Appendix M: 2016-020: Spatial management within the NSW Ocean Trawl Fishery

Background

The NSW Ocean Trawl Fishery (OTF) targets many species, in particular the Eastern School Prawn (*Metapenaeus macleayi*) and the Eastern King Prawn (EKP) (*Penaeus [Melicertus] plebejus*). However, a range of permanent and temporary closures along the coast dictates fishing activity.

The JEKP (juvenile Eastern King Prawn) closure network is a network of permanent closures within the inshore waters where juvenile EKPs reside. It was implemented by NSW DPI-Fisheries and industry to protect JEKPs and improve offshore yields of mature EKPs.

Temporary closures also occur in other parts of inshore waters. Flooding in NSW stimulates episodic migration of mature Eastern School Prawn from estuaries to inshore waters, resulting in large and high-grade catches of School Prawn. However, juvenile Mulloway (*Argyrosomus japonicus*) exhibit similar episodic migration following floods. Mulloway are overfished in NSW, are highly susceptible to capture in trawls, and bycatch reduction devices are ineffective in adequately addressing this issue. Therefore, in recent years, bycatch of this species – when fishing for Eastern School Prawns – has often led to a temporary closure of the trawling grounds, causing substantial economic impacts to the OTF.

It has been suggested that temporarily opening parts of the JEKP closure network to daytime trawling could provide alternative areas where Eastern School Prawn can be targeted when other areas are temporarily closed to limit Mulloway bycatch. This would only be feasible if areas within the JEKP closure network support abundant Eastern School Prawn without Mulloway bycatch, and the impact on JEKP and other species was appropriate. However, there is limited data to inform the implementation of such arrangements or their implications for EKP harvest or other species.

Project details

Table 99 Project summary of project 2016-020

Project code	2016-020
Title	Spatial management within the NSW Ocean Trawl Fishery
Research Organisation	NSW Department of Primary Industries
Principal investigator	Dr Matt Taylor
FRDC project manager	Adrianne Laird
Period of funding	March 2016 - March 2020
FRDC investment	$599,980
FRDC program allocation	50% Environment, 50% Industry

Rationale	This study aimed to evaluate spatial management provisions within the NSW OTF, and the potential for these to be adapted to deal with tactical challenges associated with Eastern School Prawn harvest and Mulloway bycatch following floods in northern NSW.
Objectives	• Apply existing survey techniques to quantify the abundance and size-structure of Eastern King Prawn, Eastern School Prawn, juvenile Mulloway and other species within the JEKP closure and non-closure zones, under normal conditions, and following floods • Quantify connectivity of Mulloway between key estuaries, current inshore closure and non-closure areas, and inshore and offshore trawling grounds, and the contribution of these areas to commercial and recreational landings (as a proxy for the overall stock) • Provide recommendations based on scientific data to inform the future management of access to inshore prawning grounds
Activities and outputs	• Within the JEKP closure network, a four-year regular trawl survey was conducted between 2017-2020 to investigate the abundance and size structure of EKP and other species across three areas • A prawn tagging program was conducted and a collection of Mulloway otolith chemistry analysis was conducted • Irregular trawl surveys investigating abundance of Mulloway and Eastern School Prawn were conducted following moderate flood events that approached or exceeded the threshold at which temporary closures would be implemented to minimise Mulloway bycatch • Modelling was conducted of the impact of JEKP closures on the broader fishery
Outcomes	• The JEKP closure network functioned effectively in the protection of small EKP, but the overall impact on harvest magnitude in the contemporary EKP fishery was comparatively low. However, the JEKP closure network provided significant protection for a suite of other quota-managed and bycatch species • Eastern School Prawn were sampled in economic quantities within the JEKP closure zones, suggesting that these areas may provide viable grounds for episodic harvest of Eastern School Prawn following coastal floods, when other grounds are closed due to Mulloway bycatch issues. However, the lack of flood events and associated sampling means that further research is needed to strengthen this conclusion
Potential impacts	• Continuation of the JEKP network closures with the knowledge that they provide considerable protection for a range of species from fishing mortality. Considering these closures were spearheaded by the industry, this project furthers the sustainability credentials for the fishery, and the social license which supports its operations • Provision of the groundwork for allowance of temporary trawling for Eastern School Prawn within the JEKP closure network, with considerations of an appropriate approach so as to minimise impact on the array of important species present • Greater opportunities for sustainable revenue within the OTF • Contribution to more accurate stock assessments and understanding of important life stages of species

Project investment

A breakdown of FRDC investment and contribution by others by financial year is shown in Table 100.

