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Australian Fisheries and Aquaculture Industry 2017/18: Economic contributions – Practitioner Guideline

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Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions – Practitioner Guideline FRDC project 2017-210
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ACKNOWLEDGMENTS

These guidelines are based heavily on advice and materials provided throughout the project by BDO EconSearch to the Technical Advisory Group (TAG) and reflect best practice methods and protocols as demonstrated in the *Australian Fisheries and Aquaculture* Industry 2017/18: *Economic Contributions Report* (BDO EconSearch 2019a).

IMAGE CREDITS

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ABBREVIATIONS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ANZSIC	Australian and New Zealand Standard Industrial Classification
BCI	Boat Cash Income
CGE	Computable General Equilibrium
CPI	Consumer Price Index
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FOB	Free on Board
FRDC	Fisheries Research and Development Corporation
FTE	full time equivalent
GDP	gross domestic product
GOS	gross operating surplus
GRP	gross regional product
GSP	gross state product
GVA	gross value added
GVP	gross value of production
HDR	Human Dimensions Research
IE Lab	Industrial Ecology Virtual Laboratory
I-O	input-output
IOPC	input-output product classification
NeCTAR	National eResearch Collaboration Tools and Resources

NSCP	national seafood contributions project
NSW	New South Wales
NT	Northern Territory
PIRSA	Primary Industries and Regions South Australia
RISE	Regional Industry Structure and Employment
ROI	return on investment
SA	South Australia
SA2	statistical area level 2
SIA	Seafood Industry Australia
TBCC	Total Boat Cash Costs
TBCR	Total Boat Cash Returns
VIC	Victoria

1. INTRODUCTION

1.1. Purpose and Scope

The purpose of these Practitioner Guidelines (hereafter referred to as 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. They are therefore written assuming a level of knowledge of economics commensurate with being able to conduct a contributions analysis. The guidelines can be used 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. The guidelines cover:

i. Steps in the estimation process
ii. The use of terminology and language
iii. Data collection and processing
iv. Data and modelling assumptions
v. Preparation of modelling framework
vi. Reporting and interpretation of results.

This document is part of a package of resources that together comprise "a robust and nationally-consistent framework to support data collection and estimation of economic contributions in the future". These resources were produced as part of an FRDC-funded National Fisheries and Aquaculture Industry Contributions Project 2017-210 (referred to as the National Seafood Contributions Project, or NSCP) led by FRDC's Human Dimensions Research (HDR) Subprogram.

Other NSCP outputs that complement the *Practitioner Guidelines* are:

1. *Australian fisheries and aquaculture industry 2017/18: Economic contributions data summary and framework (BDO EconSearch 2019b)*

   Provides a data framework for i) summarising of data availability and sources for data required for direct economic contribution estimation, ii) assessing data gaps, iii) reporting data matching schedules, and iv) identifying jurisdictional data custodians. The current version of the *Data Summary and Framework* document is populated for the 2017/18 financial year and as such serves as a supplement to the *Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimates Report* (BDO EconSearch 2019). Practitioners can use this document as a template for recording and reporting data availability, sources, gaps and assumptions (such as data matching) in other economic contributions evidence studies (including those that update the 2017/18 national economic evidence study), or in economic impact assessments.

2. *Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Estimate Report (BDO EconSearch 2019a)*

   Reports estimates of the economic contribution of the Australian seafood industry to national and state/Territory economies based on best available data. It is a practical demonstration of many of the processes and protocols documented in the *Practitioner Guidelines*, as well as employing the *2017/18 Data Summary and Framework*.

3. *Design Guidelines for FRDC Studies on Social and Economic Contributions of Fisheries and Aquaculture to Wellbeing (FRDC 2017-210 Final Report)*

   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. A useful resource for practitioners estimating economic contributions as part of these broader wellbeing studies.

1.2. Outline of Practitioner Guidelines

The guidelines consist 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).

2. ECONOMIC CONTRIBUTION ANALYSIS

2.1. What is an Economic Contribution Analysis?

An industry economic 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.

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?'. 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. A contribution analysis may provide 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).

The contribution of an economic activity usually extends beyond the initial round of output, income and employment generated by the activity. For example, consider an average fishing business that, in the course of its operation, purchases goods and services from other sectors. These goods and services would include fuel, maintenance and repair services, and, of course, labour. Suppliers and employees, in turn, engage in further expenditure, and so on. These flow-on or indirect effects are part of the contribution of fishing related businesses to the economy. They must be added to the direct effects (which are expenditures made in immediate support of the fishing or downstream business itself) in order to arrive at a measure of the total contribution of fisheries.

2.2. Why Undertake an Economic Contribution Analysis?

Economic contribution analyses are commonly undertaken to assist a particular firm or industry to describe its contribution or importance to national, state and/or regional economies and communities. They provide a snapshot in time of the significance of a firm or industry to the economies and communities in question and provide a baseline data set so the contribution of the industry can be tracked over time.

Economic contribution studies are often well supported by the industry of study as industry members understand the benefits of quantifying the contribution of their industry to the broader community in terms of jobs and regional income. As such, these studies can provide a starting point for ongoing economic data collection.

Although the results of an economic contributions analysis for a fishery, for example, may not provide direct input into fisheries management decision making, the results can provide background and context to fisheries management issues. Further, the data required for a contributions study, particularly cost data, can be very useful for other types of economic analyses, analyses that can have direct input into management decision making, e.g. bio-economic modelling.

A contributions study of the primary production (fishing, aquaculture) and processing sectors will provide a baseline data set that can be extended to include other links in the value chain, e.g. wholesaling, retailing and food service. A narrowly focussed contributions study can be broadened over time as interest and resources allow.

Finally, while an economic contribution analysis can be undertaken as a standalone study, it can also be part of broader contribution studies that includes social considerations (see 'Design Guideline for FRDC Studies on Social and Economic Contributions of Fisheries and Aquaculture to Wellbeing'*, FRDC 2017-210 Final Report Appendix 16)*.

2.3. Contribution vs Impact vs Benefit

The terms 'contribution', 'impact', and 'benefit' are often used interchangeably, particularly in the context of regional economic analysis where decision makers wish to use the results from such analysis to inform policy decisions, to

facilitate industry development or support a particular business strategy. Unfortunately, this creates considerable confusion around how the results of such studies should be interpreted and used.

Economic contribution, economic impact and economic benefit are separate terms for distinctly different types of analysis, all of which can be appropriate to undertake depending on the economic question that needs to be answered. It is therefore important that analysts are careful in describing their terminology and methodology and that there is consistency and uniformity in what constitutes an economic contribution, economic impact and economic benefit study.

It is worth noting that while economic contribution and economic impact are different types of analyses, they are both analyses that track the flow of dollars spent within a region/state/nation. Both economic impact and economic contribution analysis are types of economic activity analysis.

A distinction should be made between the metrics that are used in each type of analysis. Economic contribution and economic impact analyses will use measures of economic activity, typically gross value added, contribution to gross domestic product, and employment. By contrast, economic benefit studies do not have an economic activity focus, but rather are concerned with measures of social welfare. Typical metrics in an economic benefit study, such as a cost benefit analysis, include net present value, benefit cost ratio and internal rate of return.

2.4. Economic Impact Analysis

An economic impact analysis is an appropriate approach where an industry is generating new revenues that would otherwise not occur, keeping revenues in the region that would otherwise be lost, or being subject to changes that result in existing revenues being lost. Economic impacts are defined as the net changes to the economic base of a region that can be attributed to the industry or the component of the industry that would otherwise not be there (Watson et al. 2014).

An economic impact analysis will answer the question 'What is the net change to the economic activity of a national, state and/or regional economy resulting from some stimulus or shock to the economy?' In the seafood industry this stimulus or shock may be in the form of, for example, a change in revenues, technology or management arrangements. The average relationships used in methods such as standard input-output analysis is not relevant to questions about change in the operation of a firm or an industry; marginal analysis is required to answer such questions. Final consumption will depend on the relative output prices, and marginal consumption choices are different to average consumption choices.

Consequently, economic impact analysis will generally require more data than a contribution analysis and may require more sophisticated models, such as an extended input-output model or a properly specified computable general equilibrium (CGE) model, or means to estimate people's likely behaviour in response to the change (Watson et al. 2014).

