FINAL

An Impact Assessment of FRDC Investment in 2014-301: Social and economic evaluation of NSW Coastal Commercial Wild-Catch Fisheries

Agtrans Research

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FRDC Project No **2016-134**

An Impact Assessment of FRDC Investment in 2014-301: Social and economic evaluation of NSW Coastal Commercial Wild-Catch Fisheries
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Researcher Contact Details

Name:	Peter Chudleigh
Address:	Suite 36, Benson House,
	Toowong QLD 4066
Phone:	07 3870 4047
Fax:	07 3371 3381
Email:	peter@agtrans.com.au

FRDC Contact Details

Address:	25 Geils Court
	Deakin ACT 2600
Phone:	02 6285 0400
Fax:	02 6285 0499
Email:	frdc@frdc.com.au
Web:	www.frdc.com.au

In submitting this report, the researcher has agreed to FRDC publishing this material in its edited form.

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Kate Barclay, University of Technology, Sydney

Abbreviations

ABARES	Australian Bureau of Agricultural Resource Economics and Sciences
CBA	Cost-Benefit Analysis
CRRDC	Council of Research and Development Corporations
FRDC	Fisheries Research and Development Corporation
GDP	Gross Domestic Product
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
NSW DPI	New South Wales Department of Primary Industries
PVB	Present Value of Benefits
RD&E	Research, Development and Extension

Executive Summary

What the report is about

This report presents the results of an impact assessment of the Fisheries Research and Development Corporation (FRDC) investment in a project to evaluate the regional economic and social contributions of NSW commercial wild catch fisheries. The project was funded by the FRDC over the years ending June 2015 to June 2016.

Methodology

The investment in the project was analysed qualitatively within a logical framework that included activities/outputs, outcomes, and impacts. Identified impacts were then categorised into a triple bottom line framework. Principal impacts from those identified were then valued. Benefits were estimated for a range of time frames up to 30 years from the year of last investment in the project. Past and future cash flows in 2017/18 $ terms were discounted to the year 2017/18 using a discount rate of 5% to estimate the investment criteria.

Results/key findings

The major impact identified was the estimation of value to NSW coastal communities of maintaining or increasing the catch of NSW wild catch fisheries. It is expected that commercial fishers operating in the NSW wild catch fisheries, the supply chains of fishers including Australian consumers, and the NSW regional coastal communities will be the primary beneficiaries of the investment.

Investment Criteria

Total funding from all sources for the project was $0.87 million (present value terms). The value of benefits was estimated at $2.52 million (present value terms). This gave an estimated net present value of $1.65 million, and a benefit-cost ratio of 2.9 to 1.

Conclusions

The investment in this project has resulted in potential strengthening of the case for sustaining the catch from the NSW wild catch fisheries while at the same time maintaining ecological sustainability but offsetting the case for reducing the catch for other reasons such as it ‘being an old industry’.

Keywords

Impact assessment, cost-benefit analysis, coastal communities, wild catch fisheries, regional impacts

Introduction

The Fisheries Research and Development Corporation (FRDC) required a series of impact assessments to be carried out annually on a number of investments in the FRDC research, development and extension (RD&E) portfolio. The assessments were required to meet the following FRDC evaluation reporting requirements:

- Reporting against the FRDC 2015-2020 RD&E Plan and the Evaluation Framework associated with FRDC's Statutory Funding Agreement with the Commonwealth Government.
- Annual Reporting to FRDC stakeholders.
- Reporting to the Council of Rural Research and Development Corporations (CRRDC).

The first series of impact assessments, that included 20 randomly selected FRDC investments, was completed in August of 2017. The published reports for the first series of evaluations can be found at: http://frdc.com.au/Research/Benefits-of-research/2017-Portfolio-Assessment

The second series of impact assessments also included 20 randomly selected FRDC investments. The investments were worth a total of approximately $5.62 million (nominal FRDC investment) and were selected from an overall population of 96 FRDC investments worth an estimated $21.32 million (nominal FRDC investment) where a final deliverable had been submitted in the 2016/17 financial year.

The 20 investments were selected through a stratified, random sampling process such that investments chosen spanned all five FRDC Programs (Environment, Industry, Communities, People and Adoption), represented approximately 26% of the total FRDC RD&E investment in the overall population (in nominal terms) and included a selection of small, medium and large FRDC investments.

Project 2014-301: *Social and economic evaluation of NSW Coastal Commercial Wild-Catch Fisheries* was selected as one of the 20 investments and was analysed in this report.

General Method

The impact assessments followed general evaluation guidelines that are now well entrenched within the Australian primary industry research sector including Research and Development Corporations, Cooperative Research Centres, State Departments of Agriculture, and some Universities. The approach includes both qualitative and quantitative descriptions that are in accord with the impact assessment guidelines of the CRRDC (CRRDC, 2014).

The evaluation process involved identifying and briefly describing project objectives, activities and outputs, outcomes, and impacts. The principal economic, environmental and social impacts were then summarised in a triple bottom line framework.

