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An Impact Assessment of FRDC Investment in Project 2008-002: Targeting and CPUE definition in the SESSF trawl fishery

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

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Abbreviations

CPUE	Catch per Unit Effort
CRRDC	Council of Rural Research and Development Corporations
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTS	Commonwealth Trawl Sector
FRDC	Fisheries Research and Development Corporation
R&D	Research and Development
RD&E	Research, Development and Extension
SESSF	Southern and Eastern Scalefish and Shark Fishery
TAC	Total Allowable Catch

Executive Summary

What the report is about

This report presents the results of an impact assessment of a Fisheries Research and Development Corporation (FRDC) investment in *Targeting and CPUE definition in the SESSF Commonwealth Trawl Sector (CTS) through auxiliary data*. The project was funded by FRDC over the period July 2008 to October 2010.

Methodology

The project was analysed qualitatively within a logical framework that included brief descriptions of activities and outputs, outcomes, and impacts. Impacts were categorised into a triple bottom line framework. Principal impacts were then considered for valuation.

Results/key findings

The project reported the new multi-species CPUE model produced time trend results similar to the current single species CPUE estimation methods. A recommendation was made that the new model should not be used to replace the current CPUE methods. However, the process investigated was useful in building further knowledge and capacity in attempting to address the species-specific effort for CPUE measurements. The project determined that current methods were sufficient and appropriate and not needed to be changed.

Investment Criteria

Total funding from all sources for the investment was $0.71 million (present value terms). However, none of the benefits identified were valued in monetary terms. Hence, the full set of investment criteria were not estimated or reported as part of the impact assessment.

Conclusions

While the investment did not result in any significant impacts that could be valued, the process was useful in building further knowledge and capacity in attempting to address species-specific effort for CPUE measurements.

Keywords

Impact assessment, CPUE, harvest strategy

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 included 20 randomly selected FRDC investments worth a total of approximately $6.31 million (nominal FRDC investment). The investments were selected from an overall population of 136 FRDC investments worth an estimated $24.98 million (nominal FRDC investment) where a final deliverable had been submitted in the 2015/16 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 25% 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 2008-002: *Targeting and CPUE definition in the SESSF trawl fishery through auxiliary data* 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

Background

CPUE is a key input to harvest strategies, either directly or as a major input to any assessment. This was seen to continue to be a key input until enough fishery independent survey data have accumulated. There was no agreed best way to define species-specific CPUE in the Southern and Eastern Scalefish and Shark Fishery (SESSF) and different definitions could lead to different assessment results and conflicting management implications.

Rationale

This project arose from a SESSF CPUE workshop in April 2007, involving Resource Assessment Group chairs, managers, and stock assessment scientists. The workshop highlighted the sensitivity of assessment results and management advice to the way CPUE is defined in partly-targeted fisheries such as SESSF trawl, and underlined the potential futility of defining targeting based on catch alone. The workshop concluded that an improved definition of species-specific effort would be very valuable to SESSF management.

Project Details

Summary

Project Code: 2008-002

Title: *Targeting and CPUE definition in the SESSF trawl fishery through auxiliary data*

Research Organisation: CSIRO

Principal Investigator: Mark Bravington and Scott Foster, CSIRO

Period of Funding: July 2008 to October 2010

Objectives

The project objectives were:

1. To develop mixture models for log-book data that deal appropriately with "zeros" and that incorporate auxiliary data (e.g. catch composition, market price, fine scale habitat and environmental data) to help account for targeting.
2. To use models developed in objective 1 to develop predictors of fishing effort type using only the log-book and auxiliary data.
3. To make software available to fishery scientists involved in CPUE standardisation.

Logical Framework

Table 1 provides a brief description of the project in a logical framework.

Table 1:Logical Framework for FRDC Project 2008-002

Activities and Outputs	• A questionnaire was prepared to ask fishers about their targeting practices on trawl shots. The feedback from the questionnaire was used to help to structure the multi-species Catch Per Unit Effort (CPUE) model to be used in the project. • Results from the questionnaire showed that fishers have real-time access to market prices. The questionnaire also showed that economic factors (such as fuel costs) do affect decision making, and that this influence has increased over time. • A model for multi-species CPUE with economic drivers was developed for predicting fishers' trawl shots, specifically for the Commonwealth Trawl Sector (CTS) in the SESSF with the aid of the responses collected from fishers via the questionnaire. • Data from 1998 to 2008 were used to analyse multi-species CPUE including logbook data from each trawl available, environment (specifically depth range and position along the coast), Sydney Fish Market prices, and Total Allowable Catch (TAC). • The data were used to better understand targeting (which is not recorded in logbooks) and fishing effort. • The model's specific definition of targeting was unrecorded but was controlled by factors determined by the fishers (information not recorded in logbooks, but

