FRDC
FISHERIES RESEARCH & DEVELOPMENT CORPORATION

National Fisheries and Aquaculture Industry Contributions Study

FRDC Project 2017/210

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National Fisheries and Aquaculture Industry Contributions Study 2017/210

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The project has relied heavily on the cooperation of fisheries and aquaculture data custodians in each of the states, the Northern Territory and the Commonwealth. Without this assistance, the compilation and estimation of economic contribution would not have been possible. In addition, the critical input of participants at the Economic data workshop provided valuable and pragmatic insights which are reflected in the project's final recommendations concerning future economic data needs and initiatives.

Thanks also to the researchers whose work contributed to illustrating industry's contributions to regional social and economic wellbeing.

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Abbreviations

ABARES	Australia Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
AFMF	Australian Fisheries Management Forum
ANZIC	Australia and New Zealand Industrial Classification
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPINT	Department of Industry, Northern Territory
FRDC	Fisheries Research and Development Corporation
GDP	Gross Domestic Product
GSP	Gross State Product
GVA	Gross Value Added
GVP	Gross Value of Production
HDR	Human Dimensions Research Subprogram (of the FRDC)
HI	Household Income

IMAS	Institute for Marine and Antarctic Studies
IPA	Industry Partnership Agreement
I-O	Input-Output
MRIO	Multi-Regional Input-Output
NAC	National Aquaculture Council
PSG	Project Steering Group
RAC	Research Advisory Committee
RISE	Regional Industry Structure and Employment
RPN	Research Provider Network
SIA	Seafood Industry Australia
SIV	Seafood Industry Victoria
TAG	Technical Advisory Group
UoW	University of Wollongong

Executive Summary

The Fisheries Research Development Corporation (FRDC) on behalf of the Australian Government funded the National Fisheries and Aquaculture Industry Contributions Study (FRDC project 2017/210) to produce evidence of industry's contributions. The project was undertaken by the Institute for Marine and Antarctic Studies, University of Tasmania. It was supported by the project's Steering Group and Technical Advisory Group.

As part of this project, BDO EconSearch was commissioned to provide an estimate of the economic contribution of Australia's fisheries and aquaculture industries to the Australian community that is aimed at helping industry tell the story of its contribution. BDO EconSearch also produced various materials that supported the project team in generating a nationally consistent framework to support further studies.

This report presents:

- Steps and research activities undertaken to generate the research findings and develop resources;
- Results of the estimate study of economic contribution by commercial fisheries and aquaculture to the Australian economy as well as at the state or jurisdictional level for 2017/18; and the synthesis of the contributions fisheries and aquaculture industries make to social and economic wellbeing of regional communities in different parts of Australia; and
- Resources to support a nationally consistent approach to contribution studies for fisheries and aquaculture developed as part of this project.

Objectives of the project

The project had three objectives:

1. Estimate the contribution to the Australian (i.e. national) economy of total commercial fisheries and aquaculture activity using standard measures of economic contribution
2. Estimate the contribution to each state/territory's economy of commercial fisheries and aquaculture activity using standard measures of economic contribution
3. Develop a robust and nationally consistent framework to support data collection and estimation of contributions (and, potentially, impact) in the future.

Research design

Project steps and research activities were organised into two main components: 1. Evidence of economic contributions, and 2. Resources for designing and conducting future contributions studies. To achieve component 1. a review of existing contribution studies, available data and recommended methods was undertaken. This informed the design and scoping of the economic estimate study. The study included an audit of the availability of economic data in each jurisdiction and established contact with data custodians/managers in each jurisdiction. Following generation of economic contribution estimates for 2017/18, the draft economic contribution estimate report was subject to quality assurance review by international and national experts. Final estimates were also benchmarked against other studies. The synthesis of social contributions drew on the results of the initial review of existing studies. The national estimates report was launched at the *Seafood Directions 2019* conference in Melbourne, with reporting and communication of results supported nationally and in each jurisdiction by the release of a series of short summary reports.

To achieve component 2 (Resources for designing and conducting future contributions studies) a data framework to support future studies was produced based on the data audit undertaken for the 2017/18 economic contribution estimate study. A set of practitioner guidelines was produced by drawing on and extending the processes and protocols developed to conduct the 2017/18 study. A set of guidelines to the overall design of social and economic contribution studies was also developed based on findings of a series of technical workshops undertaken by the FRDC's Human Dimensions Research Subprogram in 2018 and 2019, as well as on the review and synthesis of studies which measured these types of contributions of fisheries and aquaculture to community wellbeing. A further national workshop was held with data custodians in each jurisdiction to discuss data gaps and to recommend further steps to coordinate economic data collection and collation cost-effectively.

Results

This is the first time the national economic contribution of the Australian seafood industry has been reported. Estimates are based on the best available data and most appropriate methods given data availability and project resources. Full results are provided in the Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report. This is also the first time the economic contributions of the seafood industry at each state or jurisdictional level has been reported using a nationally consistent approach. This is also the first time a synthesis of contributions the industry makes to social wellbeing has been presented alongside economic contributions at a national level. This work is therefore an exciting step forward that lays the groundwork for the seafood industry to celebrate its economic and other contributions and to showcase these to its communities and to Australians in general.

Moreover, the results of the 2017/18 economic contributions estimate study provide the starting point for monitoring contributions to Australia's economic prosperity over time. The results of the project not only provide the Australian seafood industry with an evidence base with which to tell the story of its economic contributions, but also with capacity to continue to do so in a nationally consistent and cost-effective way.

The Practitioner Guidelines provide a step-by-step guide describing processes and protocols for estimating economic contributions covering selection of indicators, use of terminology, estimation process, data collection and processing, data and modelling assumptions, preparation of modelling framework, and reporting and interpretation of results. The Data Summary and Framework served to both highlight gaps in economic data availability and quality for the 2017/18 study, as well as to provide the basis for developing a data framework for future audits and to support initiatives towards greater collaboration and coordination of economic data collection nationally. The Design Guidelines outlines recommended principles and steps to guide the design of FRDC-funded studies which estimate the social and/or economic contributions of wild catch commercial fisheries and aquaculture to community and societal wellbeing.

Implications

This work has provided management agencies and industry representative organisations evidence of the contribution to key economic indicators of contribution (gross value added, employment, gross domestic product and gross state product, household income) of fisheries and aquaculture industry activity in 2017/18 at the national and relevant state level. This evidence can be used by these groups to demonstrate legitimacy and as context to decision making, among others. This evidence will also be of use to other groups, such as state and territory governments who may wish to monitor contributions for the purposes of regional development and state growth planning. It also provides a baseline of economic contributions against which to compare the levels of fisheries and aquaculture activity and their economic contribution post-COVID19. Combined with more specific data on the changes in levels and types of fisheries and aquaculture activity, this provides support for analysis of further economic impact.

The project has also already begun to build capacity of management agency staff, industry representative organisations and researchers and economic analysts by generating a nationally consistent framework for supporting cost-effective contribution studies. In so doing, and through direct engagement with these key stakeholders, the project has also increased economic literacy in measures of economic contribution and the appreciation of the value of collecting economic data.

Recommendations

1. The national economic contribution estimate study be repeated to support monitoring of contributions, using the same methodology as used in the 2017/18 estimates report and outlined in the Practitioner Guidelines.

2. Any other future contribution study funded by FRDC be required to follow the Practitioner Guidelines

3. Resources be available for periodic review and revision of the Practitioner Guidelines

4. Efficiency of future economic contribution studies be improved by pursuing the following general economic data strategies:
    a. Engagement with national data coordination initiatives (i.e. Australian Fisheries Management Forum (AFMF) and Research Providers Network's (RPNs) data working groups) to achieve a nationally consistent approach to collecting, sharing and governance of economic data. Options include:
        i. Establish an Economic Data Working Group under either the AFMF or the RPN
        ii. Investigate the expansion of the Status of Australian Fish Stocks data and reporting platform to include selected economic indicators
    b. Update the economic data summary on an annual basis to reflect changes in data collection activities and availability across jurisdictions (see Appendix 17)
    c. Publish a Standard Operating Procedure for the collection, storage, ethical management and compliance of survey data with FAIR data principles to maximise its interoperability and assistance to industry at local, regional and national scales.

5. Precision of future national economic contributions estimates to be improved by pursuing the following:
    a. Further investment in RD&E to improve reliability of existing methods of data collection and analysis (inclusive of survey methods and use of secondary data in data matching).
    b. Establish a data governance committee at the start of any future national estimate study to support efficiencies in obtaining fisheries level data from the jurisdictions and feedback on data matching, including the timing of data matching procedure to allow earlier and better-informed input from agencies and industry representative organisations.
    c. Determine sectors for which processing is significant and instigate early contact with the major operators in those sectors regarding data availability
    d. Implement recommendation 4. (above) to improve quality and accessibility of economic data more broadly

6. Adoption and impact of future national contribution studies be improved by pursuing the following:
    a. Investment in further initiatives to increase economic literacy of data custodians, industry representatives and other end users to build greater trust in and capacity to interpret results for policy purposes. Future economic contribution studies should include targeted economic literacy initiatives run in parallel to data collation and estimation activities.

b. Investment in extension strategies to promote the importance and multiple uses of economic data and support for data collection programs amongst industry representatives and members, and agency staff.

Keywords

Economic contribution estimates; Input-Output modelling; Economic data; Social wellbeing; Economic contribution guidelines

Introduction

Recent years have seen strong interest in Australia from all sectors (i.e. wild catch commercial, recreational, Indigenous and aquaculture) to evaluate the contributions of their activities to the wellbeing of Australians at various scales (from local community to National). This interest is evidenced by FRDC investments in broadly scoped studies in New South Wales (2014-301, 2015-302) and Victoria (2017-092), and by the continued high number of Research Advisory Committees (RACs) and Industry Partnership Agreements (IPAs) which identify studies of this nature as a priority RD&E need. A central pillar in such studies is the measurement and evaluation of the extent to which a sector's activities improve some desired economic outcome for society. Several studies have measured just the economic contribution of various sectors in particular jurisdictions in recent years in Australia (for example, FRDC project reports 2017-084; 2015-302; 2014-301; 2013-301 and 2013/748.10, and Georgeson et al. 2015; Colquhoun & Ridge Partners 2015). To date, however, there has been no nationally coordinated attempt to ensure a consistent approach to method, data and reporting or to estimate economic contributions at the national level in Australia.

It is against this background that this project had its genesis. The project's focus is squarely on economic contributions of commercial fisheries and aquaculture activities, a limited but crucial part of the suite of contributions made to the wellbeing of the Australian community and society. An economic contributions analysis will answer the question 'What is the contribution or importance of the industry to national, state and/or regional economies and communities?', providing evidence of how relatively large a sector is in the existing economy and how much economic activity is being cycled through the economy by that industry (Watson et al. 2014).

Contribution analysis is a descriptive analysis that traces the gross economic activity of the industry as dollars of expenditure cycle through the regional/state/national economy. It will commonly utilise detailed industry specific data in combination with other regional/state/national data that highlight the current linkages that exist within the economy to estimate and report against indicators such as value added and employment. It is generally undertaken within a modelling framework such as a standard input-output model, with the purpose being to determine how much direct and indirect economic activity is associated with the industry. This is because the contribution of an activity usually extends beyond the initial round of output, income and employment generated by the activity. These indirect or flow-on effects are part of the contribution of fishing and aquaculture related businesses to the economy and must be added to the direct effects in order to get a full appreciation of the economic contribution of fisheries.

This project was designed to produce evidence for industry to *'tell its story'* of the contribution fisheries and aquaculture industries make to the national and state economies. It was also shaped by the overarching need to ensure that FRDC investment in contributions work produces information that is: (1) methodologically and technically robust and repeatable; (2) meets its' stated need and is credible to its' intended audience; (3) informs and improves outcomes for stakeholders; and (4) maximises the return on investment (by avoiding unnecessary duplication and ensuring comparability of results). These considerations are reflected in the project's emphasis on producing a legacy of resources and capabilities to promote and facilitate greater consistency in economic data collection and in the design and conduct of economic contribution studies nationally.

The aims of this project were therefore to, firstly, determine the extent to which, given the variation in fisheries and aquaculture industries across Australia, there was evidence of contributions (economic and social) that the industry makes to the Australian economy and communities. Secondly, the project aimed to advance how economic contributions analyses are designed and reported on in the future to support a range of economic analysis and decision making.

In order to achieve these aims the project was implemented through several iterative steps (see Methods) that included: review of existing contribution studies and available data; development of a national framework for estimating economic contributions; and deriving estimates of economic contribution using the above framework.

Objectives

The project had three objectives that were organised into two components:

Component 1: Evidence of Economic Contributions

Objective 1: *Estimate the contribution to the Australian (i.e. national) economy of total commercial fisheries and aquaculture activity using standard measures of economic contribution*

Under Objective 1, the project also undertook a synthesis of contributions to four over-arching dimensions of social wellbeing relevant at the national level, as measured in a range of existing regional studies. This enabled a more holistic portrayal of contributions of the fishing and aquaculture industry to the national community.

Objective 2: *Estimate the contribution to each state/territory's economy of commercial fisheries and aquaculture activity using standard measures of economic contribution*

Component 2: Resources for designing and conducting future contribution studies

Objective 3: *Develop a robust and nationally consistent framework to support data collection and estimation of contributions (and, potentially, impact) in the future*

Under Objective 3, the project also included development of outputs to support nationally consistent steps for the design of future contributions studies.

Methods

Project Governance

The project team was supported by a Technical Advisory Group (TAG) and guided by a Project Steering Group (PSG). Members of these groups are detailed in Table *1*. The role of the TAG was to provide technical expert advice and recommendations on the design and quality of the estimate study and practitioner guidelines. Members were economists with relevant technical and applied experience. The role of the PSG was to provide guidance on matters of scope, interaction and collaboration with data custodians (management agencies) and with industry organisations, and on communication, extension and adoption.

Table 1. Project governance and membership of groups

Project team	Technical Advisory Group	Project Steering Group
Emily Ogier (IMAS)	Sean Pascoe (CSIRO)	Jane Lovell, former Chair (SIA)
Sarah Jennings (IMAS)	Robert Curtotti (ABARES)	Aaron Irving, former CEO (NAC)
Kirsten Abernethy (IMAS)	Alistair McIlgorm (UoW and FRDC 2017-092)	Bryan McDonald (DPI NT and AFMF Fisheries Management Sub-committee)
		Johnathon Davey (SIV and FRDC 2017-092)
		Chris Izzo / Crispian Ashby (FRDC)

Overall Project Structure

To address the project objectives, research steps and activities were structured around two project components: (1) Evidence of economic contributions (described as 'the evidence study') and (2) Resources and capacity for designing and conducting future contributions studies (described as 'the framework').

Both project components comprised various sub-studies and tasks, each involving different methods of which an overview is provided below. Details of methods used in the evidence study are reported in the Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report.

Several key sub-studies were sub-contracted to BDO EconSearch (see Terms of Reference for the Economic Contributions Estimates Study). BDO EconSearch reported the required outputs to the TAG. The structure is presented in Figure *1* (below).

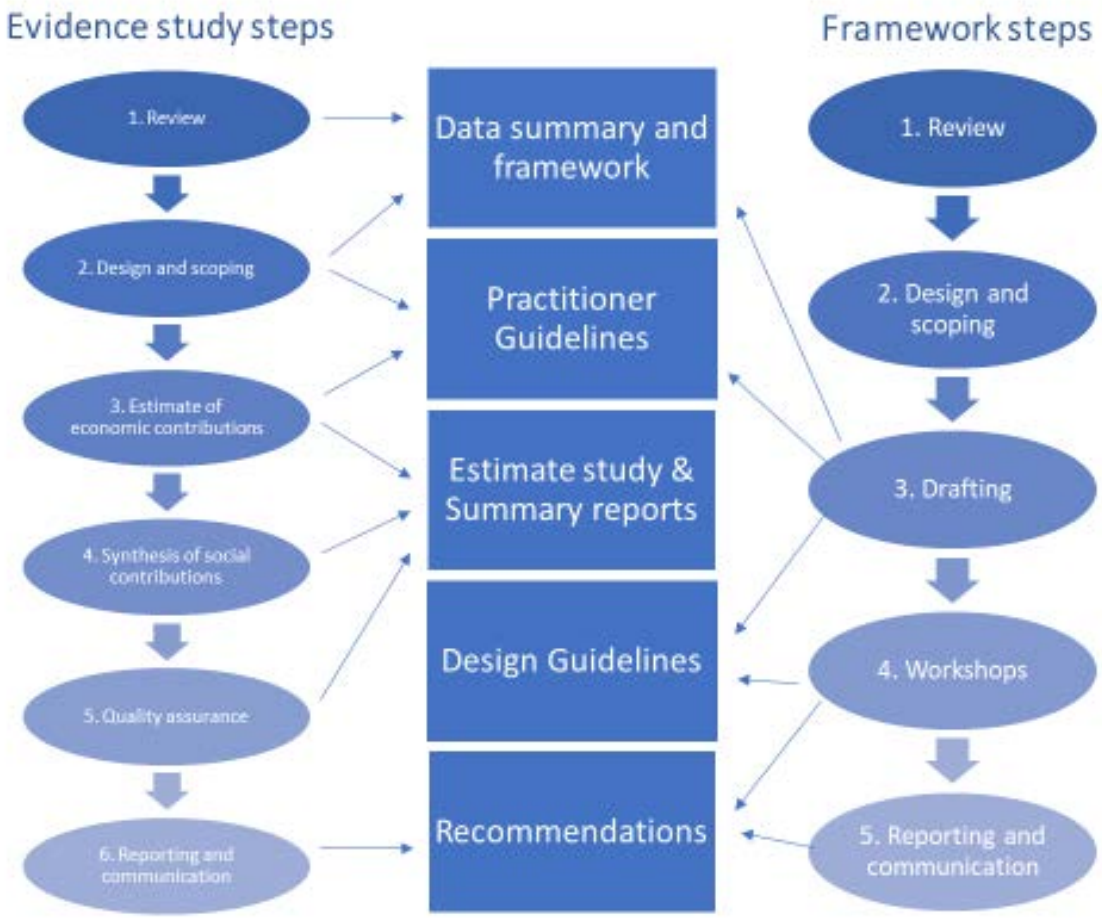

Figure 1. Project structure and process

Component 1: The Evidence Study

Review of existing studies, available data and recommended methods

A comprehensive technical review of existing contribution studies and data was undertaken to ensure that the evidence study avoided duplication by building on previous work and data collection/ analysis. The review also helped ensure that best-practice methods were used to estimate contributions, given data requirements and budget.

The review was undertaken by BDO EconSearch and comprised three working papers, each of which addressed the following question:

The aim of Working Paper 1 was to identify and critically assess all recent contributions / impact reports with a focus on fishing and aquaculture in Australia as well as a selection of key overseas studies. To do this, selection criteria were developed with the agreement of the TAG. The list of reports reviewed was compiled through a search of the academic literature and direct contact with agencies, peak bodies, FRDC, RACs and IPAs.

The aim of Working Paper 2 was to identify and audit existing data sets that could be used to support objective 1 of the national economic contribution project and identify data gaps.

The aim of Working Paper 3, which was an internal project document, was to provide preliminary recommendations to the TAG about the preferred research design for the estimate study to achieve project objective 1, including scope, method, data requirements and data collection plan.

Design and Scoping

Based on its review of WP3 the TAG drafted the Terms of Reference, which were approved by the PSG and FRDC Management. The Terms of reference specified the study scope, model approach, indicators of contribution, the data framework, and the required outputs.

In particular, the terms of reference required that estimates be provided for economic contributions:

- of commercial fishing, aquaculture and associated processing activities
- to the state or territory level in which these activities occur, as well as to the national economy
- of Commonwealth fisheries to the state or territory in which catch is landed.

In addition, the terms of reference specified that commercial activities by Indigenous fishing and aquaculture businesses be included in commercial fishing and aquaculture activity and that seafood processing of locally produced seafood was in-scope and be attributed to the state/territory economy in which it occurs. Inter-state trade flows (e.g. contribution of South Australian-produced aquaculture to the Victorian economy) was also to be captured and reported. On the other hand, fishery and aquaculture sector management activity (other than where these costs are recovered through licence fees) was excluded, as was commercial charter fishing activity, on the basis that while providing a commercial platform for recreational fishing its output is not considered part of the formal seafood sector.

Estimating economic contributions

The steps taken to generate estimates of economic contribution at both the national and state levels are illustrated in Figure 2 (below), and in ***Box 1*** (below).

The flow-on effects of state/territory fisheries, Commonwealth fisheries and aquaculture sectors for each jurisdiction were estimated using multi-region input-output (MRIO) analysis. An extended input-output model known as the RISE model (Regional Industry Structure and Employment) was used. The model includes one region for each state and territory in Australia and captured the interstate trade effects between them.

Based on the findings of Working Paper 2, BDO EconSearch undertook an audit of the availability and quality of required data for each fishery/sector in each jurisdiction (step 1 in the estimation approach). To enable this, a contact list of data custodians and managers in each jurisdiction was created with input from the senior project team (consisting of Emily Ogier (Principal Investigator) and Sarah Jennings (Co-Investigator)). Identified data custodians and managers were contacted by telephone and email during this and subsequent steps.

Best available data for 2017/18 was used to produce estimates of Gross Value of Product (GVP), and of direct employment, Gross Value Added (GVA), Gross State Product (GSP)/Gross Domestic Product (GDP) and household income (HI). Secondary data was collected from primary sources (databases) and published sources, where available, for the individual fisheries/aquaculture sub-sectors. This data included: wild catch/farm production, product prices, cost of production, license fees and employment. Further information on data sources and validation is provided in Appendix 6: Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions - Data Summary and Framework.

Where cost data was not available for a particular sub-sector, it was matched with an equivalent sub-sector for which data was available and cost data was then imputed based on available activity data including: production, GVP, total days fished, average vessel length, active vessels.