Some, but not all, of the impacts identified were then valued in monetary terms. Where impact valuation was exercised, the impact assessment uses Cost-Benefit Analysis as its principal tool. The decision not to value certain impacts was due either to a shortage of necessary evidence/data, a high degree of uncertainty surrounding the potential impact, or the likely low relative significance of the impact compared to those that were valued. The impacts valued are therefore deemed to represent the principal benefits delivered by the project. However, as not all impacts were valued, the investment criteria reported for individual investments potentially represent an underestimate of the performance of that investment.

Background and Rationale

A general hypothesis stimulating this project was that highlighting the impacts on NSW communities derived from the NSW wild-catch fishing industry could help improve the status of the industry in NSW and potentially improve industry access to wild catch resources. Previous more localised studies in NSW on regional impacts had proven to be useful in supporting commercial fishing. The NSW Fishing Research Advisory Board (now the NSW Research Advisory Committee) had promoted a project to address the issue on a whole-of-NSW basis.

The then existing socio-economic information on a State basis included the landed value of the NSW commercial fisheries catch and the number of businesses and employees in commercial fisheries as reported by the ABS. There had been no reporting of the multiplier effects of commercial fishing activity on coastal communities via service industries supplying fishers with inputs and seafood products going into markets. This meant that fishers were at some disadvantage with, inter alia, recreational fishers who had developed reporting on their economic contributions to the areas they visit, demonstrating a very large economic contribution. It was felt that, to compete on a level playing field the commercial fishing industry needed improved evidence of the economic contributions they made in order to more effectively negotiate with local and state government agencies over access to resources as well as influence other decisions affecting their business viability.

While only a small percentage of the population is directly engaged in commercial fishing, some evidence indicates that when commercial fishing declines the negative impacts spread throughout the supply chain, as well as on the 'glue' holding towns together through social contributions of fishing families. Also, while the importance of ecological protection and the contributions of recreational fishers are well recognised, the indirect contributions of commercial fishers are often viewed negatively or ignored in resource management decisions. Thus, the research addressed the issue of what communities lose if the NSW commercial fishing industry continues to contract, particularly in terms of social well-being. Improved understanding could inform policy makers, industry and local communities on how they can capitalise on these benefits by developing strategies that protect or enhance industry contributions in ways that grow overall community wellbeing.

Relevant socio-economic data required includes information on social impacts as well as economic impacts. Such data could prove useful in government decision making by highlighting the contributions commercial fisheries make to coastal regions and may reduce some of the negative public attitudes to wild catch fishing. In turn, this could enhance the social licence of the industry to fish. Also, it could improve understanding of some of the contributions from particular community sectors of commercial fishing such as the special contributions Indigenous commercial fishers.

Project Details

Summary

Project Code: 2014-301

Title: *Social and economic evaluation of NSW Coastal Commercial Wild-Catch Fisheries*

Research Organisation: University of Technology, Sydney

Principal Investigator: Kate Barclay

Period of Funding: July 2014 to June 2016

FRDC Program Allocation: Communities (100%)

Objectives

The objectives of the project were:

1. Evaluate the economic contribution of commercial wild-catch fisheries for 8 regions covering the whole NSW coast, including the regional economic impacts such as multiplier effects and employment and contributions to related sectors within regions, building on previous similar studies.
2. Evaluate the social contributions of commercial fisheries for the same regions, including the participation of fishing families in community organizations, heritage values of fishing for regions, and the social aspects of economic contributions, building on previous studies.
3. Establish a methodology to be used for ongoing social and economic evaluations as part of government reporting and industry engagement, building on recent and ongoing work in this field.
4. Write a report integrating the social and economic evaluations for each town identifying the role of commercial fisheries in that community, and highlighting threats to sustainability and viability, in a form suitable for engaging with local and state government agencies.
5. Create flyers for a general audience, including photographs and personal stories, to raise awareness of the role of commercial fisheries in coastal communities.

Logical Framework

Table 1 provides a description of the project in a logical framework developed for the evaluation.

Table 1: Logical Framework for Project 2014-301

Activities	• The NSW wild catch industry was defined as comprising coastal, estuaries and off-shore areas. • A Reference Group for the project consisting of stakeholder representatives was formed and continued operating during the project. • A desktop review of other like-projects was undertaken, along with methods for evaluating the social and economic impact of industry, and various reports about NSW coastal communities. • A survey of all commercial fishing businesses was undertaken in late 2014 to assemble information on costs and income for the economic analysis. • The results of this survey were used in modelling to estimate the current impact on regional economies. An input-output model was used to estimate relationships and impacts with other supply chain businesses in local areas.

