governments: <ul style="list-style-type: none"> • State planning departments • Coastal zone management processes • Spatial allocation issues – recreation, conservation, renewable energy, aquaculture, ports etc.
International development agencies and intergovernmental organisations: <ul style="list-style-type: none"> • World Bank, and like bodies, • United Nations institutions, • Regional institutions, such as the Pacific Island Forum Fisheries Agency 	Federal government: <ul style="list-style-type: none"> • Major departments/agencies – mining fisheries, environment, transport • Marine bioregional planning processes, GBRMPA • International issues (Regional engagement, Coral Triangle Initiative)

b. Access and Allocation

In 2012 the FRDC received a report from a sub-committee responsible for its Fisheries Resource Access and Allocation Project (AFMF Access and Allocation Subcommittee, 2012).

The report identified a number of fundamental points:

1. Fisheries resources are not inexhaustible and the need to sustainably manage this resource brings a need to establish "rights", for "access" and "allocation" as a "common property" resource and to share its benefits among the community.
2. Rights provide individuals with access, while allocation describes the level of access ascribed to each right. This is not "ownership" of fish, but a right to undertake legal activity, including harvest and recreation. Rights are specific to fisheries.

3. Governments manage these rights, as managers of the fisheries on behalf of the community. They must monitor and adjust in response to user and community need, as well as provide marine parks, reserves etc. as no-take sectors.
4. Governments must satisfy legislative objectives (e.g. environmental sustainability, cultural maintenance), as well as equitable sharing of access, and maximise benefits to the community. This involves stock conservation, and allocation of public resource among users and non-users.
5. There is no single prescription or methodology for access and allocation which will satisfy each case. Choices must be informed by knowledge of the objective for the fishery, costs, benefits and risks of each alternative. In dealing with each assessment and choice, four *Common Principles* must be followed: Natural Justice, Governance, Fisheries Legislation, and Fisheries Management.
6. Seven *Pre-conditions* should be met to assist and guide the process to ensure efficient and effective use of funds and resources:
 - Establish government objectives,
 - Establish objectives of other participants,
 - Establish the underlying nature of issues,
 - Apply a risk assessment analysis to issues,
 - Establish the availability of data,
 - Determine the nature of existing "rights",
 - Determine the need for a formal process.
7. Two broad alternative models are available - administrative models or market based models. Within that, the range of models includes:
 - Government Driven model;
 - Negotiation based model;
 - Administrative based model;
 - Statutory based model;
 - Market/Economic Evaluation based model.
8. Governments, here and overseas, have to-date preferred an administrative model. Nowhere is there a freely operating market based system for inter-sectoral re-allocations across all sectors. The principal reasons for this are the lack of common "rights" across sectors and the lack of representative organisations, especially in the recreational/charter sectors, to be responsible for holding and dealing with collective rights for the sector.

The report concluded:

- It would be possible, and even desirable in some circumstances, to construct a "rights" based market trading model for resource re-allocation. However, this would require a unique set of characteristics for the fishery (or part of the fishery), which would have to be designed for each specific fishery, and would have to be accompanied with stringent caveats on the extent of operation of the market, and be carefully assessed in terms of the costs and practicality of implementation and management compared with its benefits.
- Similarly, the use of economic valuation models in their various forms to determine allocations have to overcome a number of complex measurement and interpretation issues and suffer from the perception of their inability to satisfy all of the legislative objectives set for fisheries management - namely those around equity and fairness and other social and cultural objectives.
- There are a number of impediments to addressing access and allocation issues identified in the report; the major ones being:
 - Lack of clear policy statements from governments defining their preferred principles and processes,
 - Lack of necessary data (and the high cost of collecting it) across sectors, particularly with the recreational and Indigenous sectors; but in the case of economic and social data, this affects all sectors,
 - Lack of sophistication in, and application of, analytical methodologies to support consideration of alternative outcomes,
 - Lack of effective representative organisations which can act on behalf of the sectors in allocation discussions and their practical implementation,
 - Lack of research into specific rights based market trading possibilities in allocations.

c. Advantages and Disadvantages

Pros and cons were summarised in the report, for the leading models, as summarised in Figure 36.

d. Fishery Jurisdictions, Species, Employment, and Use

Figure 37 summarises the current state of licensing, access, key species harvest, and employment, by jurisdiction (FISHAQUASTATS 2013, PAGE 38).

ABARES estimates total commercial fishing employment in 2012-13 was 8,608, a slight increase on the 2011 figure above of 8,049. The 2013 data estimates 66% (5,650) are fulltime male employees, 2% (167) are fulltime females, 19% (1,667) are part time males, and 13% (1,124) are part time females.

The most recent national survey of Recreational and Indigenous Customary fishery activity and participation was the NRIFS in 2001. ABARES (FishAqua Stats 2013, p41) summarises national participation statistics in QLD, SA, TAS, NT since 2001, noting declines in both participation and average days per fisher. The Recreational Sector is currently in discussion with Commonwealth Dep't of Agriculture regarding a new national survey of recreational fishing.

FIGURE 36. PROS AND CONS FOR ACCESS AND ALLOCATION MODELS

Advantages	Disadvantages
<p><u>Government driven Model</u></p> <ul style="list-style-type: none"> Gov't able to act on behalf of the whole of the community, Model is responsive to social and community values and interests, as well as economic ones, Gov't able to address all objectives in legislation and hear from all parties, Gov't process can be quick and timely, Model has structural simplicity; Cost effective, Government decision provides certainty to the stakeholders and builds on existing processes. 	<ul style="list-style-type: none"> Model may not be based on rigorous socio-economic or other analyses, Model does not seek to maximize economic value to the community, Model often lacks transparency, Decision may lack scientific evidence Decision lacks pre/post evaluation; and may lack community involvement, Decision often requires the payment of compensation, Encourages competitive lobbying and reduces possible "win/win" opportunities.
<p><u>Negotiation based Model</u></p> <ul style="list-style-type: none"> Can provide for a "win/win" solution, Encourages better understanding among parties of each position, Cost effective and efficient, Allows for great flexibility in solutions, Provides a platform for improved collaboration and co-operation, Encourages the sharing of information on fishing practices and impacts. 	<ul style="list-style-type: none"> Difficult to achieve consensus, • Outcome depends on willingness to engage by all parties, • Success depends on the existence of "trade-offs" in sectors, • Often frustrated by a lack of relevant and timely information, • May not take account of the broader needs of fisheries management.
<p><u>Administration based Model</u></p> <ul style="list-style-type: none"> Provides independence and transparency to the process; Provides structural simplicity, Provides confidence that scientific and socio-economic analyses can be used to inform the decision, Allows all interested parties to be heard in the process, The range of multiple expertise on the committee can address the range of objectives behind allocation decisions, Can commission analyses required. 	<ul style="list-style-type: none"> It can be a costly and time-consuming process, with public hearings, Socio-economic analysis can be expensive and technically complex, Still requires the distillation of multiple wants and expectations by "experts", It doesn't prevent direct lobbying of government around the process, It only produces recommendations without any statutory backing for further consideration by government.
<p><u>Statutory based Model</u></p> <ul style="list-style-type: none"> It operates in a transparent way involving all the community interest, It can consider all the objectives of the legislation, Its on-going nature means that it can build up expertise in allocation issues over time and across fisheries, It can commission research and surveys where necessary, It can utilize scientific and socio-economic research to assist, It can express independent views from the Department, It has statutory under-pinning and standing, It is ultimately accountable, through the Minister, to the Parliament. 	<ul style="list-style-type: none"> It can be seen to be "captured" by the Department which provides its support and budget; It does not provide an avenue for productive cooperation among the parties, but can intensify competitive behaviours; It can be a costly and time-consuming process, through public hearings or draft public documents; It requires significant servicing in terms of collecting all the necessary data and undertaking analyses.
<p><u>"Market"/Economic Valuation based Model</u></p> <ul style="list-style-type: none"> With common property rights it is possible to bring all sectors within a common management framework which assists fisheries management. Flexibility to respond to changing circumstances simply on the basis of price information and/or survey results. Decrease in the burden of regulation. Reduced transaction costs once processes are developed. Pursue ESD goals in an economically efficient manner. Reduces conflict and political debate. A basis for compensation exists with re-allocations. 	<ul style="list-style-type: none"> Only those with financial power can engage in the market, Financial power is not distributed evenly in the community Players may have short-run goals/speculative goals and not a concern for the long-run Concurrent estimates are required of the marginal net economic value schedules of each competing use of the fishery, or part of a fishery The high cost of obtaining estimates of the value of the recreational (and other sectors) fisheries The high cost and lengthy time period to collect the necessary socio-economic data sets which drive the determination of the commercial and recreational values Often data is not available and various assumptions are required concerning relationships integral to the value schedules and economic curves which limit their applicability to real allocations.

FIGURE 37. AUSTRALIAN FISHERY JURISDICTIONS, ACCESS, SPECIES, EMPLOYMENT, AND USE 2012-13

Use	Jurisdiction	Access Arrangements (ABARES 2013)	Key Species	Employed 2011*	Harvest t.
1. Commercial Wild catch	NSW	10 fisheries - 1,986 licenses	prawns, sea mullet, oysters, rock lobster, abalone, crabs,	811 (1,106)	11,597
	VIC	9 fisheries - 723 licenses	abalone, rock lobster	432 (514)	4,236
	QLD	12 fisheries - 2,725 licenses	prawns, Coral trout, crabs	1,006 (1,460)	20,295
	WA	5 fisheries - 321 licenses; 39 boats in abalone fishery	rock lobster, prawns, scallops	817 (1,152)	18,856
	SA	14 fisheries - 741 licenses	rock lobster, prawns, abalone	883 (1,003)	44,215
	TAS	5 fisheries - 890 licenses	abalone, rock lobster, scallops	530 (643)	7,771
	NT	5 fisheries - 238 licenses	snapper, crabs, Barramundi	195 (222)	5,805
	C'wth	16 fisheries- 301 vessels,	prawns, tuna, scallops, lobster, mackerel	4 (7)	39,114
	Total			4,678 (6,108)	151,889
2. Aquaculture	NSW	609 licenses	oysters, Silver perch, yabbies	588 (709)	4,186
	VIC	128 licenses	trout, abalone, mussels, Murray cod	214 (280)	1,811
	QLD	814 development approvals	prawns, Barramundi	508 (551)	6,418
	WA	na	pearls, mussels, Barramundi	203 (325)	1,598
	SA	590 licenses	SB tuna, oysters, abalone, YT Kingfish, Mulloway	673 (766)	20,174
	TAS	175 licenses	salmonids, abalone, oysters	1,155 (935)	48,284
	NT	4 fisheries, 54 licenses / endorsements	prawns, Barramundi, pearls	30 (62)	881
	C'wth	nil	nil	n/a	n/a
	Total			3,371 (3,628)	84,606
Seafood Processing			1,783	na	
Fish and seafood wholesaling			3,981	na	
TOTAL for commercial fishing and aquaculture				13,813	na
3. Recreational#	NSW	All fishers licensed. Size/bag/gear limits apply + closures. Charters licensed + records.	flathead, bream, whiting, tailor	na	15,190
	VIC	All fishers to hold an all-state-waters license – some exemptions. Size/catch limits apply + closures.	flathead, KG Whiting, Aust. Salmon	na	11,812
	QLD	License not required, but permits required for some dams. Charters licensed + records. Size/bag/gear limits apply + closures.	whiting, bream, mullet, tailor	na	24,514
	WA	Licenses for abalone, rock lobster, marron, net fishing, freshwater angling. Recreational boat license introduced in 2009. Size/bag/gear limits apply + area/ seasonal closures. Aquatic tour/ charters licensed.	Aust. Herring, whiting, tailor, bream	na	11,485
	SA	License not required, but some species (Rock lobster) do require registered pots. Charters licensed + records. Size/bag/gear limits + closures.	Aust. Herring, KG Whiting, garfish	na	8,123
	TAS	Saltwater rod and line licenses not required. All fishers license for inland freshwater+ abalone, rock lobster and scallops. Gear limits + closures. Bag/size/possession limits + area restrictions in abalone, rock lobster, shellfish, scalefish.	flathead, Aust. Salmon, rock lobster, trout	na	2,446
	NT	License only required to enter aboriginal lands/waters. Fishing guides licensed+ logbooks. Possession limits.	sea perch, snapper, mullet	na	1,885
	ACT/Commonwealth	License not required in ACT, but permit required for powered vessels. The Commonwealth does not manage recreational fishing in its waters although in some avid recreational fishing areas (e.g. Narooma-Bermagui in NSW, an estimated 50% of recreational trips occur in Commonwealth waters (Recfish Australia, 2010))		na	24
	Total			Positions supported 90,000 (ABARES 2013)	75,481
Customary	Subject to changes undertaken by state and territory jurisdictions			Unknown	na

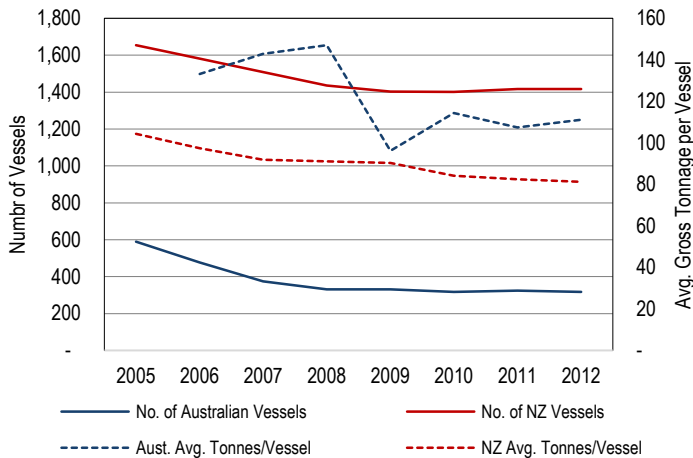
Source: ABARE FishAqua Stats 2013 page 39, NRIFS p79.. na = advice or data not currently available, * Figure in brackets is from 2009 Sector Overview # Recreational and Indigenous Customary fishery data has not been revised since the NRIFS in 2001.

3. COMMERCIAL ACTIVITY

a. Commercial Fleet

OECD data (OECD, 2013) indicates a decrease in commercial fleets in Australia and in New Zealand up to 2008, followed by a relatively stable fleets through to 2012. The average gross tonnage of vessels has steadily declined, although the Australian data seems too volatile to be accurate. Figures 38 and 39 summarise the data.

FIGURE 38. COMMERCIAL FISHING FLEETS - AUSTRALIA AND NZ



The following data is indicative only – a more detailed analysis of licensing is cited later in this Overview.

FIGURE 39. AUSTRALIAN COMMERCIAL SECTOR HARVEST TRENDS

(OECD, 2013, p. 64)	2006	2011	% change
Number of fishers	6,292	7,325	16.4%
Number of fish farmers	3,480	4,373	25.7
Total number of vessels	477	322	-32%
Total tonnage of the fleet	63,565	28,652	-55%

The management and regulation of aquaculture is primarily a state and territory responsibility. The Australian Government has a role in the coordination of policy over national issues such as quarantine, disease control, product quality, labelling, trade and taxation.

⁴ The ABARES Indices are as follows: 1997-98, 62.1; 1998-99, 62.9; 1999-2000, 64.4; 2000-01, 68.2; 2001-02, 70.2; 2002-03, 72.3; 2003-04, 74.0; 2004-05, 75.8; 2005-06, 78.2; 2006-07, 80.6; 2007-08, 83.3; 2008-09, 85.9; 2009-10, 87.9; 2010-11, 90.6; 2011-12, 92.7; 2012-13, 94.8.

b. Commercial Value at the Beach

ABARE data (Figures 40-42) confirms the landed GVP trends for commercial wild catch, aquaculture, and the total commercial sector since 1997. There are 2 graphs for each figure – in nominal and real terms. Nominal data are adjusted for inflation according to ABARES 2013 indices⁴. In all graphs the black dotted line tracks aggregated Australian Totals and refers to the right hand axis. All other trend lines refer to the left hand axis.

FIGURE 40. COMMERCIAL WILD CATCH GVP TRENDS (NOM. \$'000)

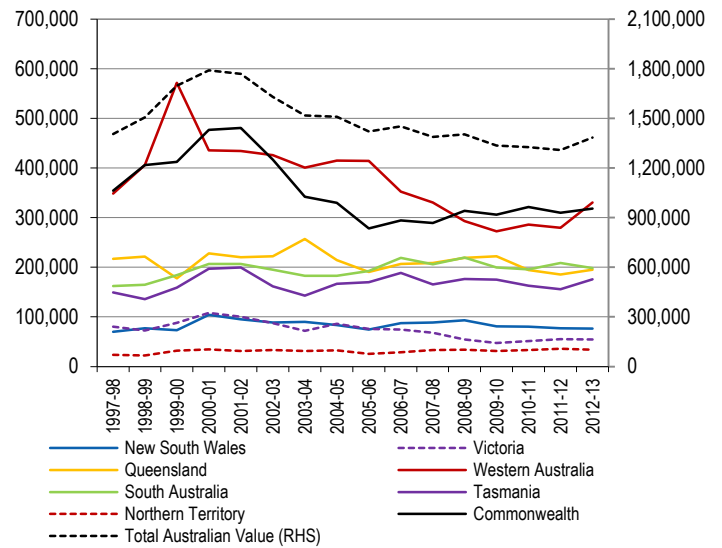
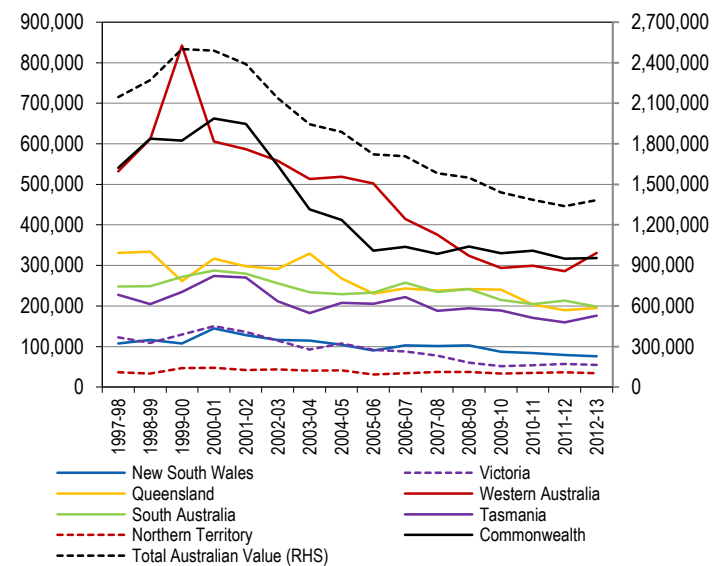


Figure 40 data expressed in real 2013 \$'000



The two graphs in Figure 40 above confirm the somewhat sobering facts that real wild catch GVP (in 2013 dollars) has declined:

- For all Australian wild catch fisheries, from \$2.5 billion in 1999-2000 to \$1.38 billion in 2012-13, a fall of 45% in real terms over the 16 year period,
- For all wild catch fisheries at an increasing rate:
 - 1997-2005 decline by 2% p.a.,
 - 2005-2013 decline by 4% p.a.,
- In all jurisdictions, but by the greatest percentage in WA and Commonwealth fisheries,

- Total aquaculture real GVP value expanded at an average rate of 1% p.a. (1997-2005), and then rising up to average 4% growth p.a. (2005-2013),
- Jurisdictional real growth over 16 years is patchy:
 - TAS growth at 11% p.a. (14% p.a. since 2005),
 - SA growth at 6% p.a. (1% p.a. since 2005),
 - QLD growth at 3% p.a. (1% p.a. since 2005),
 - VIC growth at 1% p.a. (4% p.a. fall since 2005),
 - NT fall at 1% p.a. on average since 1997,
 - NSW fall at 2% p.a. (3% p.a. fall since 2005),
 - WA fall at 6% p.a. on average since 1997.

Moving to aquaculture.....

FIGURE 41. AQUACULTURE GVP TRENDS (NOM. \$'000)

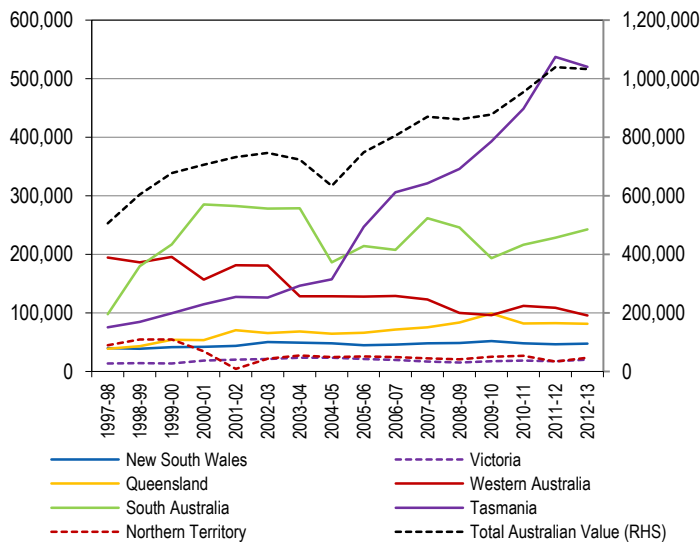
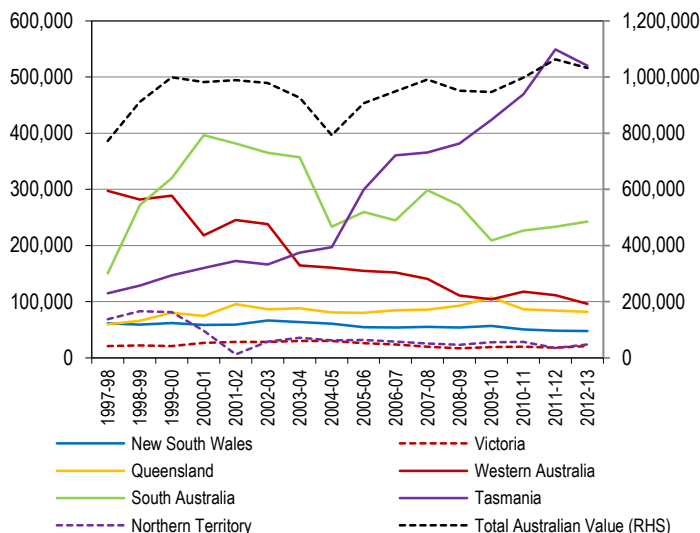


Figure 41 data expressed in real 2013 \$'000



The two graphs in Figure 41 confirm the real trends that:

Moving to the Commercial Sector overall.....

FIGURE 42. COMMERCIAL SECTOR - GVP TRENDS (NOM. \$'000)

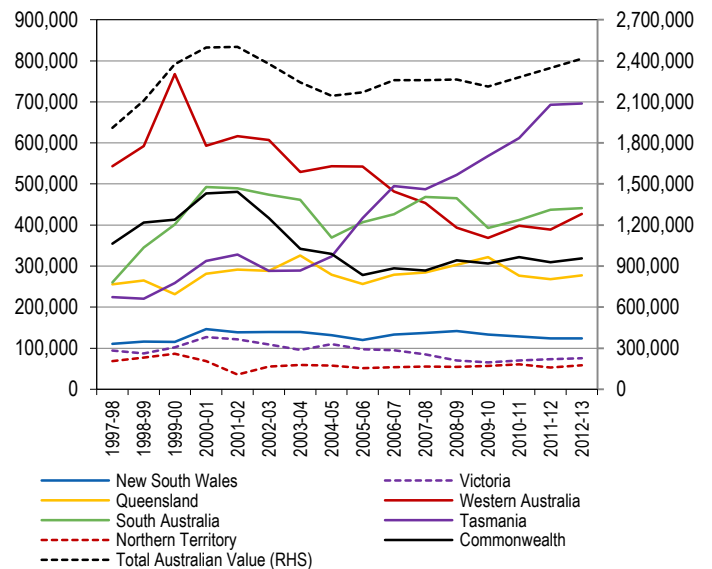
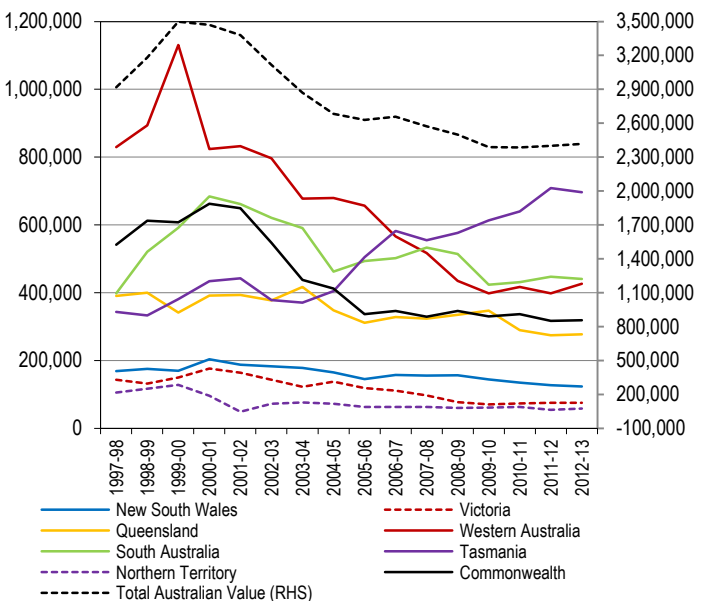


Figure 42 data expressed in real 2013 \$'000



Looking at the six graphs overall, the key points are:

- Declines in total real wild catch GVP since 2000, although tonnage has stayed reasonably stable (Total harvest in 1998 was 229,000 tonnes: in 2012 the same figure was 243,000 tonnes).
- Increases in total real aquaculture GVP since 1997, and stronger growth in the last eight years.
- Declines in wild catch tonnage and value (especially in WA and Commonwealth fisheries) have been offset by aquaculture growth in SA Tuna farming, and more recently TAS Salmon farming.
- Over the 16 year period, wild catch has a recorded average nominal landed GVP growth of 0.1% p.a., equivalent to a real value decline of 2.7% p.a. Over the same period aquaculture has achieved annual average nominal landed GVP growth of 5.2% p.a. (2.3% p.a. real), a rate that has quickened to 6% over the last 8 years.
- Across the commercial sector, the real GVP drivers for growth are evident only in TAS (5.3% p.a.), with:
 - significant decline in WA (-3.6% p.a.), VIC (-3.6% p.a.) and the Commonwealth (-3.0% p.a. for wild catch only),
 - slow declines in NSW (-1.8% p.a.), QLD (-1.8% p.a.) and NT (-1.6% p.a.), and
 - modest gains in SA (1.4% p.a.).
- An increase in Tasmanian salmonid production has masked a production decrease in other species. The largest decreases came from production of Tuna and Pearl oysters. Tuna production fell as a result of quota reductions and loss of markets, while Pearl oyster production declined in part due to changes in global financial conditions. In the last three years wild catch abalone in TAS and rock lobster in WA have also reduced harvest tonnages in response to fishery management issues.

c. Commercial Supply Chain

Robust supply chains are central to the success of agricultural industries in an increasingly competitive global market (Port Jackson Partners, 2012, p. p54). Lowering costs and increasing supply chain differentiation will be critical for Australia. The key is to create, or re-create, contestable supply chain organisations aligned with the producer in three possible ways:

- For chains dominated by large corporate players it is critical to raise alignment and trust along the supply chain, particularly with respect to encouraging investment.
- Chains that are concentrated, characteristically cooperative structures with large players, need to keep working to reduce capital constraints.
- Smaller industries (such as seafood) with relatively fragmented structures often lack an industry leader that drives innovation. Besides further consolidation, this calls for greater cooperation among players. Deep and sustained involvement by industry bodies could help drive this.

The Port Jackson Partners' report also highlighted the critical need for additional investment in infrastructure.

Areas relevant to seafood include:

- Road infrastructure investment that enables more regions to have access to higher productivity vehicles such as B-triples. Raising access to these vehicles will not only increase productivity but also improve cost competitiveness and contestability with rail, although this should be seen as complementary to investing in rail, rather than a substitute.
- Rail infrastructure investment, especially in Australia's east coast would help to address transport bottlenecks,
- Port infrastructure investment, as ageing terminals are unable to handle larger deep-sea ships.

The broader seafood supply chain includes numerous regional fishery co-operatives, processors and vertically integrated companies as well as major (Sydney and Melbourne) urban and regional fish markets supplying wholesalers, exporters, restaurants and the general public (ABARES, 2013 Aug). There has been significant consolidation in the seafood wholesale sector over the years.

The major supermarkets (Woolworths, Coles, IGA) source their domestic seafood products directly from larger fishing and aquaculture producers. Major retailers and wholesalers have shown an increasing interest in issues such a sustainable sourcing, traceability and certification, with the retailers establishing proprietary thru-chain accreditation systems.

Very little value-added processing of fish products occurs in Australia for either export or domestic consumption compared with other food commodities. The majority of establishments undertake only basic processing, such as cleaning, filleting, chilling, freezing and packaging.

The Australian seafood industry is fragmented and has a limited ability to form a whole of industry marketing capability. Recent changes to the *Primary Industries and Energy Research and Development Act 1989 (Now P...I...R...D...Act 2013)* allow rural research and development corporations, such as FRDC, to undertake marketing functions will help to address this issue.

In 2011-12 the landed value of seafood comprised \$2.4 Billion. Figures 43 and 44 (ABARES 13.13, 2013 Nov) confirm that the commercial F&A industry is a relatively small contributor to the national GVP for food and non-food items from agriculture, fishery and forest industries, and in trade.

Figure 44 confirms the negative net exports of products for the 2010-11 year, especially the fact that this negative figure (i.e. imports are larger than exports) is driven by domestic consumers' demand for processed seafood products.

FIGURE 43. ANALYSIS OF FOOD AND NON-FOOD GVP 2011-12

Commodity	Value \$Billion	Share of Total for Australia %
Food Commodities		
Seafood	2.3	4.4%
Livestock products	18.3	35.1%
Crops	24.0	46.1%
Subtotal	44.5	85.6%
Non-Food Commodities		
Pearls	0.1	0.2%
Wool	2.9	5.5%
Cotton lint and seed	2.9	5.6%
Forestry products	1.6	3.2%
Subtotal	7.5	14.4%
Total Food + Non-Food		
Fisheries Products	2.4	4.6%
Livestock products	21.1	40.6%
Crops	26.9	51.6%
Forestry products	1.6	3.2%
Total	52.0	100.0%

FIGURE 44. AUSTRALIA'S FOOD TRADE BY COMMODITY 2011-12

Commodity	Exports		Imports		Net \$Bn
	Value \$Bn	Share %	Value \$Bn	Share %	
Unprocessed fish and shellfish	0.7	2.4%	0.1	0.6%	0.7
Processed seafood	0.3	0.9%	1.3	11.9%	-1.1
Total fisheries based food	1.0	3.3%	1.4	12.5%	-0.4
Total All Australian Food	30.5	100	11.3	100	19.2

Freight

Airfreight dominates our seafood exports. An important advantage of airfreight is that food can be transported directly to inland destinations in overseas markets. Sea freight requires food to be shipped to a seaport before distribution for use in the domestic market. This direct and prompt accessibility is very important in a scenario where inland 2nd tier cities and supermarkets in China (e.g. Chongqing with a population of 21 million in 2011) are now importing cherries, citrus, dairy foods and seafood airfreighted directly from Australia.

A further potential advantage of airfreight is that it increases contestability in international supply chains, at least for high value, low volume food products. Increased contestability raises competitive pressures in the market and places downward pressure on transport costs.

How is this fisheries based food trade transported in the supply chain?

Assuming the two years illustrated in Figure 45 by ABARES (ABARES 13.13, 2013 Nov) are indicative of long term trends, the key points are:

FIGURE 45. AIRFREIGHT OF FISH BASED FOODS – REAL 2012 VALUES

Commodity	Airfreight Food Exports \$m		Share of Total Airfreight %		Share of Total Exports %	
	1996-97	2011-12	1996-97	2011-12	1996-97	2011-12
Unprocessed fish and shellfish	838	644	50.8%	39.8%	-	89.2%
Processed seafood	24	5	1.4%	0.3%	-	1.8%
Total fisheries based food	862	649	52.3%	40.1%	52.9%	64.7%
Total All Food	1,649	1,616	100%	100%	5.9%	5.3%

- Total Australian food airfreight exports (by real value) have stayed reasonably constant at around \$1.6 billion p.a. over the last 15 years. However fisheries based food airfreight exports (by real value) have declined.
- Unprocessed products dominate (97-99%) our exports of fisheries based food airfreight exports.
- Unprocessed seafood products is a large user (40%) of fresh food airfreight capacity from Australia. The seafood share of this capacity has declined from 52% to 40% over the last 15 years.
- Airfreight is very important to the seafood export trade (65% of export trade), far more so than for other non-seafood export trade (5.3% of export trade). Airfreight's share of fisheries based food exports is increasing.

The clear implication is that large seafood producers servicing overseas markets need to be proximate to high frequency /high capacity international airfreight hubs - Tasmania, Port Lincoln, are two examples where greater infrastructure investment will deliver greater market access.

VIC (42% of airfreight food volume)) and QLD (20%) were the two leading uplift points for all food export airfreight. After WA and NSW both at 16%, SA ranked 5th (5%). Nearly 100% of airfreight food exports by TAS are transshipped via Melbourne and Sydney airports. Food airfreight from NT was negligible at \$78,000 in 2011-12.

A key issue in the outlook for the food industry is the extent to which Australia can maintain or enhance its competitive advantage in these airfreight premium food exports.

Industry services

Australia operates small but high quality, high sustainability wild fisheries and aquaculture farms. This provides a sound basis for capabilities and expertise in aquaculture (including aquaponics) consulting, equipment and technology, marketing, research and development (Austrade, 2013).

Australian companies have experience in designing and producing systems for marine environments (e.g. sea ranching, surface lines, subsurface lines, racks, sea cage culture, land-based marine ponds and tanks and hatcheries), and freshwater environments such as pond and tank systems. Australia has extensive capabilities in recirculating aquaculture systems and their use in production of sustainable and ESD approved fin fish farming, such as sea bass (including Barramundi), and Murray Cod as well as in research facilities.

Australian trade development and seafood research centres are currently contributing to a range of research programs for overseas clients, including in genetics and aquaculture system development for species including rock lobster, sea bass (including Barramundi) and trepang.

d. Commercial Species – Supply and Use

A number of significant changes are underway in the supply and use of species in commercial fisheries.

Figure 46 presents ABARES tonnage data for the 30 leading species (in descending 2012 \$GVP), and related source, trade and net domestic consumption estimates. Best estimates are included for processed traded products.

Figure 47 summarises the headline figures and changes and changes.

FIGURE 46. COMMERCIAL CATCH AND TRADE FOR KEY SPECIES 2012-13

Key Species Species / type	TOTAL AUSTRALIAN CATCH 2013					WILDCATCH			AQUACULTURE			TRADE		
	Rank	Rank	Beach	Cum.% of	Tonnes	Beach	Cum.% of	Tonnes	Beach	Cum.% of	Tonnes	Identifiable Exports		Identifiable Imports
	2013	2008	GVP \$'000	Total GVP		GVP \$'000	Sector GVP		GVP \$'000	Sector GVP		Est. Tonnes	% of Prod'	Est. Tonnes
Salmonids	1	2	496,863	21%	42,978	-	-	-	496,863	48%	42,978	2,584	6%	11,945
Rock lobster	2	1	450,973	40%	10,549	450,973	33%	10,549	-	48%	-	7,819	74%	807
Prawn	3	3	277,078	51%	21,145	217,016	50%	17,403	60,062	54%	3,742	3,917	19%	34,752
Abalone	4	5	189,659	59%	5,253	165,974	64%	4,529	23,685	56%	724	2,818	54%	4
Tuna	5	4	177,215	67%	11,376	23,715	64%	3,890	153,500	71%	7,486	8,901	78%	46,931
Edible oysters	6	7	94,539	71%	12,530	-	64%	-	94,539	80%	12,530	-	-	517
Pearl oysters	7	6	79,170	74%	na	-	64%	-	79,170	88%	na	-	-	-
Crab	8	8	52,630	76%	4,634	52,630	68%	4,634	-	88%	-	446	10%	1,527
Barramundi	9	9	45,788	78%	5,142	13,017	68%	1,582	32,771	91%	3,560	-	-	-
Snapper	10	10	32,583	80%	4,177	32,583	71%	4,177	-	91%	-	-	-	-
Shark	11	12	26,608	81%	5,720	26,608	73%	5,720	-	91%	-	-	-	534
Flathead	12	16	25,627	82%	3,892	25,627	78%	3,892	-	91%	-	-	-	-
Coral trout	13	11	24,738	83%	774	24,738	78%	774	-	91%	-	-	-	-
Sardine	14	15	23,820	84%	38,437	23,820	78%	38,437	-	91%	-	-	-	4,018
Whiting	15	14	16,778	85%	2,851	16,778	80%	2,851	-	91%	-	394	14%	-
Mackerel	16	22	16,272	85%	2,494	16,272	81%	2,494	-	91%	-	-	-	1,343
Blue grenadier	17	19	15,507	86%	4,007	15,507	85%	4,007	-	91%	-	-	-	-
Scallops	18	13	14,685	87%	2,187	14,685	85%	2,187	-	91%	-	417	19%	3,121
Mullet	19	18	13,721	87%	4,722	13,721	85%	4,722	-	91%	-	-	-	-
Squid	20	28	12,656	88%	2,929	12,656	85%	2,929	-	91%	-	-	-	19,860
Mussels	21	23	10,195	88%	3,584	-	85%	-	10,195	92%	3,584	-	-	3,685
Ling	22	25	6,342	88%	1,002	6,342	86%	1,002	-	92%	-	-	-	-
Bream	23	24	5,930	89%	1,106	5,930	86%	1,106	-	92%	-	-	-	-
Billfish	24	20	5,651	89%	1,593	5,651	86%	1,593	-	92%	-	-	-	-
Pipi	25	33	4,895	89%	561	4,895	87%	561	-	92%	-	-	-	-
Emperor	26	27	4,851	89%	824	4,851	87%	824	-	92%	-	-	-	-
Aust. salmon	27	32	4,002	89%	2,820	4,002	88%	2,820	-	92%	-	-	-	-
Silver perch	28	31	3,277	90%	256	-	87%	-	3,277	92%	256	-	-	-
Blue eye trevalla	29	30	2,849	90%	309	2,849	88%	309	-	92%	-	-	-	-
Threadfin	30	29	2,767	90%	654	2,767	88%	654	-	92%	-	-	-	-
Other fish	na	na	169,856		24,797	149,672	99%	23,377	20,184	94%	1,420	-	-	-
Other NEI	na	na	61,263		3,841	6,223	99%	196	55,040	100%	3,645	8,008	na	99,347
Other crustaceans	na	na	10,971		538	7,631	100%	397	3,340	100%	141	-	-	-
Other molluscs	na	na	1,723		874	1,723	100%	874	0	100%	0	-	-	-
Total			2,381,482	100%	228,556	1,348,856		148,490	1,032,626	100%	80,066	35,304	15%	228,391

The following discussion excludes "other" unspecified species shaded in the table. This analysis relies on data points in 2008 and 2013, so analysis and interpretation of trends is on that basis. GVP dollars are in nominal terms.

