Appendix A: 2018-049: A Better Way to Fish: Testing the Feasibility of Tunnel Net 'Fish Trap' Gear in North Queensland

Background

Queensland's East Coast Inshore Finfish Fishery provides a wide range of seafood products to domestic and export markets. It is a highly varied fishery and is essential in supporting the livelihoods of several small-scale operators between Carins and southeast Queensland. It is a multi-gear operating fishery within the Great Barrier Reef World Heritage Area (GBRWHA) and targets Barramundi, King Threadfin, and other coastal species. However, a key sustainability challenge is the bycatch of Species of Conservation Interest (SOCI) such as dugongs and marine turtles. Regulatory pressures and community expectations are driving continual efforts to improve the environmental performance of net fisheries in North Queensland and elsewhere in Australia through bycatch reduction.

To assist address these issues, this project explored the feasibility of tunnel nets to replace traditionally used 'N2' gill nets in Northern Queensland (NQ).

Following this project there have been several industry developments relevant to this impact assessment. This includes recent moves by the Queensland and Australian Governments to phase out gillnet fishing in the GBRWHA by mid-2027 and the introduction of five gillnet-free areas affecting the Gulf of Carpentaria Inshore Fishery.

Description of the project

Table 6 Project summary of 2018-049

Project code	2018-049
Title	A Better Way to Fish: Testing the Feasibility of Tunnel Net 'Fish Trap' Gear in North Queensland
Research organisation	James Cook University, QLD
Principal investigator	Dr. Andrew Chin
FRDC project manager	Adrianne Laird
Project duration	January 2020 – August 2021
FRDC investment	$125,693
FRDC program allocation	50% Adoption, 25% Environment, 25% Industry

Rationale	To investigate the feasibility of using tunnel nets to replace shallow water 'N2' gill nets in Northern Queensland (NQ) and contribute to sustainable improvements in the fishery
Objectives	• Develop a preliminary feasibility trial and implementation plan through site visits and knowledge exchange between fishers • Understand community outlook and industry support for field trials of tunnel nets by conducting engagements in the community • Conduct tests to assess the feasibility of tunnel nets onsite in Mackay and Cardwell
Activities and outputs	• Consultations were conducted with site visits to commercial fishers from NQ (Moreton Bay, Cardwell and Mackay) • Tunnel net experts from Moreton Bay visited potential candidate sites across Cardwell and Mackay with local commercial net fishers and discussed factors influencing tunnel net feasibility • NQ net fishers visited Moreton Bay and viewed active tunnel net fishing and scale of operations followed by a discussion on affecting factors such as operation costs, management and finances • Field trials were conducted in Cardwell • NQ fishers participated in a small-scale trial with small gear and results on species caught and condition at time of release amongst other parameters were recorded
Outcomes	• Despite difficult weather conditions, the tunnel nets remained intact and performed well • SOCI were released alive and in good condition • Commercial viability is unknown as although the tunnel nets are feasible, they may not be a viable practical solution as they require more labour (3 to 4 fishers) to work the gear and there are limited locations where the gear may be deployed • Successful use is limited by optimal weather and seasonal conditions • Requires full scientific trials – more funding to assess financial performance, modify the configuration of traps and exclusion grids to suit local species better, etc • Further multidisciplinary work is needed to develop a holistic understanding of the impacts and benefits
Potential impacts	• Knowledge sharing and relationship building between fisheries, researchers and regions • Proof that the gear is technically feasible, however it might increase labour costs and is site specific • Provides a foundation for future work into alternative options for fishers to reduce their environmental footprint, meet regulatory requirements and improve fishery's social licence amongst consumers and communities • Identification of other trap-type gears such as arrowhead fish traps that may be a better alternative • Reduced bycatch, specifically of SOCI, and the likely release in a healthy condition • Decrease in public and regulatory scrutiny of the industry

Project investment

A breakdown of FRDC investment in the project and contribution by others by financial year is shown in Table 7.

Table 7 Total investment in Project 2018-049 from FRDC (nominal dollar terms)

Year ending June 30th	FRDC ($)	Others* ($)	Total contributions
2018/19	$0	$12,445	$12,445
2019/20	$52,277	$9,000	$61,277
2020/21	$35,656	$24,000	$59,656
2021/22	$37,759	$0	$37,759
Total	**$125,693**	**$45,445**	**$171,138**

Source: Documents provided by FRDC.