	over which fishers had control) such as depth of trawl shot, gear adjustments, effective quota[1], and prior probabilities of catch for each shot. • The model attempts to predict CPUE, based on a number of variables, along with the depth of each shot and time of year (summer/winter), as these factors determine the species that are caught. • Within the depth range and season, the multi-species CPUE model estimated the catch type of the fish caught, within a trawl shot. The model took into account the CPUE for all of the species caught within the trawl shot. • The modelling was restricted to nine species: Tiger Flathead, Silver Warehou, Pink Ling, Blue Grenadier, Jackass Morwong, Bight Redfish, John Dory, Silver Trevally and Mirror Dory. • For most fish species in the SESSF, the new model showed that targeting of species because of economic drivers is possible and has changed throughout time due to stock abundance. • The project found that the new multi-species CPUE model produced time trend results similar to the current single species CPUE estimation methods. • The project team noted that numerous improvements need to be made to get the multi-species model up to a standard that would justify it to replace current single-species CPUE estimation methods. However, it was noted that the cost of the required improvements would likely outweigh any benefits. • The project recommended that no further research take place on improving CPUE methods in SESSF for the CTS and that the multi-species model developed by the project should not be used to replace the current CPUE applications.
Outcomes	• The multi-species CPUE model has not been used in any stock assessments for the CTS in the SESSF to date. • No further investment in multi-species trawl shot CPUE has been made in the SESSF. • The project validated current approach as adequate, increasing confidence in the current methodology.
Impacts	• Potentially, improved efficiency of future R&D resource allocation through the redirection of funds to better methods (not CPUE) used to check the sustainability of stocks. • Increased knowledge and scientific capacity, specifically in CPUE research.

[1] Effective quota is the quota that a fisher could obtain while making the shot, for example via purchase of additional catch, or adjusting quota for one year over the other.

Project Investment

Nominal Investment

Table 2 shows the annual investment for the project funded by FRDC and other contributors.

Table 2: Annual Investment in the Project 2008-002 (nominal $)

Year ended 30 June	FRDC ($)	CSIRO ($)	OTHER ($)	TOTAL ($)
2009	88,381	69,086	27,000	184,467
2010	11,550	75,492	27,000	114,042
2011	31,912	48,995	0	80,907
2012	28,099	0	0	28,099
2013	0	0	0	0
2014	0	0	0	0
2015	1,993	0	0	19,993
2016	1,993	0	0	19,993
Totals	199,928	193,573	54,000	447,501

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 (1.115). 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, 2016). This multiplier then was applied to the nominal investment by FRDC shown in Table 2.

Real Investment and Extension Costs

For the purposes of the investment analysis, the investment costs of all parties were expressed in 2016/17 dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2016). No additional costs of extension were included as the project included a high-level of model user involvement.

Impacts

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

Table 3: Triple Bottom Line Categories of Principal Potential Impacts from the *Targeting and CPUE definition in the SESSF trawl fishery through auxiliary data*

Economic	• Potentially, improved efficiency of future research and development (R&D) resource allocation through the redirection of funds to better methods (not CPUE) used to manage the sustainability of fish stocks in the SESSF
Environmental	• Nil, but maintained estimation methods that allow sustainable fish stocks
Social	• Increased knowledge and scientific capacity, specifically in CPUE research

Public versus Private Impacts

Both impacts identified can be considered public impacts although there may have been private impact spillovers to fishers (both profitability and sustainability) from improved fisheries management if the multi-species model had been an improvement.

Impacts on other Australian industries

There are not likely to be any significant impacts on any other Australian industries.

Impacts Overseas

No significant benefits to overseas parties are expected.