Over the 5 year period major changes by volume and value are occurring, both in the Top 10 species that collectively contributed 80% of the Total F&A GVP, and in aquaculture's share of total F&A.

FIGURE 47. HEADLINE TRENDS IN COMMERCIAL SUPPLY

Fishery (excl. "Other")	2007-08	2012-13	5 Years % Change
GVP: \$ for all F&A (nominal)	\$2.19 Bn	\$2.38 Bn	+8.8%
For Top 10 species	\$1.74 Bn	\$1.90 Bn	+9.2%
% of GVP \$ from Top 10	80%	80%	-
For Next 20 species	\$260 m	\$241 m	-7.3%
% of Top 10 from Aqua.	45%	50%	+5%
Tonnes: All F&A (excl. Pearls)	240,517	228,556	-5.0%
For Top 10 species	112,364	117,784	+4.8%
% from Top 10 species	46%	52%	6%
For Next 20 species	89,582	80,722	-9.9%
% of Top 10 from Aqua.	50%	60%	10%
Trade: Top 10 share of est. total export tonnes	65%	75%	10%
Top 10 share of est. total import tonnes	41%	42%	1%

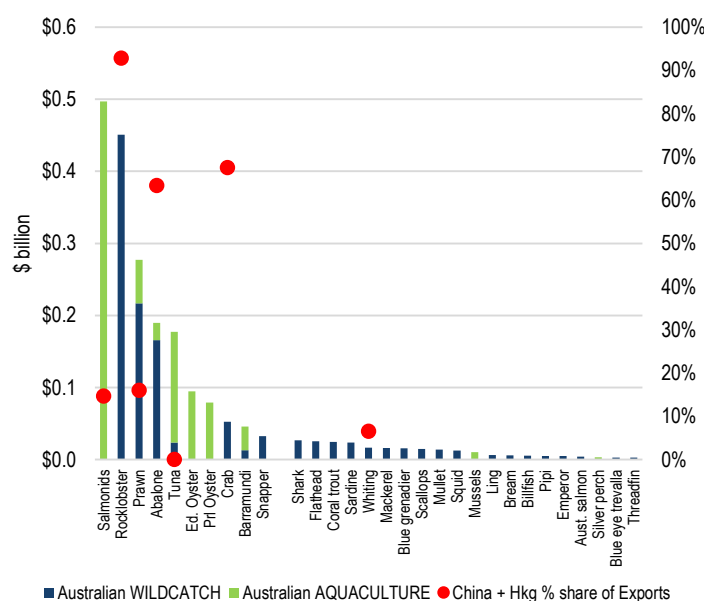
Over the 5 year period

- Annual Nominal GVP growth for F&A is +1.74%, compared to +1.75% for the Top 10, and -1.43% for the Next 20 species (the Top 10 is driving all the industry growth),
- In GVP terms, the 10 leading species contribute a relatively stable share of F&A GVP (~80%).
- Aquaculture now comprises 50% of GVP for the Top 10 species, but is around 43% for all F&A GVP.
- Total F&A harvest tonnage is falling slowly over time, but the Top 10 species are increasing their aggregate share – up from 46% to 52% in 5 years.
- Aquaculture is increasing its tonnage share of the Top 10 F&A species, where it has grown from 50% to 60% in five years, mostly from Salmon farming.
- Aggregate tonnage for the next 20 species is quite volatile but the trend is a decline at ~1.8% p. a.

- F&A export tonnages are quite volatile, but trending down from 44,000 tonnes to 35,300 tonnes in the last 5 years. The Top 10 species are increasing their share of these exports by ~2% p.a. reaching a 75% share in 2013.
- Imported volumes of seafood products are harder to assess due to the multiple and mixed formats (e.g. unspecified prepared and preserved seafood). But gross import tonnages appear to be rising at about 3% p.a., with the Top 10 species comprising a steady 41-42% of the volume.

Figure 48 confirms the dominant GVP contribution of the 10 leading species, their strong reliance on farmed production systems, and the share of that GVP (%) that is traded with China for selected species where data is available. (GVP exposure for Pearl oysters to China is unknown).

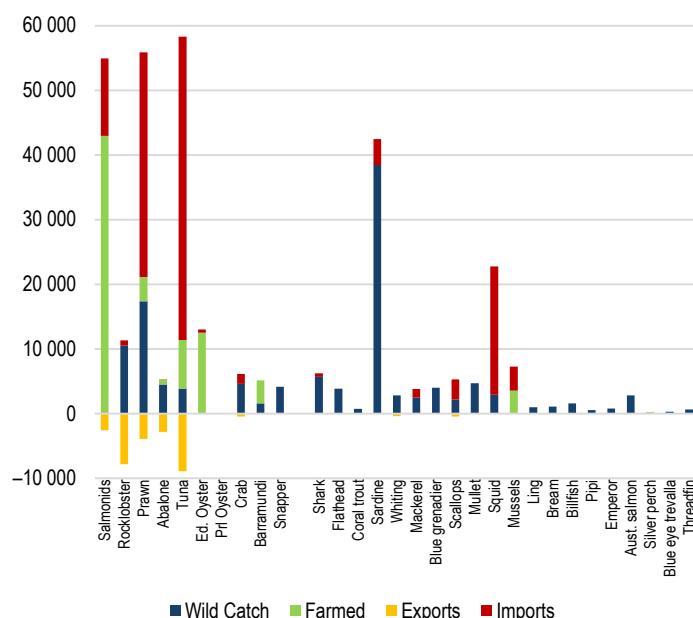
FIGURE 48. 2013 SEAFOOD GVP AND CHINA EXPORT TRADE



Note that around 98% of Australian rock lobster export value goes to China + Hong Kong, but just over half of this trade enters China indirectly via Vietnam as the so called grey trade. With the recent signing of the China Australia FTA, this grey trade is expected to switch to direct trade to China + Hong Kong in the next 1-2 years as the agreement comes into force and tariff reductions make direct trade more attractive.

Taking the analysis a step further, Figure 49 presents the domestic supply and consumption flows by tonnage.

FIGURE 49. 2013 SOURCE AND USE OF SEAFOOD – TONNES



The key points are:

- Aquaculture is the major supplier to domestic consumers of Top 10 species, via local production, and imports (mostly imported Prawns and Tuna), and for export.
- A large proportion of the wild catch component of the Top 10 species is exported, especially abalone and rock lobster,
- Imports are a large contributor to domestic demand of Top 10 species,
- The Next 20 species are predominantly wild caught, and they face import competition especially Sardines, Scallops, Squid and Mussels.

It is clear that Australia is managing two commercial fisheries resources - a leading cohort of high value traded fisheries increasingly dominated by visible and emerging aquaculture, and a larger group of smaller (mostly wild catch) domestic fisheries. To characterise these two groups further:

The leading 8-10 commercial species that contribute 80% of \$GVP:

- Service discerning global and domestic consumers,
- Are at or approaching competitive global niche market scale,

- Are native /long adapted species produced from wild catch or aquaculture harvests in a sustainable environment that is available to leverage their trade branding,
- Are increasingly operated by larger corporatised entities along the value chain, that predominantly harvest from few locations, have dedicated supply chains; and appear to be better able to access capital, invest in marketing, and attract and retain human capital,
- Maintain a large export component, which is both a threat (e.g. currency and import risk), but also offers leverage advantages (e.g. FTAs with China, Japan, and potentially India),
- Have/are establishing dedicated local R&D capacity (e.g. Industry Partnership Agreements with FRDC/SCRC investments) and funding,

The Next 20-25 commercial species contribute ~20% of \$GVP. These species:

- Service domestic consumers who have increased access to imported seafood whose quality and provenance is improving every year,
- Are sourced from smaller wild catch fisheries, with minimal aquaculture opportunity,
- Lack operating scale (by species and by license holding), both at harvest and from multiple landing locations, and therefore must share a joint commodity supply chain to offset their higher average unit costs,
- Are exposed to import seafood commodity competition (mostly from Asian based aquaculture), and from loss of access due to marine park expansion and alternate resource users (e.g. Recreational fishing),
- Are SME dominated with limited license holder collaboration on consumer marketing or branding power in most fisheries.

What is the long term trend at play here? Based on these data, it is possible, maybe even compelling, to suggest that within a couple of decades the Australian wild catch sector will be a niche supplier of sustainable branded, high quality, traceable seafood (say 30% of domestic demand) and marine recreation, and the aquaculture industry will be the commodity supplier of 70% of our seafood, both locally grown and imported.

e. Commercial Licensing

Commercial Wild Catch

The Commercial wild catch sector comprises a large number of small often family-owned companies and a smaller number of larger businesses, a few of which are subsidiary companies of publicly listed parent/holding companies. These larger companies frequently have a level of foreign participation.

Some wild catch fisheries contain a large proportion of underutilize capacity (latent effort) for example, the state Trawl Fisheries on the east coast.

Most fisheries are characterised by limited entry and the larger more profitable fisheries are often oligopoly structures with only limited competition between operators. Generally, Commonwealth fisheries are quota managed and state fisheries (excepting lobster and abalone) are effort managed. State regulated fisheries, with some exceptions, operate under low cost models facilitated by the biology of the in-shore fish species. (ABARES, 2013 Aug)

Since aquaculture largely takes place in state and territory waters (within 3 nautical miles from shore), regulation rests with the states and territories.

Aquaculture

Aquaculture sector licenses are far more concentrated, and the larger aquaculture enterprises also hold considerable interests in wild catch sector. Some aquaculture fisheries also contain considerable under-utilised license capacity (latent effort), for example the Prawn farming sector where around 50 licenses across QLD, NSW, NT and WA are unused, or are multispecies licenses that currently support other species such as Barramundi. But realistically, in many cases these latent licenses are a legacy of past failed development initiatives and now are dormant or speculative in nature and scope. They will never be used as the technology /environmental /economic /market drivers of aquaculture have become far more sophisticated in the last few years and the economic scale and site selection parameters have changed.

License approval and latent effort is a significant issue in aquaculture. The facilitation of effective, efficient, timely and transparent planning and approval processes is an important aspect of the future development of the aquaculture industry. As part of a move to simplify

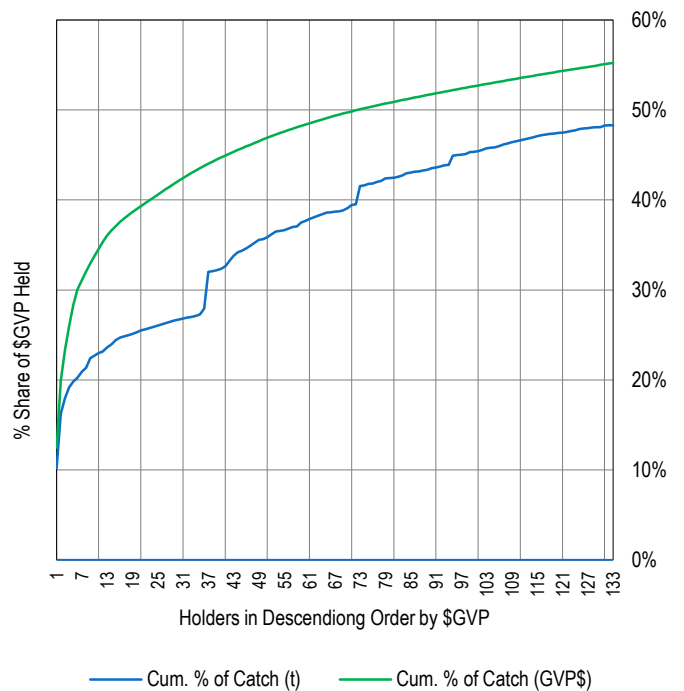
regulation the Fisheries Management Review, undertaken by Borthwick (Borthwick, 2012) in late 2012, recommended that Commonwealth Fisheries legislation should be amended, as necessary, to facilitate state and territory regulation of aquaculture in Commonwealth waters.

Blueprint Project

Data on commercial license holders is being compiled under the FRDC’s current Blueprint Project (FRDC 2014-237). While the project is not yet completed (data from one smaller jurisdiction is yet to be added to the dataset) the analysis to date points to some interesting issues. Note that these are interim comments based on initial analysis, in order to assist this Sector Overview study.

There are around 15,000 commercial licenses (including permits etc.) in the Australian F&A industry to harvest seafood and other non-edible products such as Pearls, Kelp, Undaria. By aggregating these licenses based on known enterprise affiliations or family groupings (where evident), Figure 50 indicates that around 130 leading stakeholders dominate (= >50%) the F&A commercial, sector, by both GVP value and tonnage harvested.

FIGURE 50. 130 LEADERS DOMINATE COMMERCIAL SECTOR



The initial data estimates the 15,000 licenses are comprised as per Figure 51.

FIGURE 51. ESTIMATED F&A LICENSE HOLDERS 2013

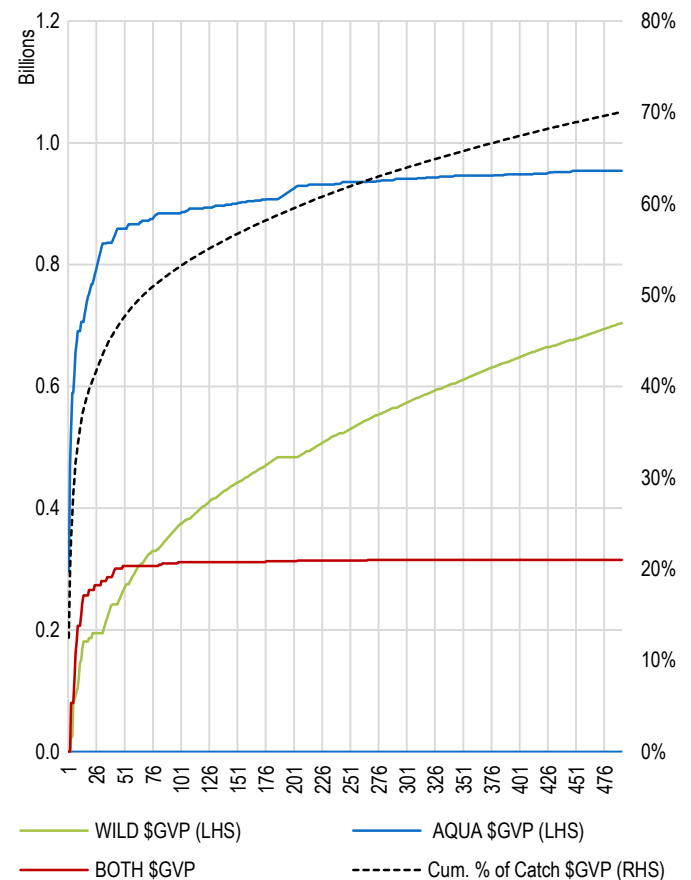
	License Holders	Harvest Kg	Beach Value
Wild Catch			
COMM	3,016	43,174,000	308,244,000
NSW	4,177	13,240,065	81,570,565
QLD	1,411	20,628,000	185,514,000
VIC	259	5,263,000	54,686,000
TAS	1,704	5,644,174	157,661,708
SA	719	46,556,665	208,839,000
WA	1,481	18,580,200	274,626,070
NT	247	5,753,500	34,104,000
Subtotal	13,014	158,839,604	1,305,245,343
Aquaculture			
NSW	572	5,440,000	54,675,000
QLD	499	6,418,000	82,509,000
VIC	123	1,811,000	16,459,000
TAS	68	48,572,797	536,965,062
SA	566	20,174,000	237,338,340
WA	426	4,711,000	109,026,391
NT	24	1,214,200	17,214,000
Subtotal	2,278	88,340,997	1,054,186,793
Total	15,292	247,180,601	2,359,432,136

Looking more closely at the leading stakeholders (grouped by known affiliation and ranked by GVP value), Figures 52 highlights that:

- The 500 leading commercial stakeholders (grouped) land around 70% of the GVP based on the right hand axis,
- These 500 stakeholders land around \$0.7 billion of wild catch GVP, and \$0.95 billion of aquaculture GVP based on the left axis.
- Their share is around half of the value of wild catch sector, but they land almost 100% of the aquaculture sector value.
- Approximately \$300 million in GVP value is landed by Top 500 enterprises that hold licenses in both sectors.
- The cohort of the Top 50 stakeholders (by GVP value) lands ~\$859 m. of farmed value which is 90% of the sector. They also land around \$267

million of the wild catch landed value, which is around 20%.

FIGURE 52. LEADING COMMERCIAL STAKEHOLDERS RANKED BY GVP



Aquaculture Regulation

The 2009 F&A Sector Overview summarised advice from the Productivity Commission regarding aquaculture regulation (Productivity Commission, 2004) at that time. (Figure 53).

Significant change has occurred in the last five years in the sector, especially regarding commercial expansion in SA (by area and species) and TAS (Macquarie Harbour) in particular, and emergent changes in WA and NSW.

The latest comprehensive advice regarding aquaculture development issues is a report to the QLD Competition Authority (CIE, 2014) comparing legislative frameworks across four leading aquaculture jurisdictions – TAS, SA, WA and QLD. The key advice from this review relates to the QCA's purpose but the advice is pertinent to national regulatory and investment issues for the sector. Advice from this report is also summarised in Figure 53.

FIGURE 53. REGULATORY ASSESSMENT OF AQUACULTURE

Regulatory Area	Productivity Commission Comments 2004	Advice from 2014 CiE Review – QLD, TAS, SA, WA [#]
Industry competitiveness	<ul style="list-style-type: none"> Regulatory arrangements that are poorly designed or implemented add costs to producers and consumers and adversely affect investor behaviour and competitiveness 	<ul style="list-style-type: none"> Although there are significant differences in aquaculture regulation across jurisdictions, many of these differences are superficial. Despite many similarities, the QLD regulatory framework for aquaculture appears more complex compared to other jurisdictions A key area where the regulatory framework is different in Queensland from other jurisdictions is the planning system for offshore aquaculture. In particular, SA and TAS have a formal planning framework for marine farming and WA is currently developing such a framework. This provides proponents with certainty and encourages industry investment and expansion in an orderly way. This planning framework has underpinned strong growth in the production of farmed salmon in TAS. This approach may <u>not</u> necessarily work well in QLD. The marine farm planning frameworks in other states were developed in response to strong industry demand. Currently, there is no operational cage aquaculture in Queensland. It is possible that this is partly due to the regulatory framework. However, it is also possible that this reflects other factors beyond the Government's control, such as climate and other environmental factors. More research is required to determine this. In relation to onshore aquaculture, the key issue is wastewater discharge standards. This appears to be a major issue constraining further development of onshore aquaculture in QLD and in the GBR catchment in particular. All states have water quality policies and guidelines that are broadly based on the <i>Australian and New Zealand Guidelines for Fresh and Marine Water Quality</i>. This provides some level of consistency in the water quality framework across jurisdictions. There are likely to be more stringent discharge requirements placed on aquaculture facilities discharging into waters that are already above, or close to, the water quality criteria for relevant pollutants. Discharge limits appear to be a much more significant issue for the QLD aquaculture industry, compared to other jurisdictions, for a number of reasons – including terrestrial pond based, GBRMP/World Heritage Area listing, and declining water quality in the GBRMP due to other factors. A well-designed and efficient offsets framework could provide a way forward for aquaculture in the GBR catchment and provide more certainty for proponents, without compromising water quality objectives.
Legislative objectives and Agency Functions	<ul style="list-style-type: none"> State aquaculture legislation often has multiple objectives, that may overlap or conflict There is often a lack of guidance as to the relative weights of parallel objectives 	
Marine resource planning and aquaculture	<ul style="list-style-type: none"> Jurisdictions have used different planning processes to allocate marine resources for aquaculture and provide for management of the marine environment Except for TAS and SA, there has been slow progress with marine aquaculture planning 	
Land use planning and aquaculture	<ul style="list-style-type: none"> A number of jurisdictions (e.g. Vic, SA, WA) do not provide planning guidance to local councils on how to address land based aquaculture in planning schemes, or how development approval should be assessed 	
Lease of public waters and/or land for aquaculture	<ul style="list-style-type: none"> Marine based - the use of marine aquaculture leases varies significantly across jurisdictions. The limited use of marine aquaculture leases in VIC, QLD, and WA has implications for the growth of marine aquaculture. Inadequate security of tenure may constrain financing for aquaculture projects. Land based – some jurisdictions lack defined processes for leasing adjacent lands and public foreshores, across which aquaculture pipelines must traverse. 	
Approvals, monitoring and reporting	<ul style="list-style-type: none"> Misguided or inefficient approval requirements can create barriers to entry into the industry or expansion of existing operations. In most jurisdictions around five state agencies as well as local government are involved with processing and approving aquaculture projects. This can lead to excessive costs and uncertainty for investors. Complex aquaculture projects may take more than 4 years to approve. Some environmental and compliance monitoring arrangements may be too prescriptive, and in some jurisdictions enforcement appears not to be adequate resourced. There appears to be limited reporting by and auditing of, the main state agencies responsible for environmental regulatory arrangements for aquaculture. 	
Quarantine and translocation	<ul style="list-style-type: none"> Progress on developing consistent translocation protocols varies significantly across jurisdictions. Inconsistencies may breach WTO rules, as well as generate higher costs for aquaculture producers. 	

[#] NSW has made significant changes to aquaculture development and regulation in the last decade. These appear to now be bearing fruit. The key change has been via adoption of a state-wide approach to aquaculture, with a specific strategy at each of 3 levels: oyster industry, land based aquaculture, and zonal development for marine aquaculture. The latter is under the direction of the State Aquaculture Steering Committee which is implementing the new *State Environmental Planning Policy 62- Sustainable Aquaculture*. Current developments are for offshore finfish leases at Port Stephens and a proposed Jervis Bay marine aquaculture zone.

f. Regulatory Efficiency and Burden

The F&A Industry is administered by 8 jurisdictions – the Commonwealth, 6 states (NSW, VIC, QLD, WA, SA, TAS), and the Northern Territory. This arrangement has existed since Federation in 1901.

Industry challenges are compounded and complicated by governance complexities in fishery management across jurisdictions. Under the Offshore Constitutional Settlement, there are over 59 arrangements that determine how cross-jurisdictional stocks are to be managed. There are also three joint authorities.

Setting and monitoring catch limits or Total Allowable Catches (TAC) on the basis of best environmental and social science, and economics, to control output is a key aspect of a “harvest strategy”. The TAC is apportioned to each concession holder on a unitary access basis based.

Resource sharing

An ABARES Paper (Draft Fishing Futures Roundtable 2013) (ABARES, 2013 Aug) considers resource sharing as an important emerging issue for the F&A industry.

Resource sharing is usually assumed to be between commercial and recreational users, but this is changing as aquaculture expands to new sites. A current issue (2014) in Tasmania is competition for fishery access to waters of the Huon Estuary. This competition is between two of Australia’s leading commercial activities – salmon aquaculture, and abalone wild catch.

The complexities in the management of particular stocks are compounded when they are a shared responsibility between different jurisdictions and issues such as equitable access and access security are key considerations. Such sharing occurs domestically across state jurisdictions or between the Commonwealth and a state and, in the case of highly migratory species, they can be shared across national boundaries.

Challenges are multiplied when different management regimes (e.g. effort versus quota management) are applied across the boundary. Another domestic stock sharing issue (with the same access concerns) occurs in relation to species that are caught and landed by both commercial fishers and recreational fishers.

- The Commonwealth’s preference for quota management is not matched in the states or NT except in very limited cases,
- Recreational fishers generally under-estimate their overall impact on stocks and present challenges for management at the national level,
- Data collection on recreational and customary catch remains a challenge and real constraint on improving fishery management in shared fisheries.

A further complication arises due to the dynamic nature of fishery stocks impacted by climate change. Species movement will require realignment of resource access and sharing arrangements to optimise community and commercial returns. This could also potentially require adjustment to the terms of the Offshore Constitutional Settlement agreement between the Commonwealth, states, and the NT.

The government has a role in ensuring the market mechanisms allow for optimal resource allocation of the community’s fisheries resources for all users. The Commonwealth fisheries have a preference for quota based management (via individual tradable - ITQs) to encourage efficiencies in fishing effort and more precisely manage catches. However the states and NT prefer management by effort. Where these choices result in oligopolies the efficiency benefits may be accrued by the operators rather than the wider public. Quota-based management may also be a higher cost approach to fisheries management. Indirectly, the public may benefit from reduced overheads and effort-based competition (driving innovation) for the resource. ABARES (ABARES, 2013 Aug) suggests:

- Further analysis be undertaken of market dynamics of quota-based and effort-based fisheries: the public and private benefits from efficiency gains, the tendency to reduced competition in some circumstances and the links between the value of fisheries and the form of management., and
- High levels of latent effort is characteristic of many Australian fisheries.

The NSW Fisheries Management Review (Stevens, Cartwright, & Neville, 2012 March) found it necessary to balance the access to fisheries resources in NSW across a range of often countervailing uses. It recommended introduction of a Resource Sharing policy. Such a policy should include

areas required for conservation, access for the recreational, commercial and Aboriginal fishing sectors and the needs and expectations of the non-fishing public that supplies of local seafood are available. The NSW commercial fishing sector has lost considerable access to fisheries resources through past decisions, which were made without an overarching resource sharing policy and process in place.

Resource access certainty is important to wild catch users, including recreational fishers, in state and Commonwealth waters. Recreational fishers, due to their numbers and increasing effort range, can present particular challenges where active or direct management is required. Quota managed fisheries (such as the Southern Bluefin Tuna fishery) where the recreational take may be significant may require high levels of monitoring and compliance reporting in addition to possibly capping the take. Capping recreational effort can be difficult both in terms of assessing and managing the level of recreational catch. Some recreational fishers may also be reluctant to accept the actual level of their impact on a fish stock particularly in comparison to commercial fishing effort. Management of recreational fishers also has cross jurisdictional considerations for inspection and enforcement.

Data access is an ongoing issue in the Recreational Fishing sector – in turn this is a barrier to informed and efficient resource sharing between sector users. While many stocks are accessed by both commercial and non-commercial fishers, the amount of competition between different sectors varies from stock to stock and location to location. Data is need to inform related access decisions.

As ABARES notes (ABARES, 2013 Aug), it may be that highly profitable fisheries that are keen to fully but sustainably exploit a fishery's resource are well suited to quota management, whereas more marginal and low value fisheries require lower cost, more 'hands off' approaches where a suitably precautionary approach will result in a lower catch level. There may be benefit in the study of the operation and role of fishing cooperatives and capital city fish markets in the wholesaling and retailing of seafood and in the promotion of innovation. The level and implications of vertical integration between domestic fishers, fish processors and wholesalers is also not well understood. Nor are the links between fresh local seafood wholesalers and the importers of seafood product. The

role of foreign investment in this sector could also be better understood.

In the Commonwealth, cost recovery arrangements have been identified as a restraint on the levels of investment on research and assessment (of stocks). While the Borthwick Fisheries Management Review found the current cost recovery to be sound, it recommended the role of alternative approaches be explored – noting that for some smaller fisheries, costs were high as a proportion of gross value of production making it difficult to fund research.

With trends towards larger fishing companies, there is likely to be more pressure for a stronger partnership approach and more delegated forms of co-management. In some instances, there is a view that someone who has 50% of the resource should have 50% of the say.

The risk to industry of additional transitional or implementation costs of new policies should be matched by the potential for increasing prices for the product. Other factors may limit price increases – such as substitution by cheaper imports (where regulatory costs of production are relatively less). The gap in regulatory cost between domestic and imported supply is also repeated to a lesser extent between Australian jurisdictions. For example, the regulatory burden and hence cost on Whiting supply is quite different between the jurisdictions but it is a single national market with little or no opportunity for differentiation given a lack of effective traceability (ABARES, 2013 Aug).

Fisheries Management

The most recent independent reviews (Commonwealth Fisheries Management (Borthwick, 2012) and NSW Fisheries Management (Stevens, Cartwright, & Neville, 2012 March)) considered approaches to managing wild fishery assets under the triple bottom line approach. Findings and recommendations pertinent to this Sector Overview are summarised as follows:

GOVERNANCE AND TRANSPARENCY

In both jurisdictions, processes lack transparency and stakeholder engagement. There is need to better integrate and explain the interrelationships between the three pillars in the triple bottom line – environment, economics and social.

PRECAUTIONARY PRINCIPLE AND HARVEST STRATEGY

Commonwealth Fisheries clarify the application of the precautionary principle (resulting from convergence of industry and environmental needs), drawing out its application through the Harvest Strategy Principle and ecological risk assessments. The Harvest Strategy approach is *"generally regarded as a watershed by every stakeholder - the time has now come to develop this approach further and to instigate a fisheries specific push to better apply these approaches formally (through policy direction and legislation), and in a coordinated and transparent way (through changes to the pursuit of scientific verification and the development of plans of management..... AFMA should give equal attention to each pillar, and to transparently address trade-offs where applicable, for example in discards and bycatch management."*

BYCATCH AND DISCARDS

- On 29th May 2013 the Council of the European Union and the European Parliament agreed on the new European Union Common Fisheries Policy. The policy included the eventual ban on discarding commercial species. There has also been a strong movement in the United Kingdom against discarding all forms of bycatch whether commercial or not.
- The Borthwick report identified the discarding of commercial species as a policy area that required further work. Discarding of quota species can be managed by including discards in the overall mortality of the species for quota allocation purposes to, in effect, subtract the total (estimated) discard tonnage from the total allocated catch for the subsequent season. AFMA applies this policy to certain fisheries and has indicated an intention to assign discard total decrements to individual licenses rather than the current practice of sharing the total level of discards equally across all boats in the fishery. In contrast, New Zealand operates a deemed value system where excess quota catch may be retained and landed but is assigned a deemed value intended to dissuade targeting of the species. Retention of over quota catch also provides for

better accounting for overall mortality in the fishery. Few other countries have adopted this approach due to its inherently high cost for administration and the practical problems with establishing deemed values for products with high variability of supply commensurate with price variation.

- The ABARES Round Table paper noted that measures to minimise bycatch and discarding of commercial species is an area of increasing debate within the Australian community and impacts on public perceptions about commercial fishing and fisheries management. Discarding is a particular challenge in multi-species fisheries where, for example, fishing methods may not allow preferential targeting of one commercial species over another. Discarding and bycatch quotas can also be a problem in relation to species that are subject to recovery plans. There are various management approaches that can be considered in this space, each with their own issues in determining and measuring parameters. Various management approaches are applied around the world – understanding what is best suited to Commonwealth, State/NT fisheries and what parameters are appropriate is the problem.

FISHERY MANAGEMENT PLANS

- For Commonwealth Fisheries, each Fishery Management Plan (FMP) needs to be driven by a strategy developed by stakeholders, which precedes the FMP "nuts and bolts"⁵. Both the Strategy and Plan must be transparent and accessible to and engaged with the public. Borthwick noted *"There is considerable scope to improve the substance of FMPs, to improve effectiveness, transparency, and give better effect to the ministerial oversight"*.
- Incorporate fishery accreditations within the EPBC Act, rather than as separate assessments.

PROPERTY RIGHTS

- In Commonwealth Fisheries, access by individuals/groups to fisheries is provided by allocating fishing concessions as a form of legal

⁵ Borthwick identified, as a minimum, the following items to be included in an FMP – fishery stocks, economic and social dimensions, harvest strategy, by-catch, discards and

mitigation strategies, ecological risk assessments and ecosystems consequences, trade-offs and related consequences, and resource sharing issues and options.

'right'. (Commonwealth fisheries currently have only a single wild catch user – the commercial sector). AFMA has the function of establishing and allocating fishing concessions in the form of statutory fishing rights (SFRs), fishing permits, or foreign fishing licenses. Environmental and Social Management agencies collaborate with AFMA and within government policy mechanisms to determine the nature and amount of access to a fishery, the framework and rules for establishing and managing fishing concessions, including provisions for their allocation, suspension or cancellation. Fishing concessions allocate 'shares' to fisheries resources, access to which is controlled by 'input' or 'output' controls or a combination; typical input controls being the number or type of fishing vessels, the amount or type of fishing gear, or the areas or times when fishing can be done; and output controls, the amount of fish that can be caught. The review concluded that rights are appropriately structured and allocated.

- In NSW, most fisheries shares are now a weak property right and management control, which also results in adverse consequences and inefficiencies. Due to an excess of these shares being issued, there is little or no scarcity, and therefore market, for most shares. Where access is based on historical rights or a minimum number of shares, there is limited or no ability for operators to 'trade up' to make their operations more viable. This has essentially prevented autonomous structural adjustment. The review recommended that shares in each fishery be linked directly to resource access in the form of catch or fishing effort to achieve the biological and economic objectives of the Act. Past allocation of commercial fishing licences and the current complex and inefficient management framework of share classes and poorly defined access rights has resulted in considerable latent effort and the failure of shares to reach their intended value as the 'currency' of each share management fishery. It has also restricted the ways in which access rights can be used to manage sustainability, which has created an inefficient and costly range of measures based on complex input and other controls. The study noted *"Without radical*

restructure and reform, the economic crisis facing industry will continue and, indeed, worsen."

Overfishing will also continue to be difficult to avoid and control effectively. Implementation of this far-reaching, complex and comprehensive reform will need to be funded adequately. In most fisheries, a relatively small proportion of active fishers (businesses) take the majority of catch and the remaining businesses holding shares have either nil or very low catches. The review recommended a structure adjustment package and encouragement for share trading and consolidation.

COST RECOVERY

- For Commonwealth fisheries consider introduction of a two part AFMA levy reflecting: an access component (to the community resource) and a research /admin component (recover costs). ABARES (ABARES, 2013 Aug) notes that Commonwealth fisheries operate on a cost recovery model which transfer a large part of the management costs to industry. If community expectations in relation to marine environment management give rise to increased measures in relation to environment protection and ethical treatment of marine creatures, the capacity of the industry to bear the costs of these expectations and remain competitive in the market may come into question. There is an increasing trend in Commonwealth fisheries to move toward individual or boat-based accountability rather than collective accountability (i.e., fishery, sector or fleet-based accountability). The implications of this trend for issues such as bycatch could benefit from closer consideration. It may be appropriate to review how fisheries management costs are borne across industry and government, including the public and private benefit equation.
- For NSW fisheries there is currently no formal cost recovery policy in place to guide fisheries management and encourage the efficient delivery of services. It will be necessary to recover a higher proportion of such costs via a flat fee per share class to ensure the continued delivery of necessary services and change the current settings, which promote the persistence of latent effort.

- The ABARES Roundtable Paper noted that there is an ongoing requirement to monitor evolving fisheries management practices and policy at a national and multinational level to ensure that our policies remain at the leading edge of best practice. The Australian Government has committed to a harvest strategy policy based on information dependent decision rules and tradable quota management of commercial species. The Commonwealth also operates under a cost recovered model of fisheries management. State and territory governments do not formally adhere to harvest policies. Only a few fisheries are quota managed and cost recovery is not the norm. It seems likely that the Australian Government operates a relatively high cost model for at least some of its domestic fisheries management fisheries. It is unclear whether the Commonwealth, with its more formally articulated policies for fisheries management, provides a best practice model for domestic fisheries managers (albeit scientific best practice) or simply a high cost model. Difference in models may to some extent be explained by the natures of the commercial fish species that are the focus of management. It is also affected by the government's, community's and industry's appetite for risk in fisheries management and by costs of management. Australia claims to be a world leader in fisheries administration but are we well placed to continue to learn from the best practices and policies applied in European, North American or Japanese fisheries?

CO-MANAGEMENT

- In Commonwealth Fisheries clarify the fishery co-management framework and goals, and seek stakeholder buy-in to: share responsibility for management; raise fisheries management and environmental standards; differentiate fishery on basis of risk; and reduce regulatory costs as industry takes on more of performance reporting burden. Resource sharing among multiple users

will need to be integrated into both the co-management and resource access frameworks.

- In NSW, the review found most of the necessary pre-conditions for the development of delegated decisions under co-management arrangements in fisheries between the Department and the commercial industry do not exist, other than in one or two fisheries. There is a need to restructure both internal and external relationships within and between the Department and industry to improve trust, transparency and relationships. When this has been achieved, and the economic circumstances of the fisheries have improved, co-management options are likely to become available in the future.

FUTURE AQUACULTURE

- Borthwick recommended all current and future aquaculture be administered by state and territory governments (subject to EPBC Act oversight) to avoid confusion and excessive costs to industry and the tax payer. This is the current arrangement.
- But industry advice and public documents indicate that greenfield farm applications and extensions are difficult to secure through existing channels. Good progress is clearly possible and achievable where jurisdictions establish a dedicated legislative framework for aquaculture (i.e. a Marine Farming Planning Act 1995 in TAS, and an Aquaculture Act 2001 in SA), and/or at a minimum, a number of preapproved and derisked aquaculture development zones, as is the case in TAS, SA and more recently in WA (Mid West Aquaculture Zones declared in Kimberley Zone in 2014⁶ and NSW in 2013 (NSW DEPT OF PRIMARY INDUSTRIES, 2014) (Marine Aquaculture Research Lease, Providence Bay, Port Stephens).
- In February 2014 the QLD Competition Authority, called for submissions seeking responses regarding the regulation and expansion of aquaculture. In the preamble the Authority stated that *"There have been no major aquaculture developments in Queensland for over 10 years, at a time when the aquaculture sector is showing significant growth in Australia and elsewhere. This*

⁶ Other jurisdictions have established reserves or areas for aquaculture development including VIC (Eastern Port Phillip Bay Aquaculture Fisheries Reserves Management Plan 2005), and QLD.

review aims to identify impediments to the development of aquaculture, and to recommend an improved regulatory framework which will promote economic development while observing appropriate environmental standards. The issues identified included:

- *Commercial appetite and development potential,*
- *Appropriate environmental standards,*
- *Principles to apply to a regulatory structure,*
- *Value of an Act to streamline the regulation,*
- *Value of a single regulatory/administrative unit,*
- *Application of the precautionary principle,*
- *Concept of overlays, similar to the zones,*
- *Redistribution of regulation - QLD and C'wealth,*
- *GBR environmental offsets for greater certainty,*
- *Potential for cage aquaculture,*
- *Suitable sites - freshwater and terrestrial,*
- *The benefits of a marketing levy for aquaculture,*
- *Financial safeguards for new developments."*
- In a formal response the Seafarm Group (Seafarms Group, 2014 March) stated:

By creating a single - point regulatory body to deal with aquaculture development applications and creating an aquaculture zoning system, is a step in the right direction.