*Contributions to the project cost not sourced from FRDC e.g. in-kind contributions

For the BCA, the cost of managing the FRDC funding was added to the FRDC contribution for the project using a management cost multiplier of 1.157. As per impact assessments in previous years, this multiplier was estimated based on a five-year average of the ratio of total FRDC non-project cash expenditure to project expenditure as reported in FRDC's Cash Flow Statement (FRDC Annual Reports, 2019-2023). No multiplier was applied to the investment by other contributors, as it was assumed that project management and administration were included in the value of funding provided.

In undertaking the impact assessment, all past costs were expressed in 2023/24-dollar terms using the Implicit Price Deflator for GDP.

Summary of impacts

Table 8 below provides a summary of the expected triple bottom line impacts (economic, environmental, and social) from the project.

Table 8 Triple bottom line impacts, including those valued as part of this evaluation (in bold)

Economic	• **Potential avoided loss of closures to the Northern Australia net fishing industry**
Environmental	• Reduction in the bycatch of non-target and/or undersized fish, as well as the bycatch of species of conservation interest (SOCI) • Captured bycatch/SOCI are more likely to be released in a healthy condition
Social	• Maintained or improved social license to operate for the North Queensland net fishing industry • Built social capital between regions of fishers and researchers

Public versus private impacts

The potential impacts identified from the project will accrue to both public and private beneficiaries. The avoided loss of further closures affecting net fishing industries in Northern Australia, and potentially elsewhere in Australia, is predominantly a private impact. Public impacts would be realised through the reduction in bycatch and by maintaining and/or improving the industry's social license to operate.

Distribution of private impacts

Private impacts realised from this project will be distributed amongst fishers in the respective net fishing areas and their supply chains.

Impacts on other Australian industries

No direct impacts to other Australian primary industries were identified.

Impacts overseas

No direct impacts overseas were identified.

Quantification of impacts

For the BCA, the identified impact of avoiding future losses due to closures affecting net fishing industries in Northern Australia was quantified. An outline of the assumptions supporting the estimates of future benefits and costs are reported below.

Estimated benefits

While the project was intended to contribute to the social license of fisheries in the GBRWHA specifically, subsequent government plans to close the area by mid-2027 means the benefits are unlikely to be seen in this region without significant regulatory adjustment. At the same time, there have been five gillnet-free areas introduced in the Gulf of Carpentaria for its Inshore Fishery. Considering the increased pressure on marine sustainability within the Gulf of Carpentaria Inshore Fishery there is potential for the project to benefit the region (QLD DAF, n.d.). Many commercial fisheries see the banning of gillnets in the GBRWHA and parts of the Gulf of Carpentaria as an indication that nets are a gear type with lesser social licence. Similar to the Gulf of Carpentaria Inshore Fishery, there is potential for the project to benefit other gillnet fisheries in Northern Australia, including the Kimberley Gillnet and Barramundi Fishery in Western Australia and the Barramundi Fishery in the Northern Territory. Table 9 below details the benefit assumptions.

Table 9 Benefit assumptions

Variable	Assumption	Source/ Explanation
a) Total net economic return of the Gulf of Carpentaria Inshore Fishery	$18,530,000	(BDO EconSearch, 2023)
b) Proportion of net economic return attributable to gillnet fishing	60%	Estimate based on species breakdown as reported in BDO EconSearch (2023)
c) Loss of area due to recent closure of gillnet fishing areas in the Gulf of Carpentaria	10%	(The Queensland Cabinet and Ministerial Directory, 2024)
d) Estimated net economic return of gillnet fishing industry in the Gulf of Carpentaria	$10,006,200	a x b x (1-c)
e) Gross Value of Production of Kimberley Gillnet and Barramundi Fishery	$600,000	(BDO Econsearch, 2023)

f) Gross Value of Production of NT Barramundi Fishery	$4,000,000	Based on report on Northern Territory Fisheries and Aquaculture (FRDC, 2019)
g) Estimated net economic return as a proportion of GVP	56%	Analyst's estimate based on applying same ratio as Gulf of Carpentaria Inshore Fishery
h) Estimated net economic return of gillnet fishing in the Kimberley Gillnet and Barramundi Fishery and NT Barramundi Fishery	$2,576,000	(e + f) x g
i) Annual risk to economic returns of further industry closures	10%	Analyst assumption
j) Annual benefit of avoiding further industry closures	$1,258,220	(d + h) x i
k) Likelihood of success in avoiding further industry closures	15%	Analyst's estimate taking into consideration the need for future work to demonstrate viability of adoption of alternative gear and for regulators to consider it to address sustainability concerns
l) Proportion of industry where alternative gear is viable and adopted	50%	Analyst assumption
Annual benefit	$94,367	j x k x l