	• A literature review of key 'quality of life' indicators used to measure community well-being was undertaken. • The reviews, combined with a pilot survey of fishers and others related to the NSW wild catch fishing industry, identified seven types of community well-being. • The project sought further information about how the wild-catch industry contributed to each of these 'domains of community well-being'; these contributions were explored using analysis of existing data, interviews of stakeholders in coastal areas and questionnaires (both social and economic). • The methods and data used were designed to so that the study could be repeated through time at low cost and required minimal additional data collection to identify trends. • Communication with commercial fishers was through a range of methods including (Kate Barclay, pers. comm., 2018): o the Professional Fishermen's Association (PFA); o fishing cooperatives; o a Facebook page; o an email mailing list of interested participants; and o most importantly through the interviews and surveys conducted as part of the project (over 90 fishers interviewed all along the coast). • The overall method represented a well-being approach encompassing measures of material well-being, subjective well-being and relational well-being.
Outputs	• The final report integrates the social and economic values of NSW commercial wild catch fishing activity and the ways commercial fisheries contribute to NSW regional communities. • It was established that viable wild catch fishing operations based along the NSW coasts are important in supporting regional employment and business profit and well-being. • The following findings are grouped under each of the seven identified 'domains of community wellbeing'. *A resilient local economy* • The Project indicated that professional fishing plus the related secondary sector (e.g. processing) contributed $436-501m to the NSW economy (2012-13 financial year). This included a Gross Value of Production (GVP) of $81.7m total direct and indirect impacts of $219.1m, $104.8m of added value, household income of $50.8m and provides 1,403 full time jobs, of which 403 are related to fishing industry suppliers. • Nine out of ten NSW coastal residents agree that professional fishing is an important industry for NSW through providing important employment opportunities in NSW towns. Eight out of ten residents were concerned about potential job losses that might occur if further restrictions were placed on the industry. o The professional fishing industry has highly complementary and inter-dependent social and economic relationships with a number of other industries that are important to local economies in regional areas. For example, both regional tourism and recreational fishing are supported by, and in turn support, professional fishing. A large proportion (89%) of NSW residents expect to eat local seafood when they visit the coast; 76% feel that eating local seafood is an important part of their coastal holiday experience and 64%

	indicated they would be interested in watching professional fishers at work while on holidays. o Recreational fishers are more engaged with seafood quality and provenance issues than non-fishers. They are more likely to support their local industry, especially their local co-operatives, when purchasing seafood products. o Recreational bait: The professional fishing industry and the NSW recreational fishing industry directly support and sustain each other through the bait market, especially sardines (pilchards) and school prawns. *Community health and safety* • Locally sourced seafood is an important source of food and nutrition within local communities, especially in regional areas where preferences and purchasing patterns indicate moderate to strong consumer demand for these products. Further growth of this market is inhibited by a lack of awareness amongst the public as to whether the products they are buying are locally caught. • Ninety six percent of NSW coastal residents indicated that the desire to support their local community was a major motivation in purchasing local product. • Professional fishing contributes to the health and wellbeing of Indigenous communities in a range of ways. A small group of Indigenous fishers are active within the industry and play a significant role in their communities through the provision of culturally and materially important food, involvement in traditional practices and providing employment opportunities. • Professional fishers play an important role in on-water safety and have undoubtedly saved many lives. Over 60% of the fishers interviewed had been involved in search and rescue activities, for inshore fishers this was often on a regular basis. *Education and knowledge generation* • There is an overwhelming reliance on informal modes of teaching within the NSW industry. Knowledge passed on within families, between mentor and trainee, or between Indigenous fishers and their communities is integral to the process of learning to be a fisher. This in turn influences the success and extent of all other contributions to community wellbeing, including economic contributions, the ability to provide seafood products to the community, and the development of environmental knowledge. • Fishers exchange information about the local environment, fish movements and weather patterns in formal and informal ways with the wider community, including regulators, researchers and recreational fishers. • The reliance on unwritten, accumulated knowledge is highly vulnerable to any disruptions in the relationships that facilitate its transfer. This vulnerability is especially relevant to Indigenous communities, where restrictions on community participation in ocean haul activities has impacted cultural teaching and learning. In addition, the transfer of knowledge is threatened by an aging industry with few new entrants, and little or no succession planning. *A healthy environment*

	• Fishers can and do contribute to overall environmental health by practicing sustainable fishing methods, monitoring environmental changes and sharing environmental knowledge with researchers, decision makers and the wider community, and by participating in stewardship activities such as cleaning up rubbish or rescuing injured wildlife. • Sixty-seven percent of the NSW public in coastal communities believe that the industry can be trusted to act in a sustainable manner. Seventy-two percent support the continuation of the industry. These levels of trust were consistent across the state and amongst recreational fishers and non-fishers. *Integrated, culturally diverse and vibrant communities* • The professional fishing industry has historically played an important role in migration of Italian, Vietnamese and Croatian families into a range of NSW coastal communities, contributing to the cultural diversity of regional NSW. Today the industry continues to contribute seafood products and job opportunities to an ethnically and culturally diverse marketplace. • Industry contributions to an integrated community are influenced by the relationships the industry has internally, with the wider community and with decision makers (referred to as bonding, bridging and linking forms of social capital). *Cultural heritage and community identity* • Professional fishing has played a crucial role in the development of many NSW coastal communities A large number of NSW coastal residents (76%) indicated that they would be concerned about a loss of character or identity in NSW communities from further reductions in professional fishing. *Leisure and recreation* • Material contributions to recreational activities provided by the wild-catch industry include the provision and maintenance of public infrastructure, such as wharfs, slipways, moorings and fuel associated with fish merchant businesses (largely co-operatives). In particular, ice is one of the most significant in-kind contributions made to local community events and groups by fish merchant businesses. • The report makes 17 recommendations; a central recommendation was for greater consideration of community wellbeing in NSW Government reporting and socio-economic impact assessment processes. • A method was developed for integrating economic and social values of commercial fishing; the method could be used for future monitoring of economic and social impact of changes in wild catch fisheries with minimal additional costs. • A further output from the project was a series of colour pamphlets aimed at improving the public profile of the commercial wild catch industry. • Other avenues used in communication included the DPI network of commercial fishers, the Sydney Fish Market website and Facebook page, media releases widely picked up in regional media in NSW, presentation on findings at the 2017 Seafood Directions conference, and the FRDC magazine FISH (Kate Barclay, pers. comm., 2018).
Outcomes	• The identification of the positive linkages between the commercial wild catch industry and regional NSW communities may influence the future management and policy decisions regarding the operation of the NSW wild catch fisheries.