COMPLIANCE

For Commonwealth Fisheries, strengthen civil and criminal penalties for violators of fisheries regulations.

OFFSHORE CONSTITUTIONAL SETTLEMENT

- There are 59 active OCS arrangements (ABARES, 2013 Aug) that are cumbersome to amend and many involve inconsistent management arrangements for the same stocks.
- For Commonwealth Fisheries, Borthwick recommends a review of the OCS via Productivity Commission, to streamline Commonwealth – State arrangements and improve management and environmental outcomes.
- The ABARES Round Table paper noted that Commonwealth fisheries that are quota managed frequently face uncertainty about allowable catch levels as a shared stock will be effort managed within state waters. Similarly, changing bycatch levels in Commonwealth fisheries for non-target species can cause concern for fish species that are

largely managed under state regulation. Optimum utilisation and long-term sustainability of a fishery can only be achieved through integrated management that requires cooperation between all responsible agents (state, territory and Commonwealth jurisdictions) of the fishing mortality. Streamlined arrangements would allow scarce fishery research resources to be combined to undertake shared stock assessments and also streamline data reporting (for example on catch, by-catch, and protected species interactions) and share information. However any change to the current approach requires all fisheries ministers' agreement and COAG sign on.

In summing up ABARES concluded that the seafood industry is geographically dispersed and makes a small but significant contribution to Australia's economy. Any drive to reduce regulatory complexity and consequent burden for industry is likely to run up against changing community expectations about the management of marine environments and the protection of various iconic species. Given the wide range of challenges facing the seafood / fishing sector, there is a clear need for a rank ordering of issues and a coordinated response from all stakeholders.

g. Business Models and Trends

The national fishing license Blueprint Project underway at FRDC, confirms that most commercial entities in the F&A Industry are private SME companies or partnerships, which include the license holding individuals.

As there is currently very limited license data available in the Recreational and Customary Sectors, it is assumed that the bulk of recreational entities (bait and tackle industry, charter services, etc.) and customary entities (Aboriginal Corporations and community service entities) are also SMEs or unincorporated.

But the bulk of commercial harvest value or tonnage is occurring across a range of structural entities. As discussed above the 500 largest commercial stakeholders (aggregated by affiliated entities and family units) land around 70% of the GVP, a large chunk of wild catch GVP, and almost all of aquaculture GVP. These entities are dominated by private company structures (with a lesser number of partnerships), and include family trusts,

superannuation entities, cooperatives and a range of joint venture interests.

The last five years (since the last Sector Overview) has seen new more sophisticated business models appearing in the industry – a welcome sign of investor motivation, experience and positioning in the search for capital, innovation and new markets. But the pace of change could be quicker and more broad-based, for everybody's benefit.

The analysis of commercial fisheries (based on Figure 46) indicated that Australian seafood and Pearl oyster supply chains and their business organisations are maturing. This transition is largely in response to engagement with opportunity and challenge in global markets, resulting in specialisation of Australian entities and business models to:

- Establish and manage supply chain relationships, especially with large discerning global supermarkets and related regulators,
- Defend against specific market competitors,
- Attract capital more efficiently from motivated private investors, and establish a governance framework appropriate to their needs,
- Create and manage investments and related intellectual property in the propriety supply (compared to commodity approaches) and marketing of products to targeted consumer profiles.

The fishery product formats may or may not change – that will respond to the customer needs – but the entity's needs and business models must change to better capture and leverage the competitive advantage into a more compelling value proposition. This growth aspiration involves transition (and often risk and pain for owners) – relevant examples include:

- Liquidator's Restructure: The collectively insolvency of 7 Atlantic Salmon aquaculture businesses in Tasmania a decade ago, restructured by a corporate liquidator, that now trade very profitably as a listed company, Tassal Ltd our largest Australian operator in our largest fishery by value,
- Response to Fishery Management and Market: The forced restructure in 2012 of the Western Rock lobster fishery due to reduced puerulus settlement and the reshaping of the export supply chain for the largest entity (Geraldton Fishermen's'

Cooperative Ltd), to now be almost totally dedicated fresh live/chilled product, on a just-in-time basis.

- The current evolution to listed company status of existing and new aquaculture ventures, including :
 - Staged Growth by staged development of acreage and harvest capacity of farmed Barramundi by Marine Produce Aust. Ltd,
 - New Growth by both acquisition of two large QLD Prawn farms in 2014, and proposed new *greenfield farm development* (Operation Sea Dragon) that will double the size of the farmed prawn sector within a decade (Commodities Group Ltd (ASX Announcement 419, 2014)), and
 - Add-on Growth to an existing large agrifood portfolio, by acquisition of Australia's largest farmed abalone operator (Jade Tiger) in Victoria by listed agribusiness form Craig Mostyn Group with a proposal to double capacity in 5 years.
- Vertical Integration: And business model maturity does not just happen in well-established and large sectors. In 2014 the leading license holders in the Pipi industry (GVP \$4 million) in the SA Lakes and Coorong Fishery chose to grow by vertical integration along their existing supply chain and establish a joint share entity to fund and manage a joint processing plant in Goolwa, SA. The strategy is to add value to a traditional TACC, reduce bait product output, and reposition volume to higher value human foods, including vacuum packaged foodservice niches in Sydney, and Melbourne.

The following analysis has been careful to protect the confidentiality of the data being assembled in the current Blueprint Project with help from all relevant agencies:

- For listed entities the summary data is publicly available, including on the ASX website,
- For cooperatives the analysis has accessed the national cooperatives data base at Cooperatives Australia, and the 4th national published listing of the Top 100 cooperatives (Cooperatives Australia, 2012 August). Australia's Top 100 Cooperatives have a combined turnover (2012) of \$17.8 billion. The agriculture and food sectors (with 21 entities in sugar, meat,

dairy, horticulture and seafood) dominate the list with a turnover of \$7.4 billion, followed by Consumer Coops (\$3.7 billion), financial services (\$3.2 billion), and Insurance services (\$2.0 billion). Four commercial wild fisheries cooperatives made the Top 100 list (1 in WA and 3 in NSW).

- For other SMES (including private entities, trusts and partnership structures) the identity of specific businesses has been kept confidential.

Figure 54 draws together information to illustrate the industry's business model development to 2014. Actual reported and publicly available data is used wherever possible, with best estimates elsewhere. The range presents entities for the 44 leading Australian F&A businesses by estimated 2012-13 turnover. It combines publicly available data from *Top 500 Private Companies* (The Australian Business Review, 2014), data from IBISWorld (IBISWorld, 2014 Sept), data from the Coops Register, data from the FRDC Blueprint Project, and personal advice to Ridge Partners.

One shortcoming of the dataset is that many large entities also operate subsidiaries in other food and fibre industries. For example Craig Mostyn Group is a major agrifood group of private companies supplying and processing pork in WA as well as owner/operator of fishing licenses (rock lobster), aquaculture farms (abalone), seafood processing and branded consumer marketing businesses (Dover in TAS) across southern states. Around 1/3 of the Group's revenue is from F&A, as shown here.

Where commercial affiliations are known between entities, they have been grouped into a single entity. The revenue of downstream seafood processing activities for most entities is not possible to estimate accurately, so the data shown for most Pty Ltd entities is based on landed beach/pond side value. The figures presented are therefore indicative only. Pearl companies are shown separately.

For each of these leading entities, the label details the revenue ranking, name of entity if publicly available, type of business entity, and the relevant F&A activities undertaken. Marketing is defined as branded consumer marketing, not just distribution or export. Colours have been used to highlight different types of business entities/models.

h. Aquaculture Volume Forecasts to 2020

What might Australian Aquaculture supply look like in 5-10 years' time?

Using data in Figures 32 (Australian competitive advantage), Figure 46 (current commercial catch and trade), and Figure 47 (Headline trends in commercial supply), Figure 55 estimates a likely scenario for aquaculture volume and nominal GVP in 2020.

The forecast assumes no real growth in landed prices through to 2020. Around 53% of the forecast tonnage growth is forecast to come from farmed Salmon.

FIGURE 54. TOP ENTITIES BY TURNOVER IN COMMERCIAL INDUSTRY (\$MIL.)

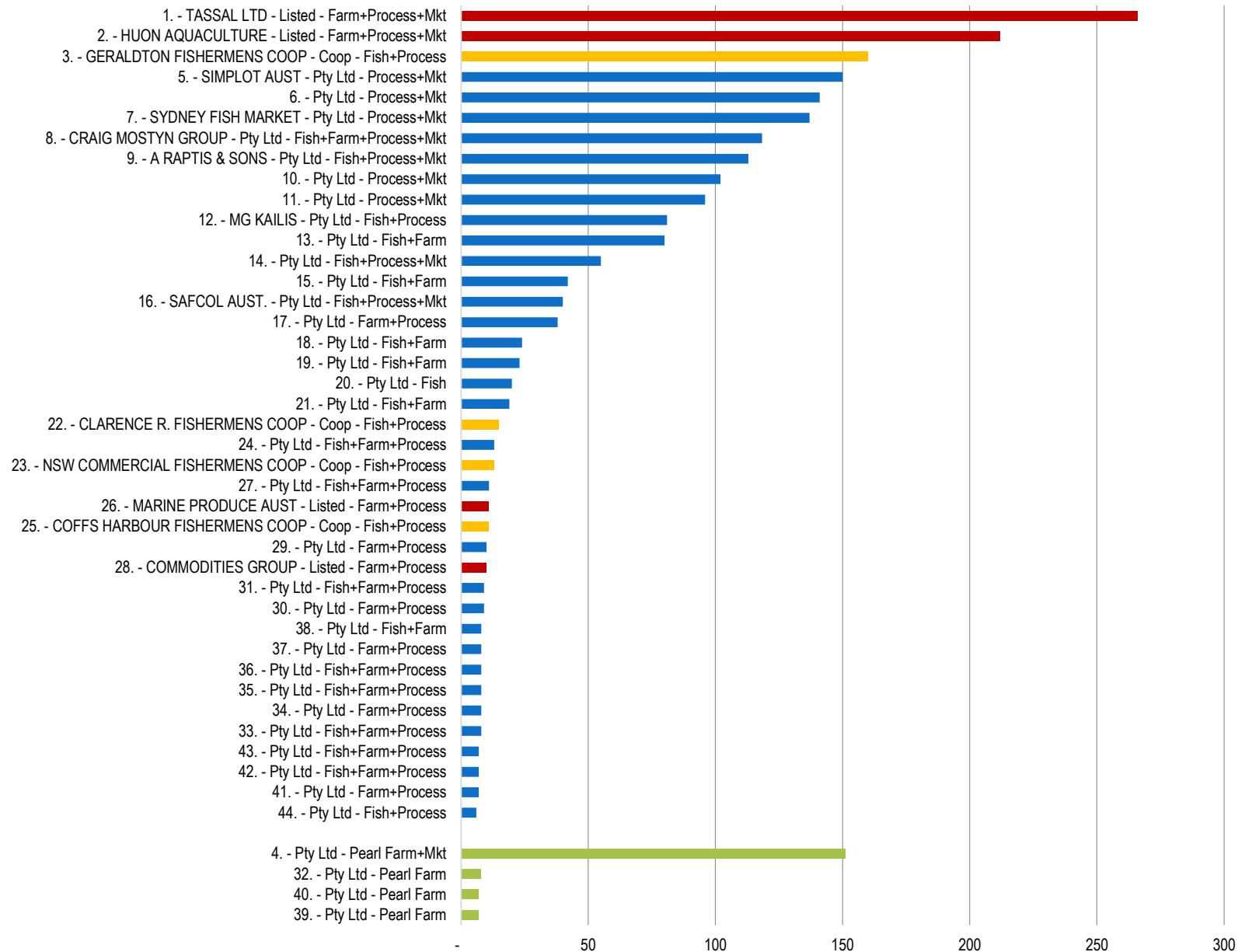


FIGURE 55. FORECAST AUSTRALIAN AQUACULTURE SUPPLY 2020

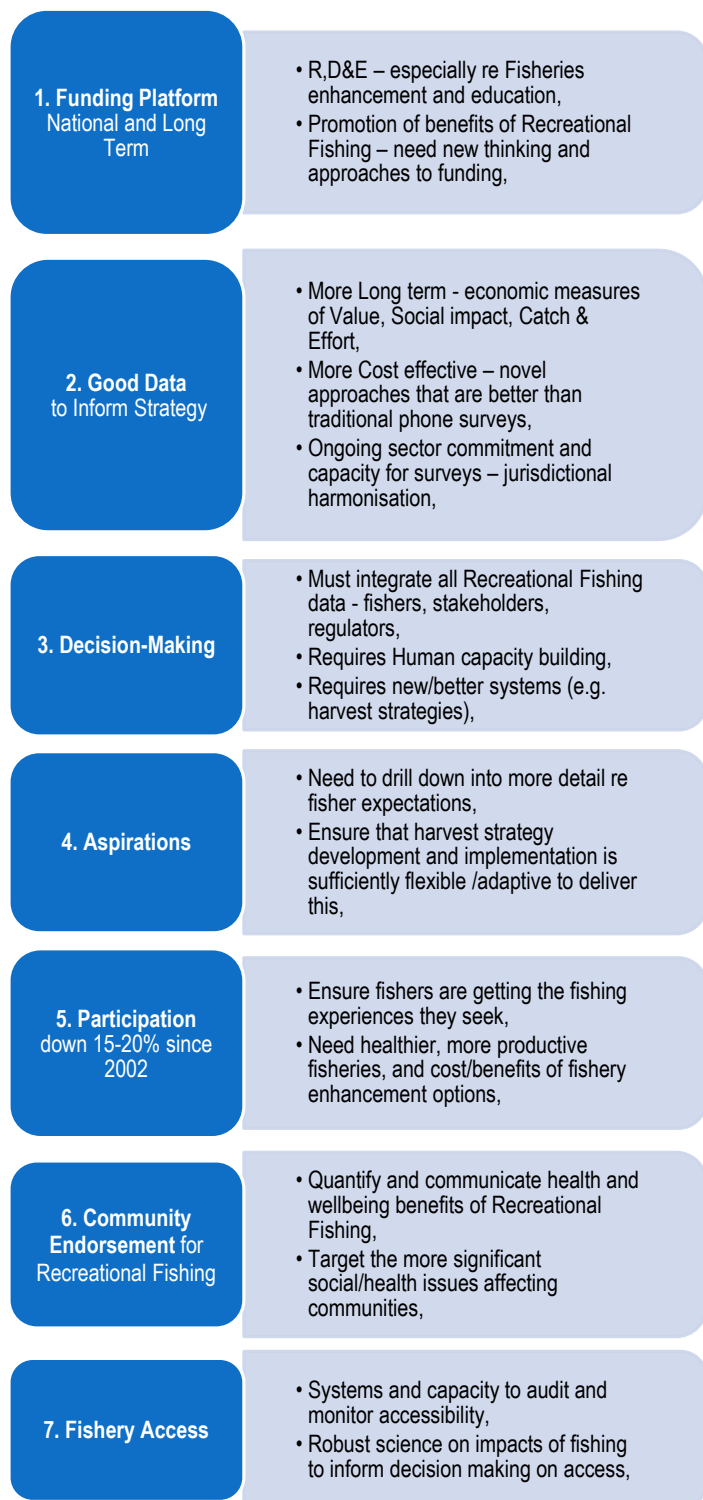
Aquaculture species	2012 Tonnes	2012 GVP'000	Growth Assumption	Forecast Tonnes 2020	Forecast Nominal GVP \$'000 2020	% Change in GVP 2012-2020
1. Salmon	44,000	513,000	5% growth / year - take up of new waters approved in TAS	65,008	757,935	48%
2. Rock lobster	0	0	No aquaculture development in Australia within 5 years	0	0	
3. Prawn	3,941	59,000	Add 1 large new farm @5,000t - per current proposals	8,603	128,790	118%
4. Tuna	7,100	150,000	3% growth / year - modest growth	8,994	190,016	27%
5. Abalone	762	23,000	13% growth / year - strong growth on back of wild sector promotions in China	2,061	61,830	169%
6. Edible Oyster	15,750	107,000	3% growth / year - modest growth	19,952	135,544	27%
7. Pearl Oyster	n/a	102,000	3% growth / year - Asian aqua competitors	0	129,211	27%
8. Barramundi	4,500	41,060	6% growth / year - lot of Asian competition	7,172	65,443	59%
9. Crab	0	0	No development. Strong competition in Asia (China, Vietnam)	0	0	
10. Snapper	0	0	No capacity to close breeding cycle	0	0	
11. Mussel	3,400	9,288	5% growth / year - consolidation of key producers and market development program	5,023	13,723	48%
12. Carp	0	0	No aquaculture development in Australia	0	0	
13. Tilapia	0	0	Nil/limited aquaculture development in Australia	0	0	
14. Silver Perch	350	4,300	3% growth / year - modest growth	443	5,447	27%
15. Sundry other species	4,600	55,000	3% growth / year - modest growth	5,827	69,672	27%
16. Scallop and molluscs	0	0	No aquaculture development in Australia	0	0	
17. Grouper	0	0	No aquaculture development in Australia	300	2,000	Indeterminate
18. Cobia	0	0	3% growth / year - modest growth	4,000	32,000	Indeterminate
19. Yellowtail Kingfish	0	0	Production from three states is emerging - SA, WA, NSW	3,000	36,000	Indeterminate
20. Aquatic plants	0	0	3% growth / year - modest growth	2,000	6,000	Indeterminate
21. Algae	0	0	3% growth / year - modest growth	5,000	15,000	indeterminate
Fish species	84,403	961,648		123,548	1,498,400	Indeterminate
Pearls, aquatic plants, algae	n/a	102,000		n/a	150,211	Indeterminate
Estimated Total	84,403	\$1,063,648		123,548	\$1,648,610	indeterminate

4. RECREATIONAL SECTOR

a. Primary Issues and Challenges

The sector has identified 7 primary issues and challenges to be addressed in the coming decade.

FIGURE 56. RECREATIONAL FISHERY ISSUES AND CHALLENGES



But there are some big challenges to overcome. This section summarises the aspirations (including some opinions in the absence of good base data) and issues for the Recreational Fishing Sector for the next decade or so. The scope of literature is relatively thin and very broad, with sources including private and reported industry advice, and specific agency and FRDC sources. (Tiliri Consulting, 2013), (Australian Society of Fish Biology, 2009), (CSIRO, 2014) and (FRDC, 2013).

Poor Data

Poor data is an ongoing challenge for the sector. Unfortunately this large fishery sector which makes a significant economic contribution (as large as the golf industry) to the Australian economy still suffers greatly from a lack of credible and comprehensive data.

The current discussions between national sector leaders and federal and state/NT agencies regarding a second national recreational fishing survey is long overdue and encouraging. However the earliest date that this initiative could publish any new data is 2016.

Sector Economic Valuation

A recent report to the FRDC by the Recreational Fishing Economic Valuation Committee (FRDC 2012-214 Recreational Fishing Economic Valuation Committee, 2014 Mar) finds that, in 2013, the sector caught an estimated 48,000 tonnes including catch and release, with a value of \$333 million, based on proxy seafood market prices for species. The report also estimated the sector's economic contribution was \$2.56 billion, including:

- An estimated \$850 million spent on related accommodation, camping, travel and related services,
- An estimated \$1.55 billion spent on boating, trailers, tackle, and diving equipment and related services,
- An estimated \$160 million spent on other recreational fish trip expenditure.

The methodology used and recommended was based on the methodology used in the so called Campbell Report (FRDC 99/158 - NRFS Economic Report, 2005) that used data from the NRIFS to value the sector. This methodology was accepted by federal agencies.

The Committee has recommended this same credible, national and internationally recognised valuation methodology be adopted as the FRDC's basis for valuing

the sector, across all jurisdictions, and as a basis for attracting RD&E investment to the sector.

b. Greater Recognition of Recreational fishing

Recent elections demonstrate that recreational fishing has become an influencer of politics and policy development. But how this translates into policy change for commonwealth and state/NT agencies is uncertain. The Borthwick Review noted the increasing need for definition and realignment of sectoral rights, including aquaculture in Commonwealth waters and the Offshore Constitutional Settlement. Currently, the Commonwealth cedes responsibility for the management and administration of recreational fisheries outside of 3 nm to states/NT. While the Commonwealth technically retains responsibility for the management of tuna and tuna-like species for recreational fisheries, this has never been explicitly applied. Many of the commercial fisheries are managed by joint authority.

Possible Scenarios to 2020: Change and clarification is needed to enable certainty for all users and investors. Change in a number of areas will be significant:

- Comprehensive social and economic valuation of the recreational fishing activities,
- The Sector takes united and national steps to engage communities and confirm an ongoing social licence to operate,
- FRDC is able to match recreational contributions for research purposes against an agreed formula which incorporates a compulsory levy (e.g. based on licenses or tackle) at say 1.5%. State contributions are in addition to this. This may also incorporate the conservation sector via contributions to all aquatic activity for non-consumptive ecotourism purposes.
- The national health, education and tourism industries recognize the benefit of recreational fishing and respectively promote the wellness benefits of fishing, make fisheries part of its primary school curriculum and promote Australia's recreational fishing industries as part of eco-friendly activities such as whale watching.
- Increased population together with a return by families to outdoor activities will slow (halt?) the decline in recreational participation. While participation among teenagers has been falling (as noted in the 2010 QLD survey) for a decade, there

will be a demographic shift, especially among females - gender is a strong predictor of fishing participation. A German study (Arlinghaus R. .2006) noted that *"major factors affecting recreational angling participation appear to include demographic and social changes such as urbanisation, an aging population, changes in income and educational levels, and the changing role of women in society. Fisheries managers should recognise how demographic change can impact the angling population and the environment in which management occurs."*

c. Technological Improvements

Fisheries Management Paper No. 252 (WA Fisheries, 2012), states *"Over the past 15 years, dramatic improvements in fishing technology have had a significant impact on the way people fish - particularly from boats. The digital technology explosion has meant that small, inexpensive, high quality fish-finding and navigation equipment is now readily available and widely used..... The availability of affordable GPS and colour sounders is helping more recreational fishers to catch more fish, more often - even those that previously had a low level of success due to their inexperience."*

Griffiths and Pepperell (Griffiths & Pepperell, 2006 Dec) noted that private recreational fishers are increasingly inclined to access Commonwealth waters as technology improves (in boats, outboard engine technologies, navigation equipment and GPS, and fishing gear) and becomes more affordable to mass market consumers. Target species of high interest in Commonwealth waters include Coral trout, Emperors, Rock cod/Groupers, Sea perch, Wrasse, Mackerels, WA Dhufish, Tuna, Snapper, Morwong, Mulloway, Trevally and Whiting.

There have been tremendous advances in survival of released fish, using improved technology (Sawynok, Pepperell, Winstanley, & (eds), 2008) and this has been enhanced by increasing community stewardship of the resource which results from these community engagement processes.

There has been a reluctance to embrace new and emerging technology across government. Some of this is due to conservatism towards changes and some of it is due to the rapidly evolving nature of these technologies.

A large majority of stakeholders view technology as an opportunity, not a threat.

Possible Scenarios: New technologies will be driven by the anglers themselves, and will be seen as an essential way to protect their activity based on evidence, and will add to the enjoyment of fishing. Increasing data based on a national coordinated approach developed by CSIRO (FRDC 2011-036) (A coordinated national data collection for recreational fishing in Australia, 2014) will also assist in providing a pathway for casual anglers to become more active. An investment in smart technology which enables a recreational or commercial fisher using a smartphone app to photograph, measure and/or weigh individual fish as they are caught and have that information sent to a database to allow for real time monitoring of catches is inevitable and should be actively pursued.

New technology will demonstrate many of the weaknesses of traditional creel surveys or stock assessments, although some biases will remain. With real time data and information on the correlation between catch and satisfaction, managing to concepts like MSY will be largely redundant. Management can be focused on the quality experiential outcomes, with information transferred through a smart chip license as people are planning to go, or actually, fishing.

The risk for the sector is that there are no changes to the current system, where “biological research confirms management mistakes and the responsibility is laid at the feet of fishing industries, irrespective of their views, objectives or drivers for management objective.”

d. Maximum Experiential Yield

There has been a significant and progressive movement of fish species from food fish to sports fish from the 1980's across Australia. Species such as Australian bass, Flathead, Murray cod, Barramundi, Snapper and Bream have all transitioned to recreational use. This has resulted in much greater release rates, with the largest fish being viewed as the most important to release carefully.

Recreational fishers place a disproportionately large 'value' on catching a large specimen. It is important to recreational fishers for there to be some (and increasing over time) expectation that they will/could catch a large specimen in their target species.

As noted by McManus et al (McManus, Hunt, Story, & White, 2011) regarding good stewardship – “*Analysis of catch and release data provides insight into the importance*

recreational fishers place on managing the future of fishery resources.”

Possible Scenarios: Angling quality becomes the key driver for recreational fisheries management. The objective for casual and other recreational fishers is to have an expectation that they will catch or encounter a fish, but that they can aspire to catch a really large specimen.

Research will concentrate on recruitment drivers and assessment, measuring changes in community measures of quality and satisfaction and analysing data derived from new technologies that are largely angler driven. This will see a major shift in research.

e. Changing Behaviours and the Impact on Fish Stocks

There is little doubt that angler attitudes have changed enormously in the last 20 years, for example the use of bag limits, and catch and release policies. The principles were to 'push' anglers to accept reasonable controls rather than having to impose much tighter management.

The change to a 'pull' management strategy will continue and will provide challenges to traditional reactive research and management paradigms.

However, the adoption of these strategies by sector stakeholders has not been universal and there are some groups who see the trend as advocating the erosion of their fishing rights. The extent to which this conflict is played out in the public arena, and the effect which it might have on new entrants to recreational fishing will be crucial to the future of fishing as an activity.

Possible Scenarios: The next 10 years are defined by increasing conflict between traditional, stock based reactive research, and more proactive and 'quality of experience' driven research. State government run research will be increasingly outsourced as is already happening in VIC, QLD.

There will be much greater involvement of recreational fishers in research, with tagging programs, monitoring of habitat and stock enhancement projects, and released fish survival projects becoming mainstream. By 2031 technology will allow real time catch reporting and the exchange of information at boat ramps etc., greatly enhances the important social aspects of fishing.

The FRDC recognises the economic contribution of recreational fishing and is able to leverage license money from those states which have them.

f. Resource Sharing

There are probably few issues which will be so challenging in the next 20 years. Traditional management and allocation models across, except for fresh water, have favoured commercial fishing interests.

In many cases, an increasing recreational fishing community, especially in inshore and near urban waters has impacted upon commercial fishing activities. The increased interaction with recreational fishers has led to a number of political decisions in favour of recreational fishers throughout Australia.

Most resource sharing debates concentrate on inter-sectoral resource sharing issues which are topical and easier to discuss due to the "us and them" aspects of the debate. During the coming 20 years, the intra-sectoral resource sharing debates will be at least as important, at least as controversial and more difficult to resolve.

Possible Scenarios: With increase rights comes increased responsibility and the recreational sector needs greater capacity to manage its impacts, for example on the number of 'refuges' from fishing exploitation. Technology creep will increase the need for fisher /stakeholder /manager diligence. It also means that adaptive management, such as closing fisheries when TACs /target catches are met, becomes a reality.

Over time, the recreational sector will increasingly realise that it is competing amongst itself for a share of the catch by areas and by species. This realisation will place enormous pressure on the avid and skilled angler to take a 'fair' share without eroding the expectation of the casual or poorly skilled angler that it is worthwhile having a go.

This debate manifests itself most obviously with the charter boat sector. 'Bad' anglers can purchase the skill and experience of the charter boat skipper and greatly enhance their catch expectation. This leads to personal conflict and the perception that the charter sector is making a 'profit' from the recreational resource. These debates have started to surface with charter-charter conflict in some fisheries at fish aggregations and will become a major management issue.

By 2030 the recreational sector will dominate resource shares for inshore stocks, including for that component of high value fisheries, such as rock lobster.

The transition will take time and be painful. The overall benefit to the community of having inshore access to fish stocks for the recreational sector is widely recognised through political channels. Export based commercial fisheries are in a far stronger position to negotiate resource sharing outcomes.

g. Property Rights

Property rights are likely to remain a difficult and complicated issue during most of this period. The capability of the recreational sector to administer property rights will take complex resolution, in spite of the belief of some recreational fishers that it is easily resolved.

The matter will have to adjust to the likely resolution and definition of Native Title rights during this period, with Mud carbs, Marron and Barramundi of most direct relevance for recreational fishers. The extent to which Native Title confers ownership and management rights for the resource will be debated and ultimately resolved by the courts; with recreational fishers needing to be able to negotiate for access and catch share irrespective of the final outcome.

There is also considerable confusion as to what property rights might look like or be applied for recreational fisheries. Having a mechanism to hold a diffuse right and administer that right for the greater good of the sector will be challenging. Translating those rights into potential commercial transactions, will also need careful legislative and administrative controls.

Some commentators think that the definition of recreational property rights will allow for direct compensation for the imposition of externally applied fishing controls such as with the Commonwealth marine parks. At best, this is a second or third generation application of recreational property rights, and of lesser concern today.

Possible Scenarios: The recreational sector spends most of the next 10 years debating what they want property rights to do. Unfortunately too many advocates want to re-fight the marine parks debate from a property rights perspective.

In the general community, most recreational fishers and politicians do not understand what property rights are, what they confer, how they are to be administered. The media typically add more heat than light to the issue. Leadership and goodwill is required from all parties, including from recreational fishers.

The potential exists for all new fisheries across the country acts to more clearly define the rights for all sectors.

h. Relationship with Other Sectors

As access risks rise, and the social licence to operate looms closer, there are bound to be considerable and increasing tensions between commercial and recreational fishing sectors.

It will be important for national Commercial and Recreational peak bodies to jointly call for a risk based approach to marine conservation management. The scientific basis and cost of management for marine park establishment is adjudicated on by the Chief Scientists in each state and the Commonwealth.

i. Meeting the Costs of Management

With increasing recognition, so too will come increasing responsibility, including for meeting the costs of management. This will provide some substantial challenges during the coming 20 year period.

There are two important considerations which will need to be resolved during this period. One is that while recreational fishing is subsidised, eco-tourism, non-consumptive diving and conservation is socialised and all costs met as part of a public good function. Given that the conservation NGO's have tax deductibility status, it could be argued that they are not only the beneficiaries of management on their behalf, they receive secondary enhanced benefits as well.

There will be a considerable debate on this public good funding component of fishing and aquatic resource management, with, among other things, the FRDC public good funding component coming under close scrutiny. Ultimately, the conservation groups will likely lose their tax deductibility status due to overt political activities not consistent with their charters.

A secondary and important consideration of this debate revolves around property rights. If recreational fisheries management continues to be subsidised for the 'public' or

community good, and some funds are either nominally or directly used to fund resource re-allocation transactions, why should the entire 'benefit' accrue to the recreational sector. Even if only dedicated recreational license income is used, the argument will remain and need careful practical and political consideration.

It is for this reason, that both the recreational and conservation sectors, if entering the resource entitlement market, will need to ensure that there is a conservative cushion (in the case of the recreational sector) or future development (in the case of the conservation sector to ensure they just don't close down the fishery because they have the funds) built into the transactional protocols.

A general angling license is inevitable. Non-consumptive diving should be subject to a license fee as there are considerable management costs, and any proponent for new sanctuary zones will be required to clearly identify or provide funding for education and compliance activities.

The entire recreational license system is archaic and should have been dramatically overhauled in the 1990's. A system which encourages anglers to keep their licenses current must be introduced, to reduce income variability and improve program planning.

Possible Scenarios: Both of the major political parties support a general angling and scuba diving license, with all funds to be administered through a national administrator. Clear rules for recreational purchases as a result of being granted formal property rights are understood. The need for an additional sustainability 'cushion' as part of these transactions further reinforces the need for a model administered by a person with judicial experience.

A general angling license is introduced before 2017, and FRDC signs a heads of agreement to allow for matching research funding, including of socio-economic. Researchers will and must become more active in recreational fishery research and fishery management once they reach this point. But for an interim period, the degree of community subsidy for recreational fishing will become increasingly political.

The recreational involvement in the re-allocation market is tried with varying degrees of success. The conservation movement pays through eco-tourism levies and scuba licenses to meet some of the management costs, but they

are not yet able to buy or trade entitlements, pending further legislative reviews.

j. Impediments to Sustainable Recreational Fishing

While there might be a number of impediments to sustainable recreational fisheries management in 2030, population increases and improving technology are not the most critical ones.

The most important requirements for sustainable recreational fishing are to continue to build upon the slow but important cultural shift that have occurred in the last decade.

1: Changing angler attitudes

Anglers themselves have increasingly accepted and understood the need for changes to ensure that recreational fishing can continue with a reasonable catch expectation in the face of increasing population and improving technology.

2: Changing agency/regulator/manager culture

As a valued contributor, economically and socially, to the national and regional Australia, the renewed approach by managers to recreational activity will create considerable benefits for communities.

3: Changing community attitudes to sustainability

The social licence to operate is a major issue for all extractive wild fisheries. The next 10 to 20 years will determine if recreational fishing is to remain as an essential activity in the Australian lifestyle, or whether it will be viewed as unsustainable, cruel and unnecessary. The recreational fishing community must increasingly recognise that they are being judged on the basis of the behaviour of the lowest common denominator and must become personally empowered to raise the overall standard on every occasion.

Fish handling must be continually assessed to keep animal welfare activists from closing down all fishing, stopping important research into tagging or barotrauma, and deeming recreational fishing to cultural irrelevance.

4: Increasing conflict with other sectors

The shift in conservation groups to an increasingly fundamentalist perspective must be managed. It is essential for recreational leaders and commercial fishers to ensure Commonwealth Government is aware of the costs and benefits of marine conservation management. Moving to a risk (even a low risk) management framework will put fisheries in a position where they can clearly demonstrate

their responsible and conservative approach to management has wide and appropriate application.

The commercial fishing industry needs to work closely with the recreational fishing sector to ensure that a small but profitable inshore commercial fishery is well and transparently managed or political decisions will align with the recreational fishing sector. In the worst case scenarios, the Recreational sector access is similarly terminated by fundamental conservation politics. It is therefore clearly in the interests of both groups to be strategic and to plan for future management.

5. INDIGENOUS FISHERIES

a. Scope and Size

Indigenous fishing practices can contribute significantly to Indigenous health and social cohesion. The 2001 NRIFS survey (the latest available) of recreational and Indigenous fishing (NRIFS, 2003) recorded that 65% of Indigenous customary fishing effort occurs in the NT: 37,300 Indigenous people (nearly 92% of the population surveyed) aged five years or older, had fished at least once during the survey year. During the survey period, Indigenous fishers made an estimated 671,000 fishing trips, with most fishing effort (70%) focused within inshore or coastal areas.

Reflecting the distribution of target species, more than half the Indigenous fishers' customary catch was taken in inshore waters and line effort accounted for more than half of total fishing effort. Hand collection was next in importance, though spears and nets were also used significantly.

The NRIFS estimated that 186,200 Indigenous people (excluding those living in the Torres Strait) participated in non-commercial fishing during the survey year. The survey estimated an average of 11.2 days fishing per person per year with over 65% of that effort occurring in the NT.

Up to date data is not available (this is a major problem), but Figure 57 illustrates the location of Indigenous ranger groups across Australia including for sea rangers supported by various state and territory jurisdictions and Indigenous councils.