It is difficult to specify generic steps for an impact analysis as it depends so much on the type of change/shock that is being envisaged. However, the following might be helpful:

a. Measuring the direct impact is generally not something that can be estimated using an economic impact model such as I-O or CGE model, but requires a fishery/sector level analysis that considers the implications for all aspects of the change – at both the boat/farm level (typically not the same for all operators – prices, costs, scale of operation, profitability, asset values, etc.) and at the fishery/industry level (catch/production, number of boats/operators, product prices, asset values (licences, concessions, boats, etc.))

b. Scope of indirect assessment: once the direct impact has been assessed, the indirect impact can be estimated. This requires a decision on the relevant geographic scope of the analysis - local, regional, state, national or some combination of these. If local or regional, what are the boundaries? An appropriate timeframe also needs to be decided upon. This is likely to be determined by the expected timing of the direct impacts. The indicators to measure the indirect impact needs to be decided upon as well (employment, GVA, GRP, household income, etc.)

c. The steps above will help decide the most appropriate method to estimate the indirect impacts. The indirect impacts of a small direct impact on a relatively large economy may be approximated at low cost with a standard I-O model or a hybrid model (such as BDO's RISE model) where some of the restrictive assumptions of the standard model (price response, household behaviour) are relaxed. Estimating the indirect impacts on a larger scale will generally be best done using some type of general equilibrium model (such as the Centre of Policy Studies' (University of Victoria) TERM model).

2.5. Economic Benefit Analysis

While contribution and impact analysis can be described as types of activity analysis, the term economic benefit is associated with a quite separate type of analysis, namely cost benefit analysis. Cost benefit analysis is concerned with overall economic efficiency and measures of social welfare.

A cost benefit analysis will answer the question 'What is the expected net benefit to the society of a nation, state or region resulting from some proposed policy or management settings?' This analysis can provide guidance on the efficient allocation of resources, even where no markets exist to provide this information 'automatically'. Cost-benefit analysis is particularly useful in contexts where there are grounds for mistrusting the signals provided by market prices: for example, where inputs are under-priced relative to economic costs, or where outputs are overpriced. Cost-benefit analysis is also helpful where, without any commercial transactions taking place, proposed changes (or projects) impose costs or benefits on third parties (Department of Finance and Administration 2006).

While it is beyond the scope of these guidelines to discuss the many subtleties and nuances in measuring benefits and costs within a cost benefit analysis, suffice to say that the term 'benefit' should be reserved for welfare and cost benefit analysis and should not be used in studies reporting either contribution or impact analyses.

3. DESIGNING AND SCOPING THE STUDY

Because of the cost of, and potential broad interest in, economic contributions studies, it is important that they are well designed and scoped. To be most effective, it is important that a contributions study first establishes and clearly articulates the **purpose** of undertaking the study, what may be its intended use, and who would be the audience for the findings. This will highlight whether a contributions analysis is the appropriate form of analyses to meet the agreed purpose of the study (see Section 2) and to contain expectations; and if it is, whether a focus solely on economic contributions is adequate or whether there is a need to account for other types of contributions within a more broadly designed contributions study (see 'Design Guideline for FRDC Studies on Social and Economic Contributions of Fisheries and Aquaculture to Wellbeing'*, FRDC 2017-210 Final Report Appendix 16)*.

Intended uses could be for advocacy purposes, demonstrating legitimacy, for engagement, for accountability, improving performance or providing background and context for decision-making.

Various organisations and community groups are potential audiences for the results of a seafood contributions study. They include:

- Businesses and business associations within the seafood industry
- Government and government agencies
- Community groups and members of the local communities where the seafood industry operates
- Seafood industry investors
- Universities and other research institutions.

Scoping the study involves identifying whose contribution is being examined (i.e. what fishery/aquaculture activity?), and who is the activity contributing to. In the case of economic contributions, this is generally to society or communities at a specific geographical scale (i.e. regional, state/territory, or Australian).

The task of scoping the study can be assisted by considering in turn the following questions:

- Which fisheries/aquaculture sectors are the focus?
- Which parts of the value chain are to be included?
- What is the timeframe of the study?
- Which geographical region or regions are to be included?
- What indicators of economic contribution are important?
- What level of accuracy is required?

The answer to all of these scoping questions should be consistent with the purpose of the contributions study (i.e. intended use and audience) and the contributions practitioner may need to provide strong advice and guidance early in the study to ensure this is the case.

3.1. Which Fisheries/Aquaculture Sectors?

It is important, to make it clear in defining the scope of the study which fisheries/aquaculture sectors are included, how they have been defined and to note any exclusions.

The analysis of individual fisheries or aquaculture sectors, if small, can lead to problems accessing data because of issues of confidentiality. Another consideration concerns the definition of a fishery or aquaculture sector. In most jurisdictions licences or permits to fish are defined by a combination of gear type, species and region. If the focus of the study (e.g. a prawn fishery) is not neatly aligned with the administrative definitions and boundaries (e.g. the prawn fishers operate

under multi-species trawl licences), there are likely to be some fishing businesses being only partially involved in the "fishery" that is the focus of the study.

To consider which activities may or may not be included, the Australian and New Zealand Standard Industrial Classification (ANZSIC) provides a useful framework for classifying activities by industry. It is a common basis for the standardised collection, analysis and dissemination of economic data on an industry basis (see Working Paper 3 (BDO EconSearch 2018c) for further explanation of the ANZSIC).

Box 3-1 ANZSIC explained

ANZSIC has a hierarchical structure of four levels as illustrated in Table 3-1. Each 'class', the fourth level of the hierarchy, is generally comprised of a number of activities. For example, Class 0411 (Rock Lobster and Crab Potting) has three primary activities, one of which is 'Rock Lobster Fishing or Potting'.

Table 3-1 Example of the ANZSIC hierarchical structure

Level	Example Code and Description	
Division	A	Agriculture, Forestry and Fishing
Subdivision	04	Fishing , Hunting and Trapping
Group	041	Fishing
Class	0411	Rock Lobster and Crab Potting

Source: ABS (2006)

For the purpose of recording and classifying data, an individual business entity is assigned by the ABS to an industry based on its predominant activity. The term 'business entity' is used in its widest sense to include any organisation undertaking productive activities, including companies, non-profit organisations, government departments and enterprises (ABS 2006).

3.2. Which Parts of the Value Chain?

An important consideration for a seafood contribution analysis is the question of which activities along the value chain to include in the analysis. The economic contribution analysis could include only farming and fishing activities or be extended to include downstream activities. These downstream activities include fish processing, transport, retailing and food service (restaurants, etc.) sectors. As a minimum, it is recommended that the contribution study include the wild catch fisheries and aquaculture activity as defined in Table 3-2. Ideally this would include Fisheries and Aquaculture Support Services as separately defined activities in industry Class 0529, Other Agriculture and Fishing Support Services. As a practical approach, those support services that are paid for/funded by industry should be included and will be identified as an indirect contribution in the same way other inputs are included in the estimation of indirect contribution. Further details of the key activities in each class are listed in Appendix Table 1-1 (aquaculture) and Appendix Table 1-2 (fishing).

Activities further down the value chain are increasingly more difficult to include and the key point is that the study should clearly state which parts of the value chain are included/excluded.

Table 3-2 Wildcatch fisheries and aquaculture activity defined, by ANZSIC classification

Subdivision	Group	Class
02 Aquaculture	020 Aquaculture	0201: Offshore Longline and Rack Aquaculture 0202: Offshore Caged Aquaculture 0203: Onshore Aquaculture
04 Fishing, Hunting and Trapping	041 Fishing	0411: Rock Lobster and Crab Potting 0412: Prawn Fishing 0413: Line Fishing 0414: Fish Trawling, Seining and Netting 0419: Other Fishing
05 Agriculture, Forestry and Fishing Support Services	052 Agriculture and Fishing Support Services	0529 Other Agriculture and Fishing Support Services (part)

Source: ABS (2006)

Processing was included in the NSCP (BDO EconSearch 2019a) and it is recommended that they would also be included in future studies of Australian caught/produced seafood. While this will require some assumptions regarding the attribution of aggregate activity to locally caught/produced seafood, production and import data are available to enable this attribution process. Further, aggregate national industry data are available for industry Class 1120, Seafood Processing (see Table 3-3), which includes wages and salaries, sales and service income, industry value added and employment (see ABS 2019). Further details of the key activities in seafood processing (Class 1120), fish and seafood wholesaling (Class 3604) and fish retailing (part of Class 4121) are listed in Appendix Table 1-3.

It should be noted that while the processing of overseas imports was excluded from the analysis in the NSCP (BDO EconSearch 2019a), the estimated contribution in each jurisdiction included all Australian caught seafood processed in the jurisdiction, not just seafood caught/produced in that jurisdiction.

Downstream activities such as transport, retailing and food service (restaurants, etc.) sectors are harder to estimate, and would require access to scorecard[1] data or a dedicated survey, which can be very resource intensive.