Table 100 Total investment in project 2016-020 from FRDC (nominal dollar terms)

Year ending June 30th	FRDC ($)	Others* ($)
2016/17	$288,002	$119,462
2017/18	$47,950	$122,072
2018/19	$144,031	$124,749
2019/20	$66,967	-
2021/22	$53,029	-
Total	**$599,979**	**$366,283**

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

Table 101 Triple bottom line impacts, including those valued as part of this evaluation (in bold)

Economic	• **Contribution to stock assessments, increasing the accuracy and cost effectiveness** • **Improved management decisions for Eastern King Prawn, Eastern School Prawn, Stout Whiting, and Mulloway among others** • Price premiums may be achieved through the increased data that can be used for consideration into third party sustainability certifications
Environmental	• Improvement in environmental stewardship through the validation, and increased knowledge of the value, of the OTF spatial closures
Social	• The proactive management approach reflects positively for the OTF social license

Public versus private impacts

The potential impacts are likely to accrue publicly and privately. The more detailed information provided can be used to improve management with both public and private considerations at the forefront of decision-making. Public benefits include the validation of spatial closures for the protection of key species, improving environmental stewardship.

Distribution of private impacts

Private impacts are likely to be realised through optimised stock assessments and adaptive management, leading to greater opportunities for fishing whilst having confidence in the preservation of social license.

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 private benefits were modelled. These are expected to be resulting from more accurate management within the OTF along with a potential for the adoption of adaptive management in the form of temporary measures to allow fishing within closure zones. Both benefits are expected to be reflected through an increase in profitability of the OTF.

Estimated benefits

Table 102 Benefit assumptions

Variable	Assumption	Source/ Explanation
Impact 1: Increased opportunities to fish in some years		
a) GVP of OTF (million)	$24.5M	Average of 2019/20 and 2020/21 (BDO, 2023)
b) Profit margin	10%	Analyst assumption
c) Increase in profitability in a year with suitable conditions	20%	Analyst assumption, avoided days of not fishing with potentially high-value replacement
d) Likelihood of adoption and occurrence of suitable conditions	50%	Analyst assumption, considering probability of implementation and occurrence of suitable conditions
e) Annual benefit	$244,500	a x b x c x d
Impact 2: Optimisation in the management of the OTF		
f) Potential profit impacted by management	10%	Analyst assumption
g) Greater efficiency in management	10%	Analyst assumption

h) Annual benefit	$24,450	b x f x g

Adoption costs

There are no expected costs associated with the modelled impacts.

Counterfactual

The counterfactual is that the benefits from this project are not realised. Specifically, management practices remain unchanged and the potential for increased profits through adaptive management is left as an unknown opportunity.

Attribution

The attribution of benefits - summarised in Table 103 – considers all benefits to be attributable to this project, of which 65% is FRDC and 35% is other parties.

Table 103 Attribution of benefits for project 2016-020

Variable	Assumptions
FRDC costs	65%
Other project party costs	35%
Total	100%

Adoption

The opportunities for increased profitability through adaptive and more efficient management are expected to be realised from the year of evaluation, with impacts that are readily adoptable.

Results

Table 104 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 $3.05 million and a favourable BCR of 3.3. Table 105 shows FRDC investment returning a NPV of $1.99 million and a BCR of 3.3.

Table 104 Investment criteria for total investment in Project 2016-020 ($M)

Year	0	5	10	15	20	25	30
PV Benefits	$0.27	$1.43	$2.35	$3.06	$3.62	$4.14	$4.40
PV Costs	$1.35	$1.35	$1.35	$1.35	$1.35	$1.35	$1.35

NPV	-$1.08	$0.08	$0.99	$1.71	$2.27	$2.78	$3.05
BCR	0.2	1.1	1.7	2.3	2.7	3.1	3.3
IRR	-22%	5%	10%	12%	13%	13%	13%
MIRR	-3%	5%	7%	7%	7%	7%	7%

Table 105 Investment criteria for FRDC investment in Project 2016-020 ($M)

Year	0	5	10	15	20	25	30
PV Benefits	$0.18	$0.94	$1.63	$2.08	$2.43	$2.65	$2.88
PV Costs	$0.88	$0.88	$0.88	$0.88	$0.88	$0.88	$0.88
NPV	-$0.71	$0.05	$0.75	$1.20	$1.55	$1.77	$1.99
BCR	0.2	1.1	1.9	2.4	2.8	3.0	3.3
IRR	-23%	5%	10%	12%	13%	13%	13%
MIRR	-3%	5%	7%	7%	7%	7%	7%

The flow of total undiscounted costs and benefits from the project is presented in Figure 12 below.