FIGURE 57. WORKING ON COUNTRY RANGER PROGRAMS

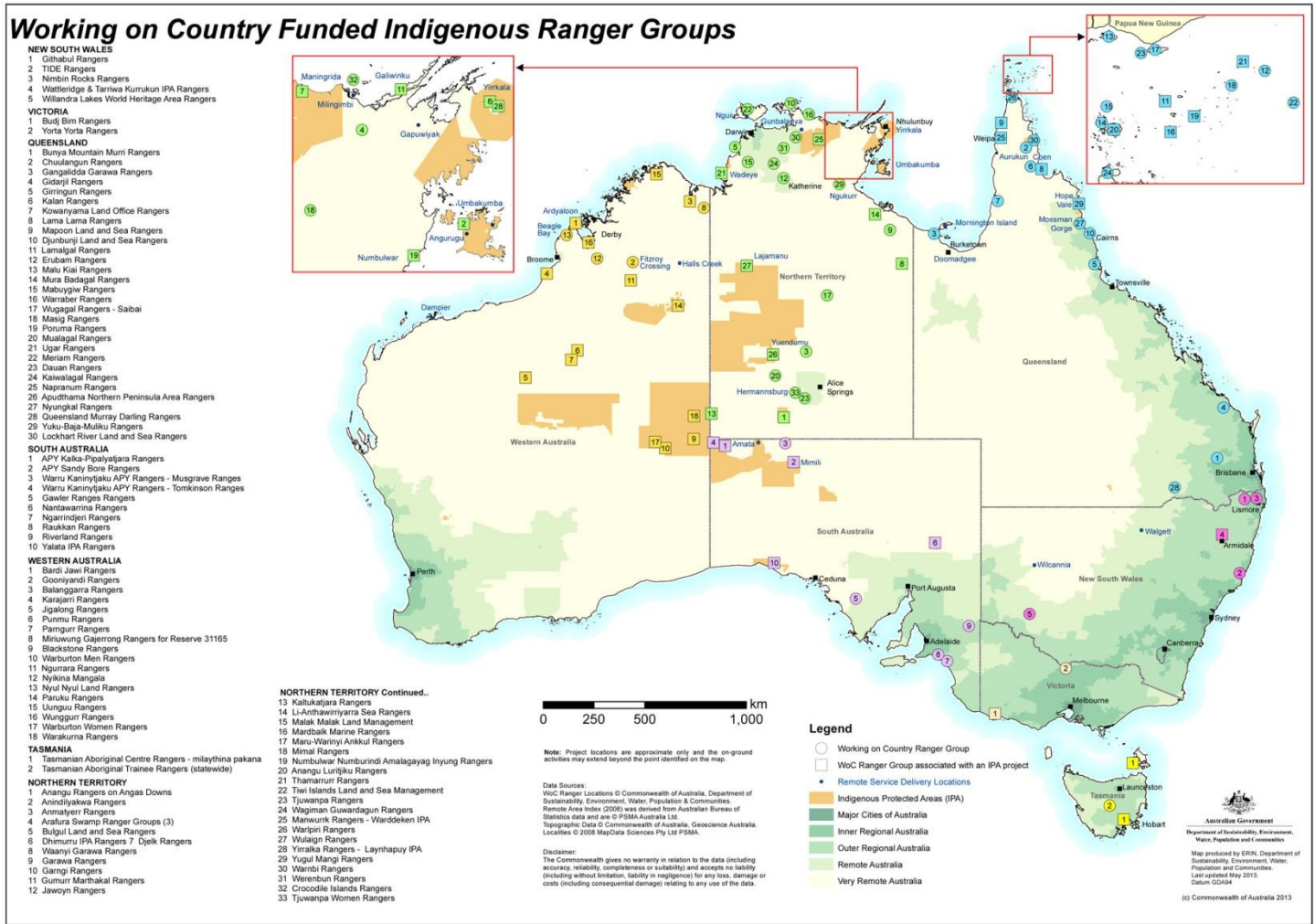


FIGURE 58. AQUACULTURE FARMS WITH SIGNIFICANT INDIGENOUS INVOLVEMENT

	2009 Approved licenses	2009 Licenses pending approval	2009 Farms applying for license	2009 EOI in an farm	2014 Status Review from Desk Research
NSW	12	0	0	3	<ul style="list-style-type: none"> NSW established Aboriginal Fishing Advisory Council Project 2009-038 reported by Schnierer \$1.6 m allocated by NSW Gov't to support Indigenous fisheries but limited evidence of ongoing projects
VIC	2	0	0	2	<ul style="list-style-type: none"> Whole of VIC Government workshop to review Indigenous seafood initiatives (FRDC 2009-326, 2010) Projects underway including East Gippsland Aboriginal Coop aquaculture venture
QLD	2	1	1	7	<ul style="list-style-type: none"> QAIF supported development and joint venture to support Indigenous aquaculture. No evidence of ongoing Indigenous aquaculture projects
SA	na	na	na	na	<ul style="list-style-type: none"> 2014 SARDI Science Bursary for Aboriginal Student awarded to aquaculture student
WA	24	2	3	3	<ul style="list-style-type: none"> Marine Produce Aust.'s Cone Bay Barramundi Indigenous joint venture aquaculture program Ngalang Boodja Aboriginal Council Corp.'s marron aquaculture venture near Manjimup
TAS	5	0	0	0	<ul style="list-style-type: none"> In 2013 IMAS (IMAS, 2013) published a summary of Tasmanian Aboriginal Values, which noted difficulties for Indigenous people to participate in aquaculture
NT	3	0	2	9	<ul style="list-style-type: none"> Projects underway that support Indigenous fishery communities, including Warrwi Community on Goulburn Is. Project also aims to enhance engagement of women in fishing and aquaculture.
Australia	48	3	6	24	Travel bursaries for the Indigenous Aquaculture Forum 2010 - FRDC project 2009-336

b. Ranger Program

Indigenous people provide an increasing service to their communities, the broader community and to the environment through a range of Land and Sea Ranger Programs.

In announcing funds for an additional 16 ranger positions in the Northern Territory, the Federal Minister for Indigenous Affairs (Minister Scullion, 2014) said *"Indigenous rangers play a vital role in managing Australia's land and sea country. Their work is instrumental in protecting and conserving Australia's environment and heritage assets, and brings with it strong social benefits through employment and economic opportunity for Indigenous people in remote communities. The Working on Country program is well on track to meet its target of 730 Indigenous ranger positions across Australia by 2015"*.

In 2002 the NT jurisdiction (where the bulk of Indigenous people live and maintain fishery communities) established through its Fisheries Division, an Indigenous Community Marine Ranger Program to support eight existing ranger groups engage coastal surveillance activities including monitoring of fishing (NT Dept of Resources - Fisheries Division, 2011).

In addition to progressive reporting of marine activity, the Fisheries Indigenous Development Unit (IDU), in liaison with other government agencies, coordinates the provision of capacity building and training on aspects of fisheries research, management and compliance. Fisheries related functions of the marine ranger groups include:

- Compilation of Indigenous knowledge related to resource management,
- Identification and protection of sacred sites and sites of significance,
- Coastal monitoring,
- Fish kill reporting,
- Bio-security,
- Fisheries surveillance,
- Natural Resource Management initiatives,
- Research activities, and
- Community education.

NT Fisheries supports marine ranger groups through contractual grants, 'fee for service' arrangements, training, and development of joint research projects.

The agency follows a clear model of engagement which includes:

1. Consultation with the relevant Land Council to discuss any new proposals,
2. Involvement wherever possible of marine rangers in any new fisheries research proposals,
3. Adherence to a Code of Conduct by NT Fisheries Staff working with marine rangers,
4. Adherence to a Code of Conduct by marine rangers undertaking work on behalf of Fisheries Division, and
5. Cross cultural training and experience for staff working with Indigenous Australians.

Similar marine/fishery ranger programs exist in QLD, and are being established elsewhere (FRDC Project 2012-215, 2013).

c. National Data and Definition

There is increased attention being paid to customary fishing across all Australian jurisdictions. However while individual jurisdiction initiatives are valued and welcome, there is little progress on the national aggregation and alignment of these data. Among other things, this limits effective investment in the sector. Slow progress is also evident in clarifying the core definitions and related rights of the sector, particularly in legal terms

Given that very little new data has been collected in over a decade the best reference for a summary of the customary sector is the FRDC's last Sector Overview (FRDC 2009/214, 2009). This data is not repeated here.

A core matter remains the definitional clarity of customary fishing across jurisdictions. This Sector Overview has described in its early pages the approach and definition it adopts for fishing by Indigenous People, as distinct from Customary Fishing activities.

ABARES most recent relevant advice in November 2014 (ABARES, 2014 Nov, p. 47) notes that *"Various definitions exist for customary, traditional or cultural fishing in Australia"*

...and also "In late 2013 in Akiba v Commonwealth of Australia, the High Court found that commercial native title fishing rights still exist in the Torres Strait and are not extinguished by Commonwealth and State fisheries legislation. It remains unclear how this judgement will affect and/or change license arrangements for Indigenous commercial fishing. As indicated by these definitions, the value attached to fishing activity and catches of individual species by Indigenous fishers extends beyond the values typically associated with commercial and recreational

fishing. For Indigenous people, fish is often viewed as an important food source, as well as a component of many cultural, ceremonial and social events.... reinforcing their social networks through the sharing of gathered food and maintaining their Traditional Fishing Knowledge (TFK) systems."

d. Aspirations of Indigenous Fishery Communities

The FRDC's Indigenous Reference Group (IRG) was established in 2010. This national RD&E advisory body draws leading Indigenous fishery representatives together to guide the corporation's investment and establish a permanent link between Indigenous fishery communities and the national RD&E planning and development framework.

The IRG faces some challenging tasks, to overcome historical momentum for lack of change⁷, with a small budget, a very diverse and disparate (culturally and geographic) Indigenous benefactor cohort, and the need to deal with multiple agencies and their related fishery management regulations and objectives.

The IRG therefore has taken a critical first step to define and describe its aspirations, objectives and priority tasks in a clear strategic road map (FRDC IRG, 2011), per Figure 60.

The strategy identifies five national aspirations for Indigenous fishing communities. Critically these aspirations integrate fishery and aquaculture activities by Indigenous people in all F&A sectors – customary, recreational, and commercial wild catch and aquaculture.

As the FRDC's FARDE – SGC seminar in May 2014, participants agreed, Indigenous fishing is *"not just about using a spear – it's about being a manager, compliance, subsistence, trading, commercial, teaching, law, religion and observation"*.

The Borthwick Report of Commonwealth Fishery Management (Borthwick, 2012) noted that "many Indigenous Australians believe their traditional fishing rights are largely

ignored or are not sufficiently explicitly recognised by all levels of government, in part due to the fact that Indigenous fisheries in Australia have remained under the radar of the broader public. The Review noted that several State/NT governments and authorities do in fact explicitly recognise – including through legislative provision – Indigenous fishing rights and opportunities. The Commonwealth Fisheries Acts, however, do not reference customary fishing beyond mention at Article 24, Schedule 2 (the Fish Stocks Agreement) of the Fisheries Management Act 1991 (FMA).

In 2013 the ABARES F&A Roundtable (ABARES, 2013 Aug) stated *"the objective of supporting sustainable, culturally appropriate, business and employment opportunities for Indigenous Australians in fisheries management, research, development, training, industry participation and resource protection is, for the most part, a responsibility for respective states and Territories. The Australian Government has been instrumental in facilitating Indigenous fishing in commercial fisheries in the Torres Strait Protected Zone (TSPZ)."*

By comparison the mining industry has had a much more comprehensive and successful engagement with Indigenous people both as employees and as new mining service enterprises. The need to quickly bring new mines into production on new sites and the ready availability of cash from recent high commodity prices has certainly prompted and helped this engagement.

e. Fishery and Aquaculture Initiatives

The 2009 Overview identified a number of Indigenous aquaculture projects underway across Australia (Figure 59). This figure summarises desk research in Nov. 2014 which suggests only limited uptake of the 2006 proposed ventures has been achieved.

This brief review of aboriginal aquaculture project participation and expert comments, indicates that Indigenous aquaculture uptake has been patchy at best and the development of more viable economic and

⁷ A report in 2007 (CAEPR, 2007) compared the development of indigenous fishery property rights in Australia, New Zealand and Canada. On page 23 the report stated "One of the major obstacles to Indigenous commercial fishing rights is the absence of a body to bring them forward. In its 1992–1993 Coastal Zone Inquiry, the Commonwealth identified the Aboriginal and Torres Strait Islander Commission and the Australian Seafood Industry Council, both of which have since been dissolved, as partners for collaboration with itself to develop Indigenous commercial fishing interests. In July 2000, the Aboriginal and Torres Strait Islander Commission released a report entitled *Towards Greater indigenous Participation in Australian Commercial Fisheries: Some Policy Issues*,

attempting to place commercial fishing on the policy agenda. That many of the same issues raised by the Aboriginal and Torres Strait Islander Commission are again considered in the 2006 Out of the Blue report indicates that not much has changed. This is not surprising given that the political organisation necessary to advance the economic interests of indigenous people does not exist, nor is it clear as to where it will come from. Even if the government decides to allocate quota and licenses to Indigenous people, the benefit will not be realised in the absence of capacity building and strong regional bodies to ensure maximum outcomes. Thus, a key component of an Aboriginal Fishing Strategy would involve a commitment for funding of skills and capacity building".

governance models will provide valuable insights. The community problems that aquaculture should address include Cultural maintenance, Seafood's contribution to diet, Enterprise development, Community employment, Aquaculture opportunities for profit, New knowledge for communities, Governance models that are self-driven and attract youth and women, and the Jurisdictional inconsistencies that continue in Indigenous F&A rights. As always, poor data limits real progress – it is hard to manage what you cannot measure.

More recently, a number of projects have been initiated by the IRG, including a number of governance case studies.

FIGURE 59. INDIGENOUS FISHERY CASE STUDY COMMUNITIES

Fishery /Community	New IRG Knowledge	IRG Priority Addressed
1. NT - Yagbani AC, Goulburn Is	<ul style="list-style-type: none"> Wild catch transition to aqua Multi species 	<ul style="list-style-type: none"> Self Determination – and barriers to involvement Economic Development Capacity development through with mentors
2. NT - Garngirr Fishing AC, East Arnhem	<ul style="list-style-type: none"> Multi community Commercial harvest Finfish 	<ul style="list-style-type: none"> Self Determination – and the barriers to involvement Economic Development Capacity development with mentors
3. QLD - Torres Strait Communities	<ul style="list-style-type: none"> Joint fishery management Wild species Charters 	<ul style="list-style-type: none"> Self Determination – quota Economic Development - self-management of fishery Capacity building – education and engagement
4. QLD - Giringun Community, Cardwell	<ul style="list-style-type: none"> Wild catch New species GBRMPA /QLD waters 	<ul style="list-style-type: none"> Primacy Traditional Fishing Knowledge Capacity Building
5. NSW - Tweed River Community	<ul style="list-style-type: none"> Impact with NSW legislation 	<ul style="list-style-type: none"> Primacy – species allocation Cultural Practice – TFK Capacity building
6. SA - Far West Coast Community	<ul style="list-style-type: none"> 4 Communities New wild catch + aqua 	<ul style="list-style-type: none"> Primacy Cultural Practice Economic Development
7. NSW – Dubbo, Murray Darling Basin	<ul style="list-style-type: none"> Inland MDB Fresh water Wild catch 	<ul style="list-style-type: none"> Primacy Capacity building – education and engagement
8. NSW –Batemans Bay Community	<ul style="list-style-type: none"> Multi community seeking access 	<ul style="list-style-type: none"> Capacity building – education and engagement
9. VIC - Gunditj Mirring Community, Heyward	<ul style="list-style-type: none"> Business plan for wild Pipi 	<ul style="list-style-type: none"> Self Determination Economic Development - Pipi licenses Capacity building
10. TAS – Flat Oyster initiative	<ul style="list-style-type: none"> Community development 	<ul style="list-style-type: none"> Primacy
11. WA – Broome tourism initiative	<ul style="list-style-type: none"> Fishing tourism Aquaculture 	<ul style="list-style-type: none"> Economic development of Indigenous tourism venture

A current IRG focus is the development of appropriate governance and economic models best able to support community economic development and cultural/TFK maintenance.

In this project (FRDC 2013-218), eleven Indigenous fishery communities are being considered as potential partner case studies, that seek to inform and develop improved governance models to promote and support economic development in fishery communities. As can be seen in Figure 59, these broadly track the national footprint of community ranger programs identified in the national Working-on-Country map.

The scope and maturing of these candidate communities has also been selected to reflect this diversity of economic and cultural needs.

f. Social Context

The capacity of Indigenous communities to utilise their fisheries resources (including customary uses) is linked to the social capacity and objectives of these communities. But, as in other F&A sectors, one size does not fit all – the social and fishery related issues in a community are often unique to its circumstances – related to location, jurisdiction, cultural, species, aquatic environment, and engagement with other communities and industries.

For example the aspirations and capacity of Indigenous fishers in Torres Strait communities are well advanced (compared to Indigenous communities elsewhere) due to ownership and self-management of the resource under joint Commonwealth-Queensland management.

By comparison the aspirations and capacity of Indigenous fishery communities in far western South Australia are much less developed economically and seeking to establish primacy of fisheries rights, and policies and practices to maintain and enhance their traditional cultural fisheries knowledge.

g. The Subprogram

With regard to the program a number of matters have been identified and need a response:

- Language and inclusivity always - talk about industry with Indigenous being upfront - not an afterthought,

- FRDC Strategic Plan to be fully inclusive of Indigenous peoples R&DE needs,
- Real engagement and representation, at FRABs, across researchers, at FRDC Board, at Fisheries Agencies, etc. But this needs resourcing,
- Inconsistency in addressing Indigenous fishing rights/interests across jurisdictions. This requires an audit of fisheries policy/strategy to identify gaps and identify and develop best practice,
- The role of the FRDC Indigenous Sub Program is to support the IRG to coordinate the sub program, but IRG is not responsible for Indigenous RD&E across all jurisdictions.

In discussion with the program stakeholders, a number of issues emerged for action:

1. Preserve and Use the Resource in the hands of Indigenous People

- Considering and understanding both near shore and offshore marine as there are often very different drivers regarding conflicts and opportunities for development,
- Reassess and reweight the ESD (Economically Sustainable Development) agenda that has traditionally focused on the E and S, back to more of the D. A lot of time is spent justifying the E and S to the detriment of D and the stakeholders have little outcome and eat less seafood as a result.
- For aquaculture there is a need to shift the conversation about the perceived negative environmental impacts to the efficiency as a food production system and low impacts on a cost benefit basis. If a stable and healthy supply of animal protein is the objective for Indigenous (and non-Indigenous) communities, aquaculture is hard to beat.

2. Access and Manage the Natural and Human Resource

- Capacity building is a 2 way street in respect to Indigenous people working with non Indigenous people – they both need better understanding of the other,
- Seek out and develop fishery community governance models that are self-driven, and attract youth and women,

- How to best address Primacy for Indigenous people in a positive way.

3. Deliver Benefits: Social, Customary, and Seafood

- Enable greater consumption of healthy traditional seafood in a healthy diet across communities,
- Understand and leverage the non-financial values of 'fish', beyond \$ per kg - health, social, cultural.
- Understand the limiters to innovations, which currently include jurisdictional regulatory constraints, real/perceived limits to capacity of leaders and stakeholders, and lack of resources.
- Break down existing and emerging management and knowledge silos - there is a need for capacity exchange and building across sectors. The IRG is always looking for 2 way capacity building.
- Poor data regarding the scope and scale of Indigenous fisheries and communities is still a serious constraint to sound planning and investment.

h. Current Issues in the Literature and Media

There are very many public (and some private) Indigenous development initiatives underway across Australia that flow into benefits for Indigenous fishing communities. Not least of these is the following small sample:

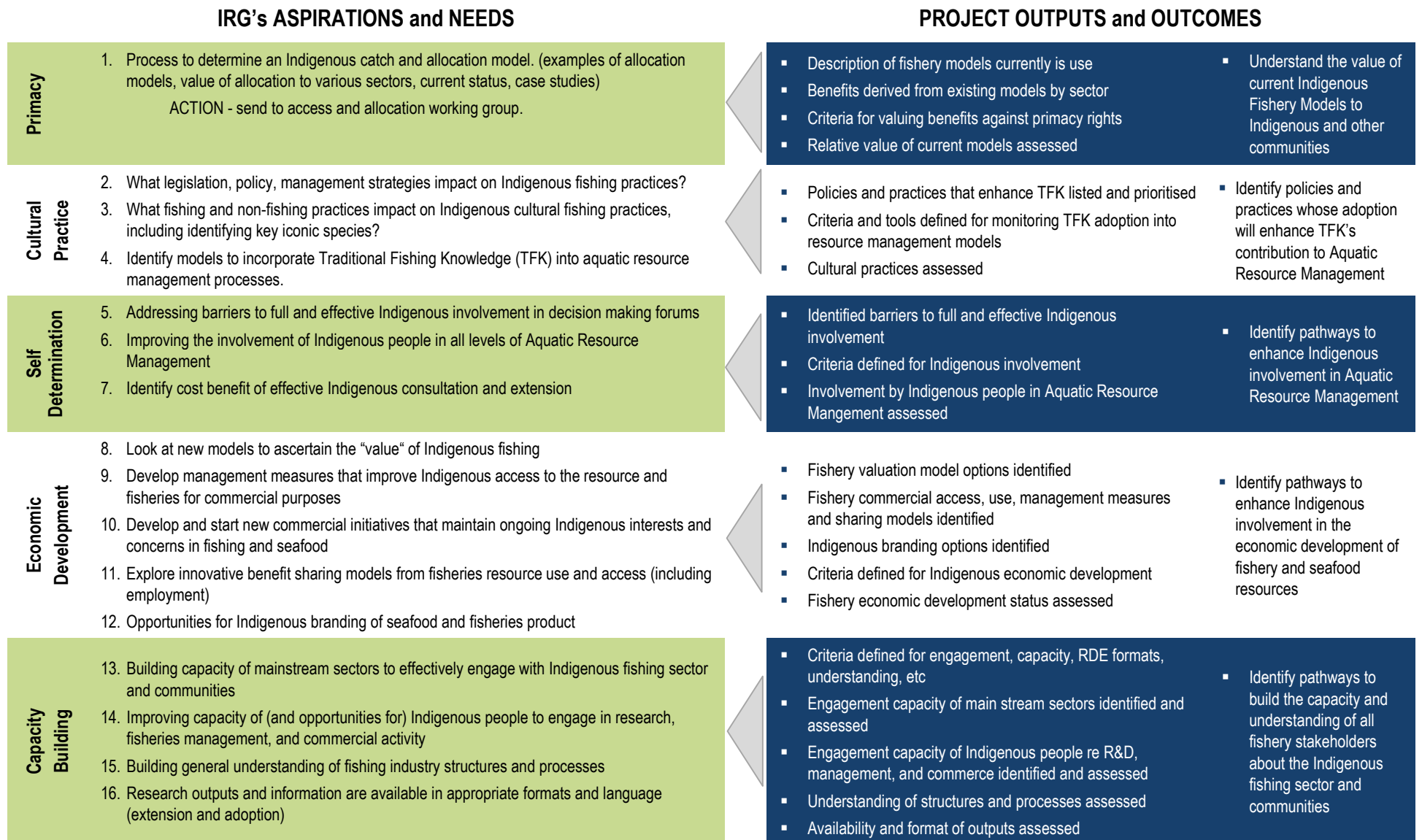
- Long standing projects in many resource and agrifood industries and jurisdictions, such as the Century Mine-Local Indigenous Communities collaboration in the Aboriginal Development Benefits Trust based in QLD's Gulf Country, sponsoring \$15 million in community development funds and creating employment for 600 Indigenous people,
- The emergent Northern Agricultural Development (AgNorth) CRC, proposing greater focus on Indigenous economic participation and international collaboration in the north (RIRDC, 2014) including for fishing and seafood.
- New national initiatives that have evolved on the back of the mineral resource boom including the Federal Government's Forrest Review – Creating Parity (The Forrest Review - Creating Parity, 2014),
- FRDC Project 2013-213 - Building the capacity and performance of Indigenous Fisheries, a current FRDC/NT Government project that is assessing

selected business models and development case studies for Indigenous fishing communities,

- FRDC 2008-328.18 – Practical implementation of social and economic elements in ecosystem based fisheries management and integrated fisheries management frameworks (SARDI),
- FRDC 2010-230 – Identifying Indigenous opportunities in the recreational fishing tourism industry on Cape York, Donald, 2012,
- FRDC 2009-038 – Aboriginal fisheries in NSW – determining catch, cultural significance of species and traditional fishing knowledge needs, Schnierer, 2012
- FRDC 2009-329 – To explore ways to engage successfully with Indigenous communities on fisheries R&D issues, Lovell, 2012

The take home message is the wide scope of research and investment (social, cultural and economic) potential being jointly assessed /supported for Indigenous people, including those of fishing communities. Long the preserve of academic institutions and public agencies, Indigenous development is becoming more a part of main-stream economic development thinking.

FIGURE 60. 2011 IRG ASPIRATIONS AND RD&E PRIORITIES



i. Scorecard on Indigenous Disadvantage

The latest 3 yearly update (Productivity Commission, 2014) published in November 2014 by the Productivity Commission on national Indigenous wellbeing, identifies improvements in health, education, and economic outcomes, with ongoing concerns in justice and mental health.

Based on 2011 Census data, around 3% (approximately 670,000 people) were estimated as being of Aboriginal or Torres Strait Islander origin.

Figure 61 presents the current scorecard (Overcoming Indigenous Disadvantage - Fact Sheet #1, 2014) across COAG and headline indicators, and identifies strategic areas for action.

In summary the report assessed changes in three areas:

Outcomes are Improving

Outcomes have improved in a number of areas, including some COAG targets:

- In the period 2005–2007 to 2010–2012 the gap in life expectancy narrowed from 11.4 years to 10.6 years for males and from 9.6 years to 9.5 years for females,
- Mortality rates for children improved significantly between 1998 and 2012,
- The proportion of 20–24 year olds completing year 12 or above increased from 45% in 2008 to 59% in 2012-13,
- The share of 20–64 year olds with or working towards post-school qualifications increased from 26% to 43% in the decade,
- The proportion of adults whose main income was from employment increased from 32% in 2002 to 41% in 2012-13, with a corresponding decrease in the proportion on income support,
- Increasing share of employed people were in full time and managerial positions.

No/slow change still Apparent

However, some indicators saw little or no change:

- No change in share of students achieving national minimum standards for reading, writing and numeracy from 2008 to 2013,
- Relatively high rates of family and community violence were unchanged between 2002 and 2008, and there was little change in alcohol and substance use and harm over time,

- Relatively high rates of disability and chronic disease have not changed.

Some Worsening

Outcomes have worsened in some areas:

- The proportion of adults reporting high/very high levels of psychological distress increased from 27% in 2004-05 to 30 % in 2012-13, and hospitalisations for intentional self-harm increased by 48% over this period,
- The adult imprisonment rate increased 57% between 2000 and 2013. Juvenile detention rates increased sharply between 2000-01 and 2007-08, and fluctuated since at around 24 times the rate for non-Indigenous youth.

The figure also highlights (in purple boxes) the key indicators that are particularly relevant to the IRG's strategy.

FIGURE 61. 2014 STRATEGIC AREAS FOR ACTION ON INDIGENOUS DISADVANTAGE

Assessment Key		COAG Targets		Headline Indicators		
☑	The main measure has shown progress	☑	4.1 Life expectancy	☑	4.7	Post-secondary education – participation and attainment
-	No significant change	☑	4.2 Young child mortality	-	4.8	Disability and chronic disease
☒	The main measure has shown regress	?	4.3 Early childhood education	☑	4.9	Household and individual income
	Data gap	-	4.4 Reading, writing and numeracy	?	4.10	Substantiated child abuse and neglect
?	Results are unclear	☑	4.5 Year 12 attainment	-	4.11	Family and community violence
#	Not applicable	?	4.6 Employment	☒	4.12	Imprisonment and juvenile detention

Strategic Areas for Action						
Governance, leadership and culture	Early child development	Education and training	Healthy lives	Economic participation	Home environment	Safe and supportive communities
5.1 Valuing Indigenous Australians and their culture	6.1 Antenatal care	7.1 Year 1 to 10 attendance	8.1 Access to primary health care	9.1 Employment by full time/ part time status, sector, occupation	10.1 Overcrowding in housing	11.1 Alcohol consumption and harm
5.2 Participation in decision making	6.2 Health behaviours during pregnancy	7.2 Teacher quality	8.2 Potentially preventable hospitalisations	9.2 Indigenous owned and controlled land and business	10.2 Rates of disease associated with poor environmental health	11.2 Drug and other substance use and harm
5.3 Engagement with services	6.3 Teenage birth rate	7.3 School engagement	8.3 Potentially avoidable deaths	9.3 Home ownership	10.3 Access to clean water, sewerage and electricity	11.3 Juvenile diversions
5.4 Case studies in governance#	6.4 Birthweight	7.4 Transition from school to work	8.4 Tobacco consumption and harm	9.4 Income support		11.4 Repeat offending
5.5 Indigenous language revitalization and maintenance	6.5 Early childhood hospitalisations		8.5 Obesity and nutrition			11.5 Community functioning
5.6 Indigenous cultural studies	6.6 Injury and preventable disease		8.6 Oral health			
5.7 Participation in community activities	6.7 Ear health		8.7 Mental health			
5.8 Access to traditional lands and waters	6.8 Basic skills for life and learning		8.8 Suicide and self-harm			

6. ANIMAL WELFARE

There have been a number of attempts by some groups to bring the issue of animal welfare to seafood production and recreational fishing but so far these have not got much traction in the general community. At present, commercial and recreational fishing and aquaculture are either excluded from State and Territory animal cruelty legislation, or have been subject to relatively little attention when compared to other primary industry sectors (ABARES, 2013 Aug).

Taking a longer term view it is possible that this issue may rise in prominence especially as consumers seek to be reassured that they are making both sustainable *and* ethical choices in selecting their seafood.

In the past, ethical campaigns have been driven by concerns about impacts on certain species (e.g. seals and dolphins) and the sustainability of fishing practices. Understanding what communication approaches or management adjustments could respond to the different animal ethics interpretations that apply across edible and non-edible fish products (e.g. extraction of wild catch fisheries for fish meal or fertiliser.)

7. CHALLENGES IN MANAGING CLIMATE CHANGE

Global and national debate (both community and public policy) regarding climate change has evolved over 10 years to deliver a very tangled mish-mash of facts, half facts, prejudicial opinions and policy reversals.

In this context it is very difficult for investors, including the FRDC and its partners, to define and prosecute a stable credible climate change objective and investment portfolio. The corporation's Climate Change Subprogram (recently closed) targeted two issues: adaptation, and mitigation.

Fishery Adaptation

CSIRO (CSIRO, 2014) has identified wild fish stock movement as a core impact of long term climate variability. Stock movement drives harvest and fishery viability/enjoyment.

Science now tells us which stock and movement impacts will arise from climate variability. However translating this science into fishery management practice and RD&E adaptation investment is a fraught exercise.

Fishery Management is one reason why adaptation is difficult, as national fish stocks are managed piece-meal by separate Commonwealth, state and territory jurisdictions.

Commercial (national, or state/territory) and recreational use (state/territory) of single stocks such as Snapper and Mulloway presents many disparate and challenging political and fishery management demands – to the point where it has become too hard to take collective action and invest RD&E funds efficiently to promote stock adaptation. (Managing stocks on national basis is a good idea anyway – the climate variability impact has simply demonstrated a further reason why it is a good idea).

A second reason why adaptation is difficult relates to how we promote resilience of wild fishery habitats. Many wild fishery habitats have been degraded (see FRDC 2012/036) over the last century, through draining of wetlands and estuaries for agriculture and urban or industrial development. While we all enjoy the benefits of these developments (via greater accessibility, improved health, etc.), the loss of fishery habitats has had a large knock-on effect to stocks - loss of habitat has reduced wild stock resilience, which has reduced fishery productivity and performance, which in turn has reduced the economic contribution of fisheries to local economies and community welfare.

Compounding this resilience problem is the difficulty in proving the investment metrics to competing recreational and commercial fishery users and policy makers. As long as the first debate rages about resource sharing and licensing to access wild fisheries, it will be near impossible to gain any traction on the second issue which is to collectively invest (possibly via a licensing regime) to enhance the habitats and resilience of fisheries facing climate variability.

Mitigation

Various local and global political and scientific leaders have urged public investment in a sustainable "blue carbon economy". But to date there has been limited real debate and no progress or national agreement on the benefits from, and pathways to, this outcome. Today, it seems that local mitigation via local investment for local outcomes is a more practical and doable strategy for the F&A industry.

What to do?

The FRDC has determined that it will continue to invest RD&E funds in climate change, but now only as part of a broader strategy that targets integrated climate impacts and policy objectives. With the forgoing discussion and risks in mind, this is a prudent and appropriate strategy.

G. CREATING PRODUCTS AND SERVICES FOR MARKETS

1. SEAFOOD PROCESSING

As in most commercial industries, data regarding the scope, nature and trends of Australian seafood processing sector are not readily available in aggregated national form, in the public domain.

This is in stark comparison to the detailed reporting undertaken by other competitors and suppliers including the UK seafood processing sector (Seafish, 2012).

However one recent national (IBISWorld, 2014 Sept) study (not publicly available) present aggregated national data for the sector and chain participants. The reports highlights a number of matters relevant to this Sector Overview:

a. Prospects

The future prospects of the industry remain tenuous, as declining production and rising imports continue to threaten the domestic industry. However in 2014-15, industry revenue is expected to grow by 3.3% as exports perform well driven by rising demand for premium seafood products in Asia, and the falling value of the A\$.

The Australian seafood processing sector is led by a small number of large listed and private firms (with associated brands), including:

- Tassal Group Ltd (Tassal), a vertically integrated Salmon farmer, processor, marketer and exporter. Around 60% of Tassal revenue comes from seafood processing. Tassal's market share of the Australian seafood processing sector is estimated to be 13.5%.
- USA owned Simplot Australia Holdings Pty Ltd (Birds Eye, John West, Lean Cuisine, Maggi, Papa Giuseppe), which processes and sells frozen, canned and baked products. Simplot's market share of the Australian seafood processing sector is estimated to be 12.9%.
- MG Kailis Holdings Pty Ltd, a diverse fishing, vessel maintenance and processing company with estimated processing market share of 4%,

Key Points: CREATING PRODUCTS & SERVICES FOR MARKETS

Most seafood processing in Australia is undertaken by integrated fisher/farming companies. Downstream value adding comprises 50-60% of F&A's economic contribution so value adding (including niche marketing) is key to extracting full value from the harvest. Greater use of technology and a falling \$A will help leverage new FTA advantages and defend against ever-rising commodity imports.

Australian each spend ~\$130 and consume around 24 kg of seafood p.a. About 72% by volume of what we consume is imported, dominated by canned tuna and prawns.

Seafood product labelling and branding is now pervasive, but consumers are confused about credence. A global initiative (GSSI) is underway to simplify the claims and brands.

Seafood exports have declined for 12 years largely due to \$A strength. More product is being exported in live/chilled/unfrozen form. The 3 new FTAs (Japan, China, South Korea) will increase export opportunities. Many Australian seafood export products currently face China entry tariffs of 6-14%. The bulk of these tariffs will be eliminated in 4 years. Seafood imports continue to increase, especially when prepared and preserved.

Agri-food, (including seafood) offers global competitive advantages to Australia, but more investment is required in skills and technology, and scaling up businesses/brands to boost productivity and compete globally.

All F&A sectors face problems securing RD&E funds, Recreational in particular. The FRDC framework (including new market powers) is responsive and efficient but hamstringing by jurisdictional complexity and related policies.

- A Raptis & Sons Pty Ltd, a fishing, seafood processing, fish wholesaling, and more recently, aquaculture company with estimated processing market share of 3.5%.
- Safcol Australia Pty Ltd, an Australian foreign owned company with business activity in fishing, seafood processing, fish wholesaling and animal food manufacture, with estimated seafood processing market share of 2.0%.

b. Revenue

In the five years to 2014-15, seafood processors have faced turbulent conditions. Revenue has been adversely affected by declining seafood production, stagnant prices and increasing imports. The industry has also become increasingly dependent on export markets as domestic prices fall from mass imports, while high-value export markets open up new opportunities for exporters. Industry revenue is expected to decline at an annualised 4.9% to total \$1.2 billion.

The government is expected to continue to implement policies to increase the sustainability of Australian seafood stocks. The policies will reduce seafood catches in the short term, but improve stock levels and profitability of the Fishing industry over the long term. Aquaculture production is forecast to grow strongly over the next five years. However, it is not expected to solve the supply problem since it represents a small share of total fish and seafood product output. In the five years through 2019-20, industry revenue is forecast to increase by an annualised 1.6% to total \$1.3 billion.

c. Structure

Profit margins remain relatively healthy for the industry, especially businesses that have operating scale and can service rising specialty exports. Larger operators have begun investing in more sophisticated automation and other machinery for seafood processing boosting their bottom lines, while building greater production efficiencies. Smaller industry operators that struggle to compete with increasing imports are expected to fare significantly worse, taking the brunt of the blow from heavy inbound competition. *IBIS World* expects that the industry will consolidate, with the number of industry enterprise falling at an annualised 1.4% over the past five years.

Seafood Processing Snapshot

Revenue of \$1.2Bn

Growth p.a. 1.6%

Trend last 15 yrs: -4.9%

Profit of \$93 million

251 Establishments located

in: QLD 21%

SA 20%

VIC 17%

WA 16%

TAS 14%

NSW 13%

Employment: 3,300 FTEs

Markets:

Exports 63% \$758 m

Wholesale 21% \$254 m

Retail 10% \$12 m

Other 6% \$7 m

Key External Drivers for Performance:

- Demand for fish and seafood wholesaling
- Domestic price of fish and other seafood
- Seafood consumption
- Import and export Trade Weighted Index and \$A.

(IBISWorld, 2014 Sept)

d. Value Adding Potential

Potential exists for increased value adding of products to supply both domestic and export markets, including:

- Transforming lower value products into higher value products, such as oven-ready items for use by the fast-food trade or processing small fish into larger fillets,
- Improving preservation techniques such as better initial handling and better refrigeration to give a fresher and hence more valuable product,
- Increasing use of by-products or waste, and better packaging, both to prolong the life of the product and to make it more attractive to consumers. Most exports are minimally processed when leaving Australia but are often further processed by the importing country.

Value-adding for the export market includes crumbed, filleted and smoked fish, fish balls for the Asian market, and marinated, spiced or herb fish for Western markets.

- Collecting and value adding (pates, fish stock, leather and oils for medicinal purposes) to fish waste as raw material prices rise and the cost of waste disposal increases. Factors that determine whether it is financially viable to process by-products include their volume and uniformity, the costs of processing them, the costs of landing bycatch and transport expenses.

- Raising the intensity of branding and promotion by focusing on its reputation for quality. Branding is particularly relevant as competing countries face mounting pollution problems.
- Much of the production sold domestically is sold at auction in major cities and distribution channels have remained relatively unchanged over the past five years. There are issues of inconsistent price and quality, low volumes and lack of consumer awareness about the species available, as noted in recent TV media (*What's the Catch* on SBS).

e. Regulation

The report considers the seafood processing sector to “exhibit high levels of regulation and policy policing” – due to the fact that it is a manufacturer fresh and prepared food for domestic and export consumers in highly regulated markets such as Europe, Japan, and to a lesser degree, the USA. Stakeholders suggest that there will be only limited reduction in this level of regulation and scrutiny as it is increasingly a part of Australia’s seafood export competitive branding and advantage, but possible increases in industry self-regulation (e.g. in emerging ready to eat product formats) may improve operator flexibility.