Table 3-3 Aquaculture and fisheries downstream activity

Subdivision	Group	Class
11 Food Manufacturing	112 Seafood Processing	1120 Seafood Processing
36 Grocery, Liquor and Tobacco Product Wholesaling	360 Grocery, Liquor and Tobacco Product Wholesaling	3604 Fish and Seafood Wholesaling

[1] Commonly used to describe an annual series of statistics on the outputs of primary industries and what happens to them along the supply chain that follows, such as the proportion exported, processed locally, retailed into the domestic market etc. (see DPIPWE 2019 and PIRSA 2019 for examples).

Subdivision	Group	Class
41 Food Retailing	412 Specialised Food Retailing	4121 Fresh Meat, Fish and Poultry Retailing (part)
45 Food and Beverage Services	451 Cafes, Restaurants and Takeaway Food Services	4511 Cafes and Restaurants (part)
		4512 Takeaway Food Services (part)
		4513 Catering Services (part)
	452 Pubs, Taverns and Bars	4520 Pubs, Taverns and Bars (part)
	453 Clubs (Hospitality)	4530 Clubs (Hospitality) (part)
46 Road Transport	461 Road Freight Transport	4610 Road Freight Transport
48 Water Transport	481 Water Freight Transport	4810 Water Freight Transport
49 Air and Space Transport	490 Air and Space Transport	4900 Air and Space Transport

Source: ABS (2006)

3.3. What Period is Covered by the Study

There are two aspects of the time dimension of a contributions analysis that need to be considered: the length of time and the reference dates for the study.

Most commonly the length of time is a full year and in Australia that is almost always a financial year. Most fisheries data are available and reported in terms of financial years, and most economic models used for contributions analysis are specified in financial years.

Given that the preferred time period is a financial year, the preferred year is generally the most recent financial year for which key data are available. The required data, however, are invariably available for different time periods. For example, detailed industry employment data will be available from the most recent population and housing census or from the most recent survey conducted in the fishery, but often these will not coincide with the most recent year for which catch, effort and price data are available. Adjustments will need to be made to the data to bring them to a consistent timeframe. Details of the source data and the adjustments made should be documented clearly.

3.4. How is the Region Defined?

The region selected for the study area will reflect the purpose of the contributions study (i.e. intended use and audience) and the availability of data. That said, the size of the study area selected is an important consideration in conducting contribution studies. The size and boundary of the study area will affect the results of an economic contribution (or impact) analysis in two fundamental ways: by affecting the size of the total contribution relative to the direct contribution, i.e. the size of the multiplier, and by affecting the total economic activity associated with the study area, thereby affecting the relative size of the contribution of a given industry.

Multipliers are a function of the structure of the local economy and the size of the multiplier depends directly on the ability of the local economy to retain revenues generated locally within the region. If a study area has a large, broad and diverse local economy it is likely that it will have the ability to recycle these revenues longer as there are more opportunities for households and industries to purchase goods and services from local suppliers. If a local economy is not very broad or diverse, it will not be as likely to have the structural capacity to recycle revenues through the economy. Small regions generally do not have highly diversified economies and must import a great many of their goods and

services. The necessity to import these goods and services represent leakages from the local economy and serve to lower a region's economic multiplier (Watson et al. 2014). It is for these reasons that the economic contribution of a fishery or aquaculture sector at a regional level will sometimes appear relatively small in the context of the local economy. Often, however, the contribution is felt much wider, e.g. elsewhere in the state, and the local economic activity represents only part of the story.

Box 3-4 Example of defining the region for a fishery or aquaculutre sector, South Australia's Mussel Farming industry

In 2017/18 the SA Mussel industry, based in and around Port Lincoln, contributed $5.7m to GRP and 49 fte jobs in the Eyre Peninsula region. At the state level the contribution was almost double, with an estimated $10.7m in GSP and 89 fte jobs. The reason for the difference is two-fold.

First, the "backward linkages" of the mussel sector (i.e. the purchase of materials and services) extend beyond the Eyre Peninsula region. Not only are some direct inputs to mussel farming sourced elsewhere in SA, but some local suppliers to the sector themselves rely on materials and services from outside the region. These out-of-region business transactions extend the contribution of the industry to the broader economy. As well, people working in the mussel sector, and in the businesses of local suppliers, will also purchase goods and services from elsewhere in SA.

Second, the mussel sector has significant "forward linkages" (i.e. transport, processing, wholesaling, retailing and use in restaurants), financial transactions that occur well beyond the borders of the Eyre Peninsula region. The activities of these businesses outside the region add to the economic contribution that can be attributed to the local mussel aquaculture sector. Consideration of the whole value chain, from input suppliers to end users, can tell a story of economic contribution that has significance greater than just the income and jobs generated in the local region.

For this reason, contribution studies that focus on just one link in the value chain, or are limited to a small geographic area, risk reporting much less than the full contribution that the local fishery or aquaculture sector makes to the broader economy.

Source: BDO EconSearch 2020, *The Economic Contribution of Aquaculture in the South Australian State and Regional Economies, 2018/19*, a report to PIRSA Fisheries and Aquaculture, April (Draft).

The NSCP had a multi-regional design, estimating contributions to society at the State, Territory and Australia as a whole level. A systematic, comprehensive sub-state contributions analysis across Australia would be a poor use of research resources given that commercial fishing and aquaculture in some regions (however defined) in some states would generate very little economic activity. This, together with the concern that the results of a contributions study may be influenced by simply changing the area of analysis, provide good reasons not to prescribe or recommend any sub-state regions for future national seafood contributions studies.

3.5. What Indicators of Economic Contribution are Important?

The clear articulation of the purpose of the contributions study will help determine the manner in which the indicators of economic contribution will be used. For example, economic indicators such as contribution to gross value added or gross product may help understand and monitor the relative importance of the seafood industry to a regional economy. More social or socio-economic indicators such as contribution to household income and employment may be important to understand and monitor the contribution of the seafood industry to regional communities. Where a seafood sector is a significant contributor to exports it may be desirable to report seafood exports from a region.

A detailed discussion of recommended indicators is provided in Section 4.

3.6. What Level of Accuracy is Required?

In contrast to the conduct of experiments in the physical sciences, it is often difficult to estimate statistical error within economics, particularly this kind of contributions analysis which is based on many single point observations and data derived from single point estimates. The various sources of error that come into play in the social sciences suggest that the error in economic observations can be substantial.

Nevertheless, a careful and correct specification of the scope of the contribution study will assist achieving a high level of accuracy of contributions estimates. As noted above, the scope of the contributions study can vary in terms of activities analysed (e.g. sectors of the economy, segments of the value chain, years covered) and geographic resolution of the activity's contribution (e.g. census blocks, GIS grid cells, towns, states, regions). The level of detail presented in the specification is an important determinant of the kinds of contribution analysis that can be conducted and the level of accuracy that can achieved. The analyst is responsible for raising questions about correct specification and data sources early in the process to ensure that the analysis is as comprehensive and accurate as possible.

The drive for a thorough, rigorous analysis should be proportional to the importance of the economic activity in question and be balanced against competing objectives such as timeliness of results, and constraints such as available resources and data availability. As a guide, perceived accuracy of studies can be generally ranked as follows:

1. Analysis using primary fishery/sector data for all relevant data inputs and input-output analysis as the method.
2. Analysis using some primary fishery/sector data, imputing some data (such as business cost structures - see Section 5.1.3) from similar studies and using input-output analysis as the method. **The key compromise here is quality of data inputs**.
3. Analysis using some primary fishery/sector data and using downscaling from a higher level study as the method (see Section 7.2). **The key compromises here are quality of data inputs and direct reliance on multipliers** (which has important limitations - see Sections 6.3 and 7.2).

There are of course exceptions to the above ranking. As a guide, the accuracy of any type of analysis also depends on the following data quality considerations:

- *Availability* – Some necessary data may not exist or may be unavailable for the study due to confidentiality constraints. In this case some data may need to be imputed based on similar studies, reducing accuracy.
- *Specificity* – Accuracy will be reduced if the study fisheries/sectors, time period, value-chain disaggregation or region do not match that by which input data are available. Accuracy concerns may exist at some levels of aggregation but not others. For example, there may be serious concerns identified when evaluating contributions of an activity for a small study region using this list of considerations, but minor concerns identified for a State study region.
- *Quality* – Quality issues may exist with the data, reducing accuracy of the study if these data are used. Incorrect data can be provided by respondents to business surveys or administrative forms (e.g. aquaculture production returns and fishing logbooks) due to ambiguous questions or other difficulties collecting data. Low response rates to surveys can lead to biased results and unreliable inferences about the population.
- *Timeliness* – Accuracy of a study to estimate current contributions will be reduced if the input data are made available only after a long delay. Some data may not ever be made available for the period in question. In this case the data may need to be adjusted to the study period (such as applying wage rate and inflation changes between the periods), reducing accuracy.
- *Benchmarks* – Accuracy will be higher if there are reliable benchmarks available to check 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 validating the

relevant intermediate study results against those published estimates will increase the accuracy of all indicators in the final results.