	• Based on the final report for Project 2014-301, a parliamentary inquiry was launched with hearings held in December 2016.
	• The following outcomes are based on feedback to the Principal Investigator from the NSW Professional Fishermen's Association Executive Officer (Tricia Beatty):
	  o The evidence in the report about the economic contributions of the industry caused the NSW government to rethink the support being given to the industry in relation to fisheries reform.
	  o The research and associated evidence base such as the contribution of the fishing industry to NSW coastal regions, allowed the PFA to interact with decision-makers and the media more effectively.
	  o The study helped reveal the importance of search and rescue activities carried out by professional fishers, resulting in the NSW government providing extra safety equipment and training in recognition of that community contribution.
	  o The documentation has been incorporated and analysis as part of the NSW Marine Estate Management Authority's Threat and Risk Assessment, as part of the NSW Commercial Fishing Reform discussions, as part of the Country of Origin Labelling discussions, and as part of discussions for the development of the NSW Seafood Awareness Campaign
	• The information is also being used as part of national, state and local government and NGO discussions as an indicator of the importance of the industry – national, state and local resource allocation debate e.g. the no-net bans campaign push etc.
	• The report was used as the basis for a Social Impact Assessment by NSW DPI.
	• The methods used in the report are currently being used in Victoria in a new FRDC project (2017-092).

Impacts and potential impacts	• The information from the report has been of significant benefit to the NSW commercial fishing industry as well as to the Australian commercial fishing industry as a whole
	• Potential impacts include
	  o Maintenance of well-being of coastal communities.
	  o Reduction in risk of unintended negative economic and/or social impacts from resource management decisions.
	  o Strengthening of future social licence to fish.
	• Regional tourism may be enhanced by the maintenance of NSW wild catch fisheries by supporting the presence of fresh locally produced seafood.

Project Investment

Nominal Investment

Table 2 shows the annual investment made in Project 2014-301 by FRDC, the research organisation (University of Technology, Sydney) and a small amount of other funding.

Table 2: Annual Investment in Project 2014-301 (nominal $)

Year ended 30 June	FRDC ($)	University of Technology Sydney ($)	Other ($)	TOTAL ($)
2014	236,864	125,230	12,500	364,594
2015	199,504	128,058	12,500	340,062
Totals	**436,368**	**253,288**	**25,000**	**714,656**

Program Management Costs

For the FRDC investment, the cost of managing the FRDC funding was added to the FRDC contribution for the project via a management cost multiplier (1.122). This multiplier was estimated based on the share of 'employee benefits' and 'supplier' expenses in total FRDC expenditure reported in the FRDC's Cash Flow Statement (FRDC, 2013-2017). This multiplier then was applied to the nominal investment by FRDC shown in Table 2.

Real Investment and Extension Costs

For purposes of the investment analysis, the investment costs of all parties were expressed in 2017/18 dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2018). No additional costs of extension were included as both the NSW commercial fishing industry and the NSW Government were closely associated with the project.

Impacts

Table 3 provides a summary of the principal types of impacts expanded from those listed in Table 1 and categorised into economic, environmental and social impacts.

Table 3: Triple Bottom Line Categories of Principal Impacts from 2014-301

Economic	• Potential maintenance of, or avoided decline in, the economic value of NSW Wild Catch Fisheries and in the number and income of fishers. • Potential maintenance of, or avoided decline in, the income of businesses in the product supply chain including consumers and businesses servicing tourists.
Environmental	• There are unlikely to be any environmental impacts from the project.
Social	• Maintenance and/or improvement of various non-financial well-being measures of NSW coastal communities through fishing and associated businesses having an improved social license to operate and a more favourable regulatory environment.

Public versus Private Impacts

Most impacts identified in this evaluation are related to the improved information available from this project on the interactions between the wild catch industry and NSW coastal communities where most fishers are located. The connections with, and influence on, the coastal communities are highlighted. In that regard, the project has the potential to benefit the public good of regional coastal communities as well as the commercial wild catch industry.

Distribution of Private Impacts

The private benefits initially will be captured initially by the individual operators in the NSW wild catch industry. It can be assumed that the final distribution of some of the benefits from the investment will be distributed between participants along the commercial fish and fish product supply chains, including final consumers.