Initiatives developed by the Australian Seafood Cooperative Research Centre (SCRC) over the last five years are improving the capacity and capability of the sector. Current initiative to restructure the business models for two initiatives developed by FRDC/SCRC, include SafeFish, and the Seafood Trade Advisory Group.

f. Technology

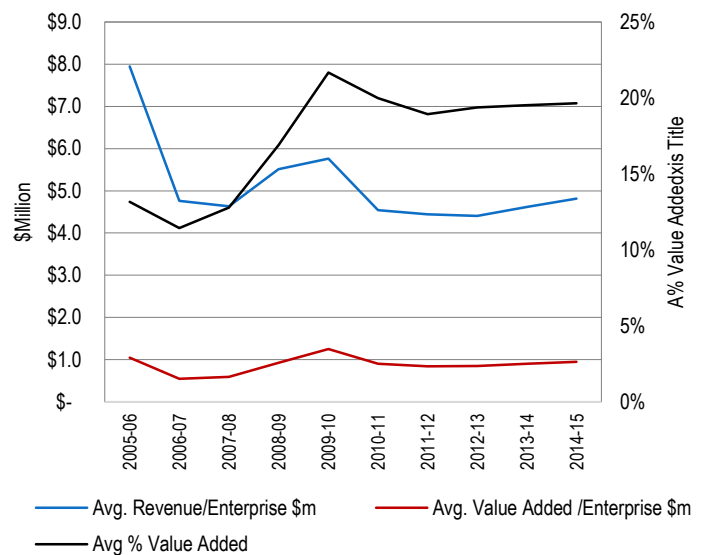
The industry is expected to have a low but increasing level of technological change. Processing (cleaning, filleting, freezing, packing, canning, smoking etc.) establishments vary greatly in size, scope of operations and in the sophistication and degree of technology applied. Compared with the overseas industry (including the sophisticated NZ seafood processing sector) and other food processing industries, there has been relatively little use of automated processing and handling outside of canned fish. The reason for this is the consumer preference for fresh, whole fish meaning that prices paid for relatively unprocessed products are favourable compared to highly processed seafood. Over the coming years, IBIS expects the rate of technological change is likely

to step up as automation becomes more prevalent due to increasingly sophisticated processing methods.

g. Trend in Performance of Sector

Figure 62 tracks trends for 3 indicators of processing sector performance based on the national data published by IBIS World in 2014

FIGURE 62. TRENDS IN AUSTRALIAN SEAFOOD PROCESSING



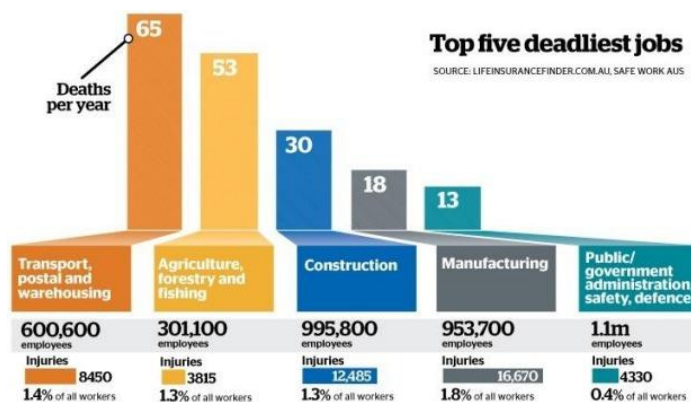
Average revenue per enterprise or business has fallen but is now trending upwards to around \$5 million per business. Note that this is for “enterprises”, not “establishments” which is the number of processing facilities or plants that exist. In other data the number of establishments per enterprise has fallen from 1.37 in 2005 to 1.13 in 2014, suggesting improvements in logistics and the need for additional capital and technology is resulting in fewer larger processing facilities.

Value adding activities by enterprises add a relatively stable dollar contribution to sales values. Around \$1 in every \$5 of sales is due to value adding in seafood processing, a number that is relatively low compared to global competitors, as Australia has a traditional emphasis on high quality and sustainable fresh species such as rock lobster and abalone. But the good news is this value adding activity has increased markedly as a percentage of sales values of the products in the last five years, from around 12% to 20% of sales/revenue values. This suggests that value adding is maintaining upward pressure on sales and therefore profits. It is unclear if this is due to increased spend on “soft” value adding activities (such as branding

and marketing) or “hard” capital intensive activities such as installing new seafood processing technology and hardware.

2. HARVEST SAFETY

In October 2014 a major newspaper published (SMH, 2014) the following graphic, which highlights the relatively high workplace risks associated with jobs in the agriculture fishing and forestry industries.



Looking more closely at the data (SAFE WORK AUSTRALIA, 2015) it is evident that:

- The F&A Industry data is not disaggregated,
- The total number of deaths in the Ag, Fishing and Forestry Industries over the five years from 2007–08 to 2011–12 equates to 16.81 fatalities per 100,000 workers, which is seven times the national rate of 2.29. Three-quarters of fatalities involved a vehicle. Drownings accounted for 16 fatalities each.
- Over the five years the Ag. Fishing and Forestry Industry accounted for 3% of all serious workers’ compensation claims. On average there were 11 claims each day from employees who required one or more weeks off work because of work-related injury or illness. The main causes of these claims were body stressing (28% of claims), being hit by moving objects (25%), and falls, trips and slips of a person (23%).
- Over the period all jurisdictions except Tasmania and South Australia recorded decreases in incidence rates. The largest fall was recorded by

Queensland (19%) followed by New South Wales (18%). Tasmania and South Australia increased by 14% and 5% respectively.

Recreational fishing also exposes fishers to significant risk of personal harm. Rock fishing, spear fishing and aquatic activities involving diving are identified by the NSW Dep’t of Primary Industries as the most at-risk activities for recreational fishers. Industry advice confirms that all too often the deceased person is of Asian background and had limited grasp of the English language and ability to read site based warning signs.

US Commercial Fishery Safety

The US commercial fishing sector maintains a very comprehensive record of occupational fatality rates and serious injury frequency rates (NIOSH, 2015). The National Institute for Occupational Safety and Health maintains the *Commercial Fishing Incident Database* (CFID), a surveillance system for workplace fatalities in the commercial fishing industry in the United States.

Further it notes that commercial fishing is one of the most dangerous occupations in the US. Many commercial fishing operations are characterised by hazardous working conditions, strenuous labor, long work hours and harsh weather. During 2000–2010, an annual average of 46 deaths occurred (124 deaths per 100,000 workers), compared with an average of 5,466 deaths (4 per 100,000 workers) among all U.S. workers. In summary:

- 545 commercial fishermen died while fishing,
- More than half of all fatalities (279, 51%) occurred after a vessel disaster,
- Another 170 (31%) fatalities occurred when a fisherman fell overboard,
- Another 56 (11%) fatalities resulted from an injury onboard,
- The remaining 40 (7%) fatalities occurred while diving or from onshore injuries

New Zealand

The New Zealand fishing industry established in 2004 an organisation called FishSAFE (not to be confused with Australia’s SafeFish seafood program). As the website (FishSAFE, 2015) notes FishSAFE is a committed fishing industry led, industry/government partnership with the aim of developing strategies to improve the safety performance

of the New Zealand commercial fishing sector – in other words, to stop fishermen injuring themselves.

FishSAFE priorities to date have been the development of the Safety Guidelines for Small Commercial Fishing Vessels, and the development of associated injury prevention training. The target audiences are the owners, operators and crew of fishing vessels under 24 metres in length. This target is focused on a category of vessel that makes up the large majority of the New Zealand fishing fleet in terms of both vessel numbers and people employed.

The New Zealand Government has worked jointly with FishSAFE to release a Fishing Sector Action Plan 2015 (MARITIME NEW ZEALAND, 2015), a comprehensive 20 page document that describes the F&A Industry occupational risks and a workplace health and safety strategy.

What should we do?

Clearly, opportunity exists for the Australian F&A industry to seek disaggregation of its national data (from Ag, Fisheries and Forestry) on a national basis, in order to target and improve the operational safety of stakeholders.

3. REGIONAL IMPACTS AND MULTIPLIERS

A small number of jurisdictional projects have considered the regional and downstream impacts of the seafood sector or specific fisheries therein. But in most cases the data is limited to a few jurisdictions, with SA maintaining the longest running dataset (since 1995) and analysis of economic data. Unfortunately all other jurisdictions are too-slowly realising the benefits to strategic direction from information about the economic drivers for F&A.

On a national basis, the FRDC's second *Performance and Use Study* (Project 2014-235) is currently framing its conclusions based on advice from more than 80 F&A fishers, farmers, researchers and other experts. Figure 63 presents estimates developed by the project for the economic impact of the seafood. Aquaculture has been included for the first time in 2014.

The figure confirms that around 60% of the economic contribution (on a Gross Operating Surplus basis) from the seafood sector is due to downstream processing and value adding activities.

FIGURE 63. ECONOMIC IMPACTS FROM F&A SECTORS

F&A Economic Impacts	2009		2014	
	\$m	%	\$m	%
Wild catch	404	100%	418	100%
Economic rent	97	24%	66	16%
Other fishing activity	116	29%	93	22%
Downstream activity	190	47%	259	62
Aquaculture	No data		358	100%
On-farm activity	No data		149	42%
Downstream activity	No data		209	58%
Total Seafood Sector	-	-	776	100%
Fishing and Farming	-	-	308	40%
Downstream activity	-	-	468	60%

This calculation currently excludes both the indirect downstream economic contributions from the sector (such as insurance), and the downstream indirect economic impacts of wages and households. FRDC's Performance and Use Assessment methodology is evolving in response to these downstream needs, including the need to integrate the large downstream economic impacts of recreational and customary fisheries.

4. INDUSTRIAL PRODUCTS AND SERVICES

Fish as food has been and continues to be the primary commercial offer from the seafood sector.

The modern Pearl Oysters industry has grown since inception in the 1970s, transforming from wild harvest to a fully farm sector that is Australia's seventh largest fishery by value.

But in the last five years pilot commercial production of microalgae has progressed at a number of locations, including the Aurora Inc. facility at Karratha (Aurora Inc, 2014) in WA. An August 2013 press release notes: "*Aurora Algae is a producer of high-performance, premium algae-based products for the pharmaceutical, nutrition, aquaculture and fuels markets. The project involves close collaboration with Durack Institute of Technology, the Batavia Coast Maritime*

Institute (BCMI) at Geraldton in state of the art training, research and development at their Separation Point facility”.

As a first world economy Australia also has sophisticated service capacity in the F&A industry. Although the industry is relatively small on the world scale there is increasing evidence of and potential for marketing Australian F&A capacity in:

- Aquaculture genetics and farming system design at UTAS/IMAS to develop rock lobster aquaculture in Malaysia for Darden Restaurants of USA) (IMAS, 2014),
- Aquaculture nutrition, including CSIRO’s current Asian rollout of proprietary licensing for the world’s first fish-free Prawn food, (CSIRO, 2014),
- Marine biology and fishery sustainability services currently contributed as aid by a range of Australian organisations, including Australian Centre for International Agricultural Research (ACIAR, 2014, p. 72), for fisheries related projects in Grouper farming in the Philippines and Vietnam, and in Papua New Guinea and eastern Indonesia /southern Philippines and the Coral Triangle Initiative,
- Marine biosecurity and wild /aquaculture sustainability in emerging economies in Asia that are and will continue to drive global aquaculture supply growth for the next 2-3 decades.

5. SEAFOOD CONSUMPTION

In 1993 Australian consumers consumed 13.5 kg of seafood per year (FRDC, 2013). In 2011 each Australian spent on average, \$131 to purchase and consume 24kg of seafood (PIRSA, 2012). Consumption and expenditure are predicted to continue to steadily increase in the coming years.

Recent growth in consumption has been on the back of consumers’ desire for healthier diets, with seafood being a healthy alternative which makes it well placed to grow its share of the Australian diet. The major drivers in consumer food choices include that food be enjoyable; convenient to purchase and consume; healthy and affordable. Seafood meets these requirements. Recent specific research has provided insights into how consumers apply them to seafood. Direct consumer research has shown that the

specific factors consumers look for when selecting between seafood products is that being affordable, Australian, fresh (not frozen) and from a trustworthy source are at the top of the list. Sustainability and animal welfare, whilst important to the industry, were of lesser importance to the consumer.

Around 72% of Australian consumed seafood is imported consisting of mainly fresh and frozen fish fillets and prawns, largely from Vietnam, Thailand, China and New Zealand and canned tuna. However the PIRSA study notes that local seafood could have a greater place in Australian diets, including specific farmed potential for oysters, mussels, Yellowtail Kingfish, and wild catch species including increased human use of Australian Sardines and Australian salmon in a range of forms (such as fresh and smoked).

As noted previously in Chapter 5 under the “Fisheries Supply and Use” heading, Australia’s consumer demand for seafood exceeds the capacity of current domestic production to supply. Growth in domestic aquaculture may be able to go some way to filling this gap in the long term, although the industry would need to build considerable capability to produce high-tonnage species that meet Australian consumers’ requirements for inexpensive, boneless, skinless white-flesh fillets (ABARES, 2013 Aug).

As is the case in many advanced economies, seafood imports will continue to be necessary to meet domestic demand into the foreseeable future. The dependence on imported seafood is frequently used by media as a lead in to stories about marine reserves and fisheries regulation in general. Our best response may be to point to the fact we export over 50% of our domestic catch (by value) and that we share this trade imbalance with most other advanced western nations.

6. RETAIL AND FOOD SERVICE TRENDS

a. Certification

Seafood is an international commodity that is increasingly subject to labelling and third party certification. The trends indicate that:

- Food labels are morphing from their initial focus on human health into every other ratable criteria,

including sustainability, pollution, deforestation, biodiversity, local, animal welfare, fair trade, and Country of Origin',

- The Corporate Focus on certification and consumer trust has proliferated a plethora of "green marks," standards, codes, labels, etc.,
- Business and NGOs all want the high-ground market advantage that they perceive will come from labelling and independent certification,
- Social media "spin" is overtaking mass media facts and integrity with an explosion in claims that have little substance or integrity,
- Consumers "want to know" the human story of their new product, as well as the baseline credence facts re safety and fitness for purpose. In the seafood sector this has boosted demand for traceability from boat-to-buyer.



These are all relevant issues to risk-averse consumers at a point-of-sale, but the fact is they create a wall of labels/certification marks and standards that simply confuses consumers.

Labelling is the mass market point-of-sale pitch to consumers re a product's point of difference. But for other audiences seafood companies are also now producing specific publications that are also heavily "labelled" and promoted to investors, bankers and NGOs. Tassal Ltd, a listed company, now publishes a Sustainability Report that packages up specific label and credence information into a publication for an ethical/sustainable investor or NGO audience. As a recent FRDC Fish Magazine (FRDC Fish Magazine, 2014) article noted, "Ironically, what was intended to provide certainty for consumers has created confusion along the entire supply chain."

Issues around the labelling of seafood tend to be around two matters (ABARES, 2013 Aug): country of origin and sustainability. There is likely to be greater demand for traceability of fish products (boat to buyer) and an expectation that non-compliant behaviour is rare – be this for third party certification, health reasons, chain of custody or compliance reasons.

Some fishers, environmental non-government organisations and major retailers continue to promote

third party certification systems and associated labelling for fresh seafood and various frozen and canned products. Woolworths has stated they are aiming to have all wild-caught fish offered for sale certified by the Marine Stewardship Council (MSC) by 2015.

There are a number of state and Commonwealth fisheries that operate under third party certification schemes, notably the MSC scheme. The WA Government is funding the pre-approval process for each of its fisheries under the MSC program.

Role of government and existing government assessment processes are often proposed as an alternative to third party certification schemes – the cost efficiency of this is not well understood nor is the degree of reliance on market failure.

Current domestic laws require all seafood sold through retail outlets for later consumption to be clearly labelled according to country origin. Some parts of the domestic industry continue to push for such labelling in fast food outlets and restaurant menus (as currently applies in the NT).

In terms of third party certification, some industry groups have promoted a role for themselves as the managers of an Australian Government sponsored certification scheme. They argue that a single government endorsed scheme would be more cost efficient and a government backed scheme could make use of the existing compliance and approval processes under the *Fisheries Management Act 1991* and the EPBC Act.

b. GSSI

The Global Sustainable Seafood Initiative (GSSI) is looking to clear some of the confusion. The GSSI was formed in February 2013 to develop a consistent global benchmarking tool that will provide transparency between labelling and seafood certification programs.

The new benchmarking framework consists of different criteria and indicators based on the FAO guidelines - *Ecolabelling of Fish and Fishery Products from Marine Wild Catch Fisheries*, and *Technical Guidelines on Aquaculture Certification*.

The GSSI initiative aims to:

- Establish uniform international criteria and indicators to measure, compare and benchmark performance of seafood certification and labelling programs,
- Provide a platform for collaboration, knowledge exchange in seafood sustainability,
- Reduce cost by improving operational efficiency of seafood certification and labelling.

It is based on 12 principles, as follows:

1. Consistent with UN (Law of the Sea), FAO, and WTO,
2. Recognize sovereign rights of States,
3. Be voluntary in nature and market-driven,
4. Be transparent, and equitable in participation,
5. Be non-discriminatory, and drive trade /competition,
6. Provide opportunity to enter international markets,
7. Be accountable to scheme owners and certifiers,
8. Incorporate reliable, independent audit and verification,
9. Use best science, and verifiable customs and knowledge,
10. Be practical, viable and verifiable,
11. Ensure that labels communicate truthful information,
12. Provide for clarity.

The GSSI benchmarking initiative for certification programs aims to help Australian buyers compare the product credentials no matter where they came from and who certified them. By reducing confusion and providing transparency, the GSSI aims to facilitate more efficient decision-making and application of seafood certification programs worldwide.

The ultimate goal is to ensure consumers retain confidence in the supply and promotion of sustainable seafood, and to promote improvements in the certification and labelling programs. A revised version of the benchmarking tool is expected to be finalised by the end of the year

c. Australian Food Brand

The concept of an Australian food brand has been seeking industry investment for some decades. However the latest attempt in late 2014 has secured support from DoA and Austrade, and is timely given the 3 new FTAs that Australia has signed with China, South Korea and Japan.

These three markets are particularly interested in “clean, green and safe” high quality food supplies.

Norway is a global leader in country branding of premium seafood, with its Norge brand appearing in high value markets in the last year.



Australia’s national food brand initiative will now be subject to a white paper, and testing of industry’s collective response and willingness to invest in the brand (Austrade advice 27Sept 2014).

d. Online Marketing

Supermarkets currently dominate China’s grocery retail landscape with a market share of around 44%, according to Euromonitor. Although this dominance is likely to continue, Euromonitor estimates that online food and drink will also grow strongly from US\$486 million in 2011, to US\$3.1 billion in annual sales in 2016.

Seafood, particularly high end premium products, are also flowing in to the online market stream. People shopping online are more educated and more affluent, and they are able to assure food quality and safety by online purchase from a trusted certified source. The death of 3 children in 2011 in China due to local contamination of imported NZ milk has raised the awareness of online food sourcing among high net worth consumers.

Online engagement with overseas target consumers is a trend that Australia’s leading sectors and exporters in the China market (rock lobster and abalone) are already pursuing.

7. TRADE AND MARKET ACCESS

a. Exchange Rates

Adverse movements in the Australian Dollar relative to our major seafood trade partners has caused financial stress for many Australian seafood and fishery businesses over the last decade.

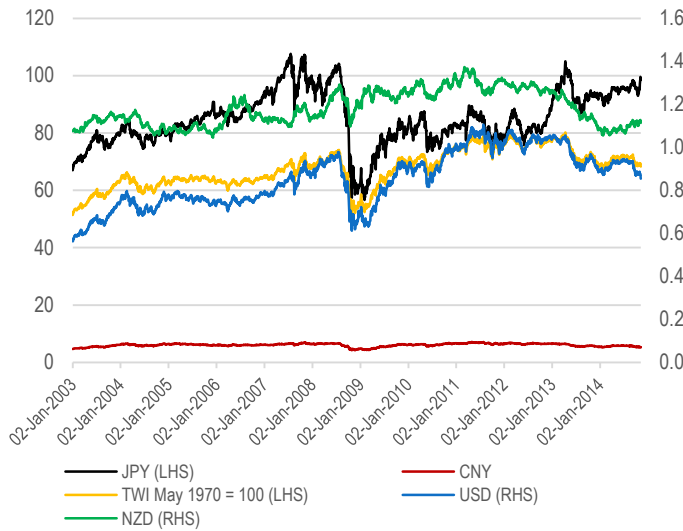
Others, notably the aquaculture Salmon sector has followed a strategic focus on raising the per capita consumption of Australians in the domestic market – up

35%, from 1.26 kg to 1.71 kg in 8 years to 2012 - and has therefore avoided much of this currency risk.

The strong resource-driven A\$ has assisted seafood and fishery product importers (Processed Tuna and frozen Prawns), and made exporters less competitive for our major export species including lobster, tuna, prawn, and abalone.

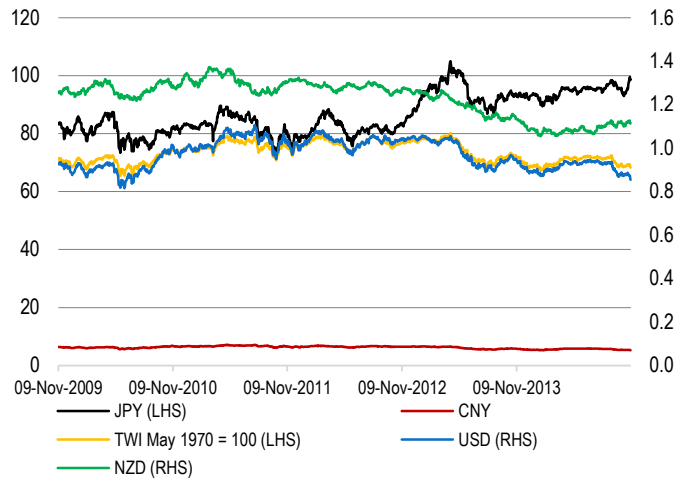
Figures 64 (11 years to Nov2014), and 65 (5 years to Nov 2014) demonstrates data from the Reserve Bank of Australia:

FIGURE 64. TRADE PARTNER EXCHANGE RATES – LAST 11 YEARS



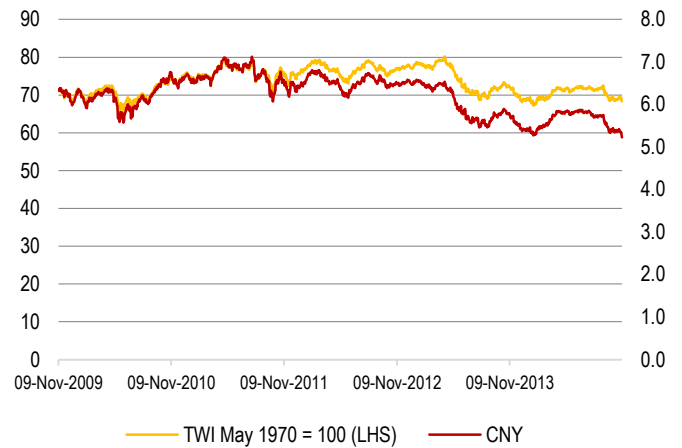
- The volatility of our trade currencies and the potential magnitude of related risk management consequences which Australian businesses face,
- The volatility of the Japanese Yen (JPY), in particular, to a point now where that currency has again weakened to parity with the A\$. (\$A1 = 100 Yen). As in the US, this recent trend is the result of quantitative easing (i.e. printing money and buying bonds to stimulate growth) and we are likely to see less volatility in coming years.
- The falling A\$ and its increased competitiveness against the NZ\$ (NZD), the US\$ (USD), and the Trade Weighted Index (TWI), as Australia’s mineral resource boom passes. This is particularly apparent in the last 2 years.

FIGURE 65. TRADE PARTNER EXCHANGE RATES – LAST 5 YEARS



The relatively stable exchange rate with the Chinese Yuan (CNY) compared to our trade currency basket over the long term. Figure 66 indicates the growing gap between the TWI and the Chinese Yuan exchange rate – this flags the increasing competitiveness of Australian seafood products against Chinese sourced competitors, and the underlying peg of the Yuan to the US\$.

FIGURE 66. CHINA TRADE CURRENCY VS TWI



b. Free Trade Agreements

As noted earlier in this paper, Free Trade Agreements (FTAs) offer significant potential gains for seafood traders to and from Australia. At a minimum, Australian seafood and product companies are seeking to enhance their global export and domestic competitiveness to equal that of competitors such as New Zealand and the USA.

Australia has seven FTAs currently in force with New Zealand, Singapore, Thailand, US, Chile, the Association of South East Asian Nations (ASEAN, including New Zealand) and Malaysia. The countries covered by these FTAs account for 26% of Australia's total trade. (DFAT, 2014).

Australia is also currently engaged in seven FTA negotiations:

- Three bilateral FTA negotiations: China, India and Indonesia; and
- Four plurilateral FTA negotiations: the Trans-Pacific Partnership Agreement (TPP), the Gulf Cooperation Council (GCC), the Pacific Trade and Economic Agreement (PACER Plus), and the Regional Comprehensive Economic Partnership Agreement.

The additional countries covered by these negotiations account for a further 29% of Australia's total trade.

Two FTA have recently been signed but are not yet in force:

- The Korea-Australia FTA signed in Feb 2014, presents a mixed outcome with Korean tariffs falling to zero over 3 years for some harmonised species codes (lobster 20% to 3%, Yellowfin Tuna 20% to 5%, Bluefin Tuna 10% to 5%) while others (abalone) have limited gain.
- The Japan-Australia Economic Partnership Agreement signed in July 2014 – Tariffs on lobsters, crustaceans and shellfish will be immediately eliminated and the tariff on Australia's largest seafood export, tuna, and Atlantic Salmon, will be phased out over 10 years. Australia's seafood exports to Japan were worth \$200 million in 2013.

The China Australia FTA was signed in November 2014.

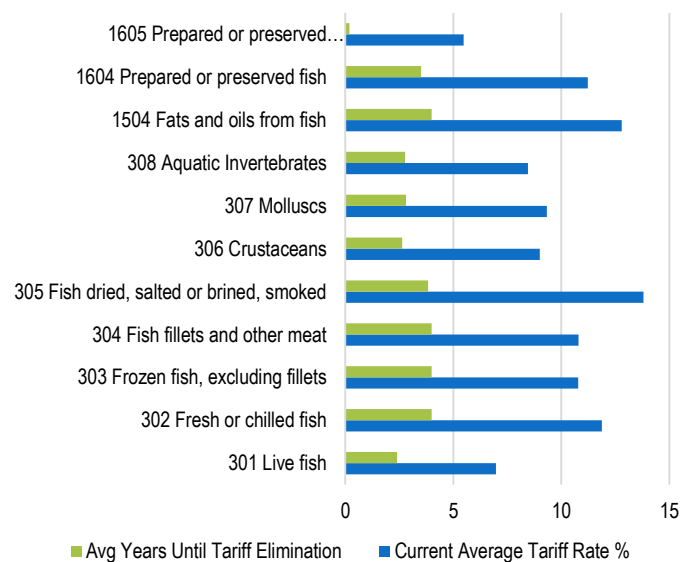
The Seafood Trade Advisory Group (an Australian seafood industry trade body) believes that seafood is a real winner from this new FTA. The key points relevant for the Australian F&A Industry are (Seafood Trade Advisory Group, 2014):

- Many Australian seafood export products (live, fresh, frozen, prepared, or preserved) currently face China entry tariffs of 6-14%. Figure 67 confirms the bulk that these tariffs (by product type) will, on average, be eliminated within four years.
- At zero % tariff Australia's seafood industries will be able to better compete with countries such as

NZ and Chile who already enjoy full access to the lucrative China market.

- Rock lobster and abalone are Australia's highest value seafood exports and it is these products that are highly sought after by Chinese consumers. In 2012 -13 rock lobster and abalone exports in all forms were valued at approximately \$632 million (FOB). This is more than the value of other major agriculture sector exports such as wine and dairy. Combined, both industries contribute \$1.25 billion in GDP and employ over 8500 jobs nationally.

FIGURE 67. KEY SEAFOOD IMPACTS FROM CHAFTA

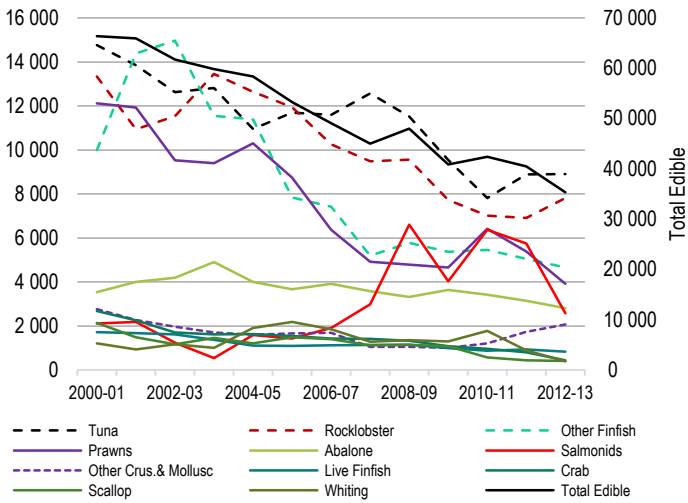


c. Exports

Drawing from ABARES data, total seafood export volumes (edible products) have been progressively declining for 12 years (Figure 68).

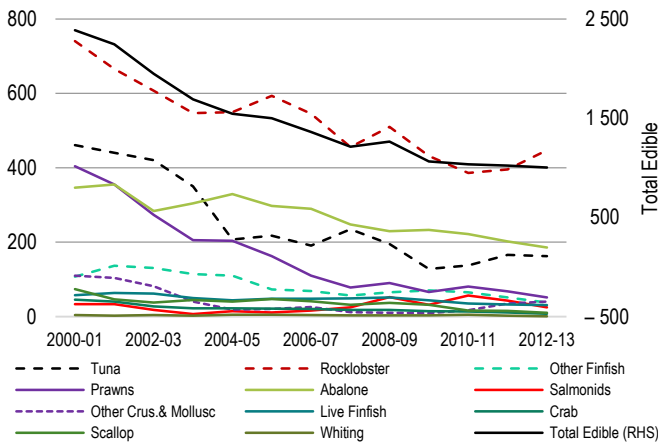
Declines are also evident for all species, except in recent years for salmonids and other crustaceans and molluscs.

FIGURE 68. SEAFOOD EXPORT TONNES IN DECLINE FOR LAST DECADE



The same trends are evident in the real (adjusted for inflation) GVP Value data (Figure 69), although prices in A\$ have improved in the last 3 years.

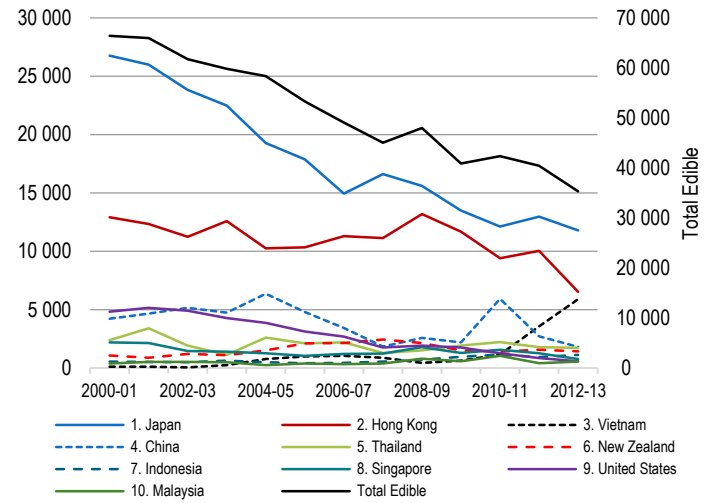
FIGURE 69. SEAFOOD EXPORTS - REAL GVP \$'000



Exports to the top 10 market destinations confirm the large decline in Total Volume, and in volume to Japan, with moderate falls in the Hong Kong / China trade.

In descending order of volume the top markets are illustrated in Figure 70. Recent volume growth to Vietnam confirms the reprocessing of Australian products (mostly rock lobster) in Vietnam for re-export.

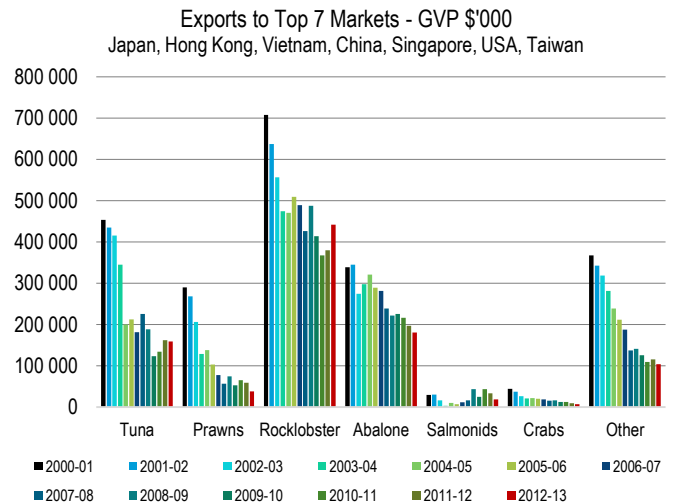
FIGURE 70. SEAFOOD EXPORT TONNES TO TOP 10 DESTINATIONS



Around 80% of Australia’s seafood exports are consistently sent to the top 7 destinations – Japan, Hong Kong, China, Vietnam, Singapore, USA and Taiwan – which have typically maintained the same order in tonnage terms.

The trends in value by real GVP for products to these 7 top markets confirm the overall trends, per Figure 71.

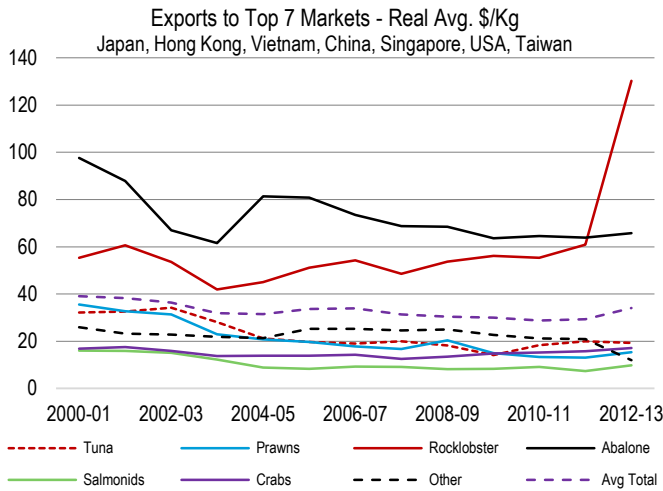
FIGURE 71. TOP 7 EXPORT DESTINATIONS – REAL GVP TREND



The value of sales has stabilised for some species in the last few years, especially Tuna, Prawns, and Other Products. Salmonid sales have increased in line with strong growth in Australian aquaculture production of Atlantic salmon.

Moving to real average prices across species sent to these top 7 markets, the average price has been relatively stable for a decade, with recent gains in the last 2 – 3 years. However Figure 72 shows that gains in rock lobster prices have offset average falls in the other key species.

FIGURE 72. REAL AVERAGE PRICES ACHIEVED TO TOP 7 MARKETS



Real rock lobster prices recovered in 2004 and have edged up over the last decade, with a strong surge in the last two years. Real abalone prices have generally trended lower as large aquaculture production of this species has come on stream in China. Real average prices received for Tuna, Prawns, Salmonids and Crabs have all declined in real terms, again with some stability in the last 3 years.

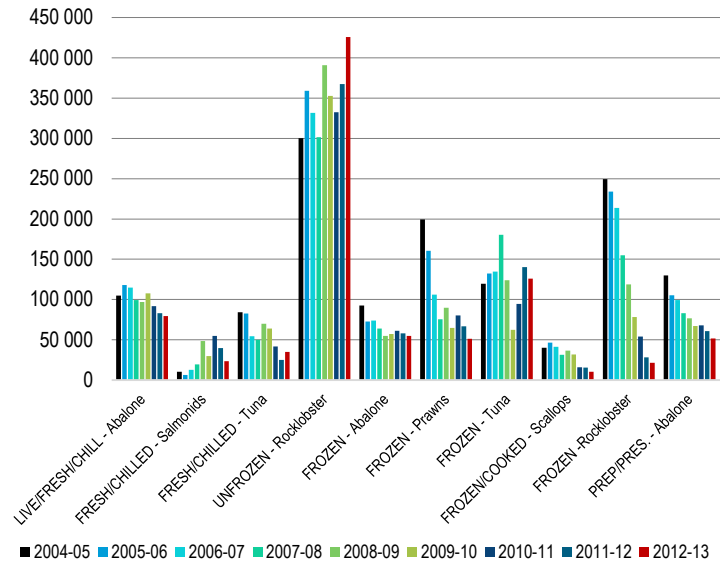
What has been the impact on export product formats?

Figure 73 illustrates the real GVP value (\$'000) trends in the product form for the major export species to our leading markets.

The product forms are quite diverse, from live through fresh and chilled, to frozen and prepared and preserved (Prep./pres.). Over the last decade the real value of these sales has declined for most categories in line with falling export sales. This underlying trend is masking any detailed analysis of product form shifts by species.

The rock lobster sector continues a long term trend to shift its products from frozen forms to unfrozen forms – the reduced TACC in the Western Rock Lobster fishery has hastened this trend in the last 3 years.

FIGURE 73. EXPORT PRODUCT FORMATS - REAL GVP \$'000

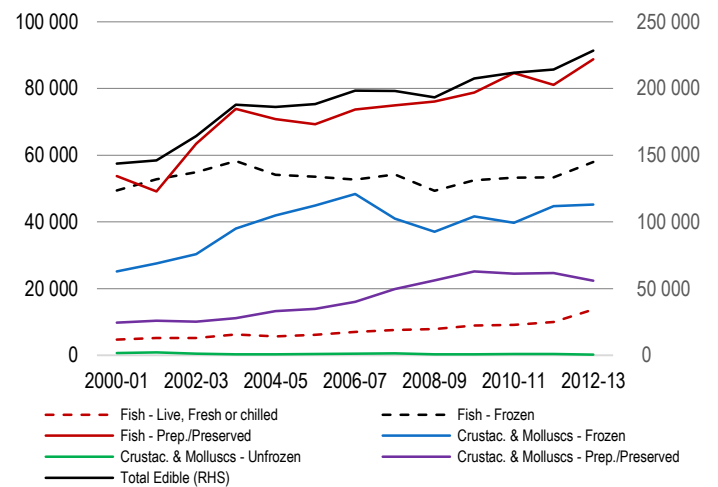


d. Imports

Fishery product imports to Australia continue to rise, in both volume and value terms. Imports provide (RUELO, 2011) just over 70% of the volume of seafood consumed in Australia.