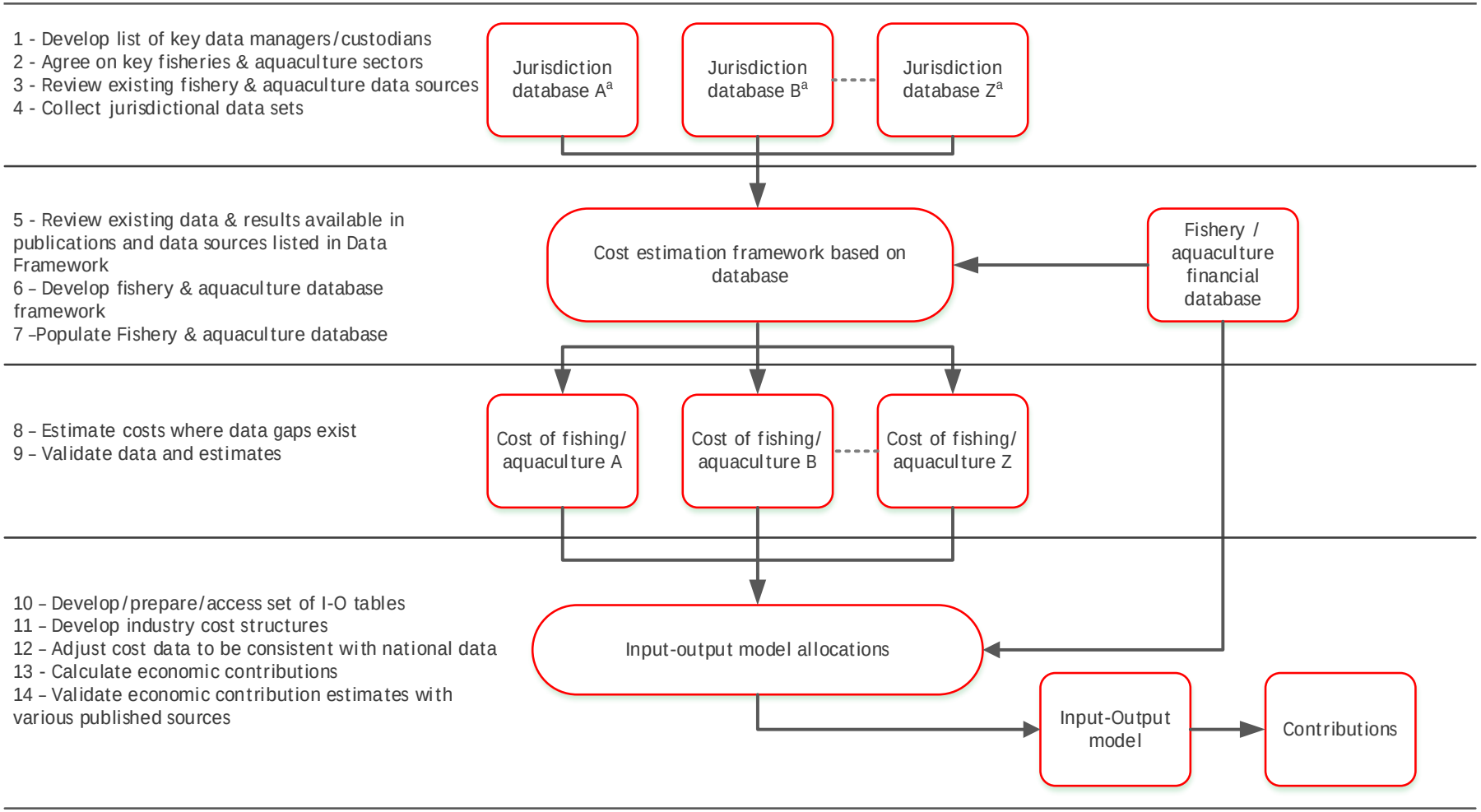

Figure 2. Estimation approach (source: Figure 7-1 in the Practitioner Guidelines).

Box 1. Steps for estimating economic contributions (source: Section 7-1, *Practitioner Guidelines*)

1. Develop/update the list of key data managers/custodians in each of the relevant jurisdictions. The Data Summary and Framework *(BDO EconSearch 2019b)* provides a useful starting point for this.
2. Agree on a list of key fisheries and aquaculture sectors by jurisdiction that will be included in the analysis.
3. Review existing fisheries and aquaculture data sources. The Data Summary and Framework can be a useful starting point from which to make initial identification of existing data sets. The report also identifies data gaps.
4. Collect regional/jurisdictional data sets from managers/custodians and published source materials
5. Review existing data and results available in the publications and data sources listed in the Data Summary and Framework and through additional research/consultation.
6. Develop a database framework on a regional/jurisdictional basis that includes the following elements for each of the key fisheries and aquaculture sectors:
    a. Catch/production
    b. Price
    c. GVP
    d. Business costs/operating costs (representative cost structures)
    e. Management costs
    f. Data update assumptions – data and assumptions that will be used to modify data, particularly cost data that are not available for the study year. This will include, for example, total days fished, price of fuel, business interest rates, consumer price index in relevant jurisdiction, wage price index
    g. Export data
    h. Employment data.
7. Populate the fishery and aquaculture database with best available information. This database links detailed cost data from existing surveys and studies into the framework.
8. Where there are data gaps, estimate proxy data using a 'fishery matching' approach, particularly in relation to industry cost data.
9. Validate fishery/sector matching and allocation of confidential data to fisheries with data custodians
10. Develop/prepare/access set of I-O tables appropriately specified for the agreed spatial definitions for the study
11. Develop industry cost structures from the database for modification/adjustment consistent with the I-O tables prepared under item 10. The following adjustments/assumptions will be required for each item of expenditure
    a. Proportion imported to the region/jurisdiction
    b. Proportion imported to Australia
    c. Identify any margins (wholesale, retail, transport, insurance, rent, leasing, interest payments, etc.) and allocate appropriately
    d. Identify any indirect taxes or subsidies and allocate appropriately.
12. Structure the database so that the sum of activity across jurisdictions is consistent with the national data having account of inter-jurisdictional trade and transactions.
13. Calculate economic contributions using the Input-Output (I-O) consistent fishery/aquaculture data and the Input-Output model.
14. Review contribution estimates with other published data sources and studies to check validity of results. For example, if a study is specified to cover all fisheries in a State and recent reliable estimates of employment and production have been published for a fishery that contributes half of GVP for the State, then the appropriate intermediate study results should be validated against those published estimates to identify any potential issues in the analysis.

Synthesis of social wellbeing contributions

In order to include a synthesis of contributions to social wellbeing at the national level, a series of steps were undertaken as follows.

Firstly, a range of frameworks for measuring and evaluating wellbeing were reviewed. From this review, the social wellbeing framework was identified as the most appropriate, after (Coulthard 2012; Coulthard, Johnson, and McGregor 2011; Voyer et al. 2017; Weeratunge et al. 2014).

The body of research studies available of contributions by Australian fisheries and aquaculture industries to community wellbeing was then examined (Barclay et al. 2016; Schirmer et al. 2016; Voyer et al. 2016; Abernethy et al. 2019) and the types of contributions (i.e. domains) was identified. Types of contributions were then collated into four overarching focal domains and the relevance of these domains to the national study were checked against a set of criteria, as follows.

1. Level of evidence for contributions made by fisheries/aquaculture to domain
2. Relevance across Australian fisheries/aquaculture activities
3. Relevance at both the community and society scales
4. Link to Seafood Industry Australia's 'Our Pledge'
5. Link to United Nations Sustainable Development Goals

These steps were conducted initially by the project team and then the collated domains were refined following a technical workshop held with social wellbeing researchers (details are provided in Table *2*).

Table 2. Workshop on wellbeing framework for contributions studies held in Melbourne 18 March 2019

Workshop	Details
Date	18th March 2019
Location	Melbourne, Tullamarine Airport
Participants	Kate Barclay, University of Technology Sydney
	Michelle Voyer, University of Wollongong
	Jacki Schirmer, University of Canberra
	Andrew Song, University of Technology Sydney
	Nyree Stenekes, Australian Bureau of Agricultural and Resource Economics & Sciences
	Kirsten Abernethy, SeaChange Consulting & project team
	Sarah Jennings, Institute for Marine and Antarctic Studies & project team
	Emily Ogier, Institute for Marine and Antarctic Studies & project team

The four focal domains of wellbeing identified were:

- Economic resilience and diversity for regional communities
- Locally produced seafood
- Experiences and services for coastal tourism and recreation
- Healthy marine and freshwater environments

Based on the review of research studies e.g., (Barclay et al. 2016; Schirmer et al. 2016; Voyer et al. 2016; Abernethy et al. 2019) evidence was compiled of contributions reported in these studies against relevant focal domains. Illustrative examples were then selected on the basis of how contemporary they were, on the types of measures (qualitative and quantitative) used, and on the spread of cases across jurisdictions and sectors (i.e. aquaculture, fisheries).

Quality assurance

Steps taken as part of quality assurance for the evidence component of the project are outlined in Table *3*. An external audit/review of the evidence study, method and model was conducted by Gentner Consulting Group (www.gentergroup.com) - an International firm with recognised expertise in contribution analysis. The Terms of Reference for the review by the TAG and by the external reviewer are provided in the Appendix 4.

Table 3. Summary of project-level quality assurance of estimates of economic contribution

Stage	Document	Who reviewed	Who approved changes
Review	Working Paper 1	TAG	TAG
	Working Paper 2	TAG	TAG
	Working Paper 3	TAG	TAG
Design and scoping	Terms of Reference	TAG	PSG, Senior Project Team and FRDC Management
Estimating contributions	Estimates report	TAG and External Reviewer	TAG (for TAG recommendations) and Senior Project Team (for External Reviewer comments)
	Estimates report (comparison of National project Victorian estimates with 2017-092 Victorian estimates)	BDO EconSearch, Prof Alistair McIlgorm, Senior Project Team	All reviewers supported a statement explaining observed differences in estimates of the two studies.
Reporting	Summaries of economic contributions	Data custodians in each jurisdiction	Senior Project Team
	Social contributions synthesis	Lead authors of existing studies	Senior Project Team

BDO EconSearch's estimation approach included two internal validation steps (see Figure *2*). Firstly, step nine involved validation of fishery/sector matching and allocation of confidential data to fisheries with data custodians. Secondly, step fourteen involved review of contribution estimates with other published data sources and studies to check validity of results. For example, where a study is specified to cover all fisheries in a state and recent reliable estimates of employment and production have been published for a fishery that contributes half of GVP for the state, then the appropriate intermediate study results should be validated against those published estimates to identify any potential issues in the analysis. In undertaking step fourteen, the estimates of the 2017/18 study were benchmarked against a number of other estimates from comparable and reliable studies. The benchmarking exercise was also used by the Senior Project Team as an internal validation step.

Reporting and Communication

The Senior Project Team was responsible for reporting and communicating the estimates and took advice from the PSG with regard to outward-facing project outputs and communication methods. Further details are provided in the Extension and Adoption section of this report.

Project updates were sent to key FRDC stakeholders, including industry representative organisations and members of the AFMF's fisheries and aquaculture management sub-committees during the review, design and scoping and estimation steps of the project. The function of these were to advise of project developments, provide a contact point for any queries, and advise of the anticipated timing of requests for review of project outputs (for example, review of the final draft summaries of economic contributions) and for publication of project outputs.

The estimates study report was disseminated by email in PDF file form in the first instance. Summary reports were sent as PDF files to relevant data managers and custodians, industry representative organisations and members of the AFMF's fisheries and aquaculture management sub-committees. The full estimates report and national summary report were launched publicly at the national *Seafood Directions* conference in October 2019 in Melbourne by Senator the Hon. Johnathon Duniam, Assistant Minister for Forestry and Fisheries. The full set of project outputs from the estimate study were then disseminated by both email and via FRDC and IMAS websites and communication platforms.

Component 2: The Framework

Three resources were developed to support future contribution study design, data collection and estimation:

- Practitioner Guidelines for economic estimate studies
- Data summary and framework
- Design Guidelines for contribution studies

A further two project outputs designed to support the above were the National Economic Data Workshop report (see Appendix 18) and the recommendations of this project for further

development of economic data and estimation capacity. Recommendations have been endorsed by the PSG, and TAG and were refined with data custodians/managers at that workshop (see Recommendations Section Below)

Developing the Practitioner Guidelines for estimation

The Practitioner Guidelines were drafted following the completion of the 2017/18 estimate study, and reflect approaches and methods that were developed and reviewed as part of the Estimate study. The scope, content and presentation of the Practitioner Guidelines were then extended and augmented, to comprehensively address project objectives, to include:

- greater explanation of some methodology and data issues that were included in the full estimates report, including worked examples of some key steps
- specific guidance on regional scale contribution scales
- stronger guidance on the use of contributions analysis and use of multipliers
- other supporting resources for practitioners.

The purpose of the Practitioner Guidelines is to support managers, policymakers and industry in estimating the economic contributions of fisheries and aquaculture industries at various scales to national, state/territory and regional levels. It was designed to support i) replication and improvement of the 2017/2018 national economic evidence study in the future, and ii) other economic contribution studies at the regional level or by individual fishery/aquaculture industry.

Developing the data framework

A review and summary of data available for a national and jurisdictional-level estimate of economic contributions and development of a data framework was undertaken by BDO EconSearch as part of Working Paper 2. The data summary and framework were then updated following review of the requisite data available for 2017/18 for the economic contribution analyses of fisheries and aquaculture activity by jurisdiction. The Data Summary and Framework report was then produced as a project output, with 2017/18 serving as an illustration. It was designed to provide a template for recording data availability and sources as well as data custodian contacts and, where relevant, data matching schedules. It is intended as a starting point for practitioners conducting new contribution studies or seeking to update/repeat existing ones. It also serves as a supplement to the Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report *(BDO EconSearch 2019)*.

Developing the Design Guidelines for contribution studies

Steps to guide the design of contributions studies which concern the economic and/or social contributions fisheries and aquaculture make to community wellbeing were initially developed as part a Technical Workshop run by the FRDC Human Dimensions Research Subprogram in Melbourne on 13 February 2017. These steps were then further refined on the basis of the workshop on Wellbeing Frameworks for Contributions Studies held in Melbourne 18 March 2019 and the synthesis of contributions to social wellbeing of regional communities. Details of these are provided in the earlier 'Synthesis of contributions to social wellbeing' subsection.

The purpose of the Design Guidelines was to outline recommended principles and steps to guide the design of FRDC-funded studies which estimate the social and/or economic contributions of wild catch commercial fisheries and aquaculture to community and societal wellbeing.

National Economic Contributions and Data Workshop

To support adoption of the project's framework and resources, a technical workshop was held to discuss and progress collection and coordination of economic data for analysis of fisheries and aquaculture activity, and for economic contribution analysis. The workshop was held 10-11 December 2019 in Melbourne. Objectives of the workshop were to:

1. describe the process for estimating economic contributions;
2. discuss economic data gaps and future data collection priorities (e.g. price data, cost of production data) from an agency perspective; and
3. explore options for supporting and coordinating further collection and sharing of economic data for future national analyses.

The workshop was run by the Senior Project Team and was attended by staff or representatives from agencies and organisations in all jurisdictions concerned with fisheries and aquaculture management and data collection. Presenters included researchers, BDO EconSearch, FRDC, ABARES, SIA/SIV, RPN, and staff from each of the management agencies. The workshop participants included members of the PSG and the TAG.

Activities included a ranking exercise undertaken to determine the prioritisation given to addressing existing data gaps. Break out group discussions were then held to identify the nature and source of high priority data gaps, and options to improve data collection and quality. The workshop discussions generated a set of workshop recommendations which were adopted in large part in the project's recommendations (see Appendix 18).

Results

Evidence of economic contributions (Component 1)

Full results of the evidence study are provided in the Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report. These results present the contribution of fisheries and aquaculture industries to national and State/Territory economies. The full estimate report provides estimates of the following indicators of economic contribution:

1. Gross value added (GVA)
2. Employment
3. Household income (HI)
4. Gross Value of Production (GVP)
5. Gross Domestic Product and Gross State Product (GDP/GSP)
6. Value of Exports.

Economic contributions are reported for the 2017/18 financial year. They are presented in this study in terms of:

- direct contribution;
- flow-on (or indirect) contribution; and
- total contribution.

Direct contributions are the initial round of effects (i.e. GVA, employment, HI and GDP/GSP) generated by an economic activity (i.e. fishing, aquaculture production and processing).

Flow-on (or indirect) contributions are the sum of production-induced effects and consumption-induced effects. Production-induced effects are additional GVA, employment, HI and GDP/GSP resulting from re-spending by firms (e.g. boat builders, feed suppliers) that receive payments from the sale of goods and services to fishing, aquaculture production and processing firms. Consumption-induced effects are additional GVA, employment, HI and GDP/GSP resulting from re-spending by households that receive income from employment in direct and indirect activities. Total contributions are the sum of direct and flow-on (indirect) contributions.

Estimates of economic contribution are reported at the state/territory and national scales:

- State/territory fishery contributions are reported towards their respective jurisdiction economies and nationally
- Likewise, state/territory aquaculture contributions are reported towards their respective jurisdiction economies and nationally
- Commonwealth-managed fisheries are reported as contributions to individual state/territory jurisdictions and in aggregate to the national economy
- The economic activity from processing of Australian caught/produced seafood is included and reported for the state/territory economies they are located in and nationally
- Inter-state trade flows (e.g. contribution of South Australian aquaculture to Victorian economy) are captured and reported.

Further data and interpretation provided in the full estimate report includes the relationship between the indicators in the composition of final contribution. As well, the breakdown of expenditure by local and imported by sector for each jurisdiction is presented. The main data tables are presented in Tables 4 - 7.

Headline results at a national level are also reported in the Australian Fisheries and Aquaculture Industry 2017/18: Economic and Social Contributions - Summary Report, and Figure *3*. These results are presented separately for production and processing.

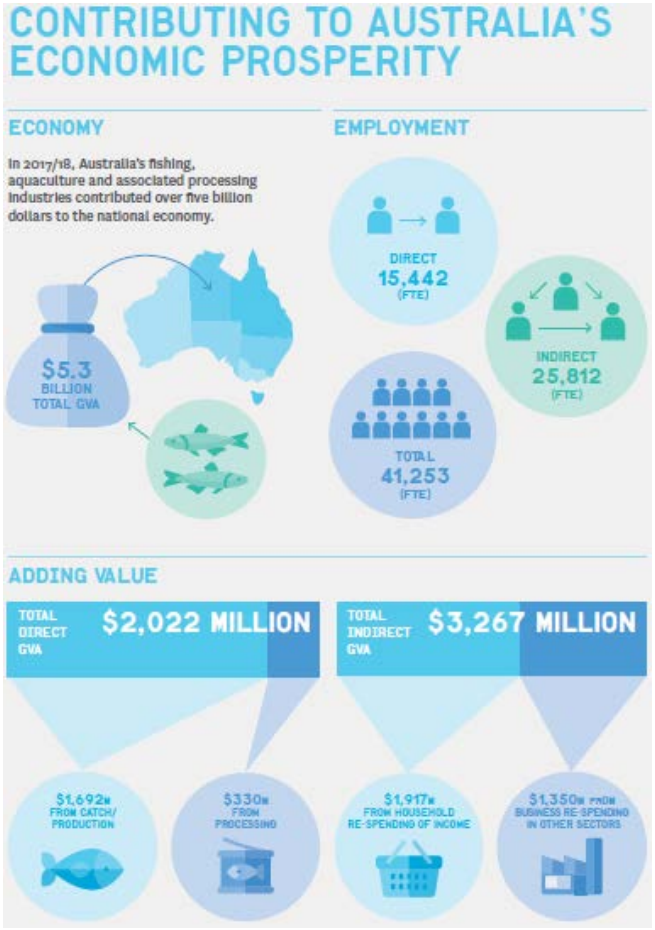

Figure 3. Headline results of the Australian Fisheries and Aquaculture Industry 2017/18 Economic Contributions Estimates Summary Report

Headline results for each jurisdiction are reported in the summary report form (see Appendix 8 –15). These report the contribution of fisheries and aquaculture within that jurisdiction to that jurisdiction's economy. These results are presented separately for production and processing.