- *Supporting metadata* – Comprehensive metadata should allow the analyst to answer all of the above points relating to data inputs. Lack of supporting metadata comes with a risk of misinterpretation and misuse of the data, reducing accuracy.

4. CONTRIBUTION INDICATORS

The fish stocks that comprise a fishery, from a production perspective, is a common pool of resource and, as such, can be thought of as being owned by the broader community, not just the fishing and aquaculture businesses who have access to the resource. The management of the fishery should therefore be on behalf of this broader community. It can therefore be expected that, while not the primary aim of fisheries management, activity generated by firms having access to these common property resources should be expected to generate some level of contribution to the economic prosperity of the public to whom the resource belongs. Indicators reflecting these broader community values might include:

- Gross value added (GVA)
- Employment (FTE)
- Gross Domestic Product and Gross State Product (GDP/GSP)
- Household income (HI)
- Gross Value of Production (GVP)
- Value of Exports.

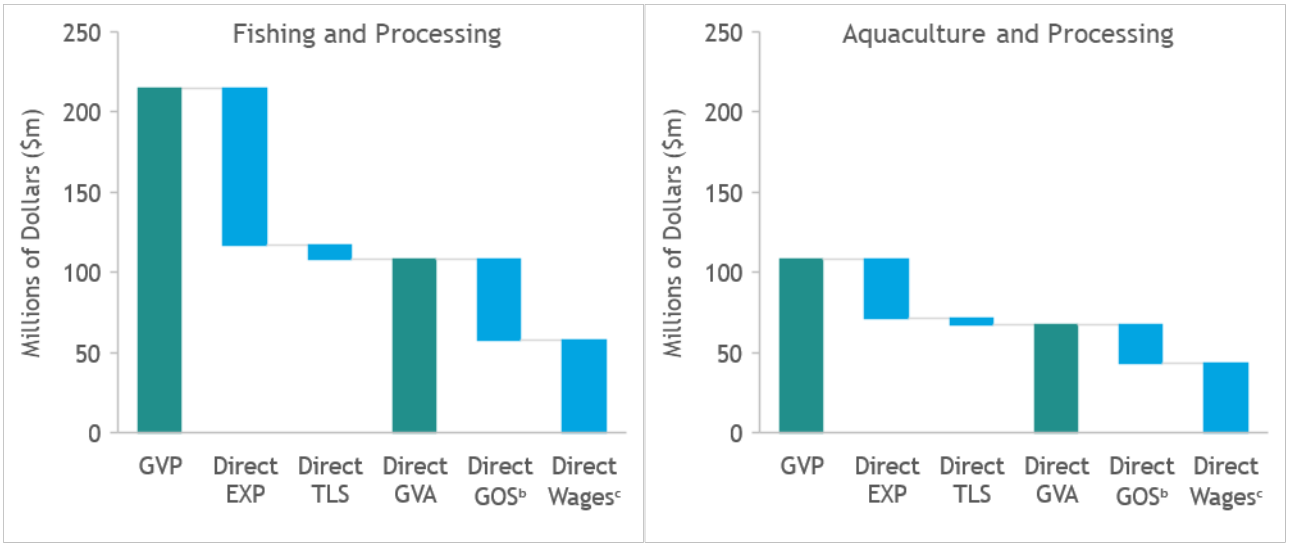
4.1. Gross Value Added

Gross Value Added (GVA) is the output of an industry or sector minus intermediate consumption. GVA represents the value of all goods and services produced, minus the cost of all inputs and raw materials used to produce that good or service. Unlike gross domestic product, GVA does not include the value of taxes minus subsidies.

GVA provides a measure of the net contribution of fishing, aquaculture and processing to the economy, excluding net taxes. In comparison to GDP, GVA is easier to estimate than gross product at an industry level as indirect taxes, which are difficult to allocate, are excluded. The National Accounts, for example, report GVA, but not GDP, at the industry level making this indicator more readily comparable with published statistics.

An example of the calculation of direct GVA drawn from the NSCP (BDO EconSearch 2019a) is shown in Figure 4-1 for NSW fishing and aquaculture sectors. GVA was calculated by subtracting non-wage business expenditure (such as fuel, trade services, professional services and transport services) including taxes less subsidies (EXP and TLS) from GVP. It can also be calculated by summing the wages (including an imputed wage for owner operators) and gross operating surplus (GOS – a measure of business profit before tax) generated by businesses. Figure 4-1 shows these calculations for NSW with fishing and associated processing in the left pane and aquaculture and associated processing in the right pane. In this example, around $109 million of GVP from fishing and associated processing is retained as direct GVA, as is around $68 million of GVP from aquaculture and associated processing.

Figure 4-1 Composition of commercial fishing[a], aquaculture and processing direct GVA and GVP, NSW, 2017/18



[a] State and Commonwealth managed fisheries.

[b] Gross operating surplus – aggregate for fishing and processing of locally caught product.

[c] Wages include an imputed wage for owner operators – aggregate figure for fishing and processing.

Source: BDO EconSearch (2019a, p. 24)

4.2. Employment

A commonly asked question is 'how many people are actually being employed as a result of fishery or aquaculture activity X?'

The employment question is generally in two parts:

- direct employment – this includes jobs directly in fishing and aquaculture operations (i.e. skipper, crew and management) and may be extended along the seafood industry supply chain to include fish processing, transport, retailing and food service (restaurants, etc.) sectors; and
- indirect employment – this is the flow-on or multiplier employment generated in the regions under consideration and represented by jobs in the seafood industry support sectors, e.g. fuel and provision suppliers, fishing gear and equipment manufacturers and retailers, business support services (accountants, lawyers), jobs in the businesses that provide support services and jobs in the businesses where the skipper and crew and others directly engaged in the seafood industry spend their money, e.g. local supermarket, restaurants, hotels, etc.

The only way to collect **accurate** direct employment estimates in the fishing industry is through a survey of fishing concession holders and other businesses in the seafood supply chain. However, a survey is not always possible and use of secondary sources of data may be necessary. Good sources of information include seafood industry scorecard data, where available, and the ABS' Australian Industry data catalogue (Cat. No. 8155.0). These can be supplemented by other published studies.

Employment in a fishing business (and other businesses along the supply chain, if relevant) should include a measure of the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent (fte) jobs[2]. While the total number of jobs may be of interest and can be reported, the number of fte jobs

[2] Full-time equivalence is calculated based on the total hours worked in a standard working week, which is typically 37.5 hours. The key aspect is to apply a consistent measure, so that fte jobs can be compared between studies and over time.

should be calculated or estimated as best as is possible as it will provide a consistent and comparable data series over time.

4.3. Contribution to Gross Domestic Product

Contribution to GDP is a measure of the net contribution of an activity to the national economy (Gross Regional Product (GRP) is the equivalent for a region and Gross State Product (GSP) the equivalent for a state). Using contribution to GDP as a measure of economic contribution avoids the problem of double counting that may arise from using value of output for this purpose. It represents payments to the primary inputs of production (labour, capital and land). Contribution to GDP is commonly measured as value of output less the cost of goods and services (including imports) used in producing the output. It can also be measured as household income plus other value added (gross operating surplus and all taxes, less subsidies).

Like employment, contribution to GDP can be categorised as either direct activity (i.e. contribution to GDP by businesses along the fishing industry value chain) or indirect activity (i.e. contribution to GDP by services to the fishing industry). This also applies to GVA and Household Income.

4.4. Household Income

Household income is a component of GVA and of GDP/GSP/GRP and is a measure of the wages and salaries attributable to the employment contribution of the fishery. It is an estimate of wages and salaries paid in cash and in kind, drawings by owner operators and other payments to labour including overtime payments, employer's superannuation contributions and income tax, but excluding payroll tax.

4.5. Gross Value of Production

GVP is a widely reported measure of the gross value of fishing, aquaculture and processing. GVP refers to the value of the total annual catch for individual fisheries, fishing sectors or the fishing industry as a whole, and is measured in dollar terms. Similarly, for aquaculture sectors GVP refers to the value of total annual production of individual sectors or the aquaculture industry as a whole. GVP, generally reported on an annual basis, is the quantity of catch or production for the year multiplied by the average monthly landed beach prices in the case of fisheries and farm gate prices for the aquaculture industry. GVP is generally reported along with the two components from which it is derived, namely average price and catch or production.