Match with National Priorities

The Australian Government's Science and Research Priorities and RD&E priorities are reproduced in Table 4. The project findings and related impacts could contribute potentially to Rural RD&E Priority 1 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

The project did not produce any quantifiable impacts so no quantitative evaluation processes were applied to estimate benefits. The impacts identified in Table 3 were not valued for the following reasons (Table 5):

Table 5: Reasons for Not Valuing Impacts

Impact/Potential Impact	Reason why Impact Not Valued
Potentially, improved efficiency of future R&D resource allocation through the redirection of funds to better methods (not CPUE) used to manage the sustainability of fish stocks in the SESSF	A lack of evidence that any such improvements in efficiencies have eventuated
Increased knowledge and scientific capacity, specifically in CPUE research	Uncertainty that the additional capacity built in multi-species modelling will be utilised in the future

Results

All past costs were discounted to 2016/17 using a discount rate of 5%. All analyses ran for the length of the project investment period plus 30 years from the last year of investment.

Investment Criteria

Tables 6 and 7 show the investment criteria estimated for different periods of benefits and costs for the total investment and FRDC investment respectively. Note that, as no benefits were valued, the investment criteria reporting is restricted to the Present Value of Costs.

In the interests of consistency with other project analyses and reporting, the Present Value of Costs was reported for the length of the investment period plus for different periods up to 30 years from the last year of investment (2015/16).

Table 6: Investment Criteria for Total Investment in the Project

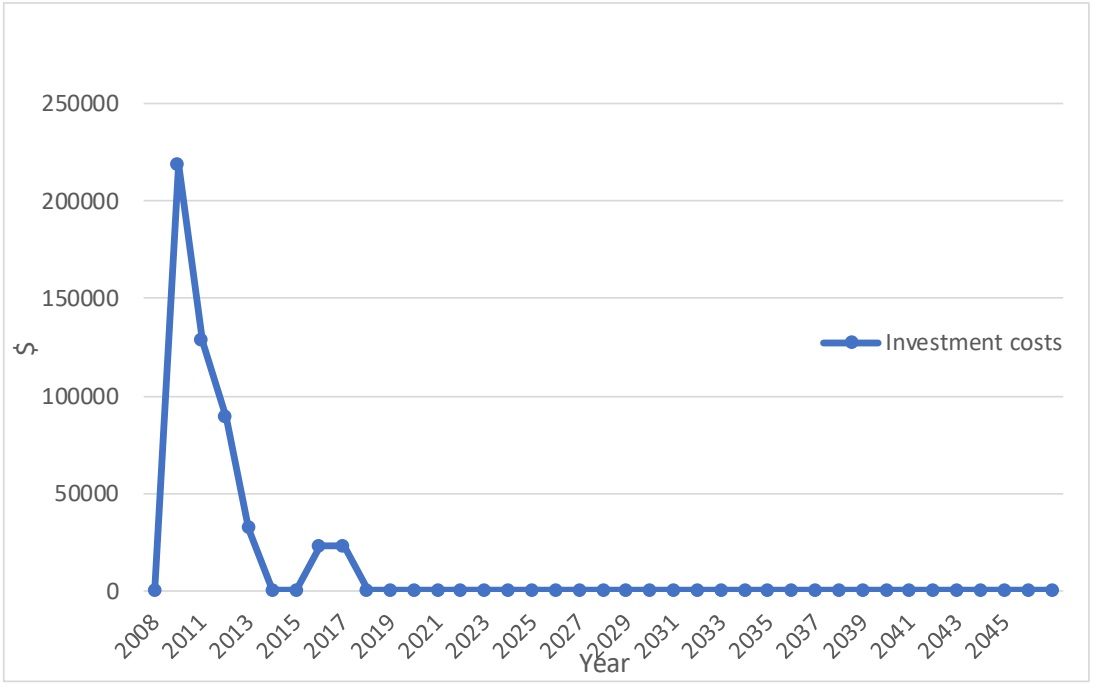
Investment criteria	**Number of years from year of last investment**						
	0	5	10	15	20	25	30
Present value of costs ($m)	0.71	0.71	0.71	0.71	0.71	0.71	0.71

Table 7: Investment Criteria for FRDC Investment in the Project

Investment criteria	**Number of years from year of last investment**						
	0	5	10	15	20	25	30
Present value of costs ($m)	0.32	0.32	0.32	0.32	0.32	0.32	0.32

The annual undiscounted cost cash flows for the total investment for the duration of investment period are shown in Figure 1.

Figure 1: Annual Cash Flow of Undiscounted Total Costs



Conclusions

Total funding for the investment over the six years totalled $0.71 million in present value terms. FRDC funding was under half of this at $0.32 million in present value terms. While the investment did not result in any significant impacts that could be valued, the process was useful in building further knowledge and capacity in attempting to address species-specific effort for CPUE measurements. The investment also confirmed that current estimation methods are adequate.

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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.