Table 4. Contribution (GVA - $m) by jurisdiction of commercial fishing, aquaculture and associated processing to Australia, 2017/18

	Gross value added ($m)	Jurisdiction							Total State & Territories
		NSW	Vic.	Qld.	SA	WA	Tas.	NT	
	Direct								
	Production	130	110	234	264	411	490	52	1,692
	Processing	46	44	16	54	119	44	8	330
(1)	*Total direct*	*176*	*154*	*250*	*318*	*530*	*534*	*60*	*2,022*
	Indirect (within jurisdiction)								
	Production induced	68	87	101	176	245	307	23	*1,007*
	Consumption induced	130	114	128	204	214	308	54	*1,152*
(2)	*Total indirect (within jurisdiction)*	*198*	*201*	*229*	*380*	*458*	*615*	*76*	*2,159*
(1+2)	**Total (within jurisdiction)**	**374**	**355**	**479**	**698**	**989**	**1,150**	**136**	**4,181**
	Indirect (rest of Australia)								
	Production induced	10	39	21	23	191	56	2	342
	Consumption induced	18	36	58	123	203	308	20	765
(3)	*Total indirect (rest of Australia)*	*28*	*75*	*79*	*146*	*394*	*364*	*22*	*1,108*
(1+2+3)	**Total (within Australia)**	**402**	**430**	**558**	**844**	**1,383**	**1,513**	**159**	**5,289**

Source: Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimate Report (BDO EconSearch 2019)

Table 5. Contribution (Employment - FTE) by jurisdiction of commercial fishing, aquaculture and associated processing to Australia, 2017/18

	Employment (fte)	Jurisdiction							Total State & Territories
		NSW	Vic.	Qld.	SA	WA	Tas.	NT	
	Direct								
	Production	1,672	920	1,995	2,239	1,932	2,987	417	12,162
	Processing	462	548	162	696	969	423	22	3,280
(1)	*Total direct*	*2,134*	*1,467*	*2,157*	*2,934*	*2,900*	*3,410*	*440*	*15,442*
	Indirect (within jurisdiction)								
	Production induced	513	799	900	1,771	1,913	2,988	185	*9,069*
	Consumption induced	883	907	971	1,582	1,468	2,405	316	*8,533*
(2)	*Total indirect (within jurisdiction)*	*1,396*	*1,706*	*1,871*	*3,354*	*3,381*	*5,393*	*501*	*17,602*
(1+2)	**Total (within jurisdiction)**	**3,530**	**3,174**	**4,027**	**6,288**	**6,281**	**8,803**	**941**	**33,044**
	Indirect (rest of Australia)								
	Production induced	64	253	136	150	1,357	381	13	2,354
	Consumption induced	129	247	413	951	1,500	2,463	153	5,856
(3)	*Total indirect (rest of Australia)*	*193*	*500*	*549*	*1,101*	*2,857*	*2,844*	*166*	*8,209*
(1+2+3)	**Total (within Australia)**	**3,723**	**3,674**	**4,576**	**7,389**	**9,138**	**11,647**	**1,107**	**41,254**

Source: Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report (BDO EconSearch 2019)

Table 6. Contribution (Household Income - $m) by jurisdiction of commercial fishing, aquaculture and associated processing to Australia, 2017/18

	Household Income ($m)	Jurisdiction							Total State & Territories
		NSW	Vic.	Qld.	SA	WA	Tas.	NT	
	Direct								
	Production	76	52	92	124	106	196	27	673
	Processing	25	21	9	27	57	24	2	165
(1)	*Total direct*	*101*	*73*	*100*	*151*	*162*	*220*	*30*	*838*
	Indirect (within jurisdiction)								
	Production induced	56	59	73	123	161	215	20	*708*
	Consumption induced	73	67	69	111	114	161	21	*615*
(2)	*Total indirect (within jurisdiction)*	*129*	*125*	*141*	*234*	*276*	*377*	*41*	*1,323*
(1+2)	**Total (within jurisdiction)**	**230**	**198**	**242**	**385**	**438**	**597**	**71**	**2,161**
	Indirect (rest of Australia)								
	Production induced	6	22	12	14	94	32	1	180
	Consumption induced	10	20	34	74	116	189	12	455
(3)	*Total indirect (rest of Australia)*	*15*	*42*	*46*	*88*	*210*	*221*	*13*	*635*
(1+2+3)	**Total (within Australia)**	**246**	**241**	**288**	**473**	**648**	**818**	**83**	**2,796**

Source: Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report (BDO EconSearch 2019)

Table 7. Contribution (GSP/GDP - $m) by jurisdiction of commercial fishing, aquaculture and associated processing to Australia, 2017/18

	Contribution to GSP/GDP ($m)	Jurisdiction							
		NSW	Vic.	Qld.	SA	WA	Tas.	NT	Total State & Territories
	Direct								
	Production	130	110	234	264	411	490	52	1,692
	Processing	59	63	23	73	174	61	13	464
(1)	*Total direct*	*189*	*173*	*256*	*336*	*585*	*551*	*65*	*2,156*
	Indirect (within jurisdiction)								
	Production induced	80	91	103	187	248	312	22	*1,043*
	Consumption induced	139	124	135	216	227	323	56	*1,220*
(2)	*Total indirect (within jurisdiction)*	*219*	*215*	*238*	*403*	*475*	*636*	*78*	*2,263*
(1+2)	**Total (within jurisdiction)**	**408**	**388**	**494**	**739**	**1,060**	**1,187**	**143**	**4,419**
	Indirect (rest of Australia)								
	Production induced	10	40	21	24	214	58	2	371
	Consumption induced	19	38	61	130	213	325	21	807
(3)	*Total indirect (rest of Australia)*	*29*	*78*	*83*	*154*	*428*	*383*	*23*	*1,179*
(1+2+3)	**Total (within Australia)**	**437**	**466**	**577**	**893**	**1,488**	**1,570**	**167**	**5,597**

Source: Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report (BDO EconSearch 2019)

The National Summary Report (see Appendix 7) also includes a synthesis of contributions to four over-arching domains of social wellbeing. Under each domain three vignettes of specific contributions made by sectors in regional Australia were presented. These vignettes were drawn from the synthesis of contributions to social wellbeing the project undertook using existing published research studies (see Methods). The domains and vignettes presented to illustrate each were as follows:

Economic resilience and diversity for regional communities:

- Livelihoods and income for Traditional Owners, Torres Strait and Milingimbi, NT
- Providing regional employment, NSW and SA
- Providing economic stability, VIC

Locally produced seafood:

- Meeting demand for Australian seafood, East coast of Australia
- Providing local Wild caught Barramundi, QLD
- Catching for culturally diverse markets, NSW

Experiences and services for coastal tourism and recreation:

- Local seafood experiences, VIC
- Providing local bait to recreational fishers, NSW and VIC
- Rescuing recreational users, WA
- Attracting tourists, VIC

Healthy marine and freshwater environments:

- Inlet fishers restoring seagrass habitat, VIC
- Abalone divers restoring reefs, VIC and TAS
- Fishing for litter, TAS

The Framework (Component 2)

The Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report demonstrates the nationally consistent approach to estimating contributions, proposed in the preliminary working papers and recommended by the TAG. Resources developed by the project support i) replication and improvement of the 2017/18 national economic evidence study in the future, and ii) other economic contribution studies at the regional level or of individual fishery/aquaculture industry. They aim to do this by providing guidance and resources for designing and conducting economic contributions studies and by improving data quality and availability.

Resources for designing and conducting future studies

1. Practitioner Guidelines

The Practitioner Guidelines provide practitioners (researchers, consultants, government analysts) with an in-depth step-by-step guide describing processes and protocols to be adopted when designing and conducting contributions study for activities within the Australian seafood sector. The report assumes a level of economic knowledge and skills equal with being able to conduct a contributions study, including access to technical modelling expertise. The Practitioner Guidelines can be found at the FRDC website.

In summary, the Practitioner Guidelines consists of:

- An introduction to economic contribution analysis, explaining what it is (and what it is not) and why it is useful (Section 2);
- Description of steps in designing and scoping an economic contributions study (Section 3);
- An overview of the key economic indicators used in a contributions study (Section 4);
- Details about the data required and processes to collect and compile the data for a seafood industry economic contribution analysis (Section 5);
- A discussion of some of the key modelling considerations in undertaking a seafood industry economic contribution analysis, including economic modelling framework, components of total economic contributions, use of multipliers and attribution of economic activity to regions. (Section 6);
- An outline of the estimation process and the steps involved (Section 7), and
- A discussion of the presentation and interpretation of the results of a seafood industry economic contribution analysis (Section 8).

The Practitioner Guidelines covers all aspects of economic contribution study design and conduct as demonstrated in the full economic contribution estimates 2017/18 report. It also includes:

- description of an approach for downscaling existing estimates for a particular fishery/aquaculture sector or region where a higher-level study has already been undertaken (generally at a larger spatial scale). Downscaling provides an alternative method to estimate economic contribution when there are limited resources available for the primary data collection and modelling that are required under the general approach.
- guidance about the derivation, use and limitations of multipliers.

It is envisaged that the Practitioner Guidelines will be periodically reviewed and revised.

2. Design Guidelines

The Design Guidelines recommends principles and steps to guide the design of FRDC-funded studies which estimate the social and/or economic contributions of wild catch commercial fisheries and aquaculture to community and societal wellbeing. While the Practitioner Guidelines embed the recommended 9-step design process, the Design Guidelines provide further detail on key design and scoping steps and are a useful resource for practitioners estimating economic contributions as part of broader, multiple domain wellbeing studies.

Resources for improving data quality and availability

1. Data Summary and Framework

The Data Summary and Framework serves as a supplement to the full estimates report (Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report (BDO EconSearch 2019) by summarising the requisite data available for economic contribution analyses of fisheries and aquaculture activity by jurisdiction for the 2017/18 financial year. Importantly though it also provides a template for jurisdictions to record and monitor economic data quality and availability and for economic practitioners to report in a nationally consistent way the availability and sources of data used in future contributions studies.

Organized by jurisdiction it includes:

- An overview of data availability and sources for data required for direct economic contribution estimation.
- Assessment of data gaps. A data gap is where a data item has not been collected ('Gap') or there is a quality concern ('Quality') with collected data. Confidential data are also identified as having a quality concern ('Quality').
- Record of data matching schedules used in analysis. The 2017/18 data matching schedule provides a useful starting point for reviewing and negotiating future data matching in any subsequent estimate study.
- Details of jurisdictional economic data custodians.

2. Practitioner Guidelines

As well as providing resources to guide practitioners in applying a nationally consistent set of processes and protocols for seafood contributions studies in Australia, the Practitioner Guidelines contains resources that can assist practitioners, managers and industry organisations to improve economic data quality and availability.

In addition to providing guidance on the use of terminology and language related to economic data and types of economic analysis (i.e., contributions analysis vs impact analysis vs economic benefit analysis) the Practitioner Guidelines include:

- a sample copy of a survey instrument designed to collect economic data from fishing businesses. The sample questionnaire represents best practice and can be adapted by users to other contexts and to aquaculture businesses; and

- a worked example of how to 'impute' fishing costs from a matched fishery. This method can be used to generate a cost structure for a fishery where no recent survey data is

available using a similar fishery for which reliable cost data is available. The fishery example shown in the Practitioner Guidelines can be adapted by users to other contexts and to aquaculture.

3. National Economic Contributions and Data Workshop findings

The National Economic Contributions and Data Workshop acted as a forum for data custodians, managers and researchers to share knowledge and ideas about how to improve the quality and availability of economic data needed for economic contributions studies, noting that the context and capacity for economic data collection varies considerably between jurisdictions. A national data gap analysis conducted by BDO EconSearch as part of this project formed the starting point for the group to brainstorm and prioritise data gaps. Table 8 and Table 9 summarise BDO EconSearch's gap assessment for fisheries and aquaculture, with data availability weighted by GVP in each jurisdiction and data quality.

Table 8. Data availability weighted by GVP and quality, 2017-18, fisheries

Jurisdiction	Catch	Price	Effort	Active vessels	Boat length	Mgmt. costs	Licence fees	Cost of fishing
NSW	100%	100%	100%	50%	0%	0%	66%	0%
VIC	100%	71%	100%	50%	0%	100%	100%	0%
QLD	100%	50%	100%	50%	50%	50%	50%	0%
SA	100%	100%	100%	50%	99%	100%	100%	99%
WA	100%	89%	100%	100%	22%	0%	0%	44%
TAS	100%	100%	99%	99%	99%	50%	50%	46%
NT	100%	100%	100%	100%	100%	100%	100%	0%
Comm.	100%	88%	100%	100%	0%	97%	0%	58%
Weighted National Average	100%	78%	100%	70%	35%	66%	51%	25%

Table 9. Data availability weighted by GVP and quality, 2017-18, aquaculture

Jurisdiction	Prod.	Price	Active operators	Mgmt. costs	Licence fees	Cost of prod.
NSW	100%	100%	100%	100%	100%	71%
VIC	100%	100%	100%	100%	100%	0%
QLD	99%	99%	100%	0%	-	34%
SA	100%	100%	100%	100%	100%	50%
WA	21%	60%	21%	0%	0%	0%
TAS	100%	100%	100%	0%	98%	97%
NT	95%	95%	0%	0%	0%	0%
Weighted National Average	95%	97%	93%	23%	83%	73%

Data gaps to address were prioritised by workshop participants for fisheries and aquaculture separately using a ranking exercise. Aggregated priorities were similar across both sectors with the top four combined priorities being:

- Costs of fishing/production;
- Beach/farm gate prices;
- Costs of management; and
- Employment.

Data on the post-harvest and other downstream sectors was also ranked highly, but since addressing this gap involves filling all individual data gaps for these activities it was not progressed as part of the workshop process.

The findings of this workshop provide the basis for progressing initiatives to support jurisdictions and industry organisations to collect, store and manage economic data in a consistent, co-ordinated and collaborative way (see Appendix 18). Broadly the findings, some of which are also reflected in project recommendations, relate to: identifying economic data gaps and future data collection priorities, and options for supporting and coordinating further collection and sharing of economic data.

Three noteworthy observations from the workshop were:

1. the value perceived by participants in the opportunity to network across jurisdictions and between data custodians/managers, managers and researchers, enabling the exchange of knowledge and potentially the sharing of resources (e.g. common survey instruments);

2. the importance of recognising the potential for economic data used in contribution studies to be used in other forms of economic analysis that are key to supporting sound fisheries and aquaculture policy and management, as well as industry strategy development, when designing data collection and management protocols for economic contribution studies; and

3. the importance of engaging with industry stakeholders and organisations on the uses of economic data and on agreed types of economic indicators to build trust in economic data collection and analysis.

Discussion

The project met its stated objectives. It has delivered an estimate of the contribution to the Australian (i.e. national) economy of total commercial fisheries and aquaculture activity using standard measures of economic contribution (see Results). It delivered an estimate of the contribution to each state/territory's economy of commercial fisheries and aquaculture activity using standard measures of economic contribution (see the Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Report). It has developed a robust and nationally consistent framework to support further data collection and estimation of economic contributions (see the Data Summary and Framework, Practitioner Guidelines, and Design Guidelines).

In addition, the project further progressed the issue of measuring social contributions by both producing a synthesis of evidence of contributions to domains of community wellbeing to support the national economic contributions estimates and in providing high-level steps for designing broader contribution studies.

Why is this important?

This is the first time the economic contribution of the Australian seafood industry has been reported. Estimates are based on the best available data and most appropriate methods given data availability. This report demonstrates a nationally consistent approach to estimating the industry's economic contributions across all jurisdictions.

The project's estimate report and resources support the ability for individual industries and jurisdictions to monitor trends in the size of contributions over time. These estimates of contribution can be used to compare the level of contributions of the fisheries, aquaculture and processing industries in different states or territories. Comparisons of these estimates can also be made with other productive industries (for example, beef or sheep).

In providing estimates of economic contributions, the project has provided a core component of a broader contribution study that might also include contributions to social and cultural wellbeing, particularly at the state/territory level. The economic study, which encompassed fishing and aquaculture activity and associated processing, also provides the basis for further extension of the estimation framework to include other links in the seafood value chain (e.g. wholesale, retail).

In conducting the estimate study, the project has produced the first systematic review and assembly of economic data for fisheries and aquaculture across all jurisdictions. The economic data used in this study provides a starting point for other forms of economic analysis that are key to supporting sound fisheries and aquaculture policy and management, as well as industry strategy development.

During the course of the project, it became evident that there remains demand for economic impact analysis and cost benefit analysis to inform specific policy and management decisions, for example resource allocation. While economic contribution studies are not suitable or sufficient in these contexts, the systematic review and assembly of economic data undertaken as part of the data audit (see the Data Summary and Framework) for this project can support these forms of analyses. In addition, the Practitioner Guidelines provides some direction as to the appropriate form of analysis for various types of economic questions, including economic impact analysis.

Limitations

The scope of the estimate study was limited because it excluded the contributions of the following activities: Commercial charter fishing, fishery/aquaculture sector management (other than where these costs are recovered through licence fees), processing of imported seafood, and any activity further downstream of immediate seafood processing (i.e. transport to retail markets, retail sector activity). It also did not distinguish Indigenous commercial fishing or aquaculture activities from broader commercial fishing or aquaculture activities.

Limitations of the estimates generated included those arising from data gaps and low data quality for some sub-sectors and for seafood processing (see the Data Summary and Framework). These were identified in the process of building a national data framework which supports the estimation of contributions and which is intended to help guide future data collection. In addition to the jurisdictional level data issues identified, a number of broader data limitations were identified including those attributable to how primary data is recorded and reported in surveys and licensing forms. Examples include errors in export data reports and attribution of production to the port of departure, and issues with the Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006 which affects employment data. These data limitations would need to be reviewed prior to repeating a national study. Addressing identified gaps by collecting data on these sectors presents an opportunity to produce more comprehensive estimates in future.

Due to the paucity of economic data in some sectors and jurisdictions, the study was reliant on data matching methods, whereby cost-structures for data-poor fisheries/sectors were imputed from the cost structures of similar sectors which were known/established in other studies (see section 2.4.3 in the Estimates report). However, further work needs to be done to refine the matching process and to better understand the magnitude of the error this introduces to estimates across different types of industries. This process needs to more directly involve data managers and custodians from management agencies, and industry representatives, to reduce the likelihood of error in the matching schedules but also to improve levels of trust in this method.

Limitations arising from the type of analysis undertaken and the scope of this study also then limit the use of the results in policy and decision making. For example, as mentioned above these estimates of contribution can be used to compare the level of contributions of the fisheries, aquaculture and processing industries in different states or territories, and compare levels with other productive industries (for example, beef or sheep). However, these latter comparisons will be less reliable due to differences in the number of sectors included (this study included only the catch/production and processing sectors), data availability and quality, and modelling across various studies.

Use of these estimates alone to predict the impact of changes in the level of activity of fisheries and aquaculture industries is not advised. While results can be used to highlight the possible size and nature of impacts, further analysis would be required to estimate the actual impact on the economic measures of such changes.

Comparisons of the economic contributions of commercial fisheries and recreational fisheries (made as fishing-related expenditures generate direct and indirect economic impacts) need to be made very cautiously. The two activities are fundamentally different and require different I-O modelling approaches, and comparison can only be made where estimates are comprehensive. For commercial fisheries this requires that estimates include backward and forward linked sectors (for example, boat building sectors, as well as seafood retail sectors). For recreational fisheries this requires that only expenditures that are directly attributable to fishing are included in the estimate. Estimates of economic contribution of the recreational fishing sector are being generated as part of FRDC project

2018-161 and this study is being designed using methods and a modelling approach that will support comparison.

Use of estimates of economic contributions to predict the impact on a state or territory economy of changes in resource allocation between commercial and recreational fisheries can complement economic benefit or efficiency analysis. However, it will require further knowledge to determine how inputs would be redeployed in the economy by other sectors were commercial fishing no longer occurring, and how recreational fishers would spend their discretionary income on substitutable activities were they not able to recreationally fish.

No significant limitations with regard to the I-O modelling approach used in the estimate study were identified by the TAG or external reviewer in addition to standard and well-acknowledged limitations of this modelling method (see Box 6.1 in the Practitioner Guidelines).

Inclusion of social, as well as economic, contributions to wellbeing

The inclusion of social contributions of the Australian fisheries and aquaculture industry to regional communities in the National summary report was undertaken to add more breadth to the national 'story'. In so doing, the project adopted the social wellbeing framework (see Method section).

The exercise did not involve any primary data collection or analysis of secondary data, but rather used synthesis as the method to identify overarching domains of contribution to social wellbeing consistent across the available evidence studies and then present the evidence of selected cases of social contributions to these domains. Limitations of the synthesis of social contributions arise primarily from the low number of studies which provide evidence of these contributions and the absence of agreed contribution indicators and basis of evidence for measuring contributions to identified domains.

Outside of the national remit of this project, the adoption of the social wellbeing framework and the four overarching domains of contribution by fisheries and aquaculture industries would need to be further reviewed and tested. In addition, further work would be required to select specific indicators and the basis of evidence of social contributions in any regional/sector specific studies.

Response and uptake by Government and Industry

Feedback received on the evidence study and summaries from all management agencies, as well as peak industry bodies in each jurisdiction, indicated that these were generally well received. This is also demonstrated by the announcement of results in media statements by a number of peak state industry bodies.

As an illustration of this, the Institute for Marine and Antarctic Studies (IMAS) has adopted the estimation framework in its social and economic assessment framework for its reporting on Tasmanian fisheries and aquaculture. This has been supported by the Department of Primary Industries, Parks, Water and Environment and the Tasmanian Seafood Industry Council on the basis of their uptake of the results of the 2017/18 estimate study. The estimation framework is being used to produce estimates at an industry/sub-sector scale to allow monitoring, and as a component of planned economic impact analysis.

However, adoption was impeded in a few cases by difficulties with terminology and by data collection and quality protocols that meant that data published either by agencies or in previous studies could not be used in the estimate study for 2017/18. The latter created a concern that available data was not used, and fisheries/sectors' contributions were estimated using the data matching method unnecessarily. In the cases where this occurred, lengthy discussions were held to

explain the data availability and quality criteria applied and produce agreed caveats in footnote form in the reports. One example of the type of challenge confronted was the exclusion of production data from the 2017/18 estimate study where agencies had marked such data as confidential due to less than five operators reporting data for that fishery/sector. Difficulties with terminology included lack of familiarity with GVA as an indicator, and it was frequently confused with GVP by data managers and industry representatives. This then created concern when GVP levels were compared with the GVA estimates produced by this study. Strategies to address and overcome these issues of data availability and quality in future studies, and of economic literacy more broadly, are included in Recommendations 5 and 6 of this report.

A further challenge to adoption of the estimate study results was the existence of relatively recent estimates of economic contribution in some states (NSW and Victoria), which were generated using differently constructed estimation frameworks. The existence of two sets of results which, in one case, used different indicators of economic contribution, was a cause of confusion and concern among some industry stakeholders. Reconciling and benchmarking the two sets of results and what differences could be attributed to actual changes in activity rather than estimation protocols was undertaken through lengthy discussions between analysts, industry organisations and the project team. This issue should be addressed in future with the availability of the Practitioner Guideline.

Furthermore, adoption of the framework this project has generated would be improved if the need signalled by management agencies and industry representatives organisations for comparability with recreation sector estimates can be met. Estimates of economic contribution of the recreational fishing sector are being generated as part of FRDC project 2018-161, in which the same multi-regional nested I-O modelling approach will be used as has been used in this evidence study of the commercial sector to support comparison.

Finally, for those jurisdictions and sectors where economic contribution is comparatively small, future contributions reporting could include a more targeted social component at the state/territory or fishery/sector level. This would demonstrate the non-economic contributions these smaller sectors make and provide evidence to support a more holistic 'story' in these cases and increase the adoption of contributions reporting by these sectors.

Supporting future contribution studies

The project has developed a suite of resources to support further studies which are nationally consistent and cost-effective. However, the full value of FRDC's investment in this project will only be realised if there is ongoing investment and coordination to support future economic contribution studies, including the routine updating of the national and state/territory level estimates reported in this project for 2017/18. Further support is needed in a number of forms.

Clear delineation is required of the roles of agencies, FRDC and key stakeholders (industry representative organisations) in driving adoption and implementation of resources developed in this project, and for instigating and facilitating collaboration. Securing the support of industry for progressing all necessary future initiatives in this space will be crucial given the link between industry support and the quality/availability of data collected through surveys; acceptance of the practice of data matching; and trust in and uptake of results.