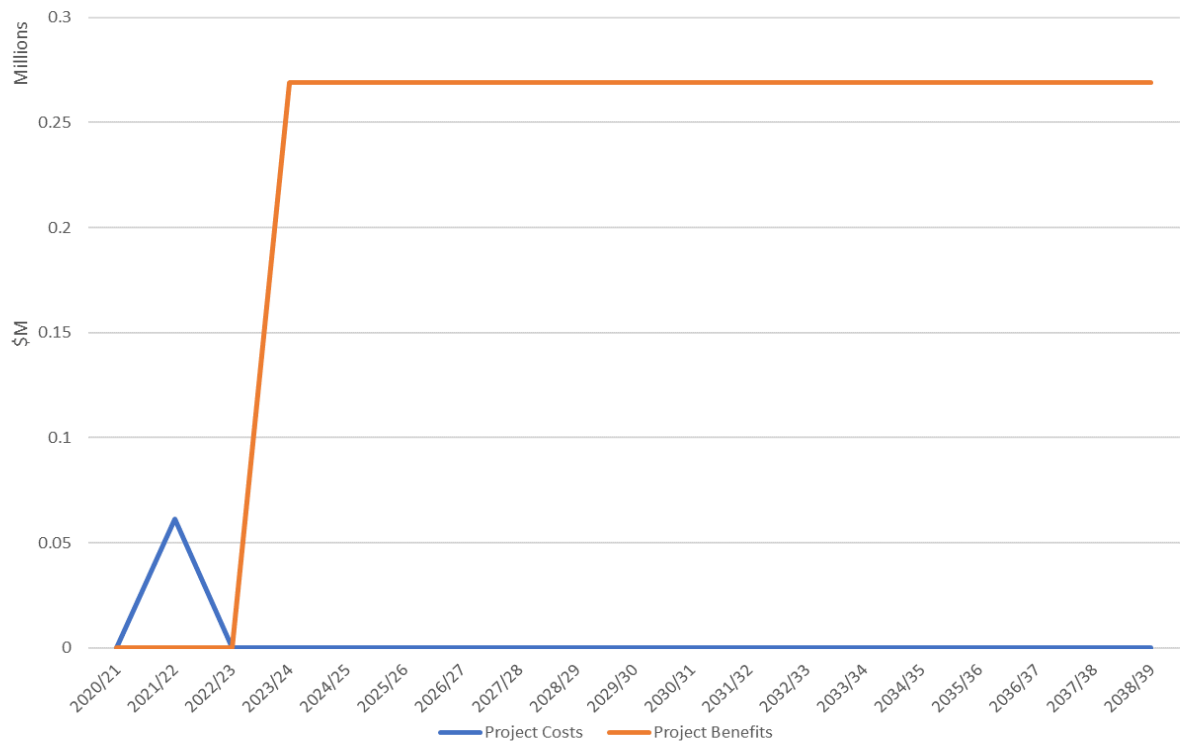

Figure 12 Flow of undiscounted costs and benefits from the project.

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 106 below shows that NPV ($M) remains positive across all scenarios.

Table 106 Sensitivity analysis

Changes to key variables	NPV ($M)	BCR	MIRR
Standard assumption	3.05	3.3	7%
Discount rate			
4%	3.57	3.6	7%
6%	2.62	2.9	8%
Likelihood of adoption			
40%	2.25	2.7	7%
60%	3.85	3.9	8%

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 107.

Table 107 Coverage and confidence ratings

Factor	Rating	Comment
Coverage of benefits	Medium	The nature of the benefits quantified are a broad and aim to capture many aspects of the potential for increases in profitability. However, other environmental and social benefits are not reflected in this value.
Confidence in assumptions	Low	Assumptions for the % of impact are considered low in confidence, with it still to be seen to what degree the project's findings will be implemented.

Conclusions

Project 2016-020: Spatial management within the NSW Ocean Trawl Fishery evaluated the spatial management provisions within the NSW OTF, and the potential for these to be adapted following flood events. The project determined that the JEKP closure network functioned effectively in the protection of small Eastern

King Prawns and other quota-managed bycatch species. Eastern School Prawn were sampled in economic quantities within the JEKP closure zones, suggesting that these areas may provide viable grounds for episodic harvest of Eastern School Prawn following coastal floods when other grounds are closed due to Mulloway bycatch issues. The project outcomes are expected to result in more accurate management within the OTF along with a potential for the adoption of adaptive management in the form of temporary measures to allow fishing within closure zones. Both benefits are expected to be reflected through an increase in profitability of the OTF. Based on the adopted assumptions, the project's investment is expected to provide a positive economic return (BCR of 3.3), which remains positive across all modelled scenarios.

References

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