While not generally recommended as a key indicator of economic contribution it is used in the calculation of a number of other economic indicators.

4.6. Exports

Because exports and balance of trade considerations have a direct effect on the macroeconomic performance of any country, detailed reporting of export statistics as part of a contributions study is highly desirable, and should include the following where possible:

- Value (free-on-board (fob)) and quantity

And for contribution studies of particular fisheries/sectors:

- Processed and unprocessed – this may include a distinction between chilled, frozen, cooked, etc.
- Country of destination – tracking the relative size of major markets over time is extremely useful and the value and quantity data can sometimes be reported for each country.

5. DATA REQUIRED FOR DIRECT ECONOMIC CONTRIBUTION ESTIMATION

GVP, direct GVA, employment, household income and GDP/GSP/GRP are estimated from primary data (catch/production, prices, cost of production, licence fees, employment), where available, for individual fisheries/aquaculture sectors. These data are described in Sections 5.1 and 5.2. Where cost of fishing/production data are not available, they can be imputed using the 'matched fishery/aquaculture sector' data with appropriate adjustments. The recommended process for imputing fishery/aquaculture sector data is described further in Section 5.1.3, with a worked example in Appendix 2.

Australian fisheries and aquaculture industry 2017/18: Economic contributions data summary and framework (BDO EconSearch 2019b) describes data used (and data gaps) by fishery and aquaculture sector in the 2017/18 estimates. This provides a useful resource for practitioners collating data for future national and state/Territory-level studies and for other seafood contributions studies.

Once the data required for direct contribution estimation has been collected, it is then possible to estimate the indirect contribution by means of economic modelling. The method of indirect contribution estimation is discussed in Section 7.

5.1. Financial Data for Fishing and Aquaculture

5.1.1. Product prices and income

Product price is an obvious data need for a contribution's analysis and an important determinant in calculating a number of related economic indicators (e.g. gross value of production, value of exports and business profitability).

For wild catch fisheries, the reference price is generally the beach price. This refers to the price received by commercial fishers at the 'port level' for their catch and is usually expressed in terms of $/kg. Processing costs are not included in the beach price, as processing operations are assumed to occur further along the value chain. The use of beach prices also removes the effect of transfer pricing by the firm if it is vertically integrated into the value chain.

Similarly, for the aquaculture sector, the reference price is generally the farm gate price. This refers to the price received by aquaculture operators at the 'farm gate level' for their production and, like commercial fisheries, it excludes processing operations and is usually expressed in terms of $/kg.

Because the indirect measures of economic contribution (i.e. the flow-on or multiplier effects) depend on estimates of expenditures by the fishing and aquaculture businesses, it is important that those expenditures relate to the same activity i.e. those incurred before the wharf/beach or farm gate only.

There are different approaches to measuring income, expenditure and the value of capital used in a fishery and in the approach taken in the preparation of economic indicators by different organisations. The chosen approach should be described along with the results to ensure their correct interpretation. In preparing fisheries financial indicators for major Commonwealth managed fisheries (e.g. Mobsby and Bath 2018) ABARES includes all income, costs and capital associated with the fishing business, including in cases where fishing businesses have operated in a number of fisheries. By contrast for PIRSA managed fisheries BDO EconSearch only considers income from the fishery under consideration, related costs and the share of capital employed in that fishery (see EconSearch 2018a). Both approaches are valid, with the ABARES approach being more appropriate in fisheries where there is significant employment of capital in other fisheries (e.g. the Northern Prawn Fishery, where most businesses operate in other state-based prawn or trawl fisheries). The BDO EconSearch approach is more appropriate where most fishing businesses operate discretely within individual fisheries and where a comparison of financial performance across fisheries is desired. The main consideration is to use the approach that best captures the costs and income for the activity as defined in study scope.

The ABARES financial indicator for enterprise income is *Total Cash Receipts*. Total cash receipts represent returns from the sale of fish, from non-fishing activities, including charter operations, and from other sources (insurance claims and compensation, quota and/or endorsements leased out, government assistance and any other revenue) in the financial year (Skirtun 2014). For consistency, marketing charges may need to be added back into fishing receipts for some boats to give a gross value. Where this is necessary, these selling costs are also added into the cost estimates to offset the new revenue figure. Receipts also include amounts received in the survey year for fish sold in previous years (Skirtun 2014).

The BDO EconSearch financial indicator for income is *Total Boat Income***.** Total boat income refers to the cash receipts for fishing received by an individual firm and is expressed in dollar terms. Total boat income is generally calculated as catch (kg) multiplied by 'beach price' ($/kg). In the case of the charter boat sector, total boat income is calculated as number of clients multiplied by average price ($/person). Total boat income is the contribution of an individual licence holder to the GVP of a fishing sector or fishery.

5.1.2. Business operating costs – survey approach

Detailed business operating costs (fuel, labour, repairs and maintenance, provisions, etc.) are important in calculating the contribution of the fishery to the regional/state/national economy. They are also important for calculating a range of other economic metrics and in various types of economic analysis.

The best practice approach to collecting a comprehensive set of fishing and aquaculture production costs is through a direct survey of fishing and aquaculture businesses. A sample questionnaire for a fishing industry survey is provided in Appendix 3. For commercial fisheries some costs, or at least indicators of the main costs, can be estimated from readily available sources and used as proxies for actual vessel operating costs. Section 5.1.3 overviews two such approaches to cost (and profit) estimation when a survey is not possible.

Fishing industry surveys to collect financial data are conducted regularly by ABARES for Commonwealth managed fisheries and by BDO EconSearch for South Australian managed fisheries. The remainder of this section overviews the different categories of cost data collected in those surveys.

ABARES estimates Total cash costs. Total cash costs include payments made for both permanent and casual hired labour and payments for materials and services (including payments on capital items subject to leasing, rent, interest, licence fees and repairs and maintenance). Capital and household expenditures are excluded (Skirtun 2014).

Labour costs are often the highest cash cost in the fishing operation. Labour costs include wages and an estimated value for owner/partner, family and unpaid labour. Labour costs cover the cost of labour involved in boat-related aspects of the fishing business, such as crew or onshore administration costs, but do not cover the cost of onshore labour involved in processing fisheries products. On many boats, the costs of labour are reflected in the wages paid by boat owners and/or in the share of the catch they earn. However, in some cases, such as where owner–skippers are involved, or where family members work in the fishing operation, the payments made can be low or even nil, which will not always reflect the market value (opportunity cost) of the labour provided. To allow for this possible underestimation, all owner/partner and family labour costs are based on estimates collected at the interview of what it would cost to employ someone else to do the work (Skirtun 2014).

BDO EconSearch's approach in terms of cost items under consideration is the same, however the costs are split into variable and fixed costs.

Total Boat Variable Costs are costs which are dependent upon the level of catch or, more commonly, the amount of time spent fishing. As catch or fishing time increases, variable costs also increase. Variable costs are measured in current dollar terms and include the following individual cost items:

- fuel, oil and grease for the boat (net of diesel fuel rebate)
- bait

- ice
- provisions
- crew payments
- fishing equipment, purchase and repairs (nets, pots, lines, etc.)
- repairs & maintenance: ongoing (slipping, painting, overhaul motor).

Total Boat Fixed Costs are costs that remain fixed regardless of the level of catch or the amount of time spent fishing. As such these costs, measured in current dollar terms, are likely to remain relatively constant from one year to the next. Examples of fixed cost include:

- insurance
- licence and industry fees
- office & business administration (communication, stationery, accountancy fees)
- interest on loan repayments and overdraft
- leasing.

Total Boat Cash Costs are defined as *Total Boat Variable Costs* plus *Total Boat Fixed Costs*.

Like the ABARES method, the BDO EconSearch approach estimates a value for *Owner-operator* and *Unpaid Family Labour*. This imputed labour cost can be included simply as another cost so that Gross Operating Surplus (GOS) takes account of this cost.

5.1.3. Business operating costs – non-survey approach

For the majority of fisheries in most jurisdictions, catch, price and revenue information is readily available[3]. However, information on the costs of fishing is often difficult to obtain without a dedicated and customised survey. Fishers are often reluctant to participate in voluntary surveys to provide detailed information on their individual financial situation (Pascoe 2008) and in any case a representative fisher survey for all fisheries of interest is often beyond the scope of economic studies, including contributions studies.