Increased economic literacy of agencies, FRDC and key stakeholders (industry representative organisations) is required. For example, communicating and socialising key contributions indicators (i.e. GVA, HI) will strengthen industry's and management's ability to effectively make use of estimates of economic contributions (e.g. for advocacy or monitoring) and avoid the erroneous use of more familiar but inappropriate indicators, such as GVP. A focus on training and communication

initiatives that demonstrate the correct use of different types of economic analysis will help ensure a better match of economic studies to research/management/industry needs.

Alignment of economic data collection, management and storage initiatives with other existing national data initiatives (such as the Status of Australian Fish Stocks) is also required to support adoption and achieve cost efficiencies. There will however always be different drivers for economic data collection in different jurisdictions for regulatory and management reasons and any emergent national economic data system must be accommodating of jurisdictional needs and initiatives, and able to reconcile different data streams. Further, the 'business case' for resourcing improved economic data collection, management and storage for contribution studies at both national and jurisdictional levels must highlight the multiplicity of additional uses economic data can be put to by managers, policymakers and industry. Data on costs of production, for example, can be used to monitor management and industry performance, in cost benefit analysis to inform decisions about key management settings, and to predict fisher behaviour in the face of changing conditions (such as climate change and Covid-19) and measure impact.

Prioritisation by the AFMF and the FRDC of research needs to improve estimates in future contributions studies is required. This exercise should consider both the expected value of improvement in the precision of contribution estimates and the expected effect on the cost of conducting contribution studies. A number of needs were identified through the National Economic Contributions and Data Workshop (see Appendix 18). Research to improve the robustness of data matching methods and to develop reliable low-cost survey methods will likely both be warranted.

Conclusion

This project has found that the Australian fisheries and aquaculture industry makes a measurable economic contribution to the Australian as well as state and territorian economies. This evidence of economic contribution provides a baseline against which the level of future contributions can be measured. This is particularly relevant at times of economic shock, such as has been experienced as a result of the COVID19 pandemic and national health crisis.

In estimating economic contributions, the project has generated the technical means to support economic analysts in measurement of economic contributions in future. This suite of technical resources includes treatments for addressing gaps in data availability and quality. However, of equal importance has been the initiatives the project has identified that are required to address key data and capacity gaps to reduce uncertainty and increase the impact these types of economic analysis can have for Australia's fisheries and aquaculture sectors.

The project's recommendations identify a pathway forward for ensuring the outcomes of this project reflect more than its' immediate project outputs, but are able to leverage the capacity built through further investment and collaboration. The continuance of economic contribution studies in the Australian seafood sector which are consistent, comparable and robust will support industry and management in improving economic outcomes.

Implications

The implications of this project for specific FRDC stakeholders are as follows.

Evidence of economic contributions is now available

- Industry representatives and management agencies have evidence of the contribution to Gross value added (GVA), Employment (FTE), Household income (HI) and Gross Domestic Product and Gross State Product (GDP/GSP) of fisheries and aquaculture industry activity in their jurisdictions, as well as at the national level. This data can be used by industry members to "tell the story" of the industry's role in the national or state economy, and by government agencies for the purposes of regional development and state growth planning, for example.

- Industry representatives, management agencies and research agencies now have a baseline of economic data from which to monitor changes in contributions by the Australian seafood industry, at national and jurisdictional levels. For example, the evidence study provides a baseline of economic contributions against which to compare the levels of fisheries and aquaculture activity and their economic contribution post-COVID19.

- Industry representatives, management agencies and research agencies can combine this contributions data with more specific data on the changes in levels and types of fisheries and aquaculture activity to enable analysis of economic impact.

Resources to support the cost-effective generation of further estimates, which are consistent and comparable, are now available

- Data managers and custodians have increased economic literacy in indicators of economic contribution and the value of collecting economic data

- Management agencies and the FRDC have an informal network of economic data managers and custodians which, if built on further (see Recommendations), could increase cost-effectiveness of economic studies and capacity to manage for improved economic performance

- Industry representative organisations and management agencies have a suite of technical resources to support the scoping and design of future economic contribution studies which will be appropriate to their needs, robust and cost-efficient in design

- Economic analysts, research organisations and research funding agencies have a suite of technical resources for supporting design of subsequent studies to ensure they are nationally consistent and comparable, as well as a baseline provided by the existing study

- RD&E funders have a suite of resources and set of guidelines to ensure investment in future studies can avoid duplication and *ad hoc* studies, and be more targeted, quality assured, cost-efficient and thereby deliver better return on investment

- In those jurisdictions where previous contribution studies have been conducted and benchmarked against this study, industry representative organisations and management agencies in jurisdictions have insights into the design of their previous contribution studies and the implications of low data availability and quality as well as *ad hoc* design.

Recommendations

1. The national economic contribution estimate study be repeated to support monitoring of contributions, using the same methodology as used in the 2017/18 estimates report and outlined in the Practitioner Guidelines.

2. All other future contribution studies funded by FRDC be required to follow the Practitioner Guidelines

3. Resources be available for periodic review and revision of the Practitioner Guideline

4. Efficiency of future economic contribution studies be improved by pursuing the following general economic data strategies:
    a. Engagement with national data coordination initiatives (i.e. AFMF and RPN's data working groups) to achieve a nationally consistent approach to collecting, sharing and governance of economic data. Options include:
        i. Establish an Economic Data Working Group under either the AFMF or the RPN
        ii. Investigate the expansion of the Status of Australian Fish Stocks (SAFS) data and reporting platform to include selected economic indicators
    b. Update the economic data summary on an annual basis to reflect changes in data collection activities and availability across jurisdictions (see Appendix 17)
    c. Publish a Standard Operating Procedure (SOP) for the collection, storage, ethical management and compliance of survey data with FAIR data principles to maximise its interoperability and assistance to industry at local, regional and national scales.

5. Precision of future national economic contributions estimates to be improved by pursuing the following:
    a. Further investment in RD&E to improve reliability of existing methods of data collection and analysis (inclusive of survey methods and use of secondary data in data matching).
    b. Establish a data governance committee at the start of any future national estimate study to support efficiencies in obtaining fisheries level data from the jurisdictions and feedback on data matching, including the timing of data matching procedure to allow earlier and better-informed input from agencies and industry representative organisations.
    c. Determine sectors for which processing is significant and instigate early contact with the major operators in those sectors regarding data availability
    d. Implement recommendation 4. (above) to improve quality and accessibility of economic data more broadly

6. Adoption and impact of future national contribution studies be improved by pursuing the following:
    a. Investment in further initiatives to increase economic literacy of data custodians, industry representatives and other end users to build greater trust in and capacity to interpret results for policy purposes. Future economic contribution studies should include targeted economic literacy initiatives run in parallel to data collation and estimation activities.
    b. Investment in extension strategies to promote the importance and multiple uses of economic data and support for data collection programs amongst industry representatives and members, and agency staff.

Further development

This project marks the first time a nationally consistent set of estimates of the economic contribution of Australia's seafood industry has been published (Component 1). It has also provided a suite of resources to assist managers and industry to measure contributions at various industry and geographical scales in the future in a robust and nationally consistent way (Component 2).

Both project components will require further development to remain current and best practice, and to maximise the impact of FRDC's investment in this project. These needs are also captured in the project's recommendations. Further developments required are:

- Review and revision of the Practitioner Guidelines periodically to incorporate data and modelling advances, and feedback from practitioners.

- Development and implementation of processes and structures to achieve improvements in the quality and availability of economic data through cross-jurisdictional co-ordination and collaboration between researchers, managers and industry. A governance arrangement and resourcing are required to achieve this. This needs to include networking opportunities for data managers/custodians and researchers to share and progress data governance and collection initiatives collectively. This should be linked to existing data sharing initiatives supported by the FRDC and the AFMF.

- Research to improve data and modelling in future studies. The widespread lack of good quality economic data in many jurisdictions remains problematic for conducting contributions analysis and more generally for the ability of managers and industry to systematically embed economic information in fisheries and aquaculture decision making. Specific areas requiring further research are as follows.

    - Data matching: the economic estimates study employed a data-matching approach to overcome this problem, but further work needs to be done to refine the matching process and to better understand the magnitude of the error this introduces to estimates across different types of industries.

    - Downscaling: the project team were asked by FRDC to consider downscaling as an alternative method to estimate economic contribution where there are limited resources available for the primary data collection and modelling that are required under the general approach. The Practitioner Guideline describes an approach for downscaling existing estimates for a particular fishery/aquaculture sector or region where a higher-level study has already been undertaken (generally at a larger spatial scale). Some preliminary testing of the error associated with this approach was performed. However, further work is needed to refine the downscaling method and to better understand the magnitude of the error this introduces to estimates across different types of downscaling contexts before the approach is encouraged by FRDC.

- Investment to increase economic literacy of FRDC stakeholders. This includes further initiatives to increase economic literacy of data custodians, industry representatives and other end users to build greater trust in and capacity to interpret results for policy purposes. Future economic contribution studies should include targeted economic literacy initiatives run in parallel to data collation and estimation activities.

- Investment in data support and presentation to make economic datasets accessible and searchable, as well as in extension strategies to promote the importance and multiple uses of economic data and support for data collection programs amongst industry representatives and members, and agency staff.

Extension and Adoption

Feedback received on the evidence study and summaries from data managers and custodians at all management agencies, as well as peak industry bodies in each jurisdiction, indicated that these were generally well received. This is also demonstrated by announcement of results in media statements by a number of peak state industry bodies (see Project Coverage, below).

As an illustration of this, the Institute for Marine and Antarctic Studies (IMAS) has adopted the estimation framework in its social and economic assessment framework for its reporting on Tasmanian fisheries and aquaculture. This has been supported by the Department of Primary Industries, Parks, Water and Environment and the Tasmanian Seafood Industry Council on the basis of their uptake of the results of the 2017/18 estimate study. The estimation framework being adopted is being used to repeat estimates of contribution to allow monitoring, and as a component of planned economic impact analysis.

A series of extension activities were undertaken by the project management team to deliver against objective 3 and to support communication and dissemination activities of outputs derived from objectives 1 and 2, both during and after the project outputs were completed.

Extension activities during the development of project outputs:

- Videoconference meetings at each of the five stages of the project of the PSG and TAG
- Direct communication with data managers and custodians by BDO EconSearch staff in undertaking steps 1, 2, 4 and 9 of the estimation frameworks steps
- Dissemination of the three Working Papers produced by BDO EconSearch as part of the Review stage to the PSG and TAG
- Technical updates provided by email to the PSG, TAG every 2-3 months
- General updates provided by email to peak industry bodies and the informal network of economic data managers/holders and users every quarter during stages 1-4, and every 2 months during stage 5
- Media strategy and public launch of the full estimate study and summary report at *Seafood Directions 2019* conference by the Hon, Senator Johnathon Duniam
- National Economic Contribution and Data Workshop held with data holders, management agencies, peak industry bodies, the PSG and TAG

Extension activities after the development of project outputs:

- Full 2017/18 estimate report and summary reports available on the FRDC website
- Dissemination of summary reports to target audiences via email and via website link
- Summary report to the AFMF on recommendations arising from the National Economic Contribution and Data Workshop
- Inclusion in FISH article

Project coverage

The project attracted media coverage from the government and industry. Most notable was a press statement by Senator the Hon. Jonathon Duniam – Assistant Minister for Forestry and Fisheries from Tasmania, who highlighted the relevance, timeliness and ground-breaking nature of the research. The press release can be found here.

The Institute of Marine and Antarctic Studies (IMAS) also released a press statement on the relevance and contribution of the study in highlighting the economic and social contributions of Australia Fisheries and Aquaculture industry to the national economy and communities.

The project has been shared widely through the media for example: The National Tribune; Cairns Post; The Mercury and the NT News.

Project materials developed

The project developed several materials that were made public and disseminated widely to stakeholders. The materials can be found online on the FRDC Project 2017/210. They are also listed here and as appendices with links to the actual documents. They included: (a) Technical reports of national and state-level economic contributions; and (b) User-friendly summaries of contributions.

Evidence of economic contributions

i. Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report
ii. Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions - Data Summary and Framework
iii. Australian Fisheries and Aquaculture Industry 2017/18: Economic and Social Contributions - Summary Report
iv. Queensland Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary
v. Northern Territory Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary
vi. New South Wales Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary
vii. Tasmanian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary
viii. South Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary
ix. Western Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary
x. Victorian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary
xi. Commonwealth Fisheries 2017/18: Economic Contributions Summary

Resources for designing and conducting future contribution studies

xii. Design Guidelines for FRDC studies on Social and Economic Contributions of Fisheries and Aquaculture to Wellbeing
xiii. Australian Fisheries and Aquaculture Industry: Economic Contributions Estimates - Practitioner Guidelines 2019
xiv. FRDC National Economic Contributions & Data Workshop 2019 - Report

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Appendices

The full technical reports of the national and state-level economic contributions and user-friendly summaries of contributions can be downloaded by clicking on the title of the appendix or document object attached. Below we provide key highlights of the different reports.

Appendix 1: Identification and critical assessment of recent contributions reports: Working Paper 1 – Literature Review

See link to the document on the FRDC project webpage: Identification and critical assessment of recent contributions reports: Working Paper 1 – Literature Review

IDENTIFICATION AND CRITICAL ASSESSMENT OF RECENT CONTRIBUTIONS REPORTS WORKING PAPER 1 - LITERATURE REVIEW

A report to The University of Tasmania and Fisheries Research and Development Corporation

2 December 2018

Prepared by
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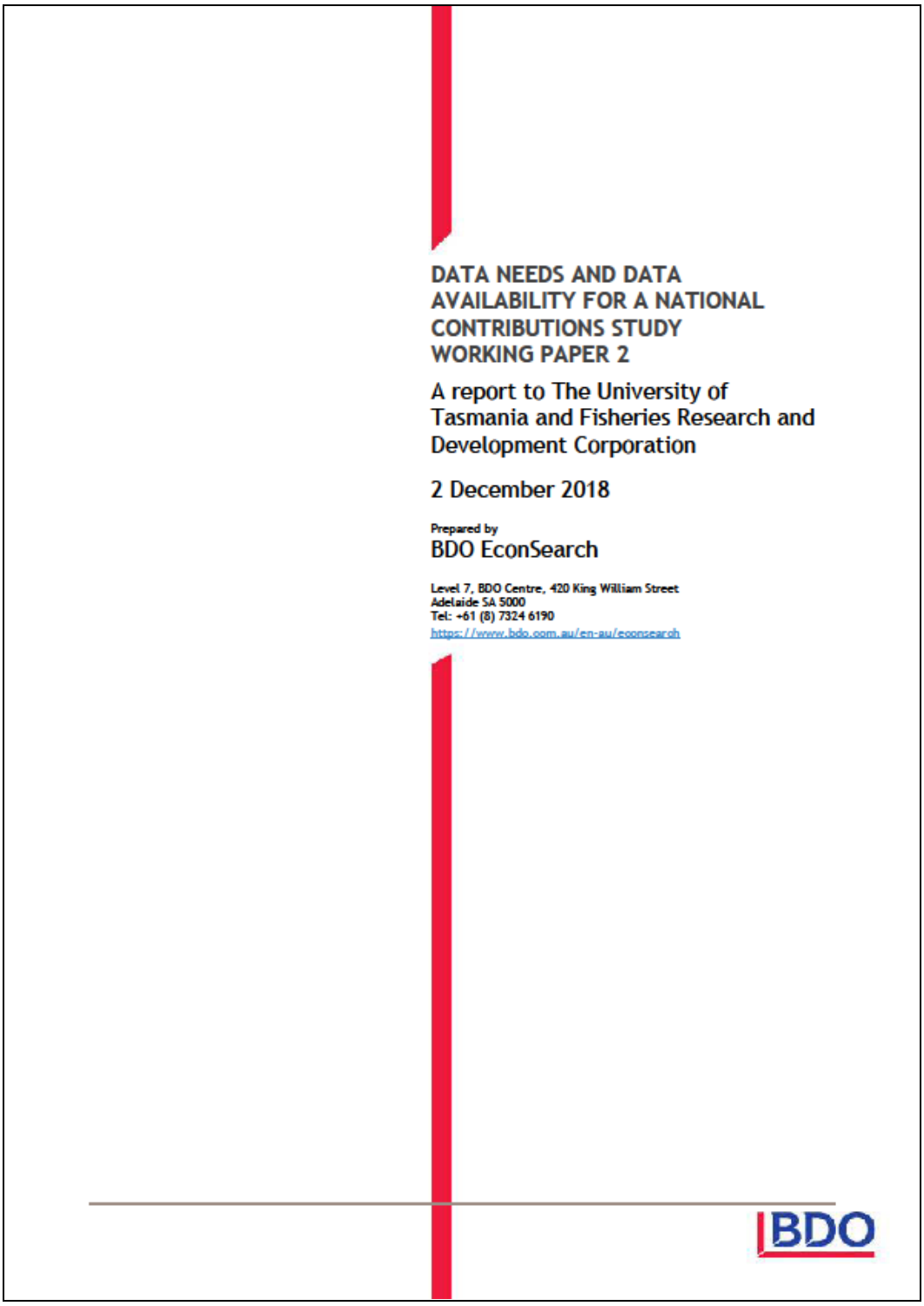
Appendix 2: Data needs and data availability for a national contributions study: Working Paper 2

See link to the document on the FRDC project webpage: [Data needs and data availability for a national contributions study: Working Paper 2]



DATA NEEDS AND DATA AVAILABILITY FOR A NATIONAL CONTRIBUTIONS STUDY
WORKING PAPER 2

A report to The University of Tasmania and Fisheries Research and Development Corporation

2 December 2018

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Appendix 3: Terms of Reference for the Economic Contributions Estimates Study

FRDC 2017/210 National fisheries and aquaculture economic contribution study: Terms of Reference	
Goal / Priority	This project aligns with the following HDR Subprogram RD&E goal and priority: Goal 4. Effective engagement to achieve socially supported fisheries and aquaculture Priority 4.3. Social and economic contributions of fisheries and aquaculture
Need	Discussions between SIA and FRDC have identified the need to gather the information required to support the Australian fisheries and aquaculture industry to "tell its story" of its contributions to the national, state and regional economies and communities. FRDC's HDR Subprogram will address this need by leading an FRDC-funded National Fisheries and Aquaculture Industry Contributions Project 2017-210 (referred to as the National Seafood Contributions Project, or NSC Project) which will: 1. Provide an estimate of the economic contribution of wild catch fisheries and aquaculture to the Australian (national) economy, and of the economic contribution of jurisdictionally based (State, Territory and Commonwealth) fisheries and aquaculture make to their State/Territory economies; 2. Provide measures of the range of social and economic contributions made by specific, selected fisheries/aquaculture sectors at the regional or product scale; and 3. Develop a robust and nationally consistent framework to support data collection and estimation of contributions in the future. This project will address 1. and 3. above by: I. Producing evidence of the economic contribution of Australia's fisheries and aquaculture sectors to the Australian community that is relevant (fit for both intended use and audience), robust, transparent and repeatable. II. Producing national guidelines to support practitioners, managers and industry in estimating economic contributions of selected fisheries and aquaculture activities at various scales. III. Producing a national economic data framework covering data collection, processing and management to support replication and improvement of the current economic evidence study in the future, other economic contribution studies at the regional level or by individual fishery/aquaculture industry, and economic impact assessments. In achieving I., the project will: ➢ Include estimates for commercial fishing (Indigenous and non-Indigenous) in each of the jurisdictions (State/Territory and the Commonwealth) and Nationally, and aquaculture production in each jurisdiction and Nationally. Seafood processing (ANZSIC 1120) will be included, based on the ability to identify activity included in this class attributable to the processing of locally caught seafood, rather than imports. Estimates of contributions from processing activity will be reported separately. That part of industry class 0529, Other Agriculture and Fishing Support Services that relate to expenditure by industry on support services will be included. Commercial charter

fishing activity and management activity (other than where cost recovered) is not within scope.

- Estimates of economic contribution will be reported at the State/Territory and National scales. At minimum therefore, there will be estimates provided of (for example) the contribution of the NT fisheries to the NT economy; Tasmanian aquaculture to Tasmanian economy; and Australian fisheries to the national economy. The following questions regarding scale will be finalised as the project progresses:
    - Whether the contribution of Commonwealth-managed fisheries will be reported as contribution to individual State/Territory jurisdictions or in aggregate to the national economy, or both;
    - The extent to which cross-jurisdictional contribution leakages (e.g. contribution of NSW aquaculture to Victorian economy) can be identified and reported separately, without unacceptable compromise to the robustness of estimates.

- Provide estimates of the following indicators of economic contribution for the 2017/18 year and based on the best available data:
    1. Gross value added (GVA)
    2. Employment (FTE)
    3. Household income (HI)

In addition to the total value of the indicator, the following components will be identified for each contribution: direct, production-induced and consumption-induced components. The following additional indicators of economic activity will also be reported:

4. Gross Value of Production(GVP)
5. Gross Domestic Product and Gross State Product (GDP/GSP)
6. Value of Exports

- Estimates of economic contributions will be derived using the I-O modelling approach and will use the Industrial Ecology Virtual Laboratory (IE Lab) framework.

- The estimation of economic contributions to be in accordance with the steps described in Working Paper #3, Proposed Data Collection and Management Plan.

- BDO/ EconSearch will consult with the Technical Advisory Group (TAG) regarding the outstanding questions of study design and any proposed changes to study design.

- BDO/ EconSearch will provide feedback to the Project Steering Group (PSG) on any communication products developed based on the outputs of the project to ensure appropriate use/interpretation of contribution estimates.