Adoption costs

While the project found that alternative gear is feasible in North Queensland and elsewhere in Australia, the researchers identified that further site-specific trials would be required to ensure commercial viability, social acceptability and ultimately adoption. For the analysis, the costs of this further work have been estimated at $200,000 per year over three years commencing in year 2, with benefits commencing at the completion of this work, i.e. year 5.

Counterfactual

The counterfactual assumes that unless alternative, more sustainable gear is trialled and adopted, there is a chance that there will be further, or full, industry closures affecting the Gulf of Carpentaria, Kimberley Gillnet and Barramundi, and NT Barramundi net fishing industries. Without this project there would be a greater probability of these closures occurring. These Northern Australian fisheries have been identified for the modelling due to recent scrutiny/closures, sufficient data, and consultation with researchers and FRDC. However, it should be recognised that there is potential to utilise this project's findings across other gillnet fisheries in Australia that could host similar benefits.

Attribution

The attribution of benefits from the project - summarised in *Table 10* – considers any past inputs and expected future development costs required to realise beneficial outcomes. Given the estimate of further work required to ensure commercial viability, social acceptability and adoption of project outcomes, the attribution of

benefits from this project are estimated to be approximately 30%, of which 23% is attributable to FRDC's investment.

Table 10 Attribution of benefits for project 2018-049

Variable	Assumptions
FRDC costs	23%
Other project party costs	7%
Future development	70%
Total	100%

Results

Table 11 below presents the modelled investment performance from the project. All past costs and benefits were expressed in 2023/24-dollar terms using the Implicit Price Deflator for GDP, while all future costs and benefits were discounted to 2023/24 using a discount rate of 5%. A reinvestment rate of 5% was used for estimating the modified internal rate of return (MIRR). The 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 (2023/24) to the final year of benefits assumed.

The results show the total investment returning a net present value (NPV) of $0.11 million and a favourable BCR of 1.5. Table 12 shows FRDC investment returning a NPV of $0.08 million and a BCR of 1.5.

Table 11 Investment criteria for total investment in Project 2018-049 ($M)

Year	0	5	10	15	20	25	30
PV Benefits		$0.02	$0.12	$0.20	$0.26	$0.31	$0.34
PV Costs	$0.23	$0.23	$0.23	$0.23	$0.23	$0.23	$0.23
NPV	-$0.23	-$0.20	-$0.11	-$0.03	$0.03	$0.08	$0.11
BCR		0.1	0.5	0.9	1.1	1.4	1.5
IRR		-21%	-1%	4%	6%	7%	8%
MIRR	-100%	-4%	3%	5%	5%	6%	6%

Table 12 Investment criteria for FRDC investment in Project 2018-049 ($M)

Year	0	5	10	15	20	25	30
PV Benefits		$0.02	$0.08	$0.14	$0.19	$0.22	$0.25
PV Costs	$0.17	$0.17	$0.17	$0.17	$0.17	$0.17	$0.17
NPV	-$0.17	-$0.15	-$0.09	-$0.03	$0.01	$0.05	$0.08

BCR		0.1	0.5	0.8	1.1	1.3	1.5
IRR		-21%	-1%	4%	6%	7%	8%
MIRR	-100%	-4%	3%	5%	5%	6%	6%

The flow of total undiscounted costs and benefits from the project is presented in Figure 1 below.