As noted in Section 5.1.2, an alternative to a licence holder survey is to impute cost data. Two examples of such imputation are:

- a method developed by Zhou et al. (2013) in their Fisheries Research and Development Corporation report: *Quantitatively defining biological and economic reference points in data poor fisheries*. This method utilises econometrically estimated equations developed using ABARES and BDO EconSearch data; and
- a method developed to support the analysis of the NSW commercial fisheries reform package (AgEconPlus Consulting et al. 2015). Under this method, operating expenditure for an average active fishing business in each fishery was imputed by aligning cost data extracted from economic indicator studies undertaken by BDO EconSearch in South Australia to relevant NSW share class fisheries, with appropriate adjustments for days fished and other comparable information.

Zhou et al. (2013) used economic data from a wide range of fisheries (both Commonwealth and South Australian) to derive simple relationship between the costs of fishing and the type of fishing activity. The key cost components that were modelled were variable costs (separated into fuel and oil, crew, freight and marketing and other variable costs), quasi-fixed costs (including repairs and maintenance), fixed costs and capital and depreciation costs. Estimates of most

[3] *Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Data Summary and Framework* (BDO EconSearch 2019b) provides more detail on the quality and availability of fisheries and aquaculture data by jurisdiction.

cost components can be imputed based on average size of vessels, their main fishing gear[4], the number days fished and the type of management under which vessels operate.

As noted above, catch and revenue estimates are available for most fisheries, however cost data imputed from Zhou et al. (2013) is on a vessel or business basis which may be utilised in other fisheries. Consequently, to estimate costs for an average vessel or fishing business in a particular fishery, fixed costs, depreciation and value of capital can be apportioned based on the days the vessel spent in the subject fishery compared to the total number of days fishing[5].

The second approach (AgEconPlus et al 2015) involved aligning cost data extracted from the SA survey-based economic indicator studies undertaken by BDO EconSearch to the relevant NSW fisheries, with appropriate adjustments for days fished and other comparable information. Each of the NSW fisheries was "matched" to a SA fishery with similar characteristics for which detailed fishing costs were known.

The data matching approach can be described in three general steps:

1. **Compile a set of matching data:** A range of data that are known in both the 'source' and 'target' fisheries. As a minimum these should include:
    - catch
    - gross value of production
    - number of active vessels
    - average days fished per vessel or other measure(s) of fishing effort
    - share of days in the fishery, i.e. days fished in fishery as a proportion of total days fished
    - average vessel length.
2. **Calculate a set of adjustment coefficients:** A range of coefficient are calculated using the above data that are known in both the 'source' and 'target' fisheries, as well as itemised cost data in the source fishery (examples are listed in Step iii below). With matching data for the source and target fisheries and cost data for the source fishery, a set of adjustment coefficients can be calculated. These might include, for example:
    - $(\text{Average days fished})_{AC} = (\text{No. days fished per vessel})_{TF}/(\text{No. days fished per vessel})_{SF}$
    - $(\text{Average boat length})_{AC} = (\text{Average vessel length})_{TF}/(\text{ Average vessel length})_{SF}$
    - $(\text{Crew share of revenue})_{AC} = (\text{Crew costs})_{SF}/(\text{GVP})_{SF}$
    - $(\text{Freight share of revenue})_{AC} = (\text{Freight costs})_{SF}/(\text{GVP})_{SF}$
3. **Apply adjustment coefficients to source fishery data:** The above adjustment coefficients are applied to a set of source fishery fixed and variable cost data. The target fishery cost data can be estimated at the same level of detail as data are available for the source fishery. Examples of individual cost item estimation using relevant data are provided below:
    - $(\text{Fuel costs})_{TF}$ = $(\text{No. active vessels})_{TF} * (\text{Share of days in fishery})_{TF} * (\text{Average days fished})_{AC} * (\text{Average boat length})_{AC} * (\text{Fuel cost})_{SF}$
    - $(\text{Crew costs})_{TF}$ = $(\text{GVP})_{TF} * (\text{Crew share of revenue})_{AC}$
    - $(\text{Freight costs})_{TF}$ = $(\text{GVP})_{TF} * (\text{Freight share of revenue})_{AC}$

4 Most fishers use multiple types of fishing gear and there is heterogeneity across fishers. However, application of the CSIRO model required selection of the main fishing gear or approach.

5 Of course this depends upon accurate reporting of days fished in each of the fisheries in which the vessel/business operates.

- (Oth vble costs)$_{TF}$ = (No. active vessels)$_{TF}$ * (Share of days in fishery)$_{TF}$ * (Average days fished)$_{AC}$ * (Average boat length)$_{AC}$ * (Other variable costs)$_{SF}$
- (R&M costs)$_{TF}$ = (No. active vessels)$_{TF}$ * (Share of days in fishery)$_{TF}$ * (Average boat length)$_{AC}$ * (Repairs & maintenance costs)$_{SF}$
- (Other fixed costs)$_{TF}$ = (No. active vessels)$_{TF}$ * (Share of days in fishery)$_{TF}$ * (Average boat length)$_{AC}$ * (Other fixed cost)$_{SF}$

A worked example of matching cost data from a source fishery to a target fishery is provided in Appendix 2.

For aquaculture sectors, the minimum requirements of matching data are not as great as for fisheries. The production systems should be as similar as possible and the matching data should include, as a minimum: production, GVP, number of production units (ponds, tanks, baskets, lines, etc.), average production unit size or capacity, and percentage utilisation (number of days utilised per year (if seasonal) or proportion of capacity utilised). As with fisheries, detailed operating cost items in the source aquaculture sector are required to impute the corresponding cost items in the target sector.

5.1.4. Business profit

Estimating business profitability is critical in any contributions study as it comprises an important component of an industry's direct contribution to gross value added (and gross domestic product). In general terms, gross value added can be measured for an individual industry, or a firm within that industry, as gross operating surplus plus wages, salaries and supplements (see Section 4.1). For this reason gross operating surplus is the relevant measure of profitability in a contributions study.

Gross Operating Surplus (GOS) is defined as *Gross Income* less *Total Cash Costs* and is expressed in current dollar terms. GOS may be used interchangeably with the term *Gross Boat Profit*. Whether a survey based (Section 5.1.2) or non-survey based (Section (5.1.3) approach to estimating total cash costs is used, it is possible to estimate GOS and with an estimate of wages and salaries, calculate direct gross value added. This approach applies equally to fisheries and aquaculture sectors.

5.2. Industry Level Data

Other data required to compile the direct contribution of the fishery/aquaculture sector.

5.2.1. Catch/production and prices

Gross value of production (GVP) refers to the value of the total annual catch for individual fisheries, fishing sectors or the fishing industry as a whole, and is measured in dollar terms. Similarly, for aquaculture sectors GVP refers to the value of total annual production of individual sectors or the aquaculture industry as a whole. GVP, generally reported on an annual basis, is the quantity of catch or production for the year multiplied by the average monthly landed beach prices in the case of fisheries and farm gate prices for the aquaculture industry. GVP is generally reported with the two components from which it is derived, namely average price and catch.

Fishery catch and aquaculture sector production data by individual fishery/aquaculture sector can generally be sourced from agency level data custodians in each jurisdiction and, in some instances, are available from published sources. Sourcing price data is discussed above (Section 5.1.1).

5.2.2. Employment data

As with catch and production data, employment (fte and total) by an individual fishery/aquaculture sector can, in some instances, be sourced from agency level data custodians in each jurisdiction and are otherwise available from published sources.

In many fishing businesses there is a component of labour that does not draw a direct wage or salary from the business. This will generally include owner/operator labour and often also include some unpaid family labour. The value of this labour needs to be accounted for which involves imputing a labour cost based on the amount of time and equivalent wages rate. Because of the importance of seasonal and part-time nature of employment in many fisheries and aquaculture sectors, a survey fishing/aquaculture businesses is often the most reliable way to estimate job numbers.

As with the estimation of costs, the number of jobs can be estimated using non-survey methods such as the fishery matching approach discussed in Section 5.1.3. Because employment in most fishing and aquaculture business will involve a fixed and variable component, the estimation process will involve two parts. The fixed component may be aligned to the number of fishing/aquaculture businesses whereas the variable component will be best aligned to catch/production or, in the case of some fisheries, a measure of effort, such as days fished or number of pot lifts.

5.2.3. Cost of management

Management costs associated with a jurisdiction's fisheries and aquaculture sectors are a significant component of the economic activity of these sectors and should be included in an economic contribution study. An objective of many jurisdictions is to achieve recovery of the costs of the agency or authority responsible for the management of the jurisdiction's fisheries and aquaculture leases. Because the management of the resource benefits the resource users, a strong argument can be made that the users should contribute to the cost of management. This is consistent with the principles and intent of the Australian Government Cost Recovery Policy (Department of Finance 2014).