Figure 74 illustrates the long term demand growth for fishery products (avg. of 4% p.a. by volume since 2000), and for prepared and preserved products in particular.

FIGURE 74. RISING FISHERY PRODUCT IMPORTS TONNES



High volume growth products include:

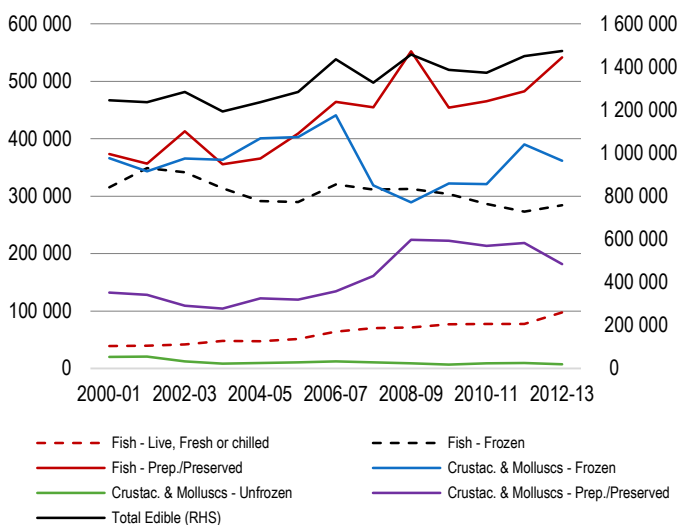
- Preserved tuna – volume grew 111% from 9,965 tonnes (2001) to 20,996 tonnes in 2013,
- Prepared and preserved formats for many other finfish species,
- Frozen prawns - volume doubled from 22,518 tonnes (2001) to 46,315 tonnes in 2013,

Of interest, imports of hake (shark) declined 50% to 6,103 tonnes over the decade.

Weakening global seafood prices driven largely by the explosion in aquaculture supply and falling processing technology unit costs, has meant that real prices for imports to Australia have been almost flat (avg. of 0.6% p.a.) for a decade.

For the edible seafood component of imports, growth in real value of the (avg. of 2% p.a. since 2000) is strongest for non-frozen products.

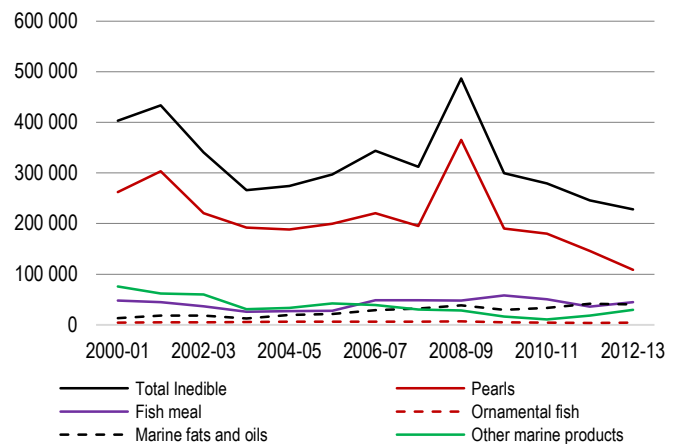
FIGURE 75. EDIBLE SEAFOOD IMPORTS - REAL VALUE \$'000



Growth in non-edible fishery product import by real value, is quite volatile, being dominated by sensitivities to luxury pearl products. Average growth of -2% p.a. (a decline) has been achieved by the category since 2000.

The top 10 suppliers of edible seafood to Australia have increased their aggregate share of volume from less than 80% in 2001, to more than 90% at 228,000 tonnes in 2013. These suppliers are, in decreasing order, Thailand, New Zealand, China, Viet Nam, Malaysia, Taiwan, USA, Indonesia, South Africa and India.

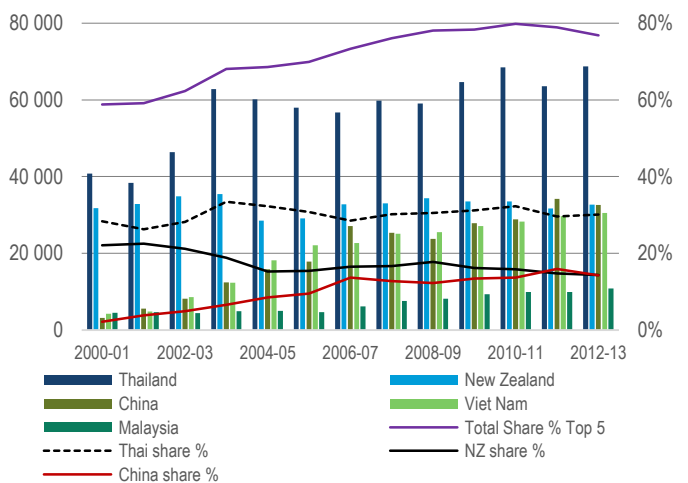
FIGURE 76. INEDIBLE PRODUCT IMPORTS - REAL VALUE \$'000



For the top 5 suppliers, the aggregate share has grown over the 12 year period from 59% to 77%, but for the last 5 years their share has remained stable at around 78%.

For the top 5 suppliers, China has recently almost edged out New Zealand, and Vietnam is a close fourth.

FIGURE 77. EDIBLE SEAFOOD IMPORT TONNES - 5 TOP SUPPLIERS



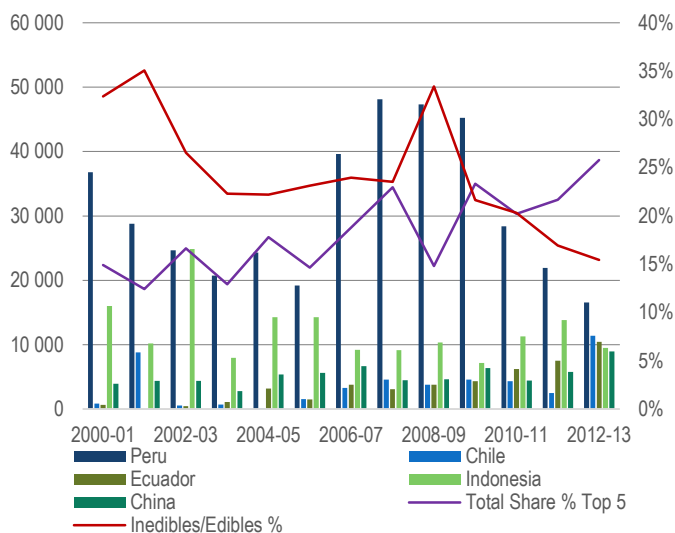
The headline import product is prepared and preserved tuna (canned) from Thailand. This single product comprises 19% of total imported edible fishery product volume, and has doubled from 22,064 tonnes in 2001 to 43,096 tonnes in 2013. Thailand has supplied around 98% of our imports since 2001.

In real value terms over the 12 years since 2000, the top 10 suppliers have increased their aggregate share from 74% of our landed import value to 89%, again with a reasonably

stable 88% over the last 5 years. Interestingly Denmark (mostly smoked Salmonids) has replaced India in the top tier of suppliers when real value is used as the import measure. For the top 5 suppliers Thailand dominates again and the balance, in order, is New Zealand, China, Viet Nam and Malaysia.

ABARES data confirms that imports of inedible products comprise fat and oil products from South American suppliers, dominated by fish meal / oil imports from Peru. The Peruvian Anchovy fishery is one of the world's largest "reduction fisheries" of pelagic species used to provide fish oil, a core ingredient in aquaculture feeds, especially for the carnivorous and expanding Atlantic Salmon sector.

FIGURE 78. INEDIBLE FISH PRODUCT IMPORTS - REAL VALUE \$'000



A significant once-off reimportation of pearls in 2009 resulted in a large decline in that year. Notably the real value of inedible imports as a percentage share of edible imports is falling. This is being driven by rising edible imports, and improved dietary options for aquaculture that rely more of plant based substitutes (e.g. soy beans).

8. HUMAN PRODUCTIVITY, SKILLS AND REGULATION

a. Critical and Current Issue

The drivers for Australia's economic success are changing significantly - from sustained productivity growth in the 1980-90s, to booming global demand for mineral commodities over the last decade. At the same time, the increasing sophistication of emerging economies and technology is allowing value chains to be reconfigured.

This is fundamentally changing the nature of global competition and work.

For Australia's F&A Industries this context is dominated by our large and growing import (\$1.4 billion edible products) and export (\$1.0 billion edible products) trade with Asian producers and customers. The high and increasing productivity of capital and labour in our trade partner economies is the basis for their costs and, therefore, our import and export trade prices. In particular it is the aquaculture prices that are the dominant baseline costs that set global commodity prices. The rapid and ready spread of modern aquaculture technology to smallholders (often in partnership with large processor corporations and traders) has driven massive productivity gains for both capital and labour in aquaculture. While their lack of biosecurity policies, poor record on environmental sustainability and perceived scant attention to social issues may worry Australian consumers (What's the Catch, SBS 2014), we are still prepared to increase our demand for their low price seafood commodities. The challenge is to move the relatively small Australian industry toward market niches that are protected from the full force of commodity costs/prices and leverage our unique competitive advantages and productivity opportunities.

This chapter starts with a summary of current status and what is needed, and then moves to the bigger sectoral and strategic issues and options. While this may seem counterintuitive – the benefit is that the reader gets a better understanding of the problem before being offered possible solutions.

b. Seafood Skills Status

In 2012 the FRDC commissioned ABARES to undertake a scoping analysis of the employment, education and training needs of the Australian seafood industry (ABARES Report 12.1, 2012). The headline conclusions were revealing:

"Firstly, it is difficult to access the available and limited datasets and information for informing workforce decisions in relation to people development in the industry.

Second, there is a gap in the current information available on employment, education and training for the seafood industry in terms of coverage and reliability."

There is a core problem here. While there are a number of national agencies that collate aggregate labour force data (ABS, DEEWR, NCVER, Census data, Melbourne Institute), there are no national sources of detailed granular data specifically related to labour and skills in the F&A industry and its downstream activities. The DEEWR Job Outlook website is a useful and comprehensive site to access profile data for employment in the seafood industry, it has limited capacity to inform productivity strategies.

ABARES Advice

Fisheries are largely state and territory managed - it is reasonable to expect detailed data will be available in those relevant agencies. ABARES reports that few jurisdictions actively collect detailed data at a fishery level:

- NSW - has limited information on employment. *The Status of the Fisheries Report ...* does not include employment statistics,
- VIC – *Fisheries Status Report* does not include data on fisheries employment,
- QLD – *Annual Fishery reports...* do not include data on employment,
- WA – *State of the Fisheries Report....* presents data on employment numbers for each bioregion, sourced from logbooks,
- SA – PIRSA/EconSearch reports *Economic Indicators for the Commercial Fisheries of SA* categorises employment numbers into commercial fisheries,
- IMAS – Assessment reports for each of the main commercial fisheries....only a very small number of these report include the number of people directly and indirectly employed by the fishery.
- NT – Fisheries Status Reports.....The employment figures presented are for the Coastal Line Fishery only. The agency indicated that they can only supply numbers of licensed operators and no other data on employment are available.

Commissioned reports often are used in jurisdictions to try to fill the information gap. These are typically (and appropriately) targeted to local issues (e.g. skills for Indigenous sea rangers in the NT). While these reports often add valuable insights, they do not enable a sufficient aggregate picture of the skills base and productivity issues across the whole industry and supply chain. The ABARE report notes that the big aquaculture states of SA and TAS

are experiencing skills access and retention challenges as their sectors expand.

ABARES identifies the questions we need to track with the core data are:

1. How many jobs, and in which location, are generated (directly and indirectly) by the seafood industry across Australia?
2. What is the demographic profile of those working in the industry and how is this changing?
3. How many students are undertaking seafood industry related studies and where are they located?
4. What is the basis for allocation of vocational education and training support funding to the seafood industry across jurisdictions and what additional data are required by these jurisdictions to better target their funding?
5. How many students completing whole qualifications or seafood industry skill sets are later employed in the seafood industry?
6. What qualifications/competencies are most sought by the industry?

A national F&A employment and skills data set and analysis system, based on the SA model would be a very sound and cost - effective platform for managing the labour productivity challenges that Australian industry must address. Such a platform would:

- identify workforce needs and pathways,
- develop career pathways,
- identify key skills and articulate job descriptions,
- identify qualifications and training resources required, and enable economic assessment to inform strategy and investment

Industry Comments

A number of points have been identified in discussion with stakeholders:

- The current data available for fishing and aquaculture human capacity is quite convoluted and includes large under-reporting, especially regarding female participation in the industry.

- The F&A Industry draws skilled employees from both the Seafood Training Package (STP) and Maritime Training Package (MTP), the later has a much greater impact due to the fact that the bulk of wild fisheries are marine based, and most large aquaculture sectors are also in the marine environment (Tuna, Salmon, cage Barramundi, Pearls, and King Fish). Mussels and Oysters are also marine but require little formal Maritime Training qualification as they are inshore.
- The Seafood Training Package was significantly amended in 2011, including considerable realignment of the two packages (i.e. STP and MTP) that has been of considerable benefit to the F&A Industry. Prior to this realignment there was some cherry-picking of subjects and trading-off by students between these two packages to reduce costs and achieve personalised training outcomes. The realignment has also resulted in more students choosing the MTP in preference to the STP. This has also made estimation of the number of students in relevant courses very difficult.
- While Aquaculture and diving qualifications have cemented themselves as core enrolment areas, these are subject to varying demand in the light of new threats such as marine parks, a slowing of investment and changes to the national labour market in 2013/14. For example the decline in marine services for the mineral resource industry has resulted in marine industry personnel returning to the F&A industry.
- There are three main areas of skill development – wild catch, aquaculture, and seafood processing including trade (export and import). The bulk of the industry training effort is in the Maritime Package and will remain so. There is only limited interest in training in the seafood processing sector and experts advise that we need a different structure to entice that sector to increase its training. Qualifications currently offered from either package are not attractive to processors/exporters. Industry is less interested in these package skills now, the seafood chain environment has changed and the need is for skills fit-for-purpose in a rapidly changing marketplace.

For example with 71% of the volume of every domestic seafood meal now coming from imports (Ruehla, 2011, p. 36), the large local businesses are more inclined to export to a processor in Indonesia and reimport the final consumer product. So the focus needs to shift from a focus on qualifications, to skills fit for purpose.

- The upshot is that the bulk of the industry training effort is delivered via the Maritime Training Package and will remain so. There is only limited industry interest in the seafood processing area and a new approach and different structure is required to entice this sector to invest more in training.
- Wild catch employment and training profiles are typically more volatile than aquaculture, due to the fact wild catch is more seasonal in operations and employs more vessel-based skills that are readily transferable to other marine industries such as petroleum, tourism charters, and merchant shipping.
- Around 2,500 students are in training nationally at any time in relevant F&A courses. There are three main training centres that deliver courses to the F&A Industry – Challenger TAFE in Fremantle, the Australian Maritime and Fisheries Academy in Port Adelaide, and the Australian Maritime College in Launceston.
- There is very little specific training capacity or demand for the development of skills specifically for the Recreational Fishing Sector. The \$700 million tackle and trade part of the sector would be the potential user of such skills.

NCVER Trends

The following summary points and charts illustrated participation and outcome trends in the Seafood Training Package (STP) over the last 5 years (2009-13). The data is drawn from the National Centre for Vocational and Education Research (NCVER, 2015).

Figures 79 - 81 below illustrate that student enrollments are declining in the Seafood Training Package, especially in older age cohorts, and especially in WA and NT where alternative marine based employment is available.

FIGURE 79. NCVER STP - ENROLLMENTS BY AGE GROUP

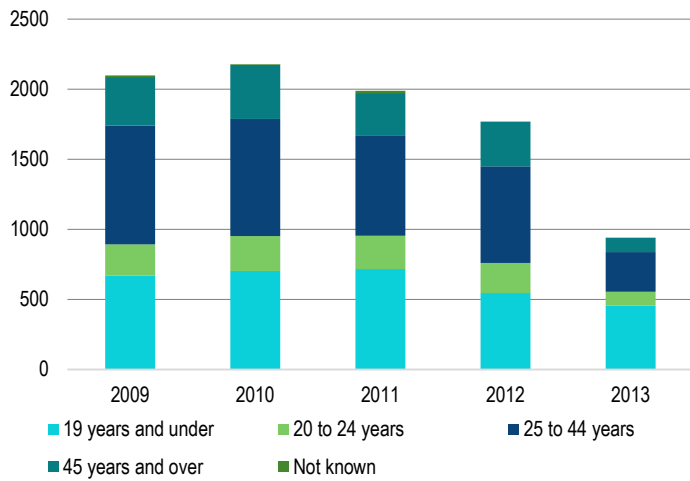


FIGURE 80. NCVER STP - ENROLLMENTS BY JURISDICTION

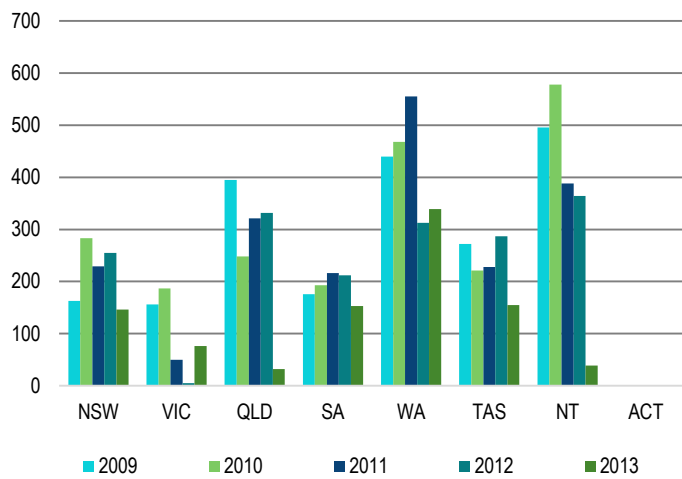


FIGURE 81. NCVER STP - ENROLLMENTS BY PRIOR EDUCATION

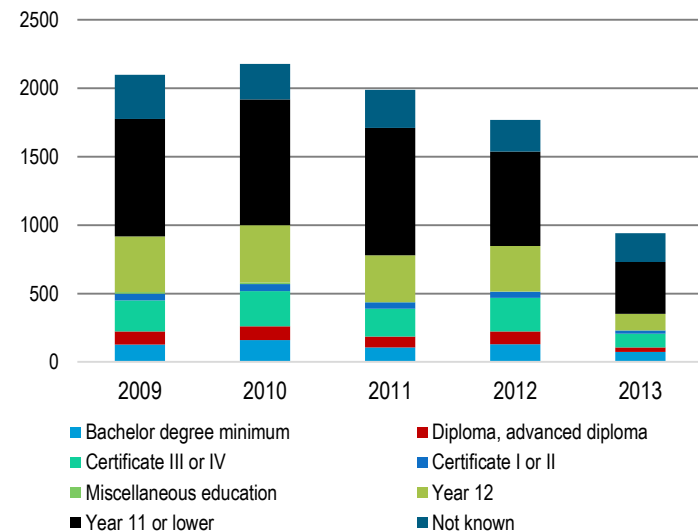
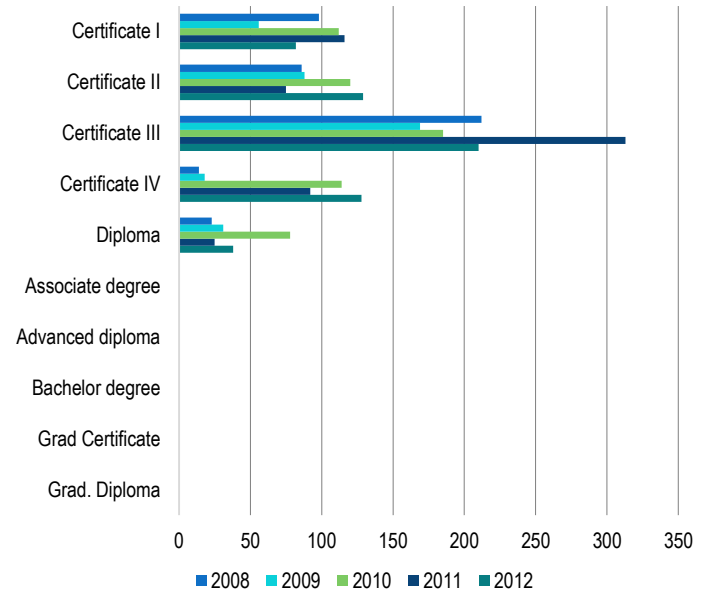


Figure 82 illustrates the range and number of VET qualifications completed from the Seafood Training Package program. Note that this data is from 2008-2012.

FIGURE 82. NCVER STP - QUALIFICATIONS COMPLETED



Additional summary point drawn from the NCVER 2009-13 analysis confirm that there is a wide range of student/trainee/apprentice outcomes from the package:

- Across the 5 years Tasmania (on average) graduated 61 trainees per year at a rate of 2.3 graduates for every Tasmanian person who cancelled or withdrew from the STP. By comparison WA graduated 3.2 trainees on average per year and achieved 0.5 graduates for every WA person who cancelled or withdrew from the STP. It is clear that the impacts of attractive alternate resource employment reduced the number of graduates and increased the percentage of people cancelling their enrollment before graduating.
- Older students (>45 years) are far more likely (2.4 graduates per cancellation) to complete their course than younger people under 20 years of age (1.0 graduates per cancellation).
- Around 7 times as many males graduate per year as females, (87 compared to 13), but females are marginally more likely to complete their course (1.8 graduates per cancellation, compared to 1.5).

- The relative remoteness of the origin of the trainee or apprentice has minimal impact on their likelihood of completing their qualification.
- An average of 6.8 Indigenous students graduate each year from the STP, but an average of 7.2 cancel or withdraw each year. Indigenous students are less likely (0.9 graduates per cancellation) to achieve graduation than non-Indigenous students (1.6) from their chosen course.
- An average of 88.6 full time students graduated each year, compared to 11 part time students. Part time students are twice as likely to cancel their course prior to graduation than fulltime students (0.8 compared to 1.7)
- More effective and efficient adoption by fishers of technologies available
- An increase in the abundance of fish,
- Shift in fleet structure toward more productive vessels—whether through autonomous adjustment as a result of concession trade or through an adjustment package

An ABARES report (ABARES, 2013) assessed the TFP for five selected fisheries (Eastern Tuna and Billfish, Commonwealth Trawl, Gillnet, hook and trap in the SESSF, Northern Prawn, and Torres Strait Prawn) to indicate how well their use of inputs produces outputs. In turn, this informs measures to improve overall fishery performance.

The study found an increasing productivity trend over the fisheries for the period analysed.

The recent restructure package (Securing our Fishing Future 2006-07) and the introduction of a Commonwealth Harvest Strategy Policy (2007) have both lead to increased productivity outcomes for the assessed fisheries. The fishers remaining after the restructure increased their innovation to adapt to changes in the operating environment largely driven by external economic factors, environmental factors and fishery management.

Recent market conditions have negatively affected profitability of fishers via increased input costs (fuel, overheads), increased competition in the seafood-export market, and the appreciation of the Australian dollar, which has increased competition in the domestic market from imported seafood. These matters have provided fishers with incentives to pursue vessel-level productivity improvements to offset some of these negative effects on profitability.

Preferred Approach

Tracking demand for training in the F&A industry is difficult and will continue to be so. Lack of good data is a perennial problem.

The current approach where one person is commissioned to collect and collate data nationally across all jurisdictions is inefficient and costly. Each jurisdiction is unique - and the industry is such that operators and information gate keepers are not motivated to support or trust any request from out-of-state.

The best approach would be to have each jurisdiction appoint and contribute an agency-based officer to a national team, for that group to agree a national data collation framework and objectives, and then for each officer to work over a 3-4 month period with his/her fishers, industry and stakeholders to collate the agreed data for their jurisdiction, before the final collation of all data at the national level.

The current labour market issues identified by ABARES from industry surveys are summarised in Figure 83.

c. Vessel Productivity

Total factor productivity (TFP) varies considerably across Australia's wild commercial fisheries. Productivity in wild catch fisheries is sensitive to four main drivers:

- Technological changes that increase the amount of outputs for a given level of inputs,

FIGURE 83. CURRENT F&A LABOUR MARKET ISSUES

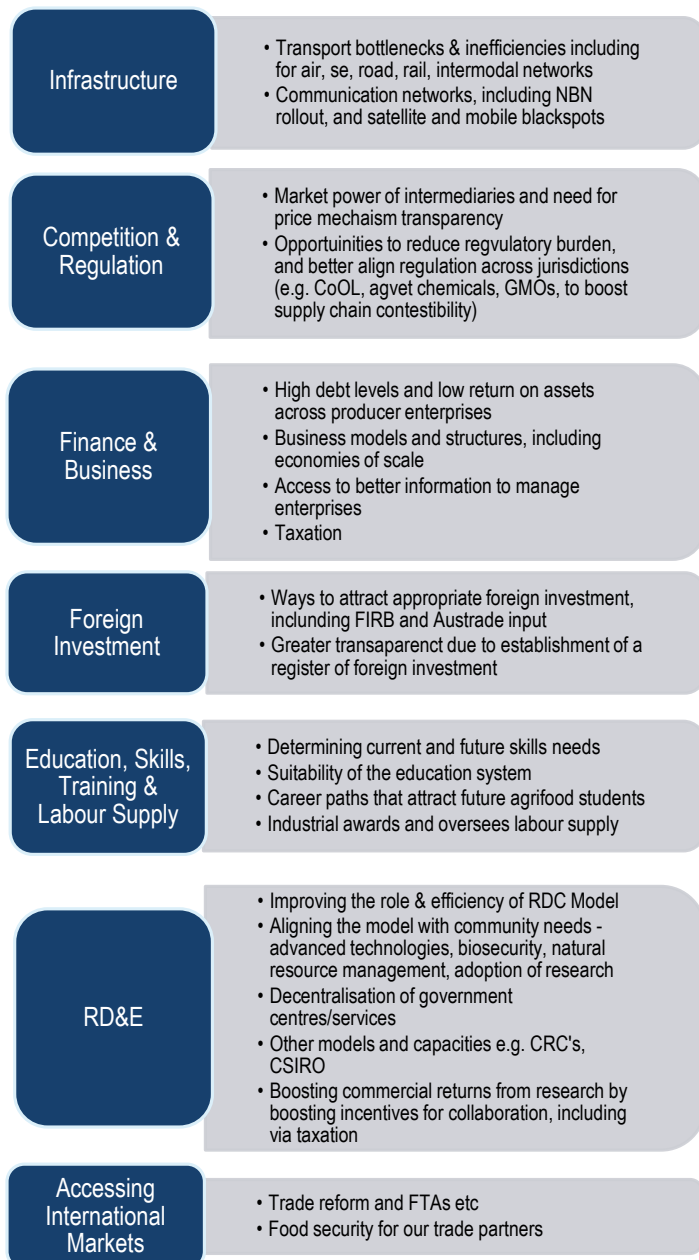
Commercial Fishing	Aquaculture	Seafood Processing
<ul style="list-style-type: none"> • Respondents highlighted the following main recurrent issues: <ul style="list-style-type: none"> ◦ General shortage of workers to crew vessels across all the major skill sets, especially engineers. Remoteness and increasing safety and insurance risks make for stringent certification and maritime regulatory standards. Wage competition from mining is acute in WA and Qld. ◦ The mineral resources sector being the main area of competition and loss of skilled employees. ◦ Australia-wide shortage of workers across fisheries – only larger businesses can afford to train-on-the-job. ◦ Lack of industry-specific training for commercial fishing. ◦ Immigration restrictions in sourcing skills from overseas. • The lack of skilled employees is so acute that many fishing businesses will recruit from overseas through work visa arrangements. • A longer term trend is the retirement of older high-skill employees who cannot be easily replaced with young people (if they are available). • Lack of interest in fishing jobs stems from the nature of the work - extended periods away from home in difficult operating environments. Younger people cite the poor access to modern communications. • Younger people's lack of interest in the industry include uncertain career paths, the view that industry is relatively informal, little career advertising being undertaken, few registered training organisations offering training opportunities, and the general seasonality of the work. • The shrinking commercial fleet is likely to exacerbate skilled labour shortages - a smaller fleet size will increase competition for the less skilled to enter the industry. • WA Rock Lobster has fewer issues now that the fleet has downsized, but there are growing shortages in northern Australia as the large gas industry developments unfold. • Increasing role for peak industry bodies to provide increased assistance to regulators to develop policy and direction toward meeting the industry's future labour and training needs. 	<ul style="list-style-type: none"> • Skills are steadily increasing and job applicants are better qualified. • Shortages arise for unskilled and skilled (farm managers, technicians). Graduate skills are lesser problem as they can be sourced overseas. • Frequent mismatch of applicant expectations and day-to-day tasks. • Unskilled labour demand on remote farms is seasonal, with higher labour demand at harvest - therefore large turnover of unskilled staff. • Backpackers /grey nomads often fill the gap - employers have no motivation to train them or boost long-term productivity. • Relatively low wages paid in the sector when compared with other sectors of the economy, exacerbates the high turnover. • Lack of career pathways, or knowledge about pathways. • Lack of employment tenure (part-time, casual), industry profile, wages and competition from other sectors (mining, agriculture) combined with poor job security and poor conditions. • Lack of a corporate culture and workplace pride in being part of a successful organisation. • Specific training courses are not appropriate to species farmed. • Oysters - skilled labour is short in a range of areas for enterprises, from hatchery technicians to farm managers. • Barramundi and Prawn - farms see little need for additional labour at present. Extreme difficulty in approving/expanding farm given current state/territory government regulations, means low demand for additional workers. Focus is on upskilling existing staff. • Salmon - farms face difficulties filling supervisory positions as older workers retire - also lose skill base. Limited number of young people applying for jobs - due potentially to poor understanding of the career paths available in the sector • Tuna - although located near a large regional centre, the Tuna sector still has constant labour supply shortages for skippers, deck-hands and divers. 	<ul style="list-style-type: none"> • Seafood processing can involve a range of skills. These include cleaning, filleting and cutting fish, preparing smoked or marinated seafood, preparing sashimi-grade fish, freezing fish, preparing shaped and crumbed products, opening oysters and other shell fish (shucking), grading and boiling prawns/crustaceans and packaging seafood. • At the sale and distribution end of the supply chain of seafood to consumers, workers need a clear understanding of the products being sold - the correct marketing names and seasonality of seafood, safe handling of fish to avoid food safety hazards, handling and packaging of seafood products, and the ideal cooking methods. At this level of the supply chain, workers may be employed by small specialist seafood suppliers, by restaurants or in seafood sections of large supermarkets. Vocational qualifications in seafood sales and distribution are available. • The ageing population and the unpredictable future of the wild-catch sector are reported as having flow-on effects on the post-harvest sector. Respondents reported that attracting and retaining skilled oyster shucking, fish filleting, prawn grading and processing and trained retail workers is a challenge for the post -harvest sector. • Some respondents felt that a strategic plan promoting the industry and encouraging younger people into various jobs would be beneficial.

d. Summary of Relevant Literature

A number of recent reports and papers have assessed the skills and productivity issues from an Australian perspective and identified the need for urgent action along pathways to improve industry productivity and skills.

To set the scene the Commonwealth released an *Agricultural Competitiveness Green Paper* (Dept of Agriculture, 2014) that considered a range of topics relevant to fisheries and seafood productivity.

FIGURE 84. DOA COMPETITIVENESS GREEN PAPER 2014



A number of other reports have been reviewed regarding Australian productivity and competitiveness:

1. ACOLA

A 2014 report by the Australian Council of Learned Academies (ACOLA, 2014) says that lifting productivity is a critical priority for Australia. This report found that there is an urgent need for Australia to increase innovation to lift productivity and build future industries.

"Time is not on our side. In the past ten years, other countries have moved ahead of us. Australia needs to reposition itself as a competitive economy based on a highly productive innovation system."

Manufacturing, including in fishing and aquaculture inputs and outputs, is increasingly integrated to services – the traditional delineation between the two is fast disappearing in a global market where winning enterprises are either "leaders" or "fast followers". The currently evolving demise of the Australian vehicle manufacturing industry confirms that sector was neither.

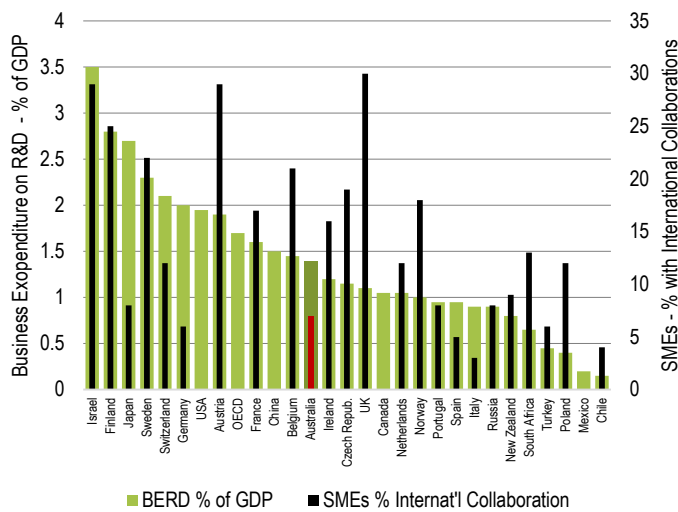
A major problem is the low level of international engagement by Australian firms in global value chains, making it difficult for them to access new, high-technology, niche sectors. Australian manufacturing is dominated by SMEs making up more than 90% of all firms in this sector and most do not operate on a global scale. They have strong innovative potential but are faced with several barriers to growth, such as: a lack of funds, risk, and a lack of access to infrastructure, processes and knowledge networks.

Because we are a small to mid-tier economy (12th largest globally) competing in a few large global industries, it is difficult for us to be leaders in many technologies. Therefore Australian businesses must be "fast followers" or early adopters of innovations developed elsewhere. International collaboration is the cost-effective key to identifying and accessing networks and new markets, by mobilising additional resources and accessing expertise needed to tackle complex issues and projects. This facilitates learning, capability development and an ability to deal with risk and uncertainty.

The capacity to attract collaborators and work effectively with them is central to the ability of organisations to create, capture, and deliver value, and hence their continuing survival and development.

Figures 85 and 86 illustrate (2005-06 data) Australia's comparative investment in business R&D, the components of R&D, and the level of international collaboration. Neither collaboration nor business R&D expenditure is strong. In addition our relative investment in intangible productivity drivers is low.

FIGURE 85. POOR COLLABORATION AND LOW R&D EXPENDITURE



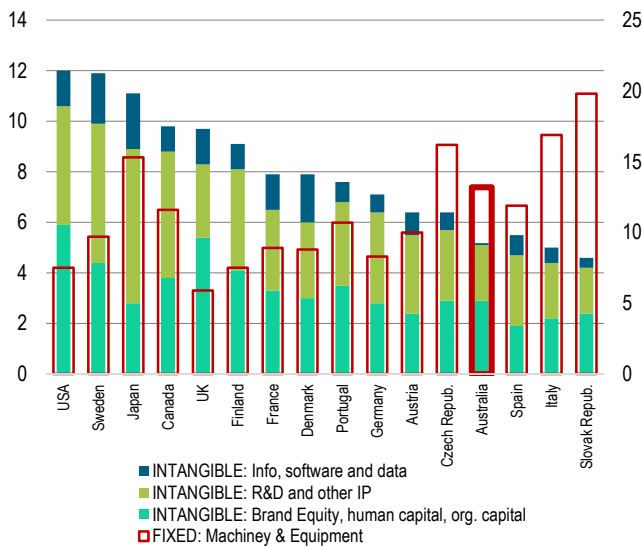
2. Ensuring manufacturing has enhanced interconnection with services.
3. Australia needs to build on existing initiatives such as the specialist collaborative structures (e.g. CRCs) to expand its efforts in this area.
4. Businesses find continual change to government assistance programs confusing. More stability is needed and unnecessary changes should be avoided.
5. New approaches to promoting the creation and growth of new firms, including small business 'set-asides', crowd-sourced equity funding and support for innovation intermediaries, are worthy of serious consideration

2. McKinsey 2014

A report by McKinsey (McKinsey Australia, 2014 July) estimates that 90% of our gross domestic income growth from 2005 to 2013 came from capital investment and terms of trade. Productivity improvements contributed very little – and this creates problems that needs urgent attention:

- The Australian economy is too domestically focused – as the 12th largest economy we are only the 21st largest trader with about half the trade levels of Germany and South Korea. New Free Trade Agreements will be a good first step in both goods and services to unlock economic growth.
- Competitiveness should be more directly linked to the employment of people in trade / export related industries where Australia has competitive global advantage – especially in agriculture, mining and extraction, and financial services.
- The barriers to higher productivity are: Lack of scale, Lack of access to growth capital, Poor access to talent and a misalignment between tertiary degrees studied and job-ready requirements, Lack of global orientation and collaboration in both the private and public sectors, Labour market rigidities including restrictive work practices and poor management – workforce relations, and regulation that is often too slow and limits growth and flexibility. The World Competitiveness Yearbook ranks Australia 128th on regulatory burden, while our nearest seafood trade competitor New Zealand, ranks 13th.
- The process and service activities that support our traded industries are also important to overall

FIGURE 86. RELATIVE INTANGIBLE INVESTMENT - % OF GDP



The ACOLA report also notes five important strategies to be implemented:

1. Urgent action to avoid some underperforming sectors being left behind by international competitors.

productivity growth – they are the enablers of productivity.

The report identifies the need for industry and enterprise scale in agriculture and fisheries and their related food sectors, as a particularly attractive productivity opportunity, given the growth of the global middleclass population. The current strong global demand for Australian dairy capacity is the start of a long term trend for global scale.

Today, the average New Zealand dairy farm is 80% larger than a Victorian one, and processing plant utilisation is 15 % higher. Fonterra, the New Zealand milk products monopoly, spends proportionately 40% more on R&D and 300% more on marketing than Australia's Murray Goulburn Co-operative.