Project outputs will comprise:

1. Technical Report including
    a) Statement of purpose of study, and final scale and scope specifications;
    b) Description of indicators and estimation methods, including any important assumptions;
    c) Description of data (best available at the time of the study), including documentation of sources, collection protocols and any important assumptions;
    d) Presentation of results;
    e) Explanation of results, including interpretation, caveats and limitations;

	f) Identification of individual fishery and aquaculture sectors for which sufficient data currently exists to generate robust estimates of contribution at the State/Territory scale. A final draft of the Technical Report will be subject to a quality assurance review by an independent, internationally recognised expert to be appointed by the PSG. BDO/EconSearch to address quality assurance review comments and to provide the TAG with a written response to reviewer comments explaining how comments have been addressed. 2. National Guidelines for Estimating Economic Contributions in Fisheries and Aquaculture including 1. A step-by-step guide describing consistent processes and protocols for estimating economic contributions at the national, state and regional levels covering: i. The use of terminology and language ii. Steps in the estimation process (based on HDR 9-step process) iii. Data collection and processing iv. Data and modelling assumptions v. Preparation of modelling framework vi. Reporting and interpretation of results 3. National Economic Contributions Data Framework, including a. Updated audit of current data availability and quality b. Update of network of data custodians and managers c. Assessment of data gaps and needs to support replication and improvement of the current Economic Evidence study in the future, other economic contribution studies at the regional level or by fishery/aquaculture industry, and economic impact assessments. d. Priorities for addressing data gaps (quality/coverage) e. Suggested roles and responsibilities of data managers and custodians and of framework governance f. Scan of barriers to uptake (including cost, capability and buy-in) g. Recommendations for implementation of data framework, including options for resourcing and training needs.
Planned outcomes	• Ability for the seafood sector to 'tell its story' of contribution based on evidence that is relevant, robust, transparent and repeatable. • Enhanced capacity for practitioners, managers and industry to estimate economic contributions at various scales in a consistently relevant, robust, transparent and repeatable manner. • Improved quality and coverage of economic data available for future contribution studies and economic impact studies.

Appendix 4: Terms of Reference for Expert and External Review

The overall purpose of this expert review is to establish the technical veracity of the estimates of economic contribution reported in the **Technical Report for the National Fisheries and Aquaculture Industry Contributions Study** (Draft) prepared by BDO EconSearch. The review process is seen as a risk mitigation action to minimise the FRDCs exposure to releasing technically indefensible and/or erroneous estimates.

The Report will be reviewed internally by the project Technical Advisory Group (TAG) and by an external expert. Reviewers are asked to address the following questions:

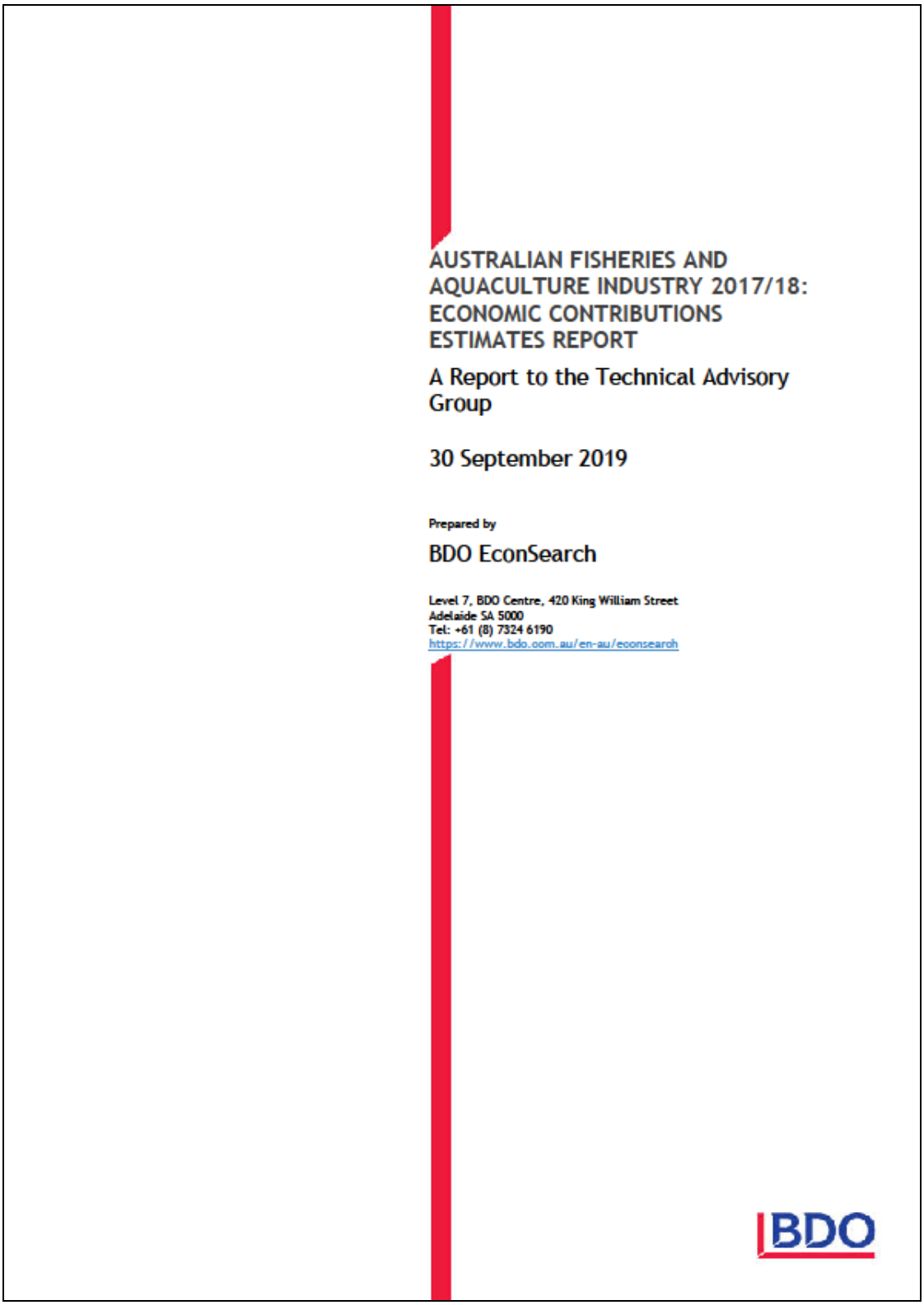
1. Does the Report deliver against the project brief/terms of reference? If not, what elements are missing or inadequate?
2. Has the methodology been applied in a robust and transparent manner that is consistent with best practice? If not, what are the deficiencies?
3. Are estimates sufficiently defensible to be used for the purposes as articulated in the National fisheries and aquaculture industry social and economic contributions study: Phase 1? If not, what additional work would need to be done to achieve this?
4. Are all important assumptions clearly stated and justified? If not, how could this be improved?
5. Does the report contain sufficient explanation/guidance regarding interpretation of estimates, including their caveats and limitations? If not, how could this be improved?

Reviewers are asked to submit a brief report addressing each of the review questions above, plus any other comments. If also returning an annotated version of the Report, please also indicate these either as comments or using track changes. Note that this Report is not intended as an outward reaching communication product aimed at informing stakeholders such as industry, management and government, although such products will be developed based on the estimates contained in this report.

BDO/ EconSearch will be required to address quality assurance review comments from both an external expert reviewer and the TAG prior to submitting a final report, and to provide the TAG with a written response explaining how all review comments have been addressed.

Appendix 5: Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report

See link to this output on the FRDC project webpage: [Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report]



AUSTRALIAN FISHERIES AND AQUACULTURE INDUSTRY 2017/18: ECONOMIC CONTRIBUTIONS ESTIMATES REPORT

A Report to the Technical Advisory Group

30 September 2019

Prepared by

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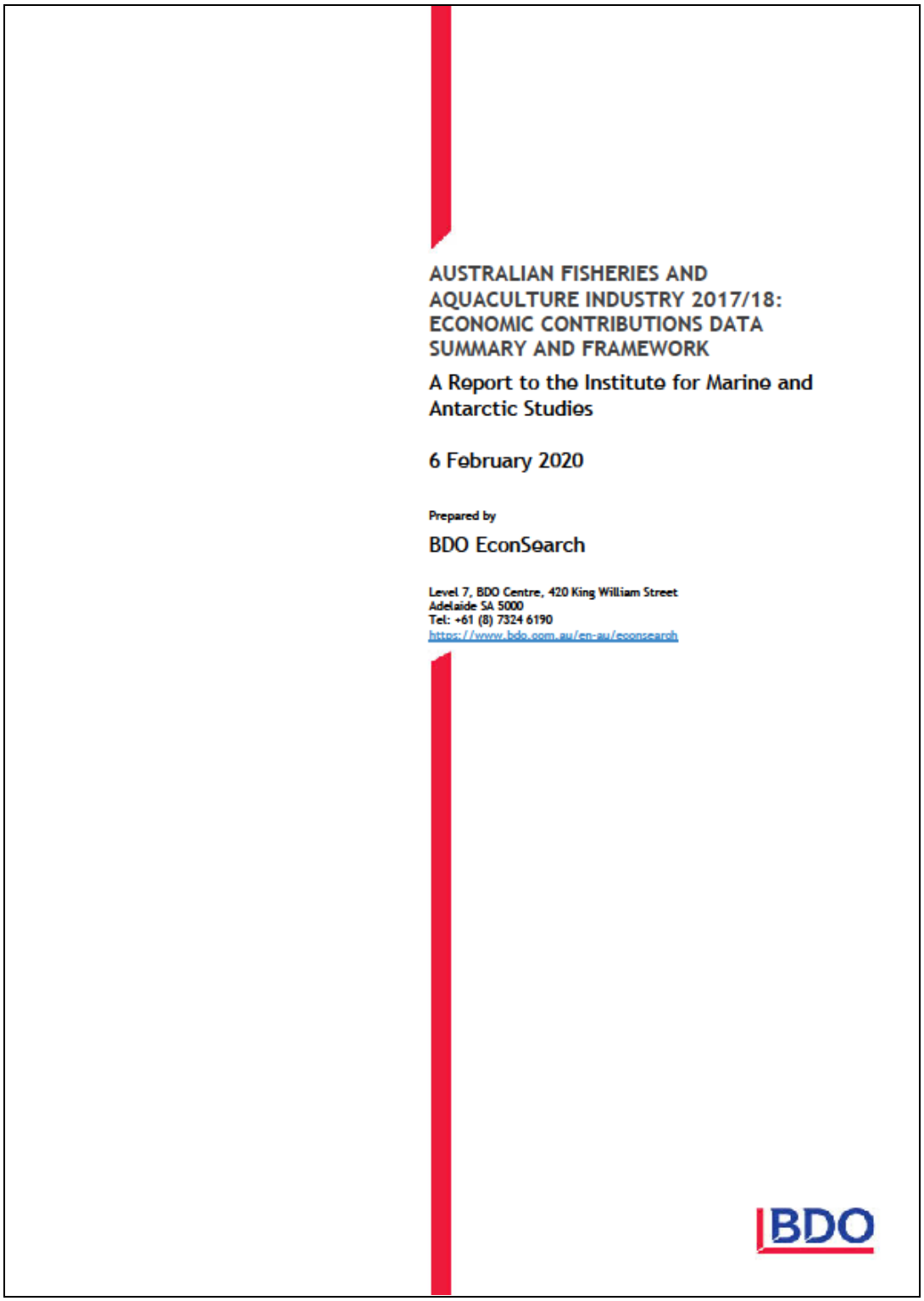
BDO

Appendix 6: Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions - Data Summary and Framework

See link to this output on the FRDC project webpage: [Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Data Framework]



AUSTRALIAN FISHERIES AND AQUACULTURE INDUSTRY 2017/18: ECONOMIC CONTRIBUTIONS DATA SUMMARY AND FRAMEWORK

A Report to the Institute for Marine and Antarctic Studies

6 February 2020

Prepared by

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Appendix 7: Australian Fisheries and Aquaculture Industry 2017/18: Economic and Social Contributions - Summary Report

This report presents a summary of the economic contribution of Australia's fisheries and aquaculture industries to the Australian community. It also provides a snapshot of the unique contributions fisheries and aquaculture industries make to social and economic wellbeing of regional communities in different parts of Australia, based on previous regional studies. This work is an exciting step forward that lays the groundwork for the seafood industry to celebrate its economic and other contributions and to showcase these to its communities and to Australians in general. It also provides the starting point for monitoring contributions to Australia's economic prosperity over time. This the first time the national economic contribution of the Australian seafood industry has been reported. Full results are provided Appendix 5 and demonstrate the nationally consistent approach.

Key highlight: in 2017/18, Australia's fishing, aquaculture and associated processing industry contributed over **$5.3 billion dollars** to the national economy. In 2017/18, total fisheries and aquaculture employment contribution in Australia was estimated to be **41,254 Full-time equivalent (FTE) jobs**.

See link to this output on the FRDC project webpage: Australian Fisheries and Aquaculture Industry 2017/18: Economic and Social Contributions - Summary Report

OCTOBER 2019

AUSTRALIAN FISHERIES AND AQUACULTURE INDUSTRY 2017/18: ECONOMIC AND SOCIAL CONTRIBUTIONS SUMMARY

Presented by the Fisheries Research and Development Corporation and the Institute for Marine and Antarctic Studies.
Economic estimates provided by BDO EconSearch.

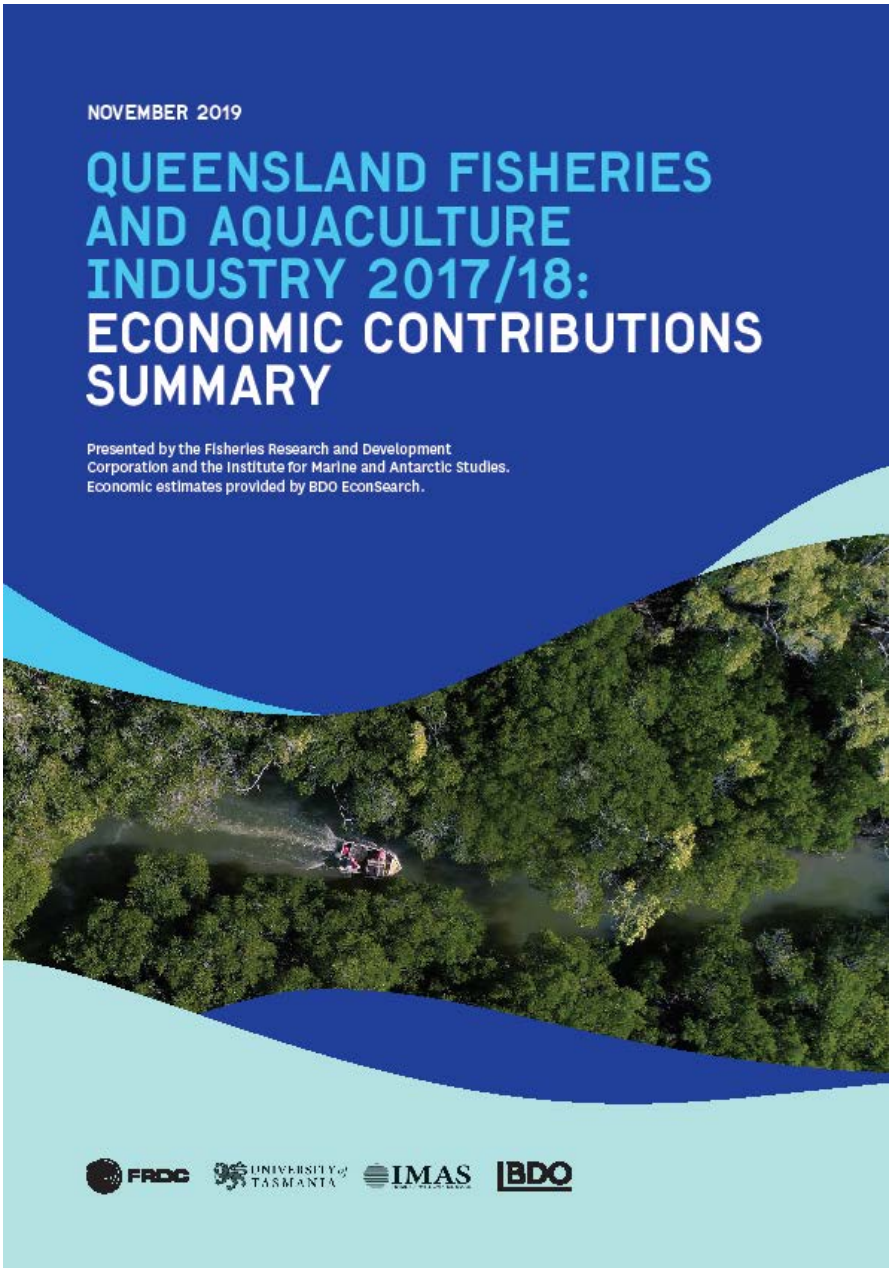
FRDC UNIVERSITY of TASMANIA IMAS BDO

Appendix 8: Queensland Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

This report presents a summary of the economic contribution of Queensland's fisheries and aquaculture industries to the Queensland community. This work is an exciting step forward that lays the groundwork for the seafood industry to celebrate its economic contributions and to showcase these to its communities and to Queenslanders in general. It also provides the starting point for monitoring contributions to Queensland's economic prosperity over time.

Key finding: In 2017/18, Queensland's fishing, aquaculture and associated processing industries contributed **$479 Million dollars** (total GVA) to the Queensland economy. In 2017/18, total employment contribution to QLD was **4,027 full-time equivalent (FTE) jobs**.

See link to this output on the FRDC project webpage: Queensland Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

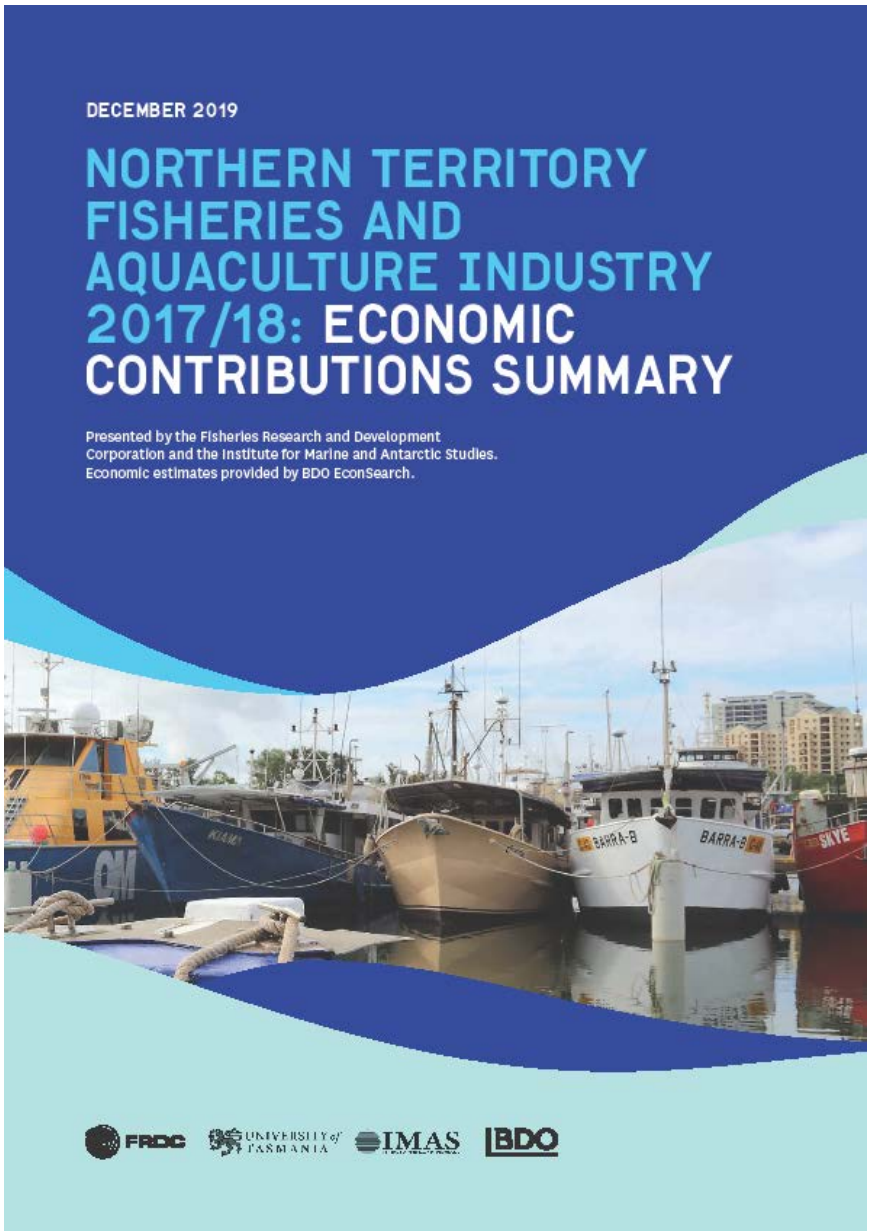


Appendix 9: Northern Territory Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

This report presents a summary of the economic contribution of the Northern Territory's fisheries and aquaculture industries to the Northern Territory community. This work is an exciting step forward that lays the groundwork for the Northern Territory seafood industry to celebrate its economic contributions and to showcase these to its communities and to residents of the Northern Territory in general. It also provides the starting point for monitoring contributions to the Northern Territory's economic prosperity over time.

Key findings: in 2017/18, NT's fishing, aquaculture and associated processing industries contributed **$136 million dollars** (total GVA) to the NT economy. In 2017/18, total employment contribution to NT was **941 full-time equivalent (FTE) jobs**.