In both commercial fisheries and aquaculture sectors, management services will generally include biological monitoring and reporting; policy, regulation and legislation development; compliance and enforcement services; licensing services; and research. Where a commercial fishery or aquaculture sector operates under full cost recovery, licence fees will be set to cover the cost of managing the fishery/aquaculture sector or at least the commercial sector's share of the resource.

In fisheries and aquaculture sectors where there is full cost recovery, it can be assumed that the cost of providing these management services to the commercial sector will be equal to the gross receipts from licence fees in the fishery/aquaculture sector.

In fisheries without full cost recovery it is appropriate to estimate both the recovered management costs (i.e. licence fees and other recovered costs) and non-recovered management costs and to present these in terms of total management costs (i.e. recovered management costs plus non-recovered management costs).

Whether management costs are recovered through licence fees wholly, partially or not at all, it is important that the total management costs be captured in an economic contribution study as they can comprise an important part of the economic activity associated with a commercial fishery or aquaculture sector. In South Australia, for example, where there is a policy of full cost recovery, fishery management costs ranged between 2.7 (Spencer Gulf Prawn fishery) and 11.0 per cent (Marine Scalefish fishery) of GVP in 2016/17, with an average of 4.8 per cent across all commercial fisheries.

5.2.4. Export data

In fisheries and aquaculture sectors where export markets are important, the compilation and reporting of export data can comprise a useful component of a contributions study. Export data can be drawn from a customised report from the ABS for International Merchandise Trade, 2017-18 (ABS 2019c). A request can be made to the ABS specifying the Australian Harmonised Export Commodity Classification Codes (AHECC) for seafood products. The AHECC requested are listed in Appendix 3 of BDO EconSearch (2019a). The fields (per code) would provide sufficient data for a comprehensive overview of fishery or aquaculture sector's export performance:

- Reference period (e.g. 2017/18)

- Country of destination
- State of origin
- Quantity (kg)
- Value (FOB).

5.3. Processing Data

Processors often source seafood inputs from more than one jurisdiction within Australia and from overseas. In the 2017/18 national study, due to data limitations and time/resource constraints, a 'top down' approach, using the MRIO model, *ABS Australian Industry* (ABS 2019b) and *ABS National Accounts Input-Output Tables* (ABS 2019d) data, was undertaken to estimate the GVP, cost of production and direct employment for the processing sector in each State/Territory. This approach would be inappropriate for a regional study as the sources of inputs to the processing sector may vary widely between regions (see Section 6.4.3). At the regional level a 'bottom up' approach would generally be more appropriate necessitating the collection of some primary data or the development of a processing sector scorecard.

In the NSCP (BDO EconSearch 2019a) processing GVP in each jurisdiction was estimated as follows:

1. *Estimate total GVP in the processing sector in each State/Territory*: The total value of output produced by the seafood processing sector for each State/Territory was sourced from the ABS publication *Australian Industry* (ABS 2019b). These estimates included the value of processing both local seafood inputs (i.e. seafood fished/produced in Australia) and imported seafood inputs.
2. *Estimate the proportion of local seafood inputs to total seafood inputs*: To exclude the activity in the processing sector from imported seafood inputs, the proportion of local seafood inputs to total seafood inputs was estimated. This was calculated from the ABS *National Accounts Input-Output Tables* (ABS 2019d) as the value of purchases by the processing sector from the Australian aquaculture and fishing sectors excluding imports[6] divided by the value of purchases by the processing sector from Australian aquaculture and fishing sectors including imported seafood[7], estimated to be 92 per cent.
3. *Estimate processing GVP resulting from the processing of local seafood*: Processing GVP of Australian sourced seafood inputs was then calculated by multiplying the GVP of the seafood processing sector by the proportion of Australian sourced seafood inputs (Step 2). This calculation implies that the processing of imported seafood inputs creates similar value, on a per unit basis, as the processing of Australian sourced seafood inputs.

Cost of production for processing in each State/Territory was derived from the transactions data of the MRIO model (i.e. purchases by the seafood processing sector) adjusted by proportion of local seafood inputs to total seafood inputs (i.e. 92 per cent local seafood inputs). The employment profiles for the seafood processing sectors for each State/Territory within the MRIO were, likewise, adjusted by proportion of local seafood inputs to total seafood inputs to give direct employment estimates.

It should be noted that while the processing of overseas imports was excluded from the analysis, the estimated contribution in each jurisdiction included all Australian caught seafood processed in the jurisdiction, not just seafood caught/produced in that jurisdiction.

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[6] Estimates sourced from Table 5 (Industry by Industry Flow Table (Direct Allocation of Imports)) of the ABS Australian National Accounts: Input-Output Tables, 2016-17, ABS Cat. No. 5209.0.

[7] Estimates sourced from Table 8 (Industry by Industry Flow Table (Indirect Allocation of Imports)) of the ABS Australian National Accounts: Input-Output Tables, 2016-17, ABS Cat. No. 5209.0.

6. MODELLING FRAMEWORK FOR ESTIMATION OF INDIRECT CONTRIBUTION

This section provides a discussion of the key modelling framework 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.

6.1. Economic Modelling Framework

It is recommended that the I-O modelling framework be adopted, given the widespread use of the approach for economic contribution analysis, particularly in fishing and aquaculture contribution studies[8].

I-O models capture the direct and indirect effects of expenditure by capturing, for each industry, the industries it purchases inputs from as well as the industries it sells its product to. In a given region, the I-O model will capture purchases from and sales to industries located in the region, as well as imports from outside the region.

I-O models do have limitations for economic analysis. One of the key limitations of a conventional input-output model is its lack of flexibility to consider different scenarios of market response and regional adjustment for impact analysis (Box 6-1).

Box 6-1 Limitations of Standard I-O models

Inter-industry models, such as the I-O model, are based on the premise that it is possible to divide all productive activities in an economy into sectors or industries whose inter-relations can be meaningfully expressed as a set of equations. The crucial assumption in the I-O model is that the money value of goods and services delivered by an industry to other producing sectors is a linear and homogeneous function of the output level of the purchasing industry with supply being infinitely elastic.

This linearity assumption implies a strict proportional relationship between input coefficients and output. For example, income coefficients are average propensities and employment coefficients reflect average labour productivity rates. In impact studies, this property can lead to an overestimation of the flow-on (multiplier) effects, particularly if the direct effects are relatively small. For example, many industries can increase output in the short-term without corresponding proportional increases in wage costs and employment, particularly if there is slack capacity.

As noted in Section 2, a contribution analysis is different from an impact analysis and will focus on actual regional/state/national data and the current linkages that exist within the economy. In these circumstances it is appropriate to use a modelling framework such as the standard I-O model. The purpose of the analysis is to determine how much economic activity is associated with the industry. By contrast, an economic impact analysis will generally require more data than a contribution analysis and may require more sophisticated models, such as an extended input-output model or a properly specified CGE model.

Given the limitations of a standard I-O model for economic impact analysis, an extended I-O model was used for the NSCP that enables relaxation of some of the more restrictive assumptions of the standard I-O model. This enables the framework to be used for impact analysis at a later date if required.

[8] As part of the NSCP, a review of recent contributions reports for fisheries and aquaculture sectors across Australia and internationally was undertaken. Of the approximately 86 analyses reviewed, 30 reported only direct contribution with the remaining 56 reporting the indirect or flow-on contribution. Of these 56 reports, 53 used I-O models, one used a CGE model and two did not specify the modelling framework.

Further, the modelling framework should be prepared in a consistent format and with common, or at least consistent, protocols at national, state and regional levels, such as the Industrial Ecology Virtual Laboratory (IE Lab) framework discussed in Box 6-2 below. This way, I-O models can be prepared for later impact analyses at any regional scale that are consistent with those used for the NSCP.

Box 6-2 The Industrial Ecology Virtual Laboratory Framework

The IE Lab framework was developed in conjunction with the National eResearch Collaboration Tools and Resources (NeCTAR) initiative, under the lead of the University of New South Wales.

IE Lab is a streamlined approach to database construction for high resolution I-O tables. IE Lab's maximum resolution encompasses all regions in Australia at the Statistical Area 2 (SA2) level and all product classifications as defined by the I-O Product Classification (IOPC).

IE Lab is a collaborative platform for multi-region input-output modelling and research. It is flexible and scalable and designed to process and analyse economic, environmental and social data from any sector or region. The IE Lab process was used in the first stage of developing the multi-region RISE model that was used for national seafood economic contribution analysis.

https://ielab.info/

Most regional input-output models used for this type of analysis will have been developed using some form of regionalisation procedures involving the application of location quotients (either employment or output based) to the national input-output table prepared by the ABS. For this reason, regional models for the same time period and same spatial definition should have a similar structure and therefore generate similar results in an industry contributions analysis.