Noting the inevitable demise of vehicle manufacturing in Australia, the McKinsey study recommends we transform our business models to:

- Identify and specialise in niches where scale is not available, but adequate degrees of freedom can differentiate products and leverage unique technologies and skills,
- Establish and build value chain orchestrators that will drive chain efficiency and productivity from soft assets such as marketing and design.
- Enable and motivate governments to identify and support painful adjustments and transitions to more sustainable markets and business models, and streamline related approvals processes.

3. BCA 2014

A 2014 study by the Business Council of Australia (Business Council of Australia, 2014 July), an employer body, has similar key messages:

- Rethink the role of government in driving growth, by facilitating competitive industry by taking a sector view of the economy and prioritising all decisions and reforms to promote Australia's comparative advantages, including specifically for agriculture and food.
- Actions to lift trade and investment and foster business risk taking to ensure growth sectors can attract the capital for major projects and achieve economies of scale, and so that transitioning sectors can make investments in productivity and restructuring.

- Regulation and competition policy for a global market to lift the performance of all sectors and allow companies to contribute to global supply chains.
- Prepare Australians to compete in a global labour market to ensure our human capital is maintained as a competitive advantage.
- Reducing labour market rigidities to allow transitional sectors to move within the value chain, drive growth in other sectors and enable competition at the task level.
- Developing physical infrastructure and population policy for an innovative economy.
- Incentivise innovation by aligning Australia's research and development efforts with our comparative advantages and fostering cross-sector collaboration.

Australian agrifood industry needs global scale and focus. Today, the average New Zealand dairy farm is 80% larger than a Victorian one, and processing plant utilisation is 15 % higher. Fonterra, the New Zealand milk products monopoly, spends proportionately 40% more on R&D and 300% more on marketing than Australia's largest processor, Murray Goulburn Co-operative. McKinsey Australia 2014

4. Deloitte Access Economics

This 2013 report (Deloitte Access Economics, 2013) recommends Australia

- Find ways to promote our safe, fresh and abundant produce to the world more effectively.
- Think laterally and invest in developing new areas of business, including aquaculture and algae, and new regions of the country.
- Invest in technologies and implement new policies and approaches to make us a world leader in producing value from semi-arid land.
- Make agribusiness attractive again to graduates, and enhance the education we provide.
- Attract the capital that will be required to manage the coming enormous transition from family-owned to corporate farms, and the accompanying generational change.

- Improve the quality and quantity of infrastructure
- Available to our agribusiness sector, including roads, rail and ports in hot demand.

The literature also offers a number of recent studies that focus on agrifood sectoral issues and solutions.

5. Productivity Commission 2011 (*Product Commission, 2011*)

The Inquiry (and its subsequent 2012 response by Government (Dept of Agriculture, 2012)) identified an exhaustive set of issues and recommendations, but the salient ones for F&A and the FRDC (a Statutory RDC structure) are:

FIGURE 87. PRODUCTIVITY COMMISSION AND RESPONSES RE RD&E

Selected PC Recommendation	Government Response and Comment
Gradual shift to more appropriate balance of public and private funds	This was rejected by DOA. While there is debate around the metrics used in the PC Study, and the public sector investment tradeoffs between Commonwealth and State/NT investments, there is expectation that an increased share of RDC investment funds will come from producers.
Provide open-ended incentives for producers to increase their investments especially where this investment profile balances long-short term and high-low risks	DoA agreed, and has altered policies to extend the capacity for matching for voluntary funds, incentivise greater private RD&E investment.
Government to provide clearer direction of specific R&D issues it believes require priority. Increased scope for RDCs to bring their expertise to bear in the formulation of research portfolios and reduce admin costs	DoA agreed and will provide clearer direction to RDCs. But it is not clear (in the Gov't response) to what extent the FRDC (including related CRC's) can adopt a flexible approach to investment in its very diverse sectoral portfolio.
Allow statutory and industry-owned RDCs to take on industry-funded marketing functions and achieve synergistic efficiencies	DoA agreed, and has altered policies to allow statutory RDCs to undertake marketing on clearly delineated terms. The FRDC has since been granted marketing support powers and is developing in-house capacity in line with industry requests.
Remove product-specific maximum levy rates and let producers take on a greater investment role in R&D	DoA agreed and will seek to remove maximum levy rates, and enable industries to increase investment in RD&E or marketing. Government matching support funding will continue to be capped at 0.5% of GVP.

6. Australian Farm Institute (*AFI, 2013 Nov.*)

This paper reflected on the Productivity Commission review noting that:

- RD&E has served the agricultural sector (including fisheries and seafood) pretty well in the past but questions are now emerging about its capacity to continually improve the productivity, profitability and competitiveness. (A 1% productivity gain is worth ~A\$500 million to the Australian agriculture sector).

- Agricultural productivity growth was quite high and averaged more than 2% per annum for an extended period in the mid-1990s, however has been low to negative since then. While severe drought has been a factor in the 2000s, the worry is that lower productivity rates in Australian agriculture appear more pronounced than in other comparable nations. The Australian RD&E and innovation system is no longer producing the level of benefits it has in the past.

- The commitment to invest funds is a problem especially the public investment trade-off between the Commonwealth on one hand and the States/NT on the other. The investment by state and territory governments has deteriorated significantly over the past decade, particularly when considered in real terms and from the perspective of research intensity down from 0.9% of Ag. GVP to 0.4% of Ag. GVP.
- The research community is losing capacity, especially Universities, who are a vital link to both centres of research and attracting and training of researchers.

7. Port Jackson Partners / ANZ Bank 2012

This paper (Port Jackson Partners, 2012) identified a seven step approach to repositioning agrifood industry to seize

Australia needs to lift its game. We are lagging behind our peers globally and are not considered a leader of innovation.

The OECD in its Science, Technology and Industry Outlook 2012, rates Australia as 'average' against its key drivers that measure competency and capacity to innovate. Our economy has traditionally been based around physical industries such as mining manufacturing, agriculture and construction. We lead the world in physical capital investment – but significantly lag in investments in knowledge capital. To find new sources of growth, we need to transition to a knowledge based economy and invest in industries such as technology, biotech and health.

(PwC Australia, 2014)

growth opportunities, especially as they are arising in Asia. A number of its conclusions are appropriate for the F&A sector:

- Sourcing capital: change business models to boost capital to source and leverage additional capital and attractive collaborators and overseas investors
- Attract skilled workers: to fill shortages and enable succession for an ageing farmer/fisher population. Boost the image of agriculture to attracting new workers and enhance education platforms.
- Focus RD&E: National agricultural R&D programs need more focus and coordination to drive long term growth particularly by identifying and pursuing the highest potential opportunities.
- Close performance gaps: Farms perform at substantially different levels with many delivering poor yield and profit outcomes. Reinvigorate public and private extension systems in order to build farmer confidence and to encourage investment in new technologies and best practices.
- Improve supply chains: Declining performance and increasing costs for major supply chains is putting competitiveness at risk. Fixing this is critical to future growth. The key is to create or recreate contestable supply chains that are aligned with the interests of the producer, fostering greater trust and coordination. Additional investment in infrastructure is crucial.
- Target key markets: Understand consumer requirements and explore more innovative ways to access new markets. Strike free trade agreements especially where they capture premium market opportunities. Ensuring industry exposure to global market challenges and opportunities is a critical element of the targeting process.

Regarding aquaculture development it specifically noted:

- Pressure on natural fisheries protein from aquatic food is an important component of dietary preference changes in developing economies.
- High quality technological capacity available in limited areas. Very diverse and extensive range of marine and freshwater environments available. Infrastructure variable.

- Potentially extensive marine locations outside conservation and tourism zones. Freshwater niches can be shared with other enterprises
- Excellent but limited RD&E capacity currently available in CRCs, CSIRO and universities. Rapid expansion would require a major increase in research capacity.
- Potential infrastructure challenges in remote marine environments. Labour costs could limit competitiveness depending on the strategic industry direction. High value, high technology enterprises are required.

The report concludes that there is large potential for aquaculture expansion given the availability of marine locations and the national scientific and technological capacity. Significant expansion will require considerable commercial investment supported by government. The benefits will be achieved through:

- Productivity increases within current export industries;
- Development of new industries that are not necessarily competing for the natural resources currently being utilised by agricultural industries, such as high value aquaculture and to a limited extent biofuels; and
- Increasing the market value of agrifood products through;
 - capturing a greater portion of the value chain locally;
 - transformation of food commodities into higher value products;
 - production of high value fresh produce; and
 - credible certification and authentication of Brand Australia products as safe quality food of known provenance.

The need for enhanced collaboration, private and public, locally and globally, is a common theme across all these studies of Australian business.

The RDC investment has delivered a high level of collaboration. The study notes that the additional investment outcomes achieved by the agricultural CRC's have been better than in other industry sectors.

FIGURE 88. PROPORTION OF RD&E INVESTMENT BY RDCs

RDC	Collaborative Investments %
Australian Egg Corp. Ltd	56
Australian Meat Processor Corp.	99
Australian Pork Ltd	93
Australian Wool Innovation	89
Cotton RDC	88
Dairy Australia	98
Fisheries RDC	95
Forest and Wood Products Australia	70
Grains RDC	90
Grape and Wine RDC	55
Horticulture Australia Ltd	71
LiveCorp	100
Meat and Livestock Australia	51
Rural Industries RDC	98
RDC	98
Weighted Average	80

The summarised discussion is reasonably clear and agreed as to WHAT we need to do.

The next questions are HOW will the F&A Industry act and invest, and Does the F&A Industry have the required structures and RD&E frameworks to implement the strategy. The FRDC is the national leader of the F&A RD&E investment strategy: does it the horsepower – what is the vehicle to do this after the CRC?

9. RECREATIONAL SECTOR

a. Size and scope

Australia's recreational fishing sector generates personal enjoyment and recreation from fishing or non-extractive use of aquatic resources (for example fish stocking in freshwater environments). It is not legal in any jurisdiction to sell fish taken recreationally.

The 2001 national survey (NRIFS, 2003) estimated that 5 million Australians participate in some form of recreational fishing in Australia, with a number of 3.4 million as regulars.

Although recreational fishers do not generate direct catch revenue, they do contribute significant indirect expenditure – one submission to the Borthwick Review (Borthwick, 2012) suggested expenditure is in the order of \$10 billion annually, but recent work by the FRDC's Recreational Fishery Valuation Committee suggests an economic valuation figure of less than \$3 billion is in order.

In some fisheries, recreational rather than commercial fishers are the dominant contributor to economic value, and recreational catch may exceed or be significant compared to commercial catch for many finfish species.

Recreational fishers fall into three broad groups

- 'Game and sports' fishers who tend to use sophisticated vessels and gear and target large pelagic fish – to which strict catch and release practices are often applied. It is estimated there are about 20,000 game/sports fishers nationally and about half are members of clubs.
- 'Charter vessel operators' who provide fishing experience and expertise on a commercial fee for service basis. Charters cater for small-medium groups of line and spear fishers with trips being from hours up to ten days in duration. It is estimated there are fewer than 500 charter operators nationally.
- 'Independent' recreational fishers who are estimated by industry sources⁸ to account for about 80% of all national recreational fishing effort. Fishers often operate from small, inshore craft or from shore and only a small percentage of them are affiliated with a club. Most members of this group catch fish for private consumption.

All up, the sector supports about 90,000 Australian jobs, largely in the fishing tackle and bait industry and the recreational boating industry. The sector is "fragmented, often poorly described, and lacks the data and organisational capacity to demonstrate its substantial outputs and outcomes to the economy and the community." (FRDC, 2010).

Figure 89 illustrates the location of recreational fishing activity, and Figures 90 and 91 present the 2001 NRIFS breakdown of the national recreational catch and release based on a standard uniform survey across all jurisdictions.

⁸ Game Fishing Association of Australia, Australian National Sportfishing Association and RecFish Australia estimates

FIGURE 89. MAP OF RECREATIONAL FISHING LOCATIONS

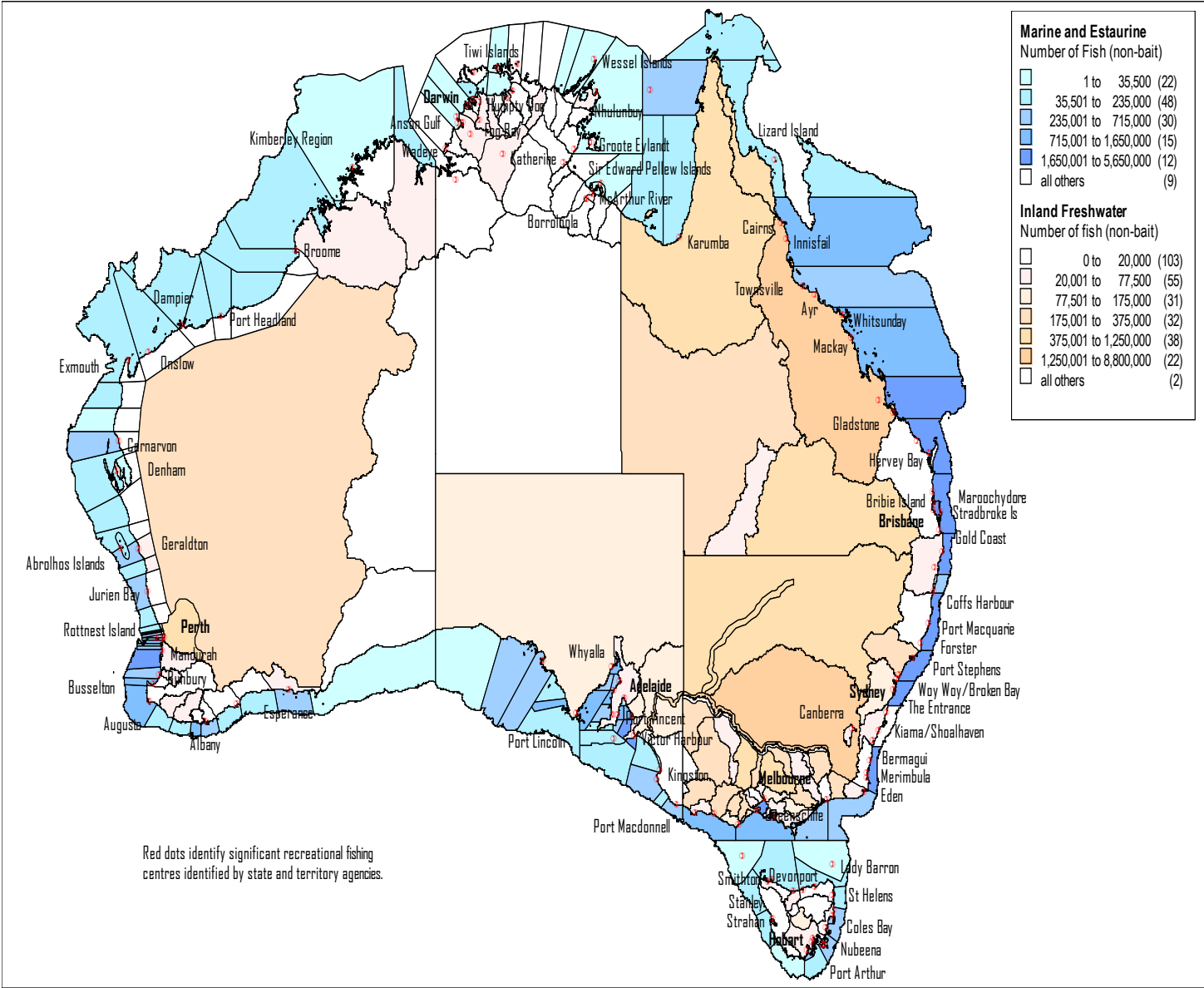


FIGURE 90. RECREATIONAL HARVEST (NRIFS)

	Harvest	Finfish	Crustaceans	Molluscs
Fish				
NSW	31,088,895	14,357,779	16,541,256	189,860
Vic	13,269,106	9,562,107	3,497,442	209,557
QLD	41,014,069	32,141,383	8,678,045	194,641
WA	15,316,049	10,442,286	4,442,562	431,201
SA	14,896,245	10,817,156	3,013,405	1,065,684
Tas	2,831,433	2,580,456	98,044	152,933
NT	763,075	638,729	124,082	264
ACT	55,671	35,735	19,936	-
Total fish	119,234,543	80,575,631	36,414,772	2,244,140
Tonnes				
NSW	7,438	6,949	413	76
Vic	3,624	3,359	173	93
QLD	13,474	12,298	1,136	39
WA	6,087	5,085	896	107
SA	4,178	3,130	616	432
Tas	1,109	957	73	79
NT	1,144	1,075	69	0
ACT	24	24	1	-
Tonnes	37,078	32,876	3,376	825

FIGURE 91. RECREATIONAL CATCH AND RELEASE

	Catch	Harvest	Released	% Released
Fish				
NSW	45,934,041	31,088,895	14,845,146	32%
VIC	22,631,282	13,269,106	9,362,176	41%
QLD	69,962,022	41,014,069	28,947,953	41%
WA	23,935,045	15,316,049	8,618,996	36%
SA	21,133,132	14,896,245	6,236,887	30%
TAS	5,318,834	2,831,433	2,487,401	47%
NT	1,835,299	763,075	1,072,224	58%
ACT	73,386	55,671	17,715	24%
Total fish	190,823,041	119,234,543	71,588,498	38%
Tonnes				
NSW	10,989	7,438	3,552	32%
VIC	6,181	3,624	2,557	41%
QLD	22,983	13,474	9,510	41%
WA	9,513	6,087	3,426	36%
SA	5,927	4,178	1,749	30%
TAS	2,083	1,109	974	47%
NT	2,752	1,144	1,608	58%
ACT	32	24	8	24%
Tonnes	60,460	37,078	23,383	38%

b. Recreational Fishing Statistics

The ongoing lack of good data limits the discussion and analysis of the size, scope, demographics and benefits flow for the recreational fishing sector to regions and nationally.

On page 91 the 2009 Sector Overview stated:

“Recreational Fishing Statistics. Desired Outcome: Data on attitudes, motivation, demographics, participation, fishing methods, catch and effort are available at state and

national levels to assist decision making on recreational fishing.”

There has been little national progress on the development of realistic and useful national statistics for the sector.

Progress has been made in economic valuations, and most jurisdictions have updated and improved their sector surveys, but these are not easily harmonised or integrated into a national picture.

c. Trends since the NRIFS

Two recent jurisdictional surveys in the same jurisdiction provide some evidence of sector changes since the NRIFS in 2001. A telephone diary Fishing Survey (QDAFF, 2010) and a Social Survey (QDAFF, 2010) were undertaken by the QLD Government of the state’s recreational fishery. The Fishing Survey indicated:

- An estimated 703,000 over 5 years of age fished (17% of the population), a participation rate higher than golf or cycling,
- Participation was highest (~26-27%) in regional Queensland,
- Almost twice as many males as females participate in the activity, and less than half are members of a fishing club,
- Approximately 13.3 million finfish were captured and 8.3 million crustaceans. Nearly half of all fish captured were released back into the water,
- Despite the rapid population growth in the state over the decade there were fewer fishers in 2010 than in the NRIFS in 2001. Similar declines in the participation rate of recreational fishing have recently been reported in SA, NT and TAS. Related research suggests that primary reasons for ceasing fishing in QLD included a lack of time, loss of interest and a perception of poor fishing quality.
- Compared to 2000, the proportion of fishers aged 45 years or more has increased, while that for younger people has decreased. In part this may be linked to the gradually ageing population in QLD. The reasons for the fall in participation among younger people are not yet well understood.
- Overall, both recreational catch and effort were less between Oct.2010 and Sept.2011 in comparison with the May2000 to Apr2001 period.
- Given the decline in the number of recreational fishers, lower catch and effort in 2010 is not

surprising; however, the results demonstrate that people caught fewer fish for similar effort compared to a decade ago.

- The report noted that many factors can influence the size of the recreational catch including variability in recruitment, weather and fishing pressure. The last survey was undertaken after heavy rains compared to the preceding dry years during the NRIFS.
- In total, 43% of the fishers who took part in the 2010 survey felt they fished less than in the previous 12 months. Around a third of these fishers cited weather as the main reason. However, the most common reasons for fishing less in 2010 were work or business commitments and family commitments. Therefore social reasons have also been responsible for the lower fishing effort in 2010. The report notes that it is possible that the introduction of stricter fishing regulations and green zones could have acted as a deterrent to fishing activity.

The key points in the Social Survey were:

- In 2011, 43% of fishers felt they fished less often (49% in 2001) and of these 35% cited work or business commitments as the main reason. In 2011, 31% of fishers felt they fished more often (14% in 2001) and of these more than half cited a change of personal preference as the reason.
- Fishers in both the 2001 and 2014 surveys ranked eight different reasons for going recreational fishing. In both surveys, the majority of fishers felt it was very important to go recreational fishing to relax or unwind, to be outdoors in the fresh air, for the enjoyment of the sport and to catch fresh fish and crabs for food. Competing in a fishing competition was not an important reason to go recreational fishing for the majority of fishers. Going fishing to spend time with family and friends was ranked much higher in 2011 than it was in 2001.
- In both 2011 and 2001, approximately 70% of fishers strongly agreed with the statement 'a fishing trip can still be successful, even if no fish or crabs are caught'. In 2011, 53% of fishers strongly agreed with the statement 'I'd rather keep one or two bigger fish than 10 smaller fish', while only

40% of fishers felt this way in 2001. Similarly, in 2011, 52% of fishers strongly agreed with the statement 'I like to fish where there are several kinds of fish to catch' compared with 43% in 2001.

- In both surveys, the majority of fishers were quite satisfied with the quality of recreational fishing in the previous 12 months. This figure increased from almost 53% in 2001 to just over 64% in 2011.
- Fishers who were not satisfied with the quality of fishing in the previous 12 months were concerned with low fish stocks. They identified the negative impacts of both commercial (21%) and recreational fishing (21%) as contributing to this cause. The same concern was mentioned by fishers in the 2001 survey (almost 75% of responses fitted this concern) however, in 2001 the most commonly mentioned cause for this concern was commercial fishing practices (30% of responses).
- Fishers were given the opportunity to comment on anything fishing related. In 2011, the majority of comments indicated fishers were generally happy with fishing and/or Fisheries Queensland (14%) but they indicated that there was a need for stricter compliance (11%). In 2001 comments were more concerned with the negative impacts of commercial fishing (23%) and the need for stricter compliance (14%).
- Over 70% of fishers in the 2011 survey were aware that Fisheries Queensland has supported stocking programs for freshwater fish in waterways and dams although only 20% of fishers were aware that over 100 waterways and dams were involved in stocking programs.
- As happened in 2001 fishers were given the opportunity to provide comments on how they felt about the surveys they participated in. Over 90% of fishers were very happy with the way the surveys were conducted, the purpose of the surveys and the interviewers conducting the surveys; demonstrating that recreational fishers are willing to participate in the sustainable management of fisheries in Queensland. Fishers recognised the benefits that contributing their data would have towards fisheries management and appreciated the efforts made by the survey design teams and interviewers to make this contribution as easy as possible.

10. AUSTRALIAN F&A RESEARCH PERFORMANCE

Fifty years ago, Australian farmers and fishers comprised one-sixth of national income in the economy, today their share is one-fiftieth.

But while many papers (refer preceding discussion) see opportunity in our unique Australian competitive advantages (including in F&A) in the next decade – Agribusiness (including agriculture and seafood), Gas, Mining, Tourism, International Education, and Wealth management – there are many leaders worried that the performance of our agricultural innovation and RD&E systems is waning and needs generational restructure.

a. Issues

A recent article in FRDC's Fish Mag (Sept 2014) discussed research capacity. It noted that more sophisticated approaches to fishing and aquaculture research are combining public and private-sector capabilities, while striving to find the balance between fundamental science and industry-specific needs. A number of changes were noted regarding Australia's fishing and aquaculture research sector over the last 5 years:

Capacity

Governments have streamlined their operations, offset by an expansion of capability in universities and private enterprise. Between 2008 and 2013, national investment in fisheries research was a decline in real terms, confirming that scientists in the fisheries sector are being asked to do more with less.

A comparison over the 5 year period (undertaken as two independent audits) shows there has been minimal change in capability between the two study periods (approximately a 2% increase).

State research agencies in QLD, VIC and SA all reported capability reductions of 10 or more positions, with NSWs reporting a reduction of slightly less than 10 positions. A past chief scientist in the NSW agency in the past two years there has been a significant movement of government fisheries scientists into the private sector, mostly for economic and private career path reasons.

Responsiveness

Private businesses are quickly able to bring together the most appropriate team of people for a particular project or task. But there are tasks better undertaken by agency staff or collaborative custom-built teams of private and public

researchers and experts. The funding of the research will still need to be both private and/or public, subject to the nature of the market failure, balance of public or private benefits, and precompetitive/competitive focus of the new knowledge created.

Critical mass and collaborating

Research by public agencies often builds on a long history that often goes back decades, providing a rich source of data and expertise as well as the big project linkages across many areas of knowledge that are relevant to fisheries industries. On a case by case basis this capacity can be boosted and reconfigured by including private experts, especially where the expertise is not available in the agency base.

Agency staff will be able to collaborate, more easily than private operators, in big projects with people in CSIRO and at other universities. Large public researchers will have a suite of people that can be drawn on in terms of their skills and expertise.

The fact that the wild fishery resource is in public hands, means having a research agency that can balance the needs of all sectors – commercial, recreational, community and Indigenous – using that resource is essential while balancing interests and potential conflicts.

The extent to which state research agencies have outsourced research varies. Based on the effectiveness of management (research, policy and compliance), the WA's Dep't of Fisheries chose to keep all its fisheries research capacity in-house when it conducted a review in 2010 into how fisheries research was best managed in the state. The free flow of information among the various divisions and the integrated management structure means that the department takes long-term responsibility for all past work, irrespective of when it was done.

The need for balance

Industry often questions how responsive public research agencies are to the needs of industry in their research priorities. Industry advice suggests that the state level tends to be much more industry-driven, but may lack independence and capacity in some areas.

One aim of a research proposal that is too often overlooked is engaging industry through adequate consultation, from the expression of interest stage to the final report, and for more research projects "owned" by

industry. The ready availability of private consultants and service providers ensure cost effectiveness in the RD&E market and enhanced outcomes for the F&A industry. In projects where detailed science is required it is the case that public or university based researchers (rather than private firms) are more likely to have the capacity and independence required. Long detailed research (e.g. stock assessments where private firms are not set up for this work) are best undertaken by government researchers, especially where there are considerable public good elements involved.

A number of industry leaders express concerns that the limitations on and ongoing reduction in the RD&E contribution from government will threaten and ultimately degrade the quality of RD&E invested and available to the F&A industry, at a time when the industry needs greater investment to compete in global markets seeking sustainable harvests.

The emerging mix of public and private research is providing new opportunities and efficiencies for industry, particularly for the aquaculture sector – where projects are much more driven by the needs of private enterprise. However, for wild fisheries, the public expects governments to maintain sufficient scientific capacity to manage these resources for current and future generations.

b. Funding the FRDC Performance

The Borthwick Review (Borthwick, 2012) noted the FRDC, as a major source of fisheries research funding, has:

- Strong research capability which provides a positive return on the Government's investment in RD&E,
- Providing an average return on investment of 5.6 to 1 in 2009-10,
- Ensures that national research priorities and rural research priorities are aligned with its research programs,
- A flexible program model able to accommodate and adopt new or changing priorities, such as climate change,
- Directs the majority of its funds in line with departmental objectives, priorities and in line with the contributions that the various fishing sectors make to the fishing industry,
- Is funded to a considerable degree from government (>60%) and far more than is provided

to any other statutory RDC), as opposed to research levies imposed on industry. This rightly reflects the public nature of fisheries and marine resources.

It follows that DAFF, and the Minister, should inject a stronger government policy overlay to the FRDC's research strategies and planning for priorities given the FRDC deals in a world where such a significant public interest component exists (unlike other rural RDCs, which deal with mainly private resources). But the Borthwick Review found no evidence that the government does any more than direct the FRDC in the same way it does all other RDC's. The Review believes there is an argument for reviewing DAFF's basic oversight, without obstructing or impeding the smooth running of the organisation by its own board and management. It stated: *"It would be reasonable for DAFF to seek advice from the FRDC on the level of funding for private interest research, which delivers a public benefit, against public interest research activities, and to provide more guidance about how public good money could be appropriately spent."*

The Review found:

- That the fisheries research dollar in a national context is significant and so, it is not so much the quantum but the efficient and effective use of the research dollar that counts most.
- There are a number of different research institutions that are funded, publicly, privately and by states and the Commonwealth. While there is broad cooperation in fisheries research – the relatively small size of the cohort assists with this – there is need for constant review and evaluation of the efficiency of the research dollar spend to inform funders and researchers alike about possible gaps and duplication, or potential increased effectiveness through joint projects or more open sharing of information.

Funds come to FRDC through a range of mechanisms primarily through Commonwealth, State and Northern Territory funds that attach an R&D contribution to licences and permits. This money is in turn matched by the Australian Government up to 0.25% of their GVP. The Australian Government in addition contributes 0.5% of the aggregate GVP to FRDC in recognition of the public good associated with fishing and aquaculture. The prawn

aquaculture sector is an exception to this in that the sector has a compulsory RD&E levy established in 2003. A lesser contribution is paid directly by industry to the FRDC generally on a project by project basis.

The ABARES Future Fisheries Roundtable (ABARES, 2013 Aug) noted that:

- State government support for fisheries research has steadily declined over recent,
- Technological advancements have led to increased efficiency of fisheries management (e.g. e-monitoring). Innovation may be able to play a significant role in improving industry efficiency and competitiveness for wild catch fishing and aquaculture. It may also have a valuable role in product improvement for the aquaculture sector where price competition from imports is likely to be an ongoing issue.

1.1. IDEAL POLICY FRAMEWORK FOR FISHERIES

Fishing and aquaculture are unique in the context of Australian primary industries in that they are founded on the use and development by individuals of publicly owned natural resources, managed on behalf of Australian communities by governments.

The dynamic nature of the fishery users (wild catch, aquaculture, recreational fishers and customary fishers) seeking access to the joint environment compounds the policy issues. It would be easier with just a single jurisdiction as in NZ, but, apart from a few compromises in the OCS process that is not a possible pathway for Australian fisheries policy development.

This common property dimension of Fishing and Aquaculture (and the complex relationships and competing interests for the community's aquatic and marine natural assets) is all pervasive and fundamental to the management of these sectors. It is also a significant driver of RD&E priorities and decision making.

Overlaid on this fundamental driver are many international developments, including globalisation of investment, technology, and trade; increased leisure driven by rising disposable incomes in emerging large economies; emergence of health, convenience and food personality as key aspects of regional consumer cultures; and the

increased focus of global communities, agencies and consumers on the sustainability of their natural resources.

These drivers are having significant impacts on the fishing and aquaculture industry, and it is imperative that the industry plans to adapt to this complex and rapidly changing world now. Risk and opportunity have no expiry date. The faster globalisation and economic and social connectedness proceed, the faster yesterday's risks morph into new risks and challenges tomorrow. Australia's fishing and aquaculture industry and the government agencies that manage and support it, must adapt and evolve at a pace to effectively respond to these changes if the industry and the natural resources upon which the industry relies are to remain viable and sustainable (FRDC 2009/214, 2009).

The World Resources Institute (WRI, 2014 June) has proposed a policy management framework for wild fisheries (in Australia's case this includes commercial, recreational and customary) that combines rights, markets, and governance.

The preferred framework for aquaculture fisheries would be also involve the four key elements (rights and incentives, enabling systems and dedicated legislation, markets, and governance) but be more in line with Australia's world class agricultural and food production policy frameworks (e.g. dairy, beef) and obviously with adjustment for non-related activities such as bycatch.

1.2. PROFITABILITY – SEGMENTS, TRENDS

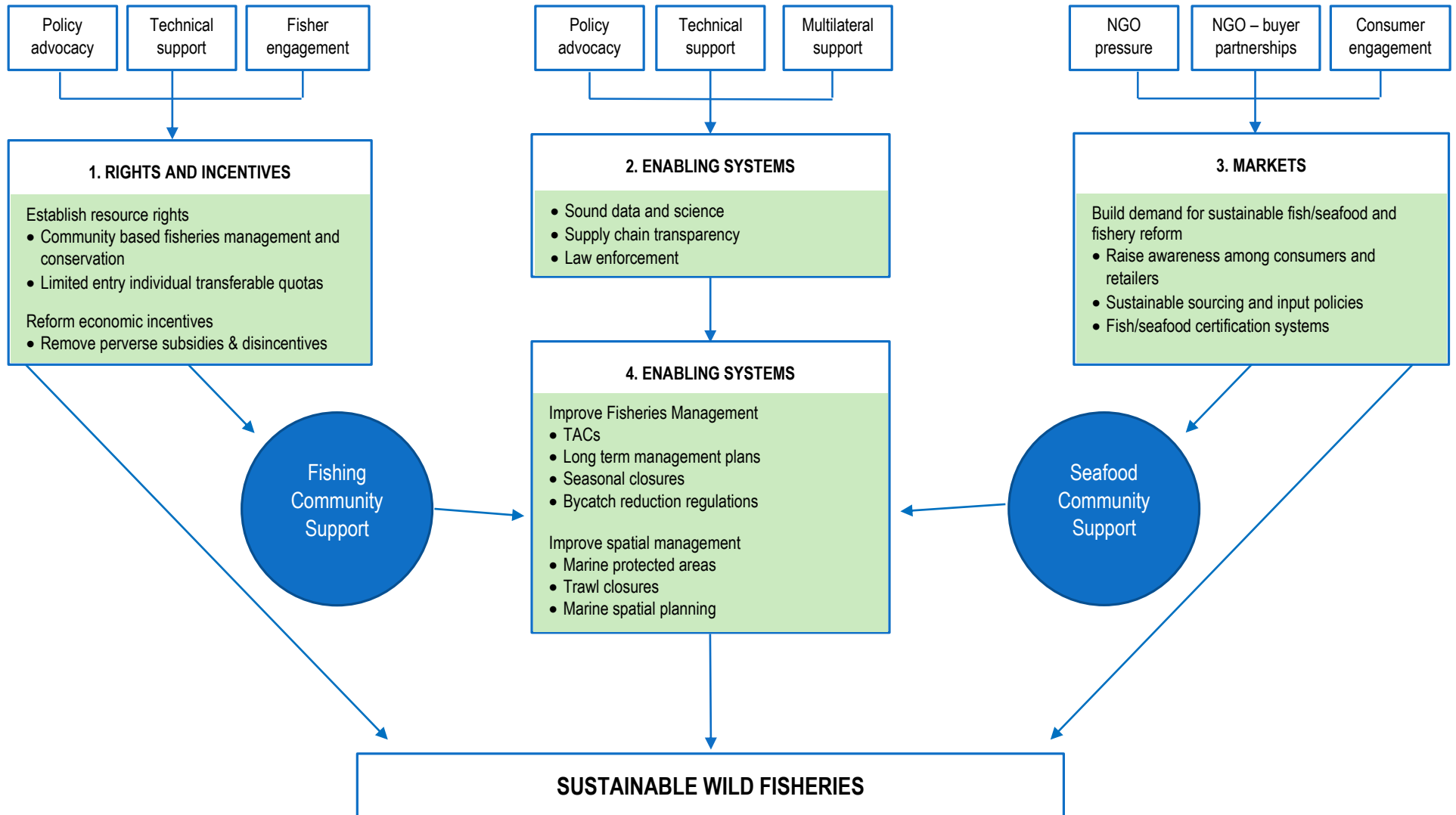
There is no easy answer to assessing F&A Industry profitability. The profitability of the industry is not documented in any comprehensive or public dataset.

While this limits our understanding of the related issues, it is not unusual. Other large industries (dairy, beef, grain) or recreations (golf, snow skiing, motorsport) are not collated and easily accessible. Private operators do not publish.

Single species industries such as beef, dairy and sugar cane (and even grains) are relatively easy to quantify, compared to multispecies complex industries such as horticulture and seafood. F&A is even more difficult because it has multiple products, supply chains and cost bases from which profits are derived. Sector based data is also difficult to access.

For most industries, private research houses will supply data for a fee, by sector, location, etc. A 20 page report from IBISWorld on the seafood processing sector alone costs around \$1,000 with comprehensive confidential industry studies running up to \$100,000 or more). That is beyond the capability of this project.

FIGURE 92. PROPOSED SUSTAINABLE WILD FISHERIES MANAGEMENT FRAMEWORK



H. SOCIAL TRENDS AND BENEFITS

1. SECTOR HOLLOWING

A detailed analysis of the commercial wild catch and aquaculture sectors has been discussed earlier in this report. The discussion of the top 30 fisheries on page 67 considered the scale and value of the commercial sector.

These analysis confirm the emergence of two cohorts within the commercial seafood sector – a smaller number of species fisheries that are more able to grow in a competitive market, and a numerically larger group of species fisheries that face viability challenges if current strategies and management regimes continue.

Looking behind this data and the evolution of global scale F&A businesses, there is a risk for smaller businesses and fisheries.

As global seafood competition (for sales in person and online) ramps up globally, the smaller Australian inshore fisheries continue to lose their competitiveness:

- Against imported commodity seafood from lower costs Asian aquaculture, and within bilateral and multilateral free trade arrangements,
- From the evolution of larger domestic seafood players who are increasingly corporatised and integrated along their supply chains. These larger players have therefore internalised their operating and supply chain systems, RD&E investment and branded marketing program, which means there is now much less economic cross over / spinoff indirect subsidy for small and multispecies fisheries from larger corporatised fisheries.
- Due to long-term decline in the funding of F&A RD&E and extension services by state and territory public agencies,
- As their history of marginal and often volatile viability has not enabled sustained reinvestment of private capital in vessels and modern equipment and productivity outcomes,
- As governments declare increasing areas of near shore waters as marine parks or no-take zones, driving the cost of wild catch commercial fishing

up as more diesel is required to travel further from the wharf,

- As marine recreational fishing technologies continue to improve and fall in price, the traditional Australian commercial fishing community (and its government) finds that it is economically better off to reallocate and rebalance available marine resource from commercial toward more recreational fishing activities.