Impacts on other Australian industries

It is assumed that project impacts will be confined to the NSW wild catch industry and its input and product supply chains, as well as the NSW coastal communities that interact with these chains. As reported earlier, the 2014-301 report is being used in another FRDC project in Victoria so may have future implications for other Australian wild catch industries.

Impacts Overseas

No significant benefits to overseas parties are expected

Match with National Priorities

The Australian Government's Science and Research Priorities and Rural Research, Development and Extension (RD&E) priorities are reproduced in Table 4. The improved industry positioning and resulting supply chain and appreciation of regional community linkages will contribute primarily to Rural RD&E Priority 3 and to Science and Research Priority 1.

Table 4: Australian Government Research Priorities

Australian Government	
Rural RD&E Priorities (est. 2015)	**Science and Research Priorities (est. 2015)**
1. Advanced technology 2. Biosecurity 3. Soil, water and managing natural resources 4. Adoption of R&D	1. Food 2. Soil and Water 3. Transport 4. Cybersecurity 5. Energy and Resources 6. Manufacturing 7. Environmental Change 8. Health

Sources: DAWR (2015) and OCS (2015)

Valuation of Impacts

Impacts Valued

Only one impact was valued; the impact was valued through a reduction in risk of reduced activity in the NSW wild catch industry including both commercial and charter boat fishing operations. The input and supply chain benefits are included in the risk reduction estimate. This policy impact change was assumed driven by the additional information now available on the NSW coastal community linkage to NSW commercial wild catch industries and its supply chains.

Impacts not Valued

Not all impacts identified in Table 3 were valued in the assessment. These impacts were not valued for the following reasons (Table 5):

Table 5: Reasons for Not Valuing Impacts

Impact/Potential Impact	Reason why Impact Not Valued
Maintenance and/or improvement of various non-financial well-being measures of NSW coastal communities	The difficulty of quantifying and valuing changes in the various non-financial well-being measures that can be attributed to the project

Valuation of Impact: Reduced risk to fishers and supply chain businesses

Total Value of the Output Supply Chain

The NSW seafood industry (including aquaculture such as oyster farmers) and its fishers, wholesalers, processors and retailers generate over half a billion dollars of economic activity each year. Of this, the wild harvest component is worth more than $90 million dollars at first point of sale (NSW DPI, 2008). The margins between the boat and final sale price for various wild catch fisheries can vary considerably depending on the added value along the various supply pathways.

For example, an oyster supply chain price analysis in 2010 determined that the fishmonger sale price for Pacific Oyster was about 2x that for the farm gate price, but about 4x for a mid-tier restaurant. Also, an international study on wild catch tuna estimated that the final sales value was 2.73x the ex-vessel value.

As a rough indication, the price multiplier between the boat price and final sale is assumed to be about 3 times. Using this multiplier, the total supply chain gross costs (including profits) are therefore estimated at about $270 million for wild catch fisheries. If profit along the product supply chain is assumed to be about 10%, total profit may be estimated at $27 million per annum.

Project Impact

With Project 2014-301 it is assumed that the catch decline may be reduced by 5% to 380 tonnes per annum valued at the latest readily available price of $7,757 per tonne for 2015/16, equivalent to $8,003 per tonne in 2017/18 dollars. The unit value of production in real terms has increased over the past 8 years to 2015/16 by about 0.4% per annum. This marginal increase has been accommodated in the estimated change in the value of production in future with and without the project.

The value of production lost is assumed be magnified by a factor of 3 as described above. While some businesses along the supply chain may be located outside the coastal regions, this can be assumed to be more than offset by the impact on local businesses supplying inputs to fishers.

The reduction in the catch decline has been assumed to extend for 15 years after which it stabilises at the then current level.

Counterfactual

Total production of the NSW wild catch fisheries has decreased over the past eight years by over 2% per annum, as shown in Table 6 and Figure 1. However, there has been some increase in price in both nominal and real terms over this period (Figure 2).

Expected future production and price have been projected for both scenarios of with and without Project 2014-301.

Table 6: Tonnage and Value of NSW Wild Catch Fisheries (Source: ABARES)

Year	Production (tonnes)	Value ($000)
2008/09	13,806	79,111
2009/10	15,731	80,502
2010/11	13,479	75,445
2011/12	13,200	77,040
2012/13	11,597	76,220
2013/14	13,614	92,479
2014/15	12,024	89,484
2015/16	11,742	91,082