See link to this output on the FRDC project webpage: Northern Territory Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

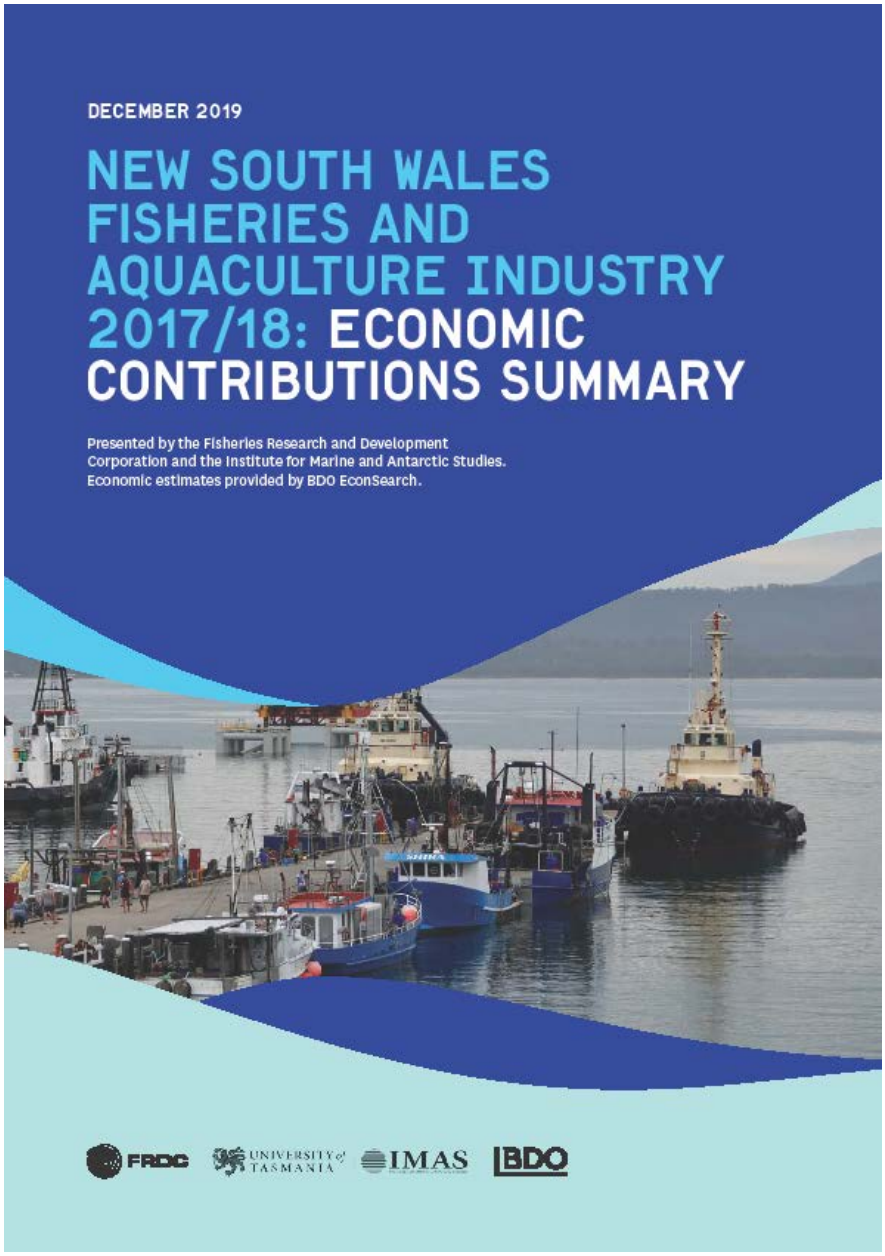


Appendix 10: New South Wales Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

This report presents a summary of the economic contribution of New South Wales' (NSW) fisheries and aquaculture industries to the NSW community. This work is an exciting step forward that lays the groundwork for the NSW seafood industry to celebrate its economic contributions and to showcase these to its communities and to residents of NSW in general. It also provides the starting point for monitoring contributions to the NSW economic prosperity over time.

Key findings: in 2017/18, NSW's fishing, aquaculture and associated processing industries contributed **$374 million dollars** (total GVA) to the NSW economy. In 2017/18, total employment contribution to NSW was **3,530 full-time equivalent (FTE) jobs**.

See link to this output on the FRDC project webpage: New South Wales Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

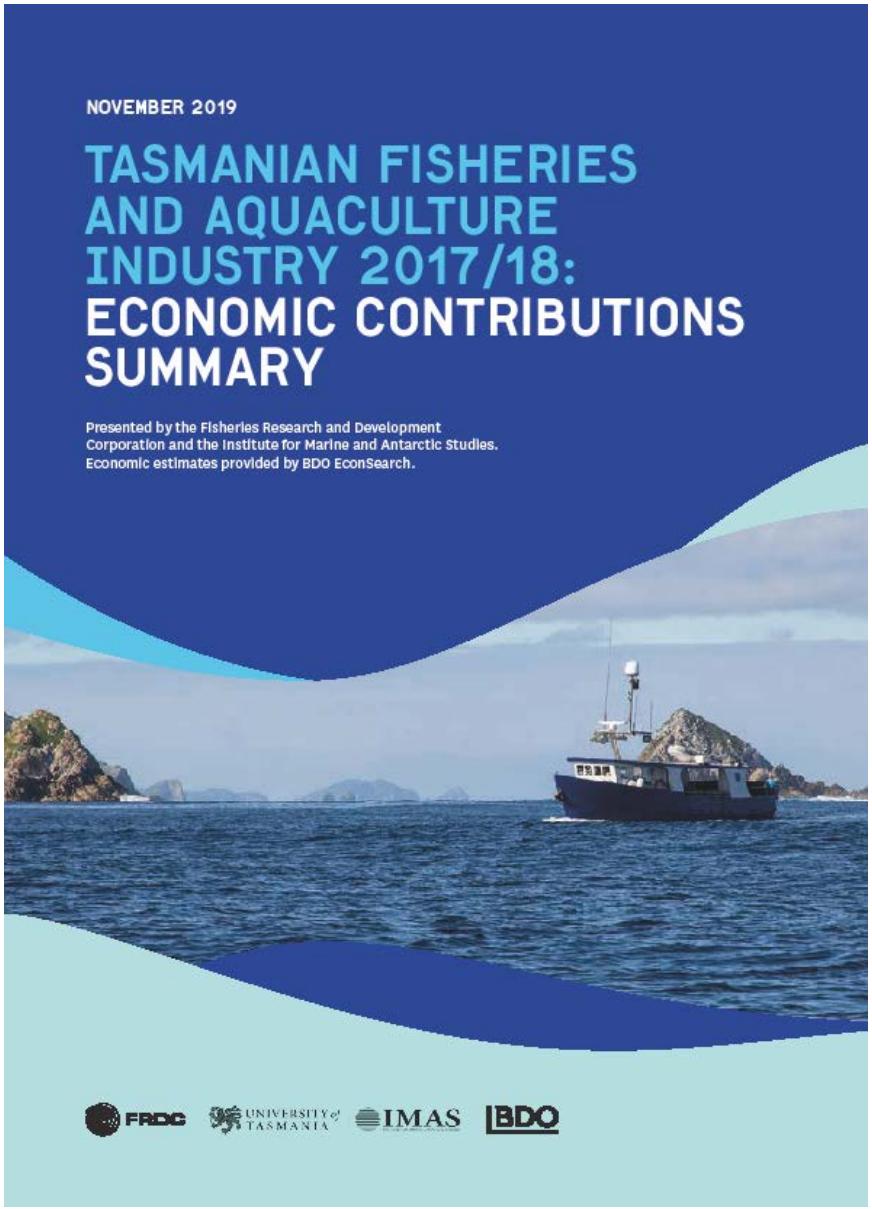


Appendix 11: Tasmanian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

This report presents a summary of the economic contribution of Tasmania's fisheries and aquaculture industries to the Tasmanian community. This work is an exciting step forward that lays the groundwork for the Tasmanian seafood industry to celebrate its economic contributions and to showcase these to its communities and to Tasmanian's in general. It also provides the starting point for monitoring contributions to Tasmania's economic prosperity over time.

Key findings: in 2017/18, TAS fishing, aquaculture and associated processing industries contributed **$1,150 million dollars** (total GVA) to the TAS economy. In 2017/18, total employment contribution to TAS was **8,803 full-time equivalent (FTE) jobs**.

See link to this output on the FRDC project webpage: Tasmanian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

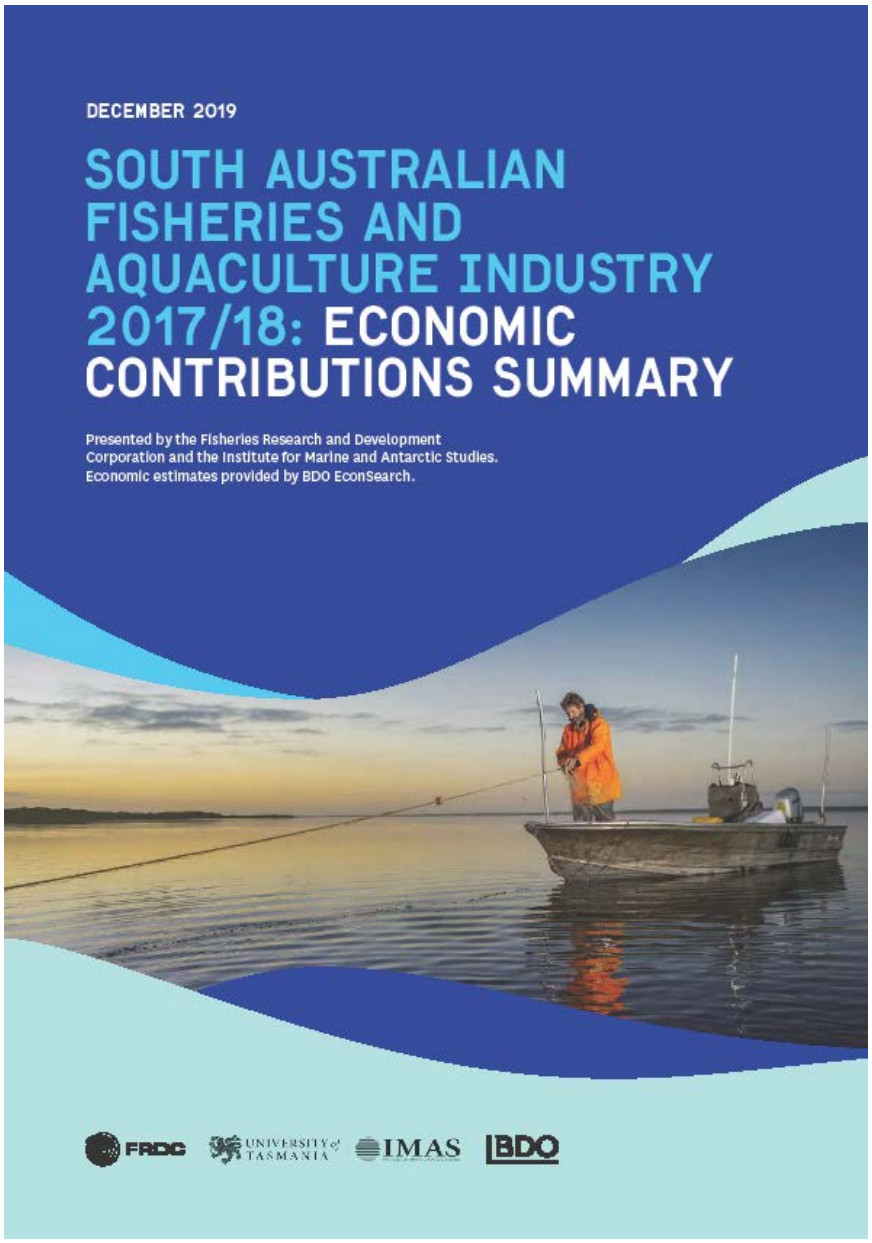


Appendix 12: South Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

This report presents a summary of the economic contribution of South Australia's fisheries and aquaculture industries to the South Australian community. This work is an exciting step forward that lays the groundwork for the South Australia seafood industry to celebrate its economic contributions and to showcase these to its communities and to South Australians in general. It also provides the starting point for monitoring contributions to South Australia's economic prosperity over time.

Key findings: in 2017/18, SA's fishing, aquaculture and associated processing industries contributed **$698 million dollars** (total GVA) to the SA economy. In 2017/18, total employment contribution to TAS was **6,288 full-time equivalent (FTE) jobs**.

See link to this output on the FRDC project webpage: South Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

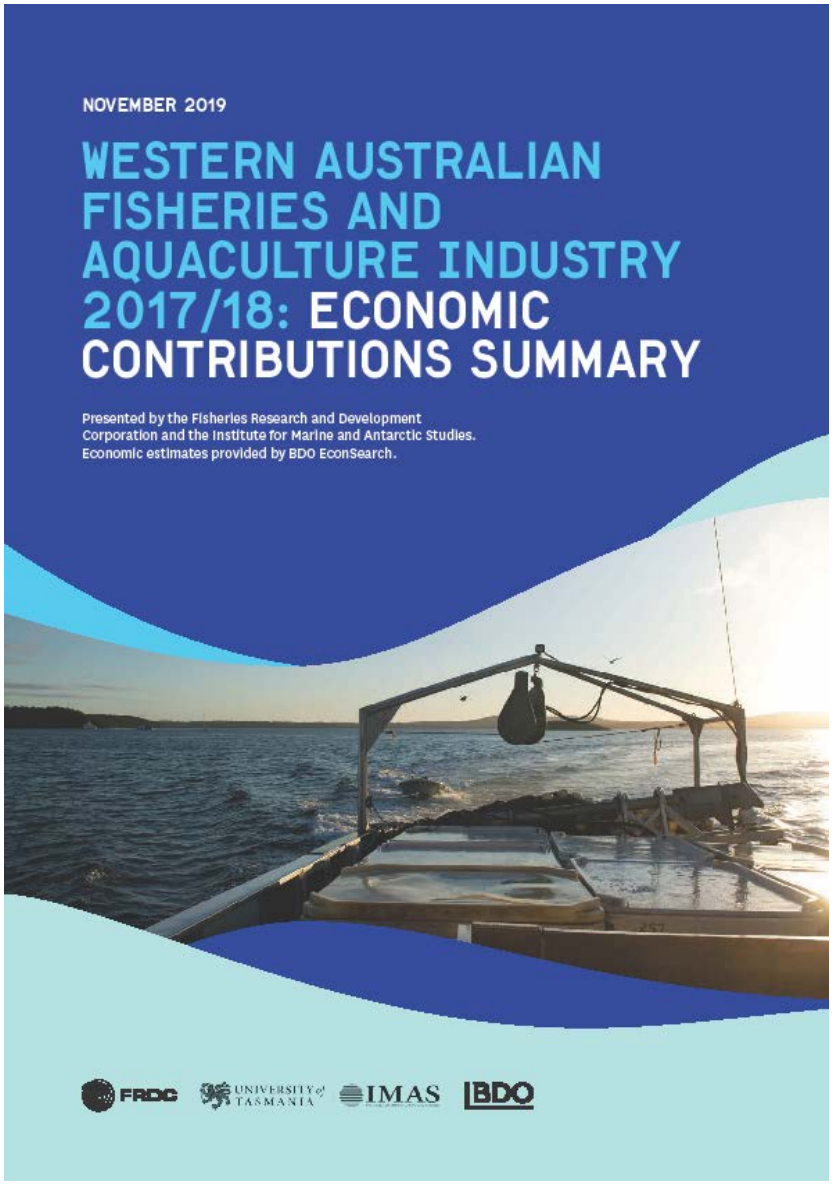


Appendix 13: Western Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

This report presents a summary of the economic contribution of Western Australia's fisheries and aquaculture industries to the Western Australian community. This work is an exciting step forward that lays the groundwork for the Western Australia seafood industry to celebrate its economic contributions and to showcase these to its communities and to Western Australian's in general. It also provides the starting point for monitoring contributions to Western Australia's economic prosperity over time.

Key findings: in 2017/18, WA fishing, aquaculture and associated processing industries contributed **$989 million dollars** (total GVA) to the WA economy. In 2017/18, total employment contribution to WA was **6,281 full-time equivalent (FTE) jobs**.

See link to this output on the FRDC project webpage: [Western Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary]

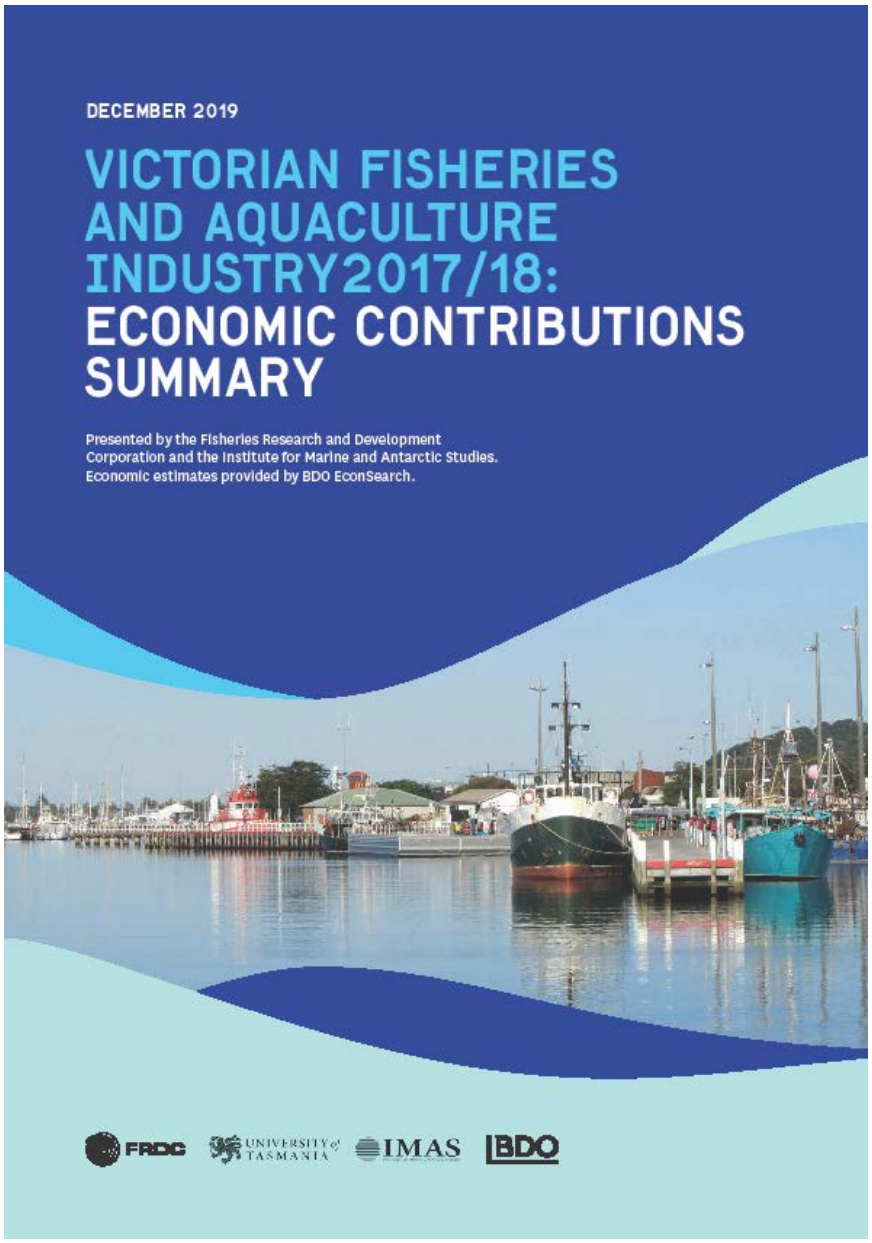


Appendix 14: Victorian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary

This report presents a summary of the economic contribution of Victoria's fisheries and aquaculture industries to the Victorian community. This work is an exciting step forward that lays the groundwork for the Victoria seafood industry to celebrate its economic contributions and to showcase these to its communities and to Victorian's in general. It also provides the starting point for monitoring contributions to Victoria's economic prosperity over time.

Key findings: in 2017/18, VIC's fishing, aquaculture and associated processing industries contributed **$355 million dollars** (total GVA) to the TAS economy. In 2017/18, total employment contribution to VIC was **3,174 full-time equivalent (FTE) jobs**.

See link to this output on the FRDC project webpage: [Victorian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Summary]

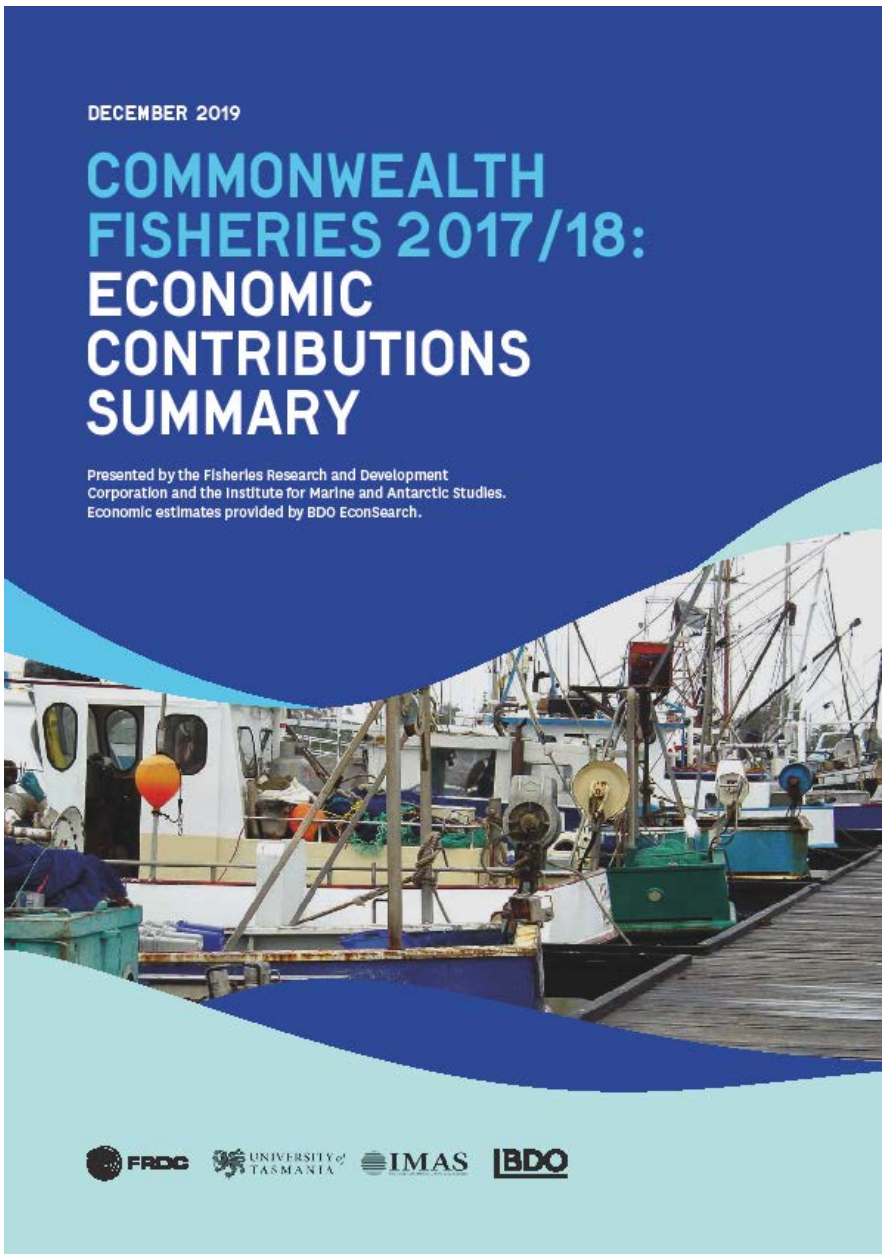


Appendix 15: Commonwealth Fisheries 2017/18: Economic Contributions Summary

This report presents a summary of the economic contribution of Australia's commonwealth managed fisheries to the Australian community. This work is an exciting step forward that lays the groundwork for the Tasmanian seafood industry to celebrate its economic contributions and to showcase these to its communities and to Australian's in general. It also provides the starting point for monitoring contributions to Australia's economic prosperity over time.