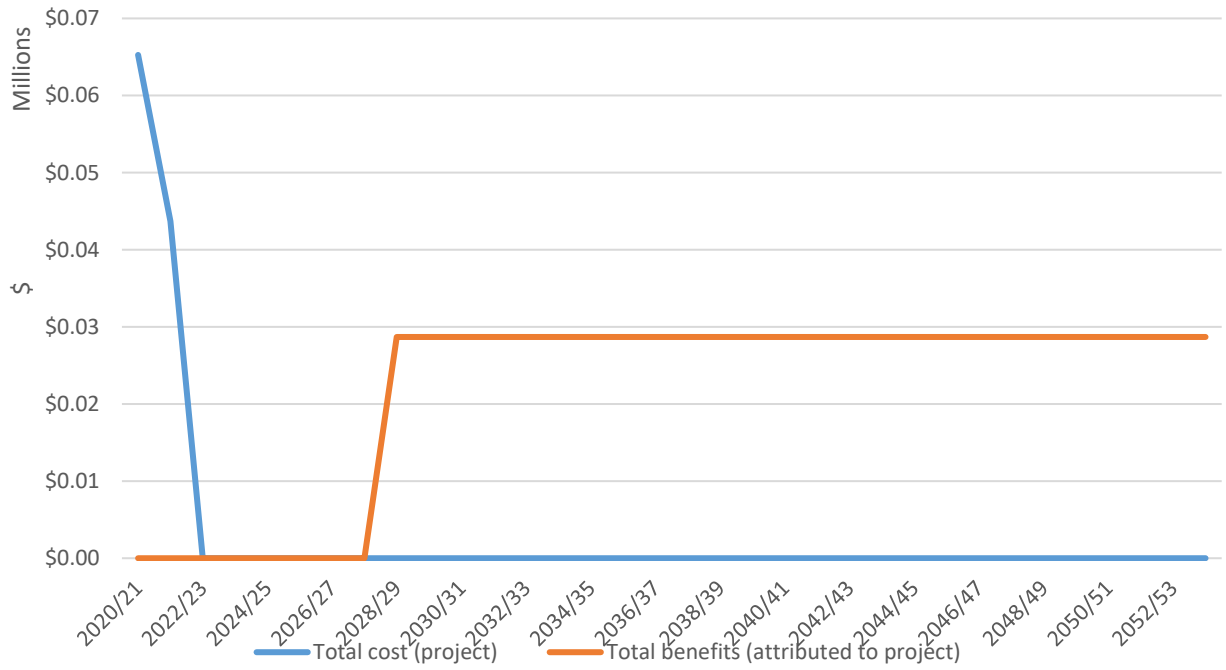

Figure 1 Flow of undiscounted costs and benefits from the project.

Sensitivity analysis

A sensitivity analysis was carried out to determine how the investment performance (NPV, BCR and MIRR after 30 years) would change based on changes to the discount rate and other key variables. The results are presented in Table 13 below.

Table 13 Sensitivity analysis

Changes to key variables	NPV ($M)	BCR	MIRR
Standard assumption	0.11	1.5	6%
Discount rate			
4%	0.16	1.7	6%
6%	0.05	1.3	6%
Likelihood of success in avoiding further industry closures			
10%	0.00	1.0	5%

20%	0.23	2.0	6%

Confidence ratings

The accuracy of the assessment is highly dependent on:

- The extent to which the analysis captures and quantifies the various benefits from the project, including non-market benefits (i.e. coverage of benefits), and
- The level of confidence in the accuracy of assumptions used (i.e. confidence in assumptions).

An assessment of coverage and confidence ratings for this project is presented below in Table 14.

Table 14 Coverage and confidence ratings

Factor	Rating	Comment
Coverage of benefits	Medium	Considering the closure of the GBRWHA, the benefits of the project are likely to be to other regions in a similar situation
Confidence in assumptions	Low	The gear's applicability to other regions, chance of success and when/if further areas will be closed for inshore gillnet fishing are largely unknowns

Conclusions

Project 2018-049: A Better Way to Fish: Testing the Feasibility of Tunnel Net 'Fish Trap' Gear in North Queensland brought researchers, fishermen knowledgeable in tunnel net fishing and Northern Queensland fishermen interested in how it may be applied, together to test its feasibility in Northern Queensland. The closing of the GBRWHA is a significant shift for the potential impacts of the outcomes produced. Although the project was successful in many of its technical aspects within the given Northern Queensland area, the impacts are now more likely to be applied to other regions under similar circumstances.

Based on the adopted assumptions this analysis has estimated the project investment will likely deliver a small positive economic benefit (BCR 1.5). The investment returns became marginal under small changes in uncertain parameters.

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