Figure 1: Trend in Total Catch for NSW Wild Catch Fisheries

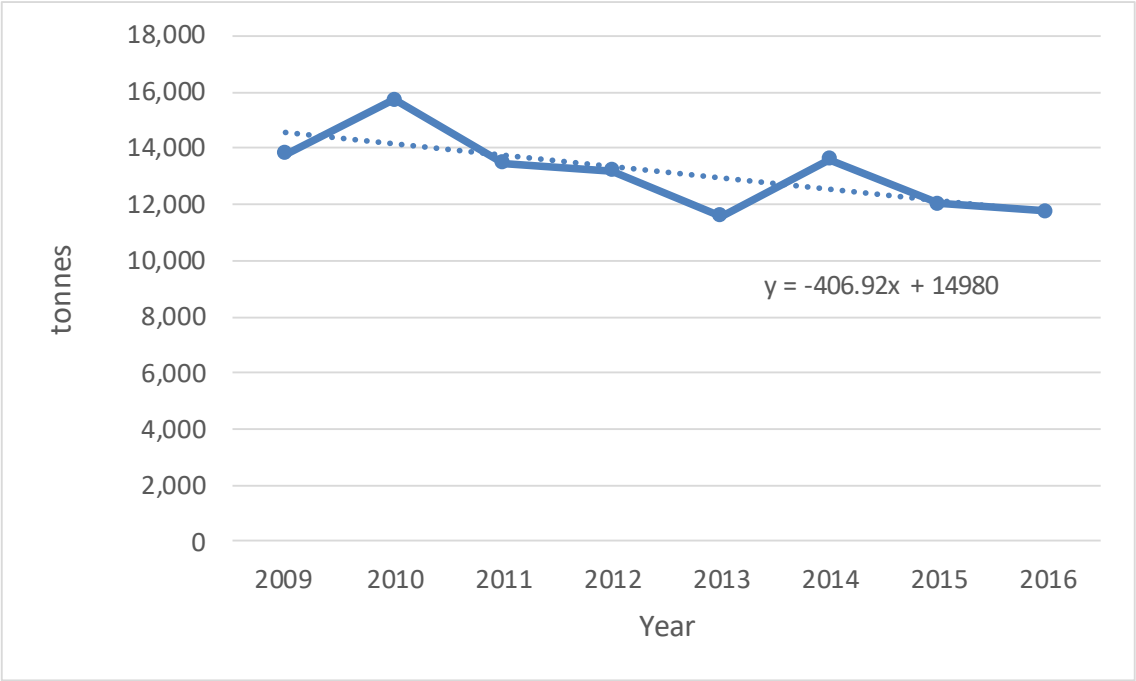
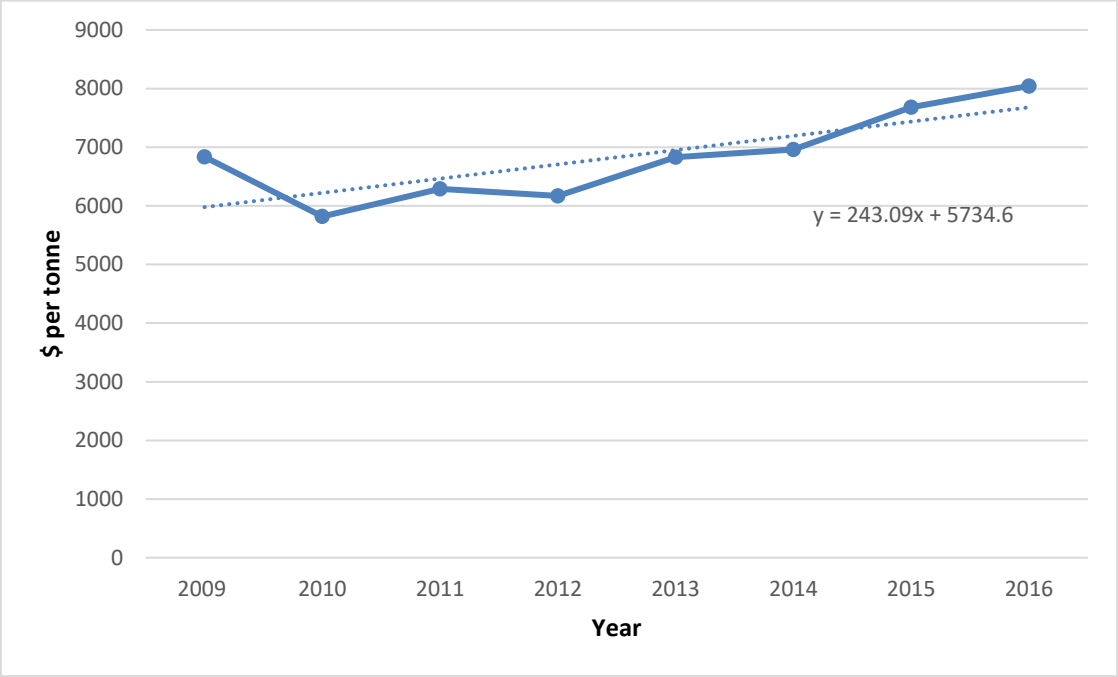


Figure 2: Trend in Unit Value of NSW Wild Catch Fisheries (Real Terms)



Without Project 2014-301 it is assumed that there was a risk that NSW commercial fisheries will be subject to further reduction in catch levels in the years ahead. Based on past data, this decline in production is assumed to continue at the historical rate of about 400 tonnes per annum into the future commencing 2018-19. This reduction will affect both the input and product supply chains as less inputs will be purchased and less products handled by associated coastal businesses.

Summary of Assumptions

A summary of assumptions made for the valuation are provided in Table 7.