Key findings: in 2017/18, Commonwealth-managed fishing and associated processing industries contributed **$632 million dollars** (total GVA) to the Australian economy. In 2017/18, total employment contribution to Australia from commonwealth-managed fisheries was **5,209 full-time equivalent (FTE) jobs**.

See link to this output on the FRDC project webpage: Commonwealth Fisheries 2017/18: Economic Contributions Summary



Appendix 16: Design Guidelines for FRDC studies on Social and Economic Contributions of Fisheries and Aquaculture to Wellbeing

Purpose

This document outlines recommended principles and steps to guide the design of FRDC-funded studies which estimate the social and/or economic contributions of wild catch commercial fisheries and aquaculture to community and societal wellbeing. The purpose of these Design Guidelines is:

- To guide RD&E investment decisions by the FRDC's Human Dimensions Research Subprogram and other groups
- To provide guidance to researchers putting together EOIs and full applications for FRDC project funds who wish to undertake research to understand the contributions the fishing and aquaculture industries make to community and societal wellbeing.

These Design Guidelines are informed by past FRDC research estimating the seafood industry's contributions to wellbeing, a Technical Workshop in Melbourne on 13 February 2017, and the Workshop on Wellbeing Frameworks for Contributions Studies held in Melbourne 18 March 2019. This document is based on work undertaken as part of FRDC 2017-210 National Fisheries and Aquaculture Industry Contributions Project carried out by the FRDC Human Dimensions Research (HDR) Subprogram.

1. Overview

1.1. What do we mean by social and economic contributions?

Seafood production through commercial wild catch fishing and aquaculture contributes to communities and society in a broad range of ways.

The seafood industries make clear economic contributions, providing employment, income and value added both directly and indirectly through the inputs into fishing and aquaculture operations and through the supply chain. This is often captured through analysis of economic contributions using formal models (for practitioner guidelines for modelling economic contributions, see: Appendix 17 and Australian Fisheries and Aquaculture Industry: Economic Contributions Estimates - Practitioner Guidelines 2019). However, there are other forms of contribution to economic wellbeing that are not necessarily captured through this standard economic modelling approach. For example, modelling outputs alone do not capture the full spectrum of ways in which the activities of seafood producers are important for the economic stability and resilience of regional communities.

The commercial fishing and aquaculture industries also make social contributions to wellbeing. These contributions are varied and numerous and are informed by the context of the place or community of interest. Social contributions include providing food t communities, contributing voluntarily to the health of aquatic environments, and indirectly contributing to other sectors such as tourism through seafood experiences. Identifying and understanding the social contributions the seafood industry makes to community and societal wellbeing calls for expanded ways of measuring and documenting these contributions.

1.2. Using the social wellbeing framework to understand social and economic contributions

The concept of wellbeing is an appropriate framework to capture the range of contributions made by the fishing and aquaculture sectors to communities and wider society. Wellbeing provides a broad and comprehensive conception of social and economic benefit and provides an analytical lens which can draw attention to the material and importantly, the non-material, benefits of fisheries and

aquaculture. It can be used to understand the linkages and interactions between different types of social and economic contributions. It can also be used to understand how contributions have changed over time (including declines in contributions), to illuminate possible negative contributions, and can be used to identify where the seafood industry can and should increase their contributions, in those cases where the industry has an identified goal or benchmark of contributing to social wellbeing.

While there are a variety of different wellbeing definitions and frameworks used in academic and non-academic studies and reports, the social wellbeing approach is a favoured approach used in current fisheries and aquaculture research e.g., (Coulthard, Johnson, and McGregor 2011; Voyer et al. 2017; Weeratunge et al. 2014). The social wellbeing approach is a systematic means of combining three dimensions of wellbeing: the material (or objectively-measured) dimension, and two non-material dimensions; relational and subjective aspects of people's varied lives (see Appendix Box 2). The approach also considers how these aspects interrelate.

Appendix Box 2. Three dimensions of social wellbeing

Material: the resources people have and the extent to which needs are met including food, income and assets, access to services and environmental quality

Relational: the extent to which social relationships enable people to act to achieve (their own conception of) wellbeing

Subjective: the level of satisfaction with the quality of life people achieve; a person's own perceptions; and the values and beliefs that shape those perceptions

(Britton and Coulthard 2013; Coulthard 2012; Coulthard, Johnson, and McGregor 2011)

2. Steps for designing fisheries and aquaculture contributions studies

Recommended steps for establishing the scope of, and undertaking, a project to identify and understand commercial fisheries and aquaculture contributions to community and society wellbeing are listed below (these design guidelines address steps 1-5 in detail).

Step 1: Determine purpose of the study

Step 2: Determine what fishing/aquaculture activity will be assessed (sector/place/people)

Step 3: Determine whose wellbeing is the contribution towards (population of interest)

Step 4: Determine domains of wellbeing and how fishing/aquaculture activities contribute to these

Step 5: Select indicators, and identify measurement approaches and required data

Step 6: Assess and analyse contributions

Step 7: Document and report

Step 8: Communicate to intended audience(s)

Step 9: Reflection, lessons learned and value-adding

2.1. STEP 1. Determine the purpose of the study

To be most effective, it is important that a contributions study first establishes and identifies **the purpose** of undertaking the study, what may be its intended use, and who would be the audience for the findings. This will inform the orientation and scope (i.e. the relevant scale of the study and the relative importance of various domains of contribution to targeted audiences). Intended uses could be for advocacy purposes, demonstrating legitimacy, for engagement, for accountability, and improving performance, and include:

- Supporting a range of activities such as communication campaigns and lobbying aimed at influencing decisions
- Demonstrating a stake, and/or improving standing as a stakeholder in resource management negotiations and discussions
- Supporting engagement with and raising the awareness of various communities of interest of shared values
- Supporting industry/sectors where making positive contributions to the wider community or society is an explicit goal, and analysing contributions to inform how to improve performance
- Undertaking reporting and/or monitoring of contributions in response to legal, regulatory or market requirements, e.g. certification, development approvals, international obligations such as the Sustainable Development Goals

A contribution study also presents the opportunity to **use the data collected for other purposes**. For example, it is possible the data could be used to inform a future social and economic impact assessment for a fishery where management or policy change is expected, to provide baseline data for trade-off analyses for resource allocation purposes, or to provide baselines for cost-benefit analyses to estimate the strengths and weaknesses of different management or policy options. The potential for other uses should be considered at this step as it may require a focus for data collection or a change of scope to ensure specific data are collected, depending on the analysis required. It will also require appropriate informed and prior consent of participants to allow anticipated other uses of data. See Appendix Table 10 (below) for examples of alternative uses for economic data collected through contributions studies.

In identifying the purpose, it is important to also consider steps 2 and 3: **whose contribution** is being examined (i.e. what fishery/aquaculture activity?), and **who's wellbeing** the fishery/aquaculture activity is contributing to (i.e. who is the population of interest?). In establishing these, it is then possible to select **what are the relevant domains of contribution** to measure which address the purpose of the contribution study (step 4).

Appendix Table 10. Examples of multiple uses of economic data for estimating contributions

Type of data	Economic contributions indicator	Other metrics/indicators	Other types of economic analysis
Cost of production/ business income	Direct GVA, GDP/GSP (via gross operating surplus), HI and indirect contributions (via expenditure)	Net economic returns/ economic rent Average profit at full equity Gross operating surplus Return on capital Input (effort) quantity/cost indices Output quantity/cost indices Typology of businesses based on vessel/business cost structure	Evaluating management decisions and settings (efficiency and distribution effects). For example: • Cost-benefit analysis of input/output controls • Bioeconomic modelling of harvest strategy settings Analysis and simulation of vessel/fleet behaviour and effort dynamics Economic impact analysis Terms of trade analysis Economic productivity/efficiency analysis Economic performance and context monitoring Financial performance monitoring
Price	Direct GVA, GDP/GSP, HI (via business income) and GVP and value of exports	Net economic returns/ Economic rent Average profit at full equity Gross operating surplus Return on capital Price index	Evaluating management decisions and settings (efficiency and distribution effects). For example: • Cost-benefit analysis of input/output controls • Bioeconomic modelling of harvest strategy settings Analysis and simulation of vessel/fleet behaviour and effort dynamics Economic impact analysis Terms of trade analysis Economic productivity/efficiency analysis Economic performance and context monitoring Financial performance monitoring Demand analysis and price integration Price forecasting
Cost of management	Direct GVA, GDP/GSP and indirect contributions (via expenditure)	Management cost as percentage of GVP	Monitoring of management performance Economic impact analysis
Employment (FTE)	Direct Employment		Economic performance and context monitoring Employment forecasting
Catch/production	GVP	Output quantity index	GVP forecasting Terms of trade analysis
Export volume	Export value		Economic performance and context monitoring Export forecasting

Notes: 1. The required form and frequency of these data types may vary across the different types of economic indicators/metrics and types of analysis. For example, contributions analysis requires only a weighted average price for the year in which an estimate is made, but to detect seasonal relationships demand analysis requires time series monthly price data. 2. Some forms of economic analysis require additional data types. For example, cost-benefit analysis often requires data on non-market values and market prices may need to be adjusted to reflect true social values of inputs and outputs. 3. Confidentiality issues and survey ethics requirements may also restrict the extent that data can be re-purposed ex-post.

2.2. STEP 2. Determine what fishing/aquaculture activity will be assessed (Whose contribution?)

Wellbeing research generally seeks to measure individuals' (or a group of individuals) wellbeing. This is the case in regional wellbeing surveys such as the one led by University of Canberra to examine the wellbeing and quality of life of rural and regional Australians[1]. In the case of fisheries and aquaculture, this may be the wellbeing of a group of individual fishers and/or aquaculturalists[2]. If, for example, the purpose of a study was to inform a social impact assessment of a policy change on a particular fishery or aquaculture activity, then wellbeing of the individuals participating in that fishing/aquaculture industry would be the appropriate scale.

However, the contributions studies in Victoria and NSW (Barclay et al. 2016; Voyer et al. 2016; Abernethy et al. 2019) were different in their purpose and these guidelines focus on recommendations following the same approach. Specifically, the purpose of these studies has been to determine the value proposition of fisheries and aquaculture to people including those not directly involved in the industry, i.e. community, regions, states. The question has therefore been **'what is the contribution of the fisheries/aquaculture activity *to* the wellbeing of the population of interest?'.**

In terms of these outward-looking studies, Step 2 is to clearly identify **what fishing/aquaculture activity** will the study focus on. This may be a sector, a place, or a group of people (see Appendix Table 11). It will also be relevant to define the **time period** of contribution e.g. a year.

Appendix Table 11. Whose contribution to wellbeing?

Whose contribution to wellbeing?		
Sector-based	**Place-based**	**People-based**
May be a fishery or aquaculture activity, e.g. southern rock lobster, inshore netting, salmon farming, in a given place, e.g. in Tasmania or Australia.	May be fishing/aquaculture activities in a geographical place, such as in a fishing community, stretch of coast or statistical zone	May be people-based such as indigenous communities fishing contributions, women's contribution, migrant communities contributions, in a given place, e.g. in Tasmania or Australia.

2.3. STEP 3. Determine whose wellbeing is the contribution towards

The next step is to determine **whose wellbeing** is the activity contributing to and at what scale will this be examined. For example, the contribution could be to geographical 'communities' at sites of seafood production or to communities directly affected by downstream activities, or to communities of interest - for example, people of particular ethnicities. Or it may be contributions to society in metropolitan/regional areas, or at a regional, state/territory, or Australian scale. Definition of whose wellbeing is to be considered should be consistent with the purpose and intended use of the contributions study.

[1] https://www.canberra.edu.au/research/institutes/health-research-institute/regional-wellbeing-survey

[2] Individual wellbeing interacts with community wellbeing. Individual wellbeing could also be scaled up to community wellbeing if the community is a fishing/aquaculture-dependent community. This is often the case in studies which are focused on wellbeing in developing countries communities.

Considerations to take account of are:

- Different wellbeing contributions and their importance will be seen differently by different people within the population of interest
- There will be an uneven distribution of contributions to wellbeing across the population of interest (i.e. some groups will benefit more than others from the seafood industry contributions in question or there may be negative trends in contributions, or negligible contributions to all or parts of populations)
- Temporal scale is important, and whether the study is interested in short-term or long-term wellbeing to a population will influence the indicators selected

2.4. STEP 4. Determine the domains of wellbeing and how fisheries and aquaculture activities contribute to these

In designing social and economic contributions studies, it is necessary to decide which types (otherwise known as domains) of wellbeing are of interest or of importance. The domains of wellbeing are the broad categories of wellbeing that are important to the population of interest, such as health, education, food supply, or economic resilience. Domains can be determined using a bottom up approach (i.e. asking the population of interest) or using a top down approach (i.e. using the literature and previous studies).

In choosing domains, it is necessary to ensure selected domains are actually reflective of what is the intended purpose and scope of the study and are reflective of what is considered important to communities of concern.

The domains of wellbeing relevant to any particular study and the methodology used to measure contributions to these domains are influenced by the previous steps of identifying whose contribution is being examined and who's wellbeing the contribution is to (see Appendix Table 12).

Appendix Table 12. Description of domains of fishing and aquaculture contributions to wellbeing at different scales. 'Community' will depend on definition and may be a community of place or community of interest. 'Society' will also depend on definition and may be a region, state, or nation.

Domains of wellbeing depends on 'whose wellbeing'		
Individuals	**Community**	**Society**
Domains are focussed on individual's wellbeing. They include individual livelihoods, life satisfaction, level of health, knowledge and education, identity, place attachment, rights and voice, and relationships	Domains are focussed on contributions to the community (geographical community or community of interest). They include contributions to a resilient and diverse local economy, local food supply, local tourism, local community health, knowledge, the environment, integrated and diverse communities, culture and identity, history, infrastructure and governance.	Domains are similar to community wellbeing domains but the contribution to the economy will differ in scale, and the importance of community-specific contributions will reduce. They include direct and indirect contributions to the economy, food supply and culture, tourism, environmental management, and research and innovation.

Appendix Box 3. Drawing on Contribution Studies in NSW and Victoria

Contributions studies have the potential to be exploratory and broad. This has been the case with previous large-scale studies examining the contributions of NSW and Victorian fisheries and aquaculture activities (FRDC 2014-301, 2015-302, 2017-092).

In these studies, fisheries and aquaculture activities were identified as contributing to the following the domains of wellbeing: economic resilience and diversity of communities, seafood provision, interrelated tourism and recreation industries, healthy aquatic environments, and the social fabric of communities.

These studies have been useful to identify and explore different domains of wellbeing and how fisheries and aquaculture industries contribute to them. For any subsequent studies, there is a need to focus on measuring contributions to a common, nationally consistent set of domains of wellbeing.

Four focal domains of community/societal wellbeing to which the seafood industry contributes to have been identified based on the following selection criteria:

- Strength of contributions made by fisheries/aquaculture as evidenced by previous FRDC-funded contributions projects
- Relevant across most Australian fisheries/aquaculture activities
- Relevant at both the community and societal scales
- Relatable to areas of industry actions and effects identified in 'Our Pledge' project (FRDC 2017-242)
- Relatable to Sustainable Development Goals (https://sustainabledevelopment.un.org/?menu=1300)

The four focal domains of wellbeing are:

- Economic resilience and diversity for regional communities
- Locally produced seafood
- Experiences and services for coastal tourism and recreation
- Healthy marine and freshwater environments

A description of each domain and examples of how fisheries and aquaculture may contribute to each domain are presented in Appendix Table 13. These four focal domains are not the only domains of wellbeing the seafood industries contribute to and, depending on the purpose and scope of the study, contribution studies should not necessarily be limited by these. The examples given are illustrative and not exhaustive and will not apply in all cases.

Selection of specific contributions should be specific to the context of each study and be based on the ability to generate evidence that links the contributions measured to the domains of wellbeing.

Appendix Table 13. Four focal domains of wellbeing and examples of contributions made by commercial fishing and aquaculture industries to each domain

Domain	Examples of fisheries and aquaculture contributions to domain
Economic resilience and diversity for regional communities	The fishing and aquaculture industries may contribute to economic resilience and diversity in regional communities through: • Direct and indirect economic contributions of fishing and aquaculture activities and related activities across the supply chain, through flow of income and expenditure through economy. • Direct and indirect employment: - Direct employment in a diversity of jobs in the industry from on the boat or the farm, to the office. - Direct employment for a diversity of people, including young people, women, people of different ethnicity, and people from different socio-economic backgrounds. - Direct employment in regions where few employment opportunities exist - Indirect employment in a diversity of jobs in associated industries, including businesses that service and provide inputs into seafood production, post-harvest businesses that transport, process, and sell the seafood products produced; as well as the tourism and hospitality sectors • Being part of a diverse mix of interrelated and interdependent economic activities • Providing a baseline of economic activity throughout the year in regional communities, where often industries operate seasonally, such as tourism
Locally produced seafood	The fishing and aquaculture industries may contribute to local seafood supply to metropolitan and regional communities through providing: • Locally produced alternative to imported seafood and other Australian-produced sources of protein • Diversity of species caught and farmed which are important to Australia's culturally diverse marketplace • Access to Australia's fisheries not otherwise available to those who do not catch fish recreationally
Experiences and services for coastal tourism and recreation	The fishing and aquaculture industries may contribute to regional tourism and recreational experiences and services through: • Offering tourism attractions (e.g. wharves, aquaculture farms) and tourism 'branding', particularly to regional coastal towns • Providing seafood experiences for both international and domestic tourists • Providing local bait supplies and infrastructure services for recreational fishers • Sharing information to recreational users of the aquatic environment such as where to go fishing and conditions • Supporting maritime safety of recreational users of the sea through aiding and rescues
Healthy marine and freshwater environments	The fishing and aquaculture industries may contribute to improving the health of marine and freshwater ecosystems through: • Voluntary stewardship activities, such as implementing voluntary codes of practice, data collection, and gear modifications to reduce their environmental footprint • Participation in environmental monitoring, conservation activities and projects, such as habitat restoration and marine debris clean ups, to improve the health of freshwater and marine environments • Sharing accumulated local ecological knowledge with researchers and students, organisations, decision-makers and communities to benefit the health of marine and freshwater environments

2.5. STEP 5. Determine the suitable indicators of contributions

A large range of indicators are available to measure contributions of the identified domains of wellbeing, in both the theoretical literature and in applied studies(Breslow et al. 2016; Hattam, Hooper, and Papathanasopoulou 2017; Schirmer et al. 2016; Weeratunge et al. 2014), and prescribing specific indicators of contributions to social wellbeing is unnecessarily limiting. However, consideration should be given to determine which indicators (quantitative or qualitative) can be best used to assess the strength of both material and non-material dimensions of selected contributions, while also being meaningful and understandable to the intended audience of the study. Types of indicators (drawing on quantitative measures) of the four focal domains of contributions are provided in Appendix Table 14.

Appendix Table 14. Four focal domains of wellbeing and examples of indicators of specific contributions

Domains	Examples of indicators
Economic resilience and diversity for regional communities	• Contribution to GVA (see Practitioner Guidelines) • Contribution to Household Income (see Practitioner Guidelines) • Employment (FTEs), direct and indirect (see Practitioner Guidelines) • Regional economic sectors profile • Socio-economic indicators of employment such as: Diversity of employment; Quality of employment; Relative regional availability of jobs; Demographics of people employed; Employment opportunity for people from CALD backgrounds
Locally produced seafood	• % of per capita annual seafood consumption at a regional/state level which is locally produced (compared to imported, sourced from outside 'local' region) • Local consumer surplus estimate • Sustainability status of locally produced seafood • Nutritional values of locally produced seafood • Value chain pathways and indicators • Diversity metric of locally produced species
Experiences and services for coastal tourism and recreation	• Level of importance of seafood/fishing/aquaculture-related activities/heritage in choice of tourist/recreational destination • Tourism consumer surplus • % of industry-related/provided maritime infrastructure • % of bait supplied by seafood industry • Number of maritime rescues by industry per year
Healthy marine and freshwater environments	• Level of industry contribution (cash and/or in-kind) to stewardship activities (beyond compliance) • Level of industry contribution (cash and/or in-kind) to voluntary environmental monitoring • Level of contribution (cash and/or in-kind) to wider environmental programs and activities • Level of impact of industry-funded environmental RD&E • Level of engagement in environment-based (non-industry) committees

Indicators which are SMART (specific, measurable, attributable, relevant, time-bound) are recommended for measuring material and many relational dimensions of wellbeing, particularly where the purpose would be to measure changes in contribution or impact. Ensuring that indicators are SMART therefore requires checking that the contribution being measured is substantive and not trivial or immaterial. Questions to ask at this point include: is there clear evidence of the link

between the activity whose contribution is being assessed and the indicator; and, is there an evident or causal relationship between what is being measured and the condition of the relevant domain?

A single indicator may be used to measure multiple contributions (potentially across multiple domains). For this reason, planning is required to determine how the indicators will be used in analyses.

Indicators can include those that use quantitative or qualitative methods to directly measure contributions, or proxies to reflect data availability. It is important to be clear about which method will be used and what are the required datasets and potential weaknesses.

Given the resources required and difficulty of collecting primary data, **existing secondary data** sources should be reviewed and where possible used to develop indicators. Examples of secondary data types and potential sources are given in Appendix Table 15.