These are the drivers for the ongoing process of commodity to niche hollowing out that is underway in many coastal fishing communities. In the space of a couple of decades a working fishery waterfront has become a recreational waterfront with a strong “culinary tourism” base, and this changes the aspirations of the community and the type and nature of jobs it offers. As the process has been documented more closely in the USA (University of Maine, 2009) for some time the hollowing out process appears to be lagging in Australia.

2. FISHERY BEST USE AND PERFORMANCE

A second review of the Performance and Use of Australian Fisheries is currently being completed and headline results across the four fishery sectors to date are presented below. The final report will be available in June 2015.

Note that the 2003 rating were completed by Experts in 2009, based on their hindsight review of fishery performances in 2003. The 2009 and 2014 ratings were undertaken as current assessments, not hindsight assessments.

The Fisheries are rated confidentially in a multi-round Delphi Process by Stakeholder Experts (Fishers, Managers, Researchers, Stakeholders) Ratings are out of a score of 10.

The 2014 study introduced a new assessment framework to building on the 2009 assessment framework. The 2014 “Compact Framework” specifically identified assessment criteria for each of the four main sectors and recorded performance ratings.

FIGURE 93. 2014 PERFORMANCE AND USE - HEADLINE RESULTS

	2003	2009	2014
	Wild Catch	Wild Catch	All Sectors
EXPERTS ENGAGED IN PROCESS			
Experts Engaged at Start of Study	96	96	186
License Holders and Stakeholders	20-23	20-23	17-23
Fishery Managers	12-14	12-14	8-13
Technical Experts	19-20	19-20	16-19
Anonymous online feedback	-	-	3-5
NO. OF FISHERIES RATED	23	23	58
Wild Catch Commercial	-	-	38
Recreational	-	-	8
Indigenous Customary	-	-	4
Aquaculture	-	-	8
PERFORMANCE RATINGS (Max 10)	2.8	5.8	5.6
Commercial Wild catch fisheries (38)	2.8	5.8	5.9
Recreational fisheries (8)	-	-	4.9
Indigenous Customary fisheries (4)	-	-	3.7
Aquaculture (8)	-	-	6.1
Seafood Harvest (46)	-	-	5.8
High Level Ratings – All Sectors	2.8	5.8	5.6
Management Criteria	1.6	5.5	6.1
1. Arrangements	-	-	6.1
2. Controls	-	-	6.6
3. Values	-	-	5.8
Environmental Criteria	5.0	7.7	6.5
4. Arrangements	-	-	6.2
5. Controls	-	-	7.2
6. Values	-	-	6.2
Economic Criteria	1.2	6.5	5.6
7. Arrangements	-	-	5.5
8. Controls	-	-	5.7
9. Values	-	-	5.7
Social and Engagement Criteria	3.1	4.6	4.0
10. Arrangements	-	-	3.9
11. Controls	-	-	3.8
12. Values	-	-	4.2

The number of experts engaged illustrates a range, in accordance with multiple Delphi engagement rounds in each year. It is also worth noting that the experts were

busier and had more demands on their time in 2014. A number wanted to be involved but were stretched to the point that they could not take the time to be involved. Slightly lower numbers achieved in 2014 were not through lack of interest in the project.

Overall, the Headline Performance Ratings by Experts in 2014 (5.6) are in line with 2009 (5.8). However this is a comparison of apples and oranges - the 2014 assessment framework was more comprehensive and fully included Recreational and Indigenous Customary Fisheries, included Engagement criteria into Social Assessment, and added the Aquaculture Sector. The 2014 assessment framework and rating process is now considered by 88% of participating experts to be an acceptable and authoritative assessment tool. The 2014 assessment framework and rating process is now more authoritative across all users and across many more fisheries (58, up from 23).

But there are further improvements to make. For example the number of 2014 responses (4) from Indigenous Customary Fisheries is quite low, comprising only 7% of all expert responses. Two of these responses are from experts who provided combined ratings for their fishery for “all users” – this may introduce some bias on such a small sample size of 4.

Compared to the overall 2014 average rating of 5.6, Aquaculture (6.1) and Commercial Wild catch fisheries (5.9) have rated higher, while Recreational (4.9) and Indigenous Customary fisheries (3.7) have rated lower.

The performance against the 12 High Level Rating Criteria are instructive while carrying some unintentional bias as the 2014 assessment framework is far more comprehensive (as noted above). Experts believe that:

- Management performance improved: 5.5 to 6.1,
- Environmental performance declined: 7.7 to 6.5,
- Economic Performance declined from 6.5 to 5.6,
- Social and Engagement Performance declined: 5.6 to 4.0.

Further analysis of High Level Ratings by sector are presented on the next page. The Bottom Line for the Wild Catch Commercial Fishery, which has been consistently assessed in 2009 and in 2014, Experts rated the performance in 2014 (5.9) slightly improved from 2009 (5.8).

Analyses of High Level Performance and Use Ratings, by sector are:

Wild Catch Commercial Fisheries

- The Sector’s best performance is in Environmental criteria (6.7), with ratings all above the sector’s average of 5.9. Use of specialised gear to protect species and reduce impacts is particularly strong.
- Experts believe the sector’s Management performance is also quite strong, at 6.5,
- In both the Environmental (6.7) and Management (6.5) areas, the sector is strong against control criteria,
- Social and Engagement performance at 4.1 is well below the sector’s overall average of 5.9.

Aquaculture Fisheries

- The sector’s best performances occur in the Environmental area (7.1), with all ratings at or above the sector average of 6.1. Detailed ratings (not shown here) suggest more work should be done in best practice education.
- Management performance (6.1) is generally solid, while the Economic performance (6.5) is even better,
- Social and Engagement performance (4.2) is well below sector average of 6.1.

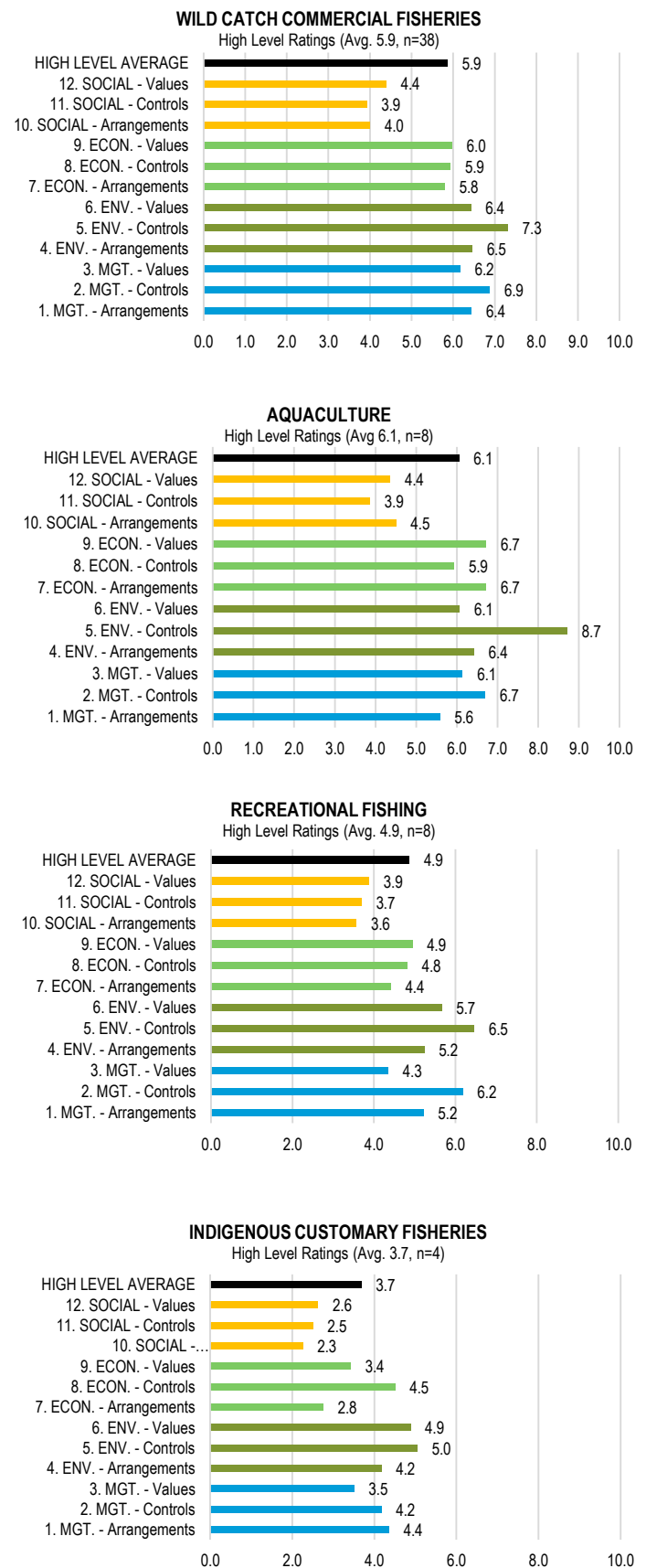
Recreational Fisheries

- At a rating of 4.9, the sector is performing well below the national F&A average of 5.6,
- The Sector’s best performance occurs in Environmental criteria, with all ratings above the sector’s average (4.9),
- In both the Environmental (5.8) and Management (5.2) areas, the sector is strong against control criteria,
- Social and Engagement performance (3.7) is well below the sector’s overall average of 4.9. The lowest rating (3.6) indicates expert’s views that the sector does not have adequate or equitable access to fish.

Indigenous Customary Fisheries

- The sample size for the sector is too small to make informed comments regarding overall performance,
- The sector’s average rating (3.7) is very low compared to the average for all sectors (5.6),
- Best Performances occur in the Environment (4.7) and Management (4.0) areas, with performance against Economic controls also strong at 4.5.

FIGURE 94. HIGH LEVEL RATINGS BY SECTOR



Considering the High Level Performance Rating Trends from 2003 to 2014:

FIGURE 95. HIGH LEVEL PERFORMANCE TRENDS

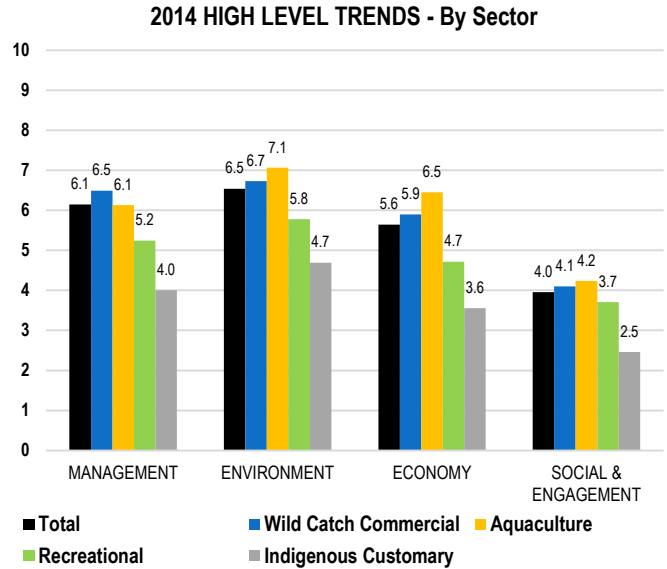
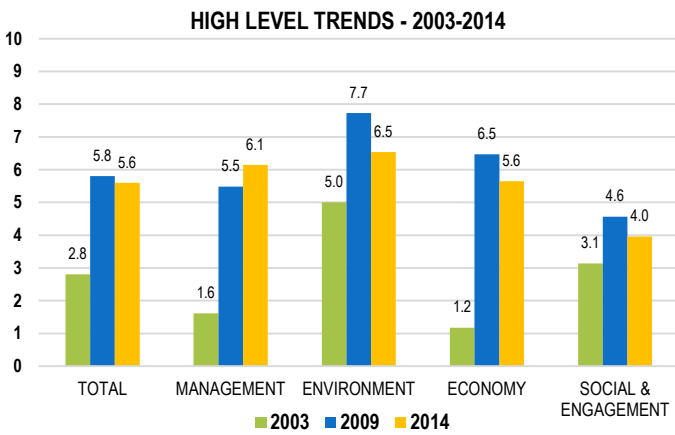
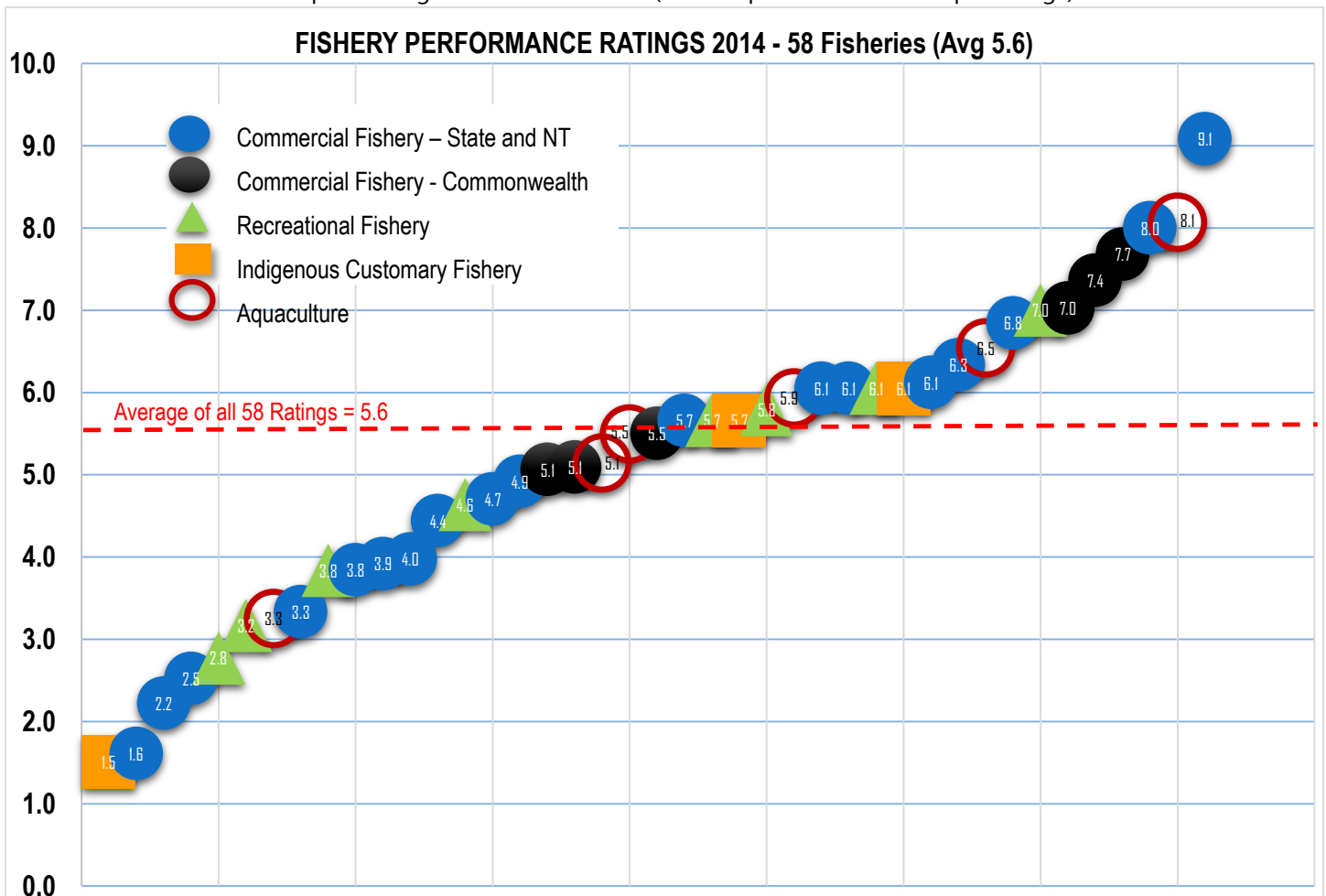


FIGURE 96. EXPERT RATINGS OF PERFORMANCE 2014

A distribution of the 2014 Expert Ratings across 58 Fisheries (41 data points due to multiple ratings) is as follows:



The Performance & Use Study 2014 has identified the ten most important priorities (identified by experts) as presented in the following chart. A comparison of 2014 and 2009 rankings also presented below shows an increased emphasis on documented harvest and management strategies, improved fisheries data, and informing the community on performance.

FIGURE 97. PERFORMANCE & USE PRIORITIES FOR ACTION 2014

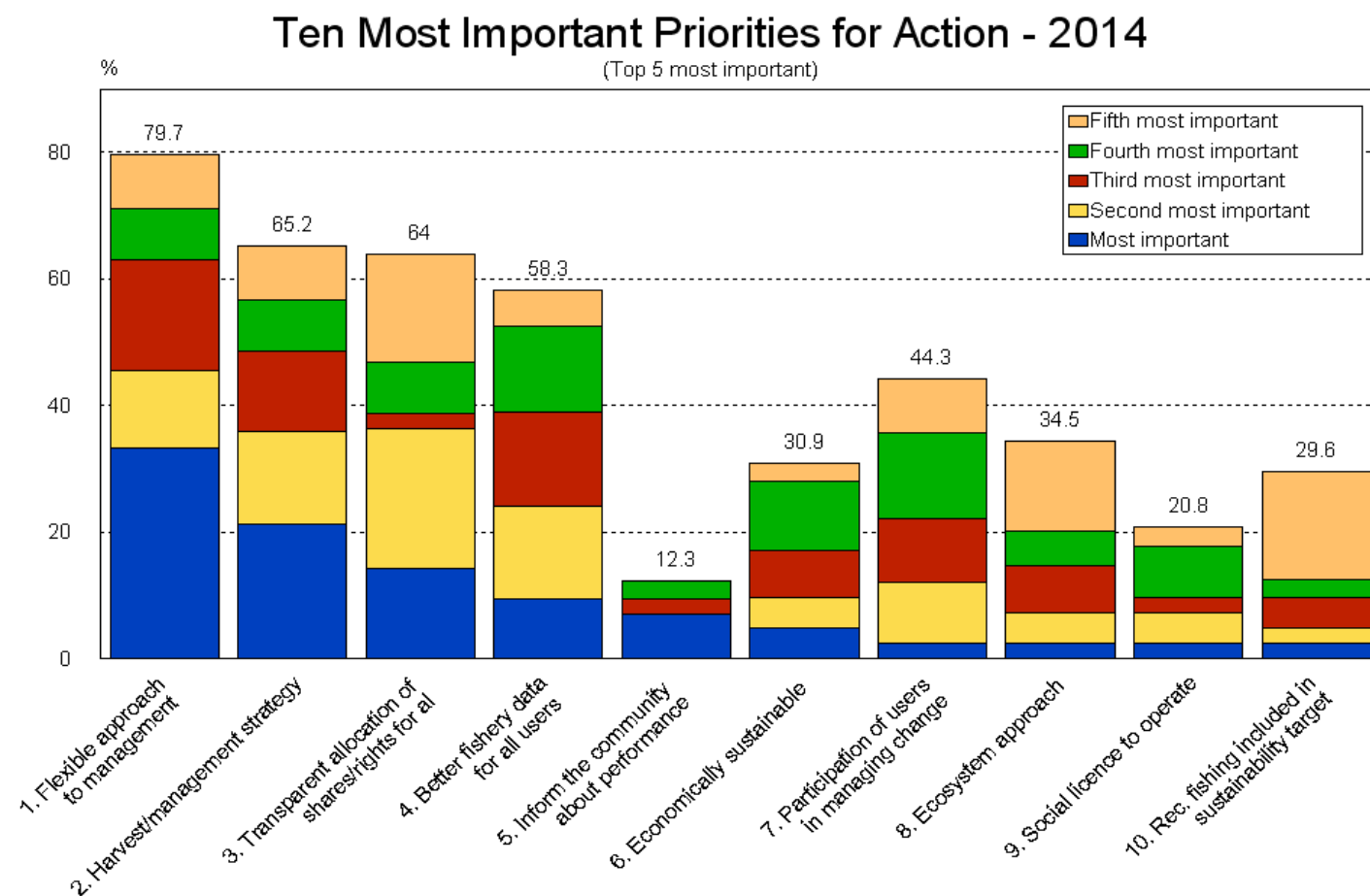


FIGURE 98. ACTIONS TO REDUCE THE PERFORMANCE GAP - 2009 AND 2014

Actions to Reduce the Fisheries and Aquaculture Performance Gap	2014 Ranking	2009 Ranking
More flexible fisheries management to respond to future change and a more strategic approach to management for each fishery, including the setting of clear objectives for performance across all Uses.	1	1
Documented harvest and management strategy with goals set for ecosystem, biomass and target stock sustainability.	2	5
Efficient, transparent allocation of shares and associated property rights for all Uses – commercial, recreational, and customary.	3	2
Improved data at fishery level for all Users - fish stocks, mortality, total economic value, community views and other data to track performance.	4	7
Inform the community on performance of wild catch fisheries, and the need to conserve the fishery resource.	5	10
Economically sustainable operation of the fishery, based on a greater awareness and use of economic analysis and return on investment to inform management decisions about fishing chain values and performances.	6	6
Increased participation of fisheries Users (commercial, recreational, customary) in, and collaboration on, fisheries management and implementing change.	7	4
Ecosystem or multi species approach to fishery management.	8	3
Measures of community support or social licence to operate .	9	Not covered
Sustainable levels of recreational fishing are integrated with overall sustainability targets and the harvest strategy for the fishery.	10	8

3. TRENDS RE NGOs

The Future Fishing Paper (ABARES, 2013 Aug) identified changing community values and attitudes regarding fishery access, use and performance.

It is likely that the Australian fishing sector will see more eNGO and public scrutiny of domestic fisheries management and imported seafood products.

This reflects apparent changes in community views of fisheries management; the utilisation of fisheries and marine resources, and balancing seafood trade and importing seafood have shifted and will continue to change over time.

Research indicates that the fishing industry and government bodies are not considered to be trusted sources of information by the public and that a very low percentage of the community are aware of the work being undertaken to ensure sustainability of the industry.

The Borthwick Review (Borthwick, 2012) of Fisheries Management proposed changes to arrangements in Commonwealth fisheries management to address community responses.

APPENDICES

1. METHODOLOGY

The Natural Resource

Global Context

2015-20 FRDC Planning Issues

1. Environment
2. Sustainability / ESD
3. Legislation & Regulation
4. Planning & Engagement Frameworks
5. Climate & Ocean Health
6. Food Security
7. Global Context
8. Public Perception
9. Technology & Innovation
10. Human Capacity & Innovation
11. Investment – public & private
12. Communication
13. Habitat management

A. Preserve & Use the Resource			
	Marine	Brackish	Fresh
1. Wild Capture	•	•	•
2. Aqua culture	•	•	•

Sector Overview Priorities

1. Context – global & Australian
2. Environmental Capacity & Status
3. Sustainability / ESD
4. Regulatory efficiency & burden
5. Community & public perceptions
6. Risk of food crises
7. Rights of Indigenous Australians
8. Regional Infrastructure / demographics / impacts
9. Nature of property rights across sectors
10. Potential yield growth to meet markets
11. Australian research system
12. Ideal policy framework for fisheries
13. Aqua efficiency as a production system

2015-20 FRDC Planning Issues

1. Property right & access – Native Title
2. Industry capacity – human, financial
3. Community – social licence to operate
4. Regional infrastructure – impacts
5. Stock status and fish health
6. Resource use, performance, efficiency
7. Animal welfare / MPAs / NGOs
8. Climate change impacts and adaptations
9. Harvest & Chain robustness and efficiency
10. Investment: drivers /returns /derivatives
11. Org. models, risks, issues (North Ag)
12. Industry Leadership and strategy
13. Government interface and engagement
14. Co-management

B. Access and Manage the Fishery			
	Commercial	Recreational	Customary
1. Wild Capture	•	•	• Customary vs commercial: note "Akiba" High Court decision title fish rights
2. Aqua culture	•	•	• Customary aquaculture
Timeline	•	•	•
• Events shaping F&A			
• Projects that responded to issues			

Sector Overview Priorities

1. Sector aspirations – vision and culture
2. Fleet / farm capacity and capability
3. Harvest – access, equity, efficiency, quality
4. Data – license, stakeholder, workforce
5. Technology use and trends
6. Industry maturity and trends
7. Regulatory burden: co-mgt and cost/benefit
8. Input costs , margins, returns
9. Business models and trends
10. Agency interface and policy
11. Catch to Asian / other market needs
12. Bottle necks in managing climate change
13. Aquaculture volume / value forecasts to 2020
14. Indigenous value – two way, and primacy

2015-20 FRDC Planning Issues

1. Seafood Consumption drivers
2. Industrial product drivers
3. Demand – species and products
4. Regulation, food safety, etc
5. Chain value add – inputs, leverage, output, impacts
6. Chain / product certification
7. Productivity of harvest, process and market offer
8. Profitability – harvest, chain process, and market offer
9. Consumer Markets and promo – commodity to braded
10. Currency A\$
11. Biosecurity and other risks
12. Market competition

C. Create Products & Services for Markets				
	Product & Service Inputs	Process & Outputs	Impacts	Economic Returns
1. Seafood	•	•	•	•
2. Inedible Products	•	•	•	•
3. Co & Bi Products	•	•	•	•
4. Human Capacity	•	•	•	•
5. Financial Capacity	•	•	•	•
6. Innovation & Knowledge	•	•	•	•

Sector Overview Priorities

1. Scope & scale – products and services trends
2. Sector aspirations – vision and mission
3. Seafood value – fish +health +social +cultural
4. Supply – species utilisation, bycatch, data
5. Harvest – yield / safety / efficiency
6. Regional inputs, impacts, multipliers
7. Seafood – value/appeal/demand/consumption
8. Industrial & co /bi-products
9. Market demographics, duopoly
10. Competitors – NZ, ASEAN, Other
11. Commodity to niche – hollowing
12. Trade & MA – FTAs, Asia/other trends
13. Human: culture, skill gaps, productivity, trend
14. RD&E: trends, investment leverage, adoption
15. Retail & Food Service trends
16. Profitability – segments, trends
17. Market & chain data
18. Limits to innovation: human, \$, skills, regulation., etc

2015-20 FRDC Planning Issues

1. Benefits: food, recreation, culture, \$
2. Capacity and capability
3. Benefits & returns: across sectors
4. Fishery Sector aspirations and values
5. Fisheries – Best Use and Performance
6. Public perception: NGOs, key players
7. Demographics – all 3 sectors
8. 3 Sectors – maturity, leadership, participation
9. Agency interface and engagement
10. Industry-Community Interface – opportunity to maximise benefits

D. Deliver Social & Customary Benefits				
	Recreation & Outdoors	Health & Wellness	Custom Benefit	Intergenerational
1. Wild fishers	•	•	•	•
2. Aquafarmers	•	•	•	•
3. Regional Communities	•	•	•	•
4. Public	•	•	•	•
5. Government	•	•	•	•
6. NGOs & 3 rd Parties	•	•	•	•

Sector Overview Priorities

1. Commercial Sector – size, scope demographics & benefits flow to industry, regions, nation
2. Recreational – size, scope, demographics and benefits flow to industry, regions, nation
3. Indigenous – size, scope, demographics and benefits flow to industry, regions, nation
4. Fishery resource – Best Use and Performance
5. Community and Public perceptions of sectors
6. Human and Investment capital
7. Spin off sectors and impacts
8. Trends re NGOs
9. Overseas experience and trends

2. KEY PROJECTS IN THE RD&E INVESTMENT

Investment Area	Related FRDC Project Investment in Project Number Order	
	Significant National Projects	Regional, Sectoral or Species Specific Projects.
Seafood Consumption	<p>2003/237 Development of a quality index for Australian seafood</p> <p>2008/720 SCRC A community intervention approach to increasing seafood consumption</p> <p>2008/779 SCRC Tracking seafood consumption and measuring consumer acceptance of innovation in the Australian seafood industry</p> <p>2009/721 Eat More Fish – Expanding the Consumption of Seafood Through Retail Channels</p>	<p>2004/249 The retail sale and consumption of seafood in Melbourne</p> <p>2006/237 Consumer research to assist growth for Australian farmed prawns</p> <p>2009/216 Tracking the impacts on seafood consumption at dining venues arising from the Northern Territory's seafood labelling laws</p> <p>2009/220 Development of the Eyre Peninsula Retail and Food Service Seafood User Guide</p> <p>2009/775 SCRC: prevention of muddy taints in farmed barramundi</p> <p>2010/774 SCRC: Successful sardines - post-harvest optimisation and new product development for human consumption</p>
Seafood Marketing, Differentiation and Promotion	<p>2004/401 SCRC: A market access guide for seafood exporters: International Residues standards</p> <p>2004/413 Developing an Australian seafood strategy for export growth - stage 1</p> <p>2005/233 Developing and implementing a business model for marketing and branding Australian seafood</p> <p>2006/401 Seafood industry export information package - direct extension to overseas customers of Australian seafood</p> <p>2010/228 Developing a dynamic regional brand - focus on flavour</p>	<p>2004/251 Identification of new market opportunities for southern rock lobster exports</p> <p>2004/404 Identification of demand drivers, distribution requirements and supply chain efficiencies to assist development of the Hiramasa Kingfish™ and Suzuki Mulloway™ brands in Melbourne</p> <p>2008/205 Empowering Industry R&D: Developing quality standards for the Queensland Trawl industry as part of the pathway towards an integrated clean and green promotional strategy</p> <p>2008/794.2 SCRC: repositioning Australian farmed Barramundi in the domestic market</p> <p>2009/723 SCRC: analysis of product differentiation opportunities for Australian wild caught Abalone in China</p>
Wild fishery access and allocation	<p>2003/039 Dynamic modelling of socio-economic benefits of resource allocation between commercial and recreational use</p> <p>2010/040 Developing and testing social objectives for fisheries management</p> <p>2010/226 An assessment of the threats to marine biodiversity and their implications for the management of State and Commonwealth fisheries</p> <p>2011/032 Incorporating the effects of marine spatial closures in risk assessments and fisheries stock assessments</p> <p>2014/030 Status of key Australian fish stocks reports</p> <p>2012/202 Operationalising the risk cost catch trade-off</p> <p>2013/203 Development of an approach to harvest strategy management of internationally managed multi-species fisheries</p>	<p>2007/025 Competition to collaboration: exploring co-management models for the Spencer Gulf Prawn Fishery</p> <p>2009/211 Whose fish is it anyway? - Investigation of co-management and self-governance solutions to local issues in Queensland's inshore fisheries</p> <p>2009/774 Seafood CRC: harvest strategy evaluations and co-management for the Moreton Bay trawl fishery</p> <p>2013/013 Development of robust assessment methods and harvest strategies for spatially complex, multi-jurisdictional toothfish fisheries in the Southern Ocean</p> <p>2013/209 Optimising processes and policy to minimise business and operational impacts of seismic surveys on the fishing industry and oil and gas industry</p>
Recreational Fisheries	<p>1999/158 Implementation of the National Recreational and Indigenous Fishing Survey</p> <p>2007/227 Recfishing Research: National Strategy for Recreational Fisheries Research, Development and Extension</p> <p>2010/001 Predicting the impacts of shifting recreational fishing effort towards inshore species</p> <p>2012/022 Development of methods for obtaining national estimates of the recreational catch of southern bluefin tuna</p> <p>2012/214 Measuring the economic value of recreational fishing at a national level</p> <p>2013/401 Recfishing Research 2.0: a revitalized approach to addressing national RD&E priorities and increasing investment and coinvestment in RD&E relevant to the recreational sector</p>	<p>2003/047 Evaluation of methods of obtaining annual catch estimates for individual Victorian bay and inlet recreational fisheries</p> <p>2003/074 National Strategy for the Survival of Released Line Caught Fish: survival of snapper and bream released by recreational fishers in sheltered coastal temperate ecosystems</p> <p>2005/061 Gear interaction of non-targeted species in the Lakes and Coorong commercial and recreational fisheries of South Australia</p> <p>2006/018 Australian salmon (<i>Arripis trutta</i>): Population structure, reproduction, diet and composition of commercial and recreational catches in NSW</p> <p>2006/053 Sustainability of recreational fisheries for Murray cod in the Murray Darling Basin</p> <p>2008/311 Moving to a common vision and understanding for equitable access for indigenous, recreational and commercial fishers:- NT fishing and seafood industry delegation to NZ</p>

	2014/402 Planning, developing and coordinating national/regional research, development and extension (RD&E) for Australia's recreational fishing community	2009/060 Enhanced Murray cod recreational fisheries outcomes across the Murray-Darling Basin through improved collaboration and alignment of management and research activities 2010/230 Identifying indigenous business opportunities in the recreational fishing tourism industry on Cape York Peninsula 2013/025 Assessing post-release survival of southern bluefin tuna from recreational fishing
Indigenous Fishing and Aquaculture	2003/078 Implementation of the National Recreational and Indigenous Fishing Survey 2003/308 Indigenous Fishing Rights conference 2008/326 People Development Program: FRDC indigenous development scholarships 2010/205 Identifying the key social and economic factors for successful engagement in aquaculture ventures by indigenous communities 2010/214 Investigating the development process of a large scale aquaculture farm incorporating Indigenous cultural considerations 2010/401 Shaping advice for Indigenous fishing and aquaculture RD&E within the national strategy 2012/216 Indigenous cultural fishing and fisheries governance 2012/405 Facilitation of the FRDC Indigenous Research Coordination Program (IRCP) to progress RD&E outcomes (Phase 2) - 2010/405 continued	2008/311 Moving to a common vision and understanding for equitable access for indigenous, recreational and commercial fishers:- NT fishing and seafood industry delegation to NZ 2010/230 identifying indigenous business opportunities in the recreational fishing tourism industry on Cape York Peninsula 2010/304 Impact of management changes on the viability of Indigenous commercial fishers and the flow on effects to their communities: case study in NSW 2010/320 Developing a model for enhanced consultation and collaboration between indigenous communities and the fishing industry: A case study of NPF/Industry/Carpentaria LC/Wellesley Island elders 2012/215 R&D for the Modelling and establishment of an SA Aboriginal Sea Ranger Program 2012/223 Assessment of heavy metals in tropical rock oysters (blacklip and milky) and implications for placement into the Australian seafood market and for Indigenous enterprise development in the NT
Social issues, data and License to Operate	2003/056 ESD Reporting and Assessment Subprogram: a social assessment handbook for use by Australian fisheries managers in ESD assessment and monitoring 2008/328 Practical implementation of social and economic elements in ecosystem based fisheries and integrated fisheries management frameworks 2009/041 Fisheries Social Sciences Research Coordination Program 2010/040 Developing and testing social objectives for fisheries management 2010/205 Identifying the key social and economic factors for successful engagement in aquaculture ventures by indigenous communities 2011/525 Communicating sustainability to build aquaculture's social license to operate 2012/301 Let's Talk Fish: Assisting industry to understand and inform conversations about the sustainability of wild-catch fishing	2003/066 Comparing conventional 'social-based', and alternative output-based, management models for recreational finfish fisheries using Shark Bay pink snapper as a case study 2004/247 A scenario analysis of the social impact of the Western Rock Lobster industry management options on fleet hosting communities 2008/073 Social Science Research Coordination Program: identifying, communicating and integrating social considerations into future management concerns in inshore fisheries in Coastal Queensland 2009/054 Social Science Research Coordination Program - a socio—economic evaluation of the commercial fishing industry in the Ballina, Clarence and Coffs Harbour regions 2009/100 Providing social science objectives and indicators to compare management options in the Queensland trawl planning process 2010/219 Establishing regional indicators of social sustainability in the Tasmanian aquaculture industry - a pilot study 2011/038 Human wellbeing indicators for the FAO EAF- Nansen project 2011/203 Governance, social and economic sustainability of WA's lobster and finfish industries
Performance and Productivity	2006/071 Evaluating the Performance of Australian Marine Capture Fisheries (2009) 2006/068 Co-management: managing Australia's fisheries through partnership and delegation 2010/311 Seafood Directions 2011 - The Productivity Challenge 2013/411 Improving the environmental and economic performance of Australian rocklobster fisheries through collaboration and cooperation across research, management, harvest, transportation and markets 2014/235 Evaluating the Performance of Australian Marine Capture Fisheries (2014)	2005/082 Determining the impact of environmental variability on the sustainability, fishery dynamics and economic performance of the West Coast Prawn Trawl Fishery 2007/061 Determining and evaluating performance indicators for management of Australian abalone fisheries – WORKSHOP 2007/707 Seafood CRC: Resolving larval rearing, juvenile development and productivity constraints for propagated Southern Bluefin Tuna. Improvements to the production of Yellowtail Kingfish and Mulloway 2011/402 People development program: Enabling productivity and efficiency gains in Australian rock lobster fisheries – the 2011 trans-Tasman 7th Rock Lobster Congress.

Climate change (FRDC, 2011)	<p>2010/023 El Nemo South East: quantitative testing of fisheries management arrangements under climate change using Atlantis</p> <p>2009/073 El Nemo South East: social and economic risk assessment of the fishing and aquaculture sectors in the south eastern Australia region due to climate change</p> <p>2009/070 El Nemo South East: risk assessment of impacts of climate change for key species in south eastern Australia</p> <p>2009/056 El Nemo South East: understanding the biophysical implications of climate change — project 1 and 2</p> <p>2009/055 El Nemo South East: adaptation of fishing and aquaculture sectors and fisheries management to climate change in South Eastern Australia Work Area 4, Project 1 Development and testing of a national integrated climate change adaptation assessment framework</p> <p>2009/053 Tactical Research Fund: spreading the risk — management strategies for multi-method inshore fisheries in a changing climate</p>	<p>2010/217 Atlantic Salmon Aquaculture Subprogram: forecasting ocean temperatures for salmon at the farm site</p> <p>2010/565 Management implications of climate change impacts on fisheries resources of tropical Australia.</p> <p>2010/554 Effects of climate change on reproduction, larval development and population growth of coral trout.</p> <p>2010/542 A climate change adaptation blueprint for coastal regional communities.</p> <p>2010/535 Management implications of climate change effects on fisheries in Western Australia.</p> <p>2010/534 Ensuring that the Australian oyster industry adapts to a changing climate: a natural resource and industry spatial information portal for knowledge action and informed adaptation frameworks..</p> <p>2010/524 Identification of climate-driven species shifts and adaptation options for recreational fishers: learning general lessons from a data rich case.</p> <p>2010/506 Adaptive management of temperate reefs to minimise effects of climate change: developing effective approaches for ecological monitoring and predictive modelling.</p>
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