Table 7: Summary of Assumptions

Variable	Assumption	Source
General		
Production from NSW commercial wild catch fisheries	11,742 tonnes in 2015/16	ABARES (2017)
Multiplier to estimate total value of product supply chain	3x	Poseidon Aquatic Resource Management (2016)
Annual reduction in past 7 years	2.7% per annum	From Figure 1
Profit assumed along product supply chain	10% of total production value along the supply chain	Agtrans Research
Counterfactual		
Annual reduction in catch	400 tonnes per annum from 2018/19 to 2032/33 after which the catch stabilises at the 2032/33 level	Figure 1
Base price assumed for 2018/19	$7,757 per tonne	Based on value on 2015/16 adjusted to 2017/18$ by the GDP deflator

Value increase thereafter	0.4% per annum	Derived from nominal unit values adjusted to constant $ terms (2017/18$)
With Project 2014-301		
Annual reduction in catch %	5% less	Agtrans Research
Annual reduction in catch	380 tonnes per annum from 2018/19 to 2032/33 after which the catch stabilises at the 2032/33 level	
Base price assumed for 2018/19	$7,757 per tonne	Based on value on 2015/16 adjusted to 2017/18$ by the GDP deflator
Value increase thereafter	0.4% per annum	Derived from nominal unit values adjusted to constant $ terms (2017/18$)
Probability of outcome	50%	Agtrans Research
Probability of impact	75%	

Results

All benefits after 2017/18 were expressed in 2017/18 $ terms. All costs and benefits were discounted to 2017/18 using a discount rate of 5%. A reinvestment rate of 5% was used for estimating the Modified Internal Rate of Return (MIRR). The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All analyses ran for the length of the investment period plus 30 years from the last year of investment (2014/15) to the final year of benefits assumed.

Investment Criteria

Tables 8 and 9 show the investment criteria estimated for different periods of benefits for the total investment and FRDC investment respectively. The present value of benefits (PVB) attributable to the FRDC investment only, shown in Table 9, has been estimated by multiplying the total PVB by the FRDC proportion of real investment before discounting (63.8%).

Table 8: Investment Criteria for Total Investment in Project 2014-301

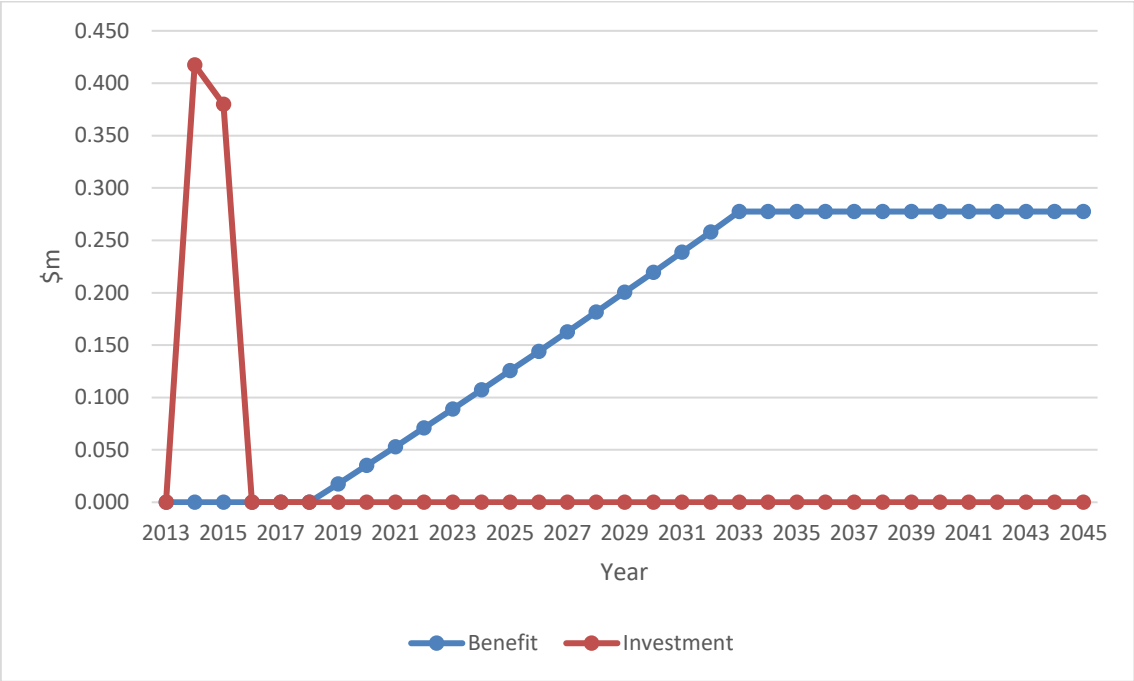
Investment criteria	**Number of years from year of last investment**						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present value of benefits ($m)	0.00	0.05	0.39	0.95	1.58	2.11	2.52
Present value of costs ($m)	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Net present value ($m)	-0.95	-0.90	-0.56	0.00	0.64	1.16	1.57
Benefit-cost ratio	0.00	0.05	0.41	1.00	1.67	2.23	2.66
Internal rate of return (%)	negative	negative	negative	5.0	8.9	10.4	11.1
MIRR (%)	negative	negative	negative	6.5	9.3	9.7	9.6

Table 9: Investment Criteria for FRDC Investment in Project 2014-301

Investment criteria	**Number of years from year of last investment**						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present value of benefits ($m)	0.00	0.03	0.25	0.60	1.01	1.34	1.61
Present value of costs ($m)	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Net present value ($m)	-0.60	-0.57	-0.35	0.00	0.41	0.74	1.00
Benefit-cost ratio	0.00	0.05	0.41	1.00	1.67	2.22	2.66
Internal rate of return (%)	negative	negative	negative	5.0	8.9	10.4	11.1
MIRR (%)	negative	negative	negative	5.0	8.2	8.9	8.9

The annual undiscounted benefit and cost cash flows for the total investment for the duration of investment period plus 30 years from the last year of investment are shown in Figure 3.