Appendix Table 15. Types and examples of secondary data sources available for contributions studies

Secondary data type	Secondary data sets	Examples of potential sources of data
Economic activity data (see Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report and Practitioner Guidelines)	Licence/operator data	Management agency
	Catch and effort data	Management agency
	Management costs	Management agency
	Price data and GVP	Management agency, published sources
	Business/operating costs	Existing surveys e.g. *Australian Bureau of Agricultural and Resource Economics and Sciences,* BDO EconSearch
	Business profitability	Existing surveys e.g. *Australian Bureau of Agricultural and Resource Economics and Sciences,* BDO EconSearch
	Employment data	Australian Bureau of Statistics, existing surveys
	Export data	Australian Bureau of Statistics FRDC Seafood Trade Data https://www.frdc.com.au/services/seafood-trade-data
Seafood product data	Sustainability status	FRDC Status of Australian Fish Stocks Reports https://www.fish.gov.au/
	Import/export data	*Australian Bureau of Agricultural and Resource Economics and Sciences* Fisheries and Aquaculture statistics, FRDC Seafood Trade Data http://www.frdc.com.au/services/seafood-trade-data
	Diversity of species	Management agency
	Nutrition	FRDC health reports and data http://www.frdc.com.au/issues/health-benefits-of-seafood
	Community preference	FRDC market research reports and data http://www.frdc.com.au/services/market-research
Tourism data	Visitor surveys	Tourism Research Australia databases https://www.tra.gov.au
	Importance of seafood industry for tourism	Existing survey data for Vic, NSW (FRDC 2017-092, 2014-301, 2015-302)
Environment data	Industry contribution to R&D	FRDC Annual report, Environment program

2.6. STEPS 6 - 9

Steps 6-9 (Assess and analyse contributions**,** Document and report findings, communicate findings, Reflect, learn and value add) are not presented in detail in this document as they will differ depending on the context of the study. However, these steps are important to consider during the design phase of contribution projects.

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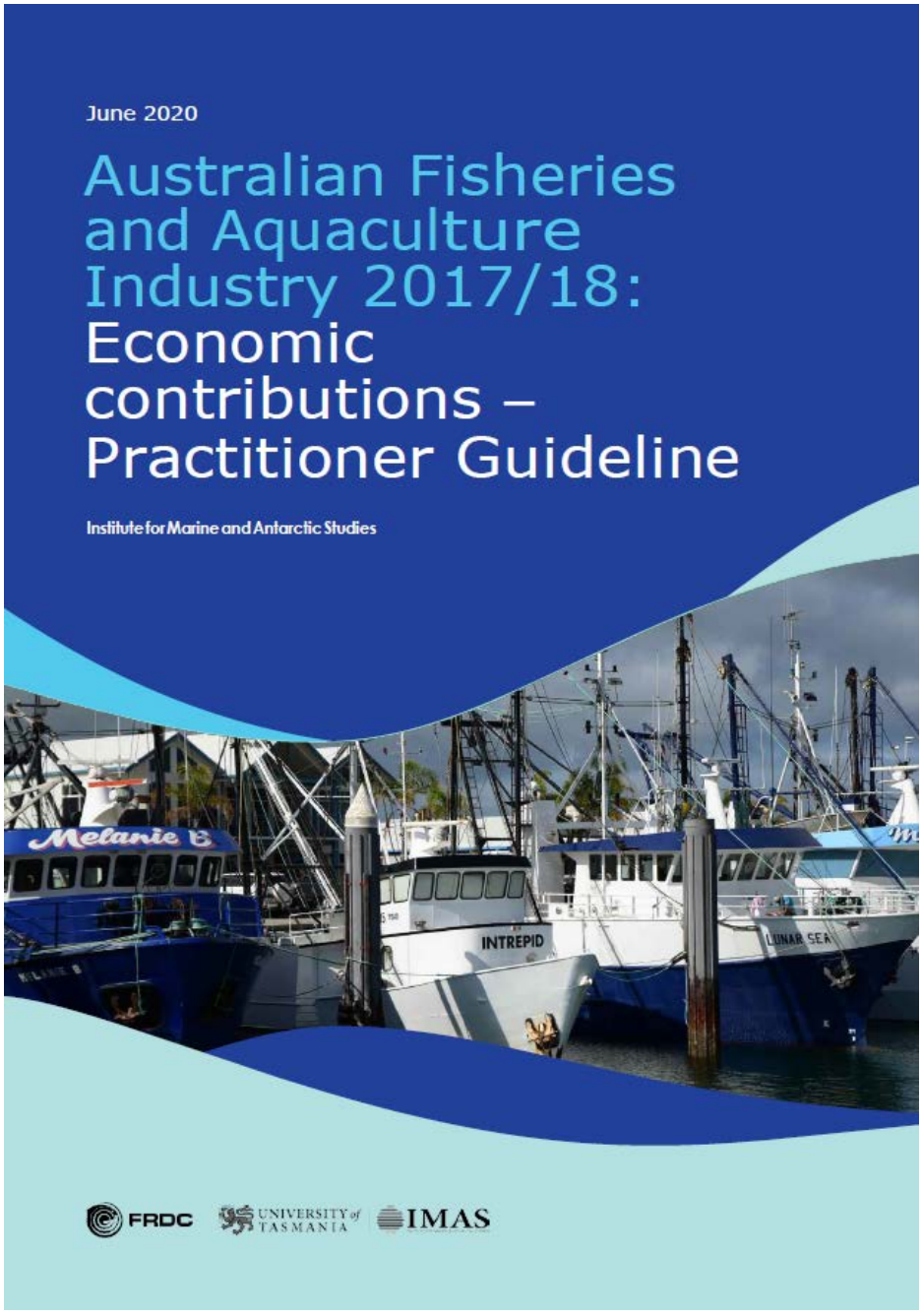
Appendix 17: Australian Fisheries and Aquaculture Industry: Economic Contributions Estimates - Practitioner Guidelines 2019

The purpose of the guidelines is to support managers, policymakers and industry in estimating the economic contributions of fisheries and aquaculture industries at various scales to national, state/territory and regional levels. The guidelines do this by providing practitioners (researchers, consultants, government analysts) with an in-depth step-by-step guide describing consistent processes and protocols.

See link to this document on the FRDC project webpage: Australian Fisheries and Aquaculture Industry: Economic Contributions Estimates - Practitioner Guidelines 2019



Appendix 18: FRDC National Economic Contributions & Data Workshop 2019 – Report

WORKSHOP REPORT:
FRDC National Economic Contributions & Data Workshop
10-11 December 2019 Hotel Park Royal Melbourne Airport

Background and purpose

As part of the FRDC 2017-210 project, *National Fisheries and Aquaculture Industry Contributions Study*, a technical workshop was held to discuss and progress collection and coordination of economic data for analysis of fisheries and aquaculture activity, and for economic contribution analysis. Objectives of the workshop were to:

4. describe the process for estimating economic contributions;
5. discuss economic data gaps and future data collection priorities (e.g. price data, cost of production data) from an agency perspective; and
6. explore options for supporting and coordinating further collection and sharing of economic data for future national analyses.

The workshop was run by Emily Ogier and Sarah Jennings (leaders of 2017-210 project and of the FRDC Human Dimensions Research Subprogram) and was attended by staff or representatives from agencies and organisations in all jurisdictions concerned with fisheries and aquaculture management and data collection. Presenters included researchers, FRDC, ABARES, SIA/SIV, RPN, and each of the management agencies (see ***Appendix Table 16***). A summary of key discussion points and recommendations is presented below.

Objective 1. Process for estimating economic contributions

The scope and steps involved in generating an estimate of economic contribution as presented in the Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report and in associated national and jurisdictional summaries were described. Standard measures of contribution were reported (gross value added, employment, household income, gross state/domestic product, value of exports). The data requirements to support this estimate were outlined and included catch/production levels, prices, costs of fishing/production, direct employment levels for each fishery and aquaculture sub-sector (i.e. Victorian Rock Lobster Fishery, South Australian oyster aquaculture). The non-survey method to address gaps in cost of fishing/production data – known as data matching - was described.

Key discussion points included:

- Exclusion of the charter fishing sector from the scope of the study is an issue for some jurisdictions, however as most jurisdictions do not manage this activity as a commercial fishery, it was acknowledged that this was reasonable
- Exclusion of the secondary processing, transport, wholesale and retail sectors from the scope of the study was noted, and the commencement of a project with the Australian Council of Prawn Fisheries to demonstrate a method to estimate contributions down stream of catch/production and

immediate processing was also noted with interest as a possible means to address this gap in future studies
- Need for a separate analysis of contributions arising from industry investment in RD&E
- The use of the results in a 'numbers game' being played between recreational and commercial sector advocates in some states was noted, and options were discussed for presenting the results to reduce this

Appendix Figure 4. Workshop participants

Objective 2. Economic data gaps and future data collection priorities from agency perspectives

Data needed for estimating economic contribution were outlined and included: catch/production levels; beach price/farm gate price; cost of fishing/production; business income; management costs; employment (FTE); export; and other update data and imputation (matching) data. BDO EconSearch presented the data framework used in the national estimate study and an audit of data gaps by types of issue (data quality or data availability) – see Data Summary and Framework report. A basis for prioritising data gaps to address was proposed using the proportion of GVP affected by a given data gap, as this reflected the reduced level of error or improved reliability addressing data gaps would generate for a jurisdiction's estimate. Other uses of the economic data used in contribution studies were also identified by a variety of presenters (see ***Appendix Table 17***), and these multiple uses of data could provide the basis for agency prioritisation of data gaps to address.

Data gaps to address were prioritised by workshop participants for fisheries and aquaculture separately using a ranking exercise. Aggregated priorities were similar across both sectors with the top four combined priorities being Costs of fishing/production; Prices; Costs of management; and Employment. Data on the post-harvest and other downstream sectors was also ranked highly, but since addressing this gap involves filling all individual data gaps for these activities it was not progressed as part of the workshop process. Workshop participants worked in breakout groups to describe the nature/source of the gap for each of the prioritised data items as described below:

2.1 Costs of production

Availability and quality issues arise from:
- Lack of systematic process for collection of cost of production data in most jurisdictions due in part to high costs and lack of understanding of potential benefits
- Lack of knowledge of availability of data sets collected on an *ad hoc* basis and of how this data can be accessed
- Where data is available it is often too old to be useable, even with updating, or does not relate to

species-based definitions of fisheries
- Potential value in a nationally coordinated approach to collection and collation of data, due to methodological and operational efficiencies was noted
- Low level of trust in agency-led data collection initiatives in some jurisdictions, require independent provider with skilled on-ground survey staff
- Generally greater confidence in fixed costs of production than in variable costs when using data matching due to the reliance on effort estimates for variable costs.

Further data gaps discussion points included:
- Explore opportunities to share data vessel data held by AMSA to improve data matching

2.2 Price data

Quality issues arise from:
- Variation in methods of collecting price data, which differ markedly between agencies and between species (i.e. via logbook or grower returns, or fish receiver returns, and on trip or monthly basis, and on number of fish or weight basis, and by what level of species specificity), and whether these are later adjusted through combining data sources
- Lack of systemic mechanisms for collecting farm gate price data for aquaculture in many cases
- Perverse incentives for some sub-sectors to report price accurately (e.g. where GVP used as basis of determining fees)
- High cost of obtaining independent sources of price data make its availability low or ad hoc
- Retrospective adjustment of price and production data by agencies due to delays in processing producer/fisher returns post reporting of prices to ABARES can increase likelihood of error

Further data gaps discussion points included:
- Low quality of price data reduces reliability of projections which are needed to inform industry and management planning

2.3 Costs of management

Availability and quality issues arise from:
- Reliance on using licence fees in non-cost recovered fisheries as a proxy for management costs means likely incomplete coverage and underestimate of contributions
- Lack of accepted standard for apportioning management costs across different user groups /jurisdictions in non-cost recovered fisheries
- Noted that management costs vary by jurisdiction and across time in response to policy and management structures.

2.4 Employment

Quality issues arise from:
- Reliance on ABS employment data, which is based on classifications and assumptions that could introduce a degree of error
- Level of seasonality and non-retention of employees and sub-contractors, which makes conversion to FTEs difficult (employment reported as part-time/full-time positions in some jurisdictions)
- Level of dual licensed operators, which confounds attribution of their employment to a single sub-sector
- Level of inactive licenses if relying on agency licensing data to infer number of operators

Further data gaps discussion points included:
- Export data is limited by the definition of exported seafood applied by the ABS, which results in

aggregation of species and reporting of products as exported against the port of export, which is not necessarily the jurisdiction of catch/production.

- Effort data to improve non-survey methods of estimating costs of catch/production (i.e. data matching or imputation) was also noted as a priority which could be partly addressed through working with agency data management staff to set up queries which extract data on effort. This applied especially to data on vessel length and, where available, engine size, number of days of fishing.
- Other types of employment data in addition to FTEs, such as number of jobs, relative level of availability in region, quality of employment, etc, was also noted as a priority where seeking to understand the industry's contribution to wellbeing more broadly.

Appendix Figure 5. Break out groups at work

Objective 3. Options for supporting and coordinating further collection and sharing of economic data for future national analyses

Options for addressing data gaps and for improving data governance were identified in breakout group discussions as well as in presentations/comments by agencies and organisations. The main points identified by the groups for addressing gaps are presented in ***Appendix Table 18***.

Options for obtaining sufficiently reliable cost of fishing/production data was a major theme of presentations and discussion. At the agency level, options for obtaining costs of fishing/production data are to:

- collect primary data through survey methods, which has associated costs, or
- apply non-survey methods of estimating cost of catch/production through use of secondary datasets and data matching.

Selecting whether to use survey or non-survey data matching methods for each fishery and aquaculture sub-sectors could be on the basis of 'size' (i.e. those with the largest GVP warrant survey methods), or opportunity for reliable data matching (i.e. those whose cost of fishing/production characteristics are more similar to those in other jurisdictions for which there is reliable data).

Agency participants indicated this was a decision to be made in consultation with industry representatives to determine their preference and willingness to support primary data collection or refinement of the data matching procedure for their sub-sector. Furthermore, the purpose of undertaking the contribution studies will partly determine the level of reliability of estimates needed, which in turn affects the decision as to whether primary data collection is or is not a priority need.

Key points arising from discussion were that:

- Industry support for economic surveys is typically very low initially, however this increases as the benefits of having this data become apparent over time
- Frequency of conducting surveys as well as sample sizes can be low where cost structures for fishing or aquaculture operations are stable and more uniform (e.g. BDO EconSearch conducts full surveys for each fishery every 3 years), especially where secondary data sources are available to update any changes in costs and activities (e.g. landings data, effort data from agencies)
- Providing details to industry of the use of the economic data in economic contributions analysis, for example, can improve support and incentivise participation in surveys
- Communicating and socialising key contributions indicators (i.e. gross value added) is needed to increase overall economic literacy, as well as trust in and uptake of any supporting data collection activities by industry members and agency staff
- Benefits of routine data collection include opportunity to re-purpose data for other economic and social analysis (see Table 2 for examples)
- Policy climate is an important factor and source of bias in levels of support for and participation in surveys. For example, proposed reforms and policy uncertainty create climates not conducive to industry support.

Recommendations arising from the workshop

Participants identified a need and willingness for the following initiatives. These will be provided to the AFMF and the FRDC for consideration.

1. Realisation of the benefit of the national contribution estimates study by repeating it at regular intervals
2. Working collaboratively toward a nationally consistent approach to collecting, sharing and governance of economic data to support future contributions studies [3]
3. Research to improve cost effectiveness and reliability of existing methods of data collection and analysis (inclusive of survey methods and use of secondary data as a data source and in data matching)
4. Extension strategies to promote the importance and multiple uses of economic data and support for data collection programs amongst industry representatives and members as well as agency staff
5. Networking opportunities for data managers/custodians and researchers to share and progress data governance and collection initiatives collectively.

[3] This could be achieved through publishing a Standard Operating Procedure (SOP) for the collection, storage, ethical management and compliance of survey data with FAIR data principles to maximise its interoperability and assistance to industry at local, regional and national scales.

Appendix Table 16. Workshop participants

Jurisdiction	First Name	Last Name	Organisation	Email
QLD	Tobias	Probst	QDAF	Tobias.Probst@daf.qld.gov.au
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TAS	Sarah	Jennings	FRDC	sarah.jennings@utas.edu.au
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SA	Anders	Magnusson	BDO EconSearch	Anders.Magnusson@bdo.com.au
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COMM	Nigel	Abery	AFMA	Nigel.Abery@afma.gov.au
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NSW	Alistair	McIlgorm	UoW	amcilgor@uow.edu.au

Appendix Table 17. Examples of multiple uses of economic data for estimating contributions

Type of data	Economic contributions indicator	Other metrics/indicators	Other types of economic analysis
Cost of production/ business income	Direct GVA, GDP/GSP (via gross operating surplus), HI and indirect contributions (via expenditure)	Net economic returns/ economic rent Average profit at full equity Gross operating surplus Return on capital Input (effort) quantity/cost indices Output quantity/cost indices Typology of businesses based on vessel/business cost structure	Evaluating management decisions and settings (efficiency and distribution effects). For example: • Cost-benefit analysis of input/output controls • Bioeconomic modelling of harvest strategy settings Analysis and simulation of vessel/fleet behaviour and effort dynamics Economic impact analysis Terms of trade analysis Economic productivity/efficiency analysis Economic performance and context monitoring Financial performance monitoring
Price	Direct GVA, GDP/GSP, HI (via business income) and GVP and value of exports	Net economic returns/ Economic rent Average profit at full equity Gross operating surplus Return on capital Price index	Evaluating management decisions and settings (efficiency and distribution effects). For example: • Cost-benefit analysis of input/output controls • Bioeconomic modelling of harvest strategy settings Analysis and simulation of vessel/fleet behaviour and effort dynamics Economic impact analysis Terms of trade analysis Economic productivity/efficiency analysis Economic performance and context monitoring Financial performance monitoring Demand analysis and price integration Price forecasting
Cost of management	Direct GVA, GDP/GSP and indirect contributions (via expenditure)	Management cost as percentage of GVP	Monitoring of management performance Economic impact analysis
Employment (FTE)	Direct Employment		Economic performance and context monitoring Employment forecasting
Catch/production	GVP	Output quantity index	GVP forecasting Terms of trade analysis
Export volume	Export value		Economic performance and context monitoring Export forecasting

Notes: 1. The required form and frequency of these data types may vary across the different types of economic indicators/metrics and types of analysis. For example, contributions analysis requires only a weighted average price for the year in which an estimate is made, but to detect seasonal relationships demand analysis requires time series monthly price data.

2. Some forms of economic analysis require additional data types. For example, cost-benefit analysis often requires data on non-market values and market prices may need to be adjusted to reflect true social values of inputs and outputs.

3. Confidentiality issues and survey ethics requirements may also restrict the extent that data can be re-purposed expost.

Appendix Table 18.Addressing economic data gaps and improving data governance: factors and options

Data gap	Relevant factors	Options to address
Cost of fishing/ production	*Data collected by surveys:* • Sample bias can be an issue particularly where non- participation is linked to certain types of operations/operators resulting in them being underrepresented • Availability of data collected as part of one-off research projects for subsequent analysis can be limited by research ethics provisions *Data used in data matching (non-survey method):* • Data matching to impute cost of fishing/production may be the only option for many sub-sectors due to the costs of survey methods • Improving data matching and imputation methods is therefore imperative • Currently, acceptability of and trust in data matching is low amongst some industry sectors • Some sub-sectors are more or less "matchable" based on types of fishing or aquaculture operations (e.g. multi gear and multi species fisheries are much harder to match without introducing more error) • Data matching requires good quality	*Data collected by surveys:* • Use of BDO EconSearch's survey template (provided in the Practitioner Guidelines, available via link on FRDC 2017-210 project webpage) by agencies and research organisations will increase availability of data • Establish a single provider of economic data collection through surveys to enhance national consistency and efficiencies *Data used in data matching (non-survey method):* • Formalise data agreements with agencies well in advance of next study to ensure required data on operations and production characteristics can be obtained • Undertake data matching and validation of imputed costs with agencies and industry representatives early in the process in person (i.e. through a series of short workshops) • Further research: o Development of a reliable data matching method for commonly occurring types of small-size fisheries is needed o Testing of the reliability of results from data matching and imputation method against primary data on costs of fishing /production for a small number of sub-sectors o Development of index (adjustment factors) for cost-estimation for sub-sectors based on operation and production characteristics o Explore potential for using logbook information on input use in conjunction with input prices to construct cost of production data as alternative to survey-based data collection

Data gap	Relevant factors	Options to address
	imputation data on operations and production characteristics to reduce matching error • Availability of data on operations and production characteristics can be constrained by data confidentiality protocols	
Price	• Legal issues associated with accessing near real-time finer-scale price data (i.e. confidentiality) need to be overcome • Benefit of having more accurate price data needs to be deemed to outweigh cost of purchasing	• Develop data sharing agreements between agencies and/or FRDC and markets for regular updates of price data • Purchase price data from independent sources (e.g. Nielsen, SFM) • Survey methods to collect price data from fishers/producers to adjust price data from other sources
Cost of management	• Disaggregation of cost of management at the sub-sector level is not supported by some agencies for policy reasons • A number of agencies do not have cost recovery policies, in which case license fees are used as a proxy	• Model and estimate contributions of management costs at whole-of-jurisdictional/aggregated level separately to estimating contributions from fishing or aquaculture activity itself • Audit of management costs (i.e. definitions, inclusions/exclusions) and cost recovery across jurisdictions and sectors to test the validity of continuing to apply license fee costs as a proxy for costs of management for agencies without cost recovery
Employment	• ABS classifications for industries are not well-aligned for fisheries and aquaculture however they are unlikely to change in the near term • Use of 37.5 hours to define an FTE is standard and allows comparability of employment contributions across time and with other sectors	• Develop a method to adjust ABS employment data based on available secondary data on characteristics of work (e.g. trips), basis for wages (e.g. share of catch); seasonality and retention; nationality and visa status; taxation levels; vocational qualifications. • Secondary data sources could include logbooks, ATO data, industry employment programs, registered training organisation data, AMSA data. • Collect employment data directly through industry surveys
Data governance	• Lack of metadata more broadly is a barrier to addressing specific data quality	• Ask the AFMF and Research Provider Network committees charged with implementing data governance principles to provide guidance on any future

Data gap	Relevant factors	Options to address
	and availability issues • Data availability issues are compounded by the lack of coordinated data sharing between agencies, research organisations and other data custodians (e.g. AMSA), and by disputes over data ownership/custodianship	economic data governance initiatives • Approach these committees to discuss automation of data extracts from agencies if the National Economic Contributions study is to be repeated at regular intervals • Develop a common economic data vocabulary to support further estimates