Figure 3: Annual Cash Flow of Undiscounted Total Benefits and Total Costs



Sensitivity Analyses

A sensitivity analysis was carried out on the discount rate. The analysis was performed for the total investment and with benefits taken over the life of the investment plus 30 years from the last year of investment. All other parameters were held at their base values. Table 10 presents the results. The results showed a moderately high sensitivity to the discount rate.

Table 10: Sensitivity to Discount Rate
(Total investment, 30 years)

Investment Criteria	**Discount rate**		
	0%	**5% (base)**	**10%**
Present value of benefits ($m)	5.51	2.52	1.32
Present value of costs ($m)	0.95	0.95	1.12
Net present value ($m)	4.71	1.57	0.20
Benefit-cost ratio	6.91	2.66	1.18

Pessimistic and Optimistic Scenarios

A sensitivity analysis was undertaken for pessimistic and optimistic levels of the variables with the highest level of uncertainty: the probability of outcome (changes in the regulatory environment) and probability of impact (changes in the regulatory environment translated into a higher catch level). Results are reported in Table 11. Results show that the investment criteria for the pessimistic scenario are marginally negative.

Table 11: Sensitivity to Combined Assumptions for Probability of Outcome and Impact
(Total Investment, 30 years)

Investment Criteria	**Sensitivity to Probability of Outcome and Impact**		
	Pessimistic (25% and 50%)	**Most likely (50% and 75%)**	**Optimistic (75% and 100%)**
Present value of benefits ($m)	0.84	2.52	5.04
Present value of costs ($m)	0.95	0.95	0.95
Net present value ($m)	-0.11	1.57	4.09
Benefit-cost ratio	0.89	2.66	5.32

Confidence Ratings and other Findings

The results produced are highly dependent on the assumptions made, some of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes.

A confidence rating based on these two factors has been given to the results of the investment analysis (Table 12). The rating categories used are High, Medium and Low, where:

High:	denotes a good coverage of benefits or reasonable confidence in the assumptions made
Medium:	denotes only a reasonable coverage of benefits or some uncertainties in assumptions made
Low:	denotes a poor coverage of benefits or many uncertainties in assumptions made

Table 12: Confidence in Analysis of Project

Coverage of Benefits	**Confidence in Assumptions**
Medium	Medium-Low

The coverage of benefits was assessed as medium due to the focus of benefits on the commercial fisheries value and linkages to the product value chain centred on regional businesses. The assumptions were well supported in part by statistical analyses on production and value trends but assumptions on associated future outcomes and impacts were necessarily subjective and were made with only low confidence

Conclusions

The investment in this project has resulted in the identification of a significant impact to NSW coastal communities of maintaining or increasing the catch of NSW wild catch fisheries. It is expected that commercial fishers operating in the NSW wild catch fisheries, the supply chains of fishers including Australian consumers, and the NSW regional coastal communities will be the primary beneficiaries of the investment.

Funding for the project over the two years totalled $0.95 million (present value terms) and produced estimated total expected benefits of $2.52 million (present value terms). This gave a net present value of $1.57 million, a benefit-cost ratio of 2.66 to 1, an internal rate of return of 11.1% and a modified internal rate of return of 9.6%.

Several social impacts associated with community well-being were identified but not valued. Nevertheless, combined with conservative assumptions for the impact valued, investment criteria as provided by the valued benefit are likely to be as underestimate of investment performance.

Glossary of Economic Terms

Cost-benefit analysis:	A conceptual framework for the economic evaluation of projects and programs in the public sector. It differs from a financial appraisal or evaluation in that it considers all gains (benefits) and losses (costs), regardless of to whom they accrue.
Benefit-cost ratio:	The ratio of the present value of investment benefits to the present value of investment costs.
Discounting:	The process of relating the costs and benefits of an investment to a base year using a stated discount rate.
Internal rate of return:	The discount rate at which an investment has a net present value of zero, i.e. where present value of benefits = present value of costs.
Investment criteria:	Measures of the economic worth of an investment such as Net Present Value, Benefit-Cost Ratio, and Internal Rate of Return.
Modified internal rate of return:	The internal rate of return of an investment that is modified so that the cash inflows from an investment are re-invested at the rate of the cost of capital (the re-investment rate).
Net present value:	The discounted value of the benefits of an investment less the discounted value of the costs, i.e. present value of benefits - present value of costs.
Present value of benefits:	The discounted value of benefits.
Present value of costs:	The discounted value of investment costs.

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