Potential modelling errors (differences between approaches) are more likely to arise in the compilation of the industry data (procedures outlined in Section 5) and in the processes to adjust the data, cost data in particular, to be consistent with the accounting conventions of the I-O model. Step 11 of the Contribution Estimation Process (Section 7), details the key steps in the treatment of industry cost structures for modification/adjustment consistent with the I-O tables.

6.2. Components of Economic Contribution

It is recommended that, as a minimum, the reporting of the components of economic contribution include the following:

- Direct contribution (as discussed in Section 6)
- Flow-on (or indirect) contribution, comprised of:
  - Production-induced contribution
  - Consumption-induced contribution
- Total contribution.

Direct contribution is the initial round of value added, employment and household income generated by an economic activity, e.g. seafood processing, oyster production.

Flow-on (or indirect) contribution is the sum of production-induced contribution and consumption-induced contribution.

- **Production-induced contribution** is additional value added, employment and household income resulting from re-spending by firms (e.g. transport contractors) that receive payments from the sale of services to firms undertaking, for example, oyster production.
- **Consumption-induced contribution** is additional value added, employment and household income 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 contributions.

While it may not be necessary to disaggregate the production-induced and consumption-induced components of the indirect contribution, it does provide some high-level insight into the source of the contribution, whether it is predominantly business-to-business transactions (production-induced), household to business transactions (consumption-induced) or an even mix of the two.

6.3. Derivation, Interpretation and Limitation of Multipliers

6.3.1. A caution about multipliers

Input-output modelling, as described in these guidelines, is often confused with a related but heavily simplified approach commonly called 'multiplier analysis'. This involves multiplying some direct economic activity by a number greater than one (a 'multiplier') to estimate total economic activity. It is an inappropriate use of multipliers that commonly leads to overestimation of economic contributions as it ignores important nuance in the regional economy (described below) and in how business expenditures change with a change in business activity (it conflates average and marginal effects). For these reasons, such simple application for contributions or impact analysis is strongly advised against. Nonetheless, this approach is sometimes used by analysts as its simplicity can seem misleadingly intuitive. While, multipliers are implicit in input-output tables and are essentially what drives the estimation of indirect economic contribution, the appropriate method of estimation is more involved than this heavily simplified approach.

6.3.2. Derivation and interpretation of multipliers

Input-output analysis, as an accounting system of inter-industry transactions, is based on the notion that no industry exists in isolation. This assumes, within any economy, each firm depends on the existence of other firms to purchase inputs from, or sell products to, for further processing. The firms also depend on final consumers of the product and labour inputs to production. An I-O transactions table is a convenient way to illustrate the purchases and sales of goods and services taking place in an economy at a given point in time.

The transactions table can be used to describe some of the important features of a national, state or regional economy, the interrelationships between sectors and the relative importance of the individual sectors. It allows the estimation of economic contribution through implied 'multiplier effects' at the sector level. These implied multipliers can also be calculated directly from the I-O transactions table.

A multiplier is an index (ratio) indicating the total contribution from all sectors that is required to satisfy a level of activity in a particular sector(s), in this case the fishing and aquaculture sectors. A multiplier indicates the strength of the linkages between the sector of interest and the rest of the economy.

Multipliers can be calculated for each economic indicator (gross value added, household income and employment). Multipliers are derived from the different components of economic contribution, described generally in Section 6.2 above and elaborated on below:

(i) The direct (or initial) contribution: refers to the effect of dollar level of sales associated with the activity (GVP in the case of a fishery or aquaculture sector). This is the unity base of the multiplier calculation. Associated directly with this dollar of output (GVP) is own-sector (direct) household income (wages and salaries for employed skippers, crew, staff; drawings by owner operators etc.) used in the production of that dollar of GVP. Household

income, together with other value added (gross operating surplus for the fishing/aquaculture business), provide the total contribution to gross value added from the production of that dollar of output. Associated also will be own-sector employment (skipper, crew, aquaculture enterprise managers and staff, etc.).

(ii) The first-round contribution: refers to the effect of the first round of expenditures by the fishery/aquaculture sector. In the sectors where this expenditure occurs (fuel, provisions, repairs and maintenance, insurance, finance, etc.) there will (first-round) household income effects and, similarly, first-round gross value added and employment effects.

(iii) Industrial-support contribution: this term is applied to 'second and subsequent round' effects as successive waves of activity occur in the economy to provide industrial support, as a response to the original dollar of output. The industrial support household income, gross value added and employment are similarly defined.

The first-round and industrial-support contributions are the result of business to business transactions and together are termed the production-induced contribution.

(iv) Consumption-induced contribution: is defined as that induced by the household income associated with the original (direct) dollar stimulus in sales (GVP).

(v) Indirect (flow-on) contribution: is calculated as total contribution less the initial contribution.

Multipliers are calculated on a 'per unit of initial effect' basis (i.e. responses to one dollar of output). Household income, gross value added and employment multipliers, as described above, refer to the household income per initial unit of output, gross value added per initial unit of output and employment per initial unit of output. These multipliers are conventionally converted to ratios, expressing a 'per unit' measurement, and described as Type I and Type II multipliers (the difference being the inclusion or otherwise of consumption-induced effects). For example, with respect to employment:

Type I employment multiplier = [direct + first round + industrial support]/direct

and

Type II employment multiplier = [direct + production induced[9] + consumption induced]/direct

6.4. Attribution of Economic Activity to Jurisdictions/Regions

The method of attributing economic activity to jurisdictions and regions will vary for 1) state managed fishing and aquaculture; 2) Commonwealth managed fishing; and 3) processing operations. The following attribution methods are recommended.

6.4.1. State managed fishing and aquaculture

Catch/production, GVP and effort are assumed to occur within the managing state/territory. In the case of a regional analysis, it is recommended to assume that business activity occurs where the product is landed/produced (unless there is information that suggests otherwise). In the regional case, management activity may need to be assumed to occur partly where product is landed/produced (such as monitoring, enforcement and data collection) and partly at the 'head office' that manages the relevant jurisdiction, this may mean treating some management costs as 'imports' is they occur outside of the region.

6.4.2. Commonwealth managed fishing

Catch, GVP and effort are attributed to jurisdictions based on each fishery's primary landing port(s), as reported in the latest ABARES Fishery Status Reports. This attribution is straightforward where the fishery has primary landing ports in

[9] Where (first round + industrial support) = production induced.

one jurisdiction. However, many Commonwealth managed fisheries have more than one jurisdiction with a primary landing port, and further data manipulation is required to allocate production and GVP to the relevant jurisdictions. The ABARES *Australian Fisheries and Aquaculture Statistics* report provides production and GVP by major fish groups (across all sectors) by jurisdiction:

- By location of catch and production (Table S6 in the most recent publication, Mobsby 2018). This table provides fishery/aquaculture production by state, which includes catch occurring outside of a jurisdiction but landed within its boundaries.
- By state (Table S5 in the most recent publication, Mobsby 2018). This table provides fishery and aquaculture data by location of catch/production, i.e. states/territories and the Commonwealth.

The difference between these two estimates, for each species group by state, can be used to identify the Commonwealth component of production and GVP for these species. There may be other individual Commonwealth fishery studies that may be used to provide more granular data than the ABARES *Australian Fisheries and Aquaculture Statistics* report. For example, catch landed outside the nominated jurisdictions in the NSCP were excluded, e.g. Torres Strait Tropical Rock Lobster fishery catch landed at Daru in PNG. A regional study may take the same approach as for state managed fisheries of assuming fishery activity occurs where the product is landed, however, no publication was identified in the NSCP that described this level of detail for Commonwealth managed fisheries.

6.4.3. Processing

Processors often source seafood inputs from more than one jurisdiction within Australia and from overseas. Where seafood scorecard data (see Section 3.3) are available for processing, these data can be used. Ideally, a survey of processors to better attribute processing activity between imported and locally sourced seafood (where scorecard data is not sufficient) should be undertaken. When these more 'bottom up' approaches are not feasible using transactions data in an I-O model (i.e. a 'top down' approach) is the next best alternative though this is only appropriate at the state/territory and national scales. Bottom up approaches (scorecard data or business surveys) are more appropriate for regional analysis as the differences in source of inputs for processors can vary widely from region to region. The top-down I-O model transactions data approach is described in detail in Section 5.3, including the following steps:

1. Estimate total GVP in the processing sector in each State/Territory.
2. Estimate the proportion of local seafood inputs to total seafood inputs.
3. Estimate processing GVP resulting from the processing of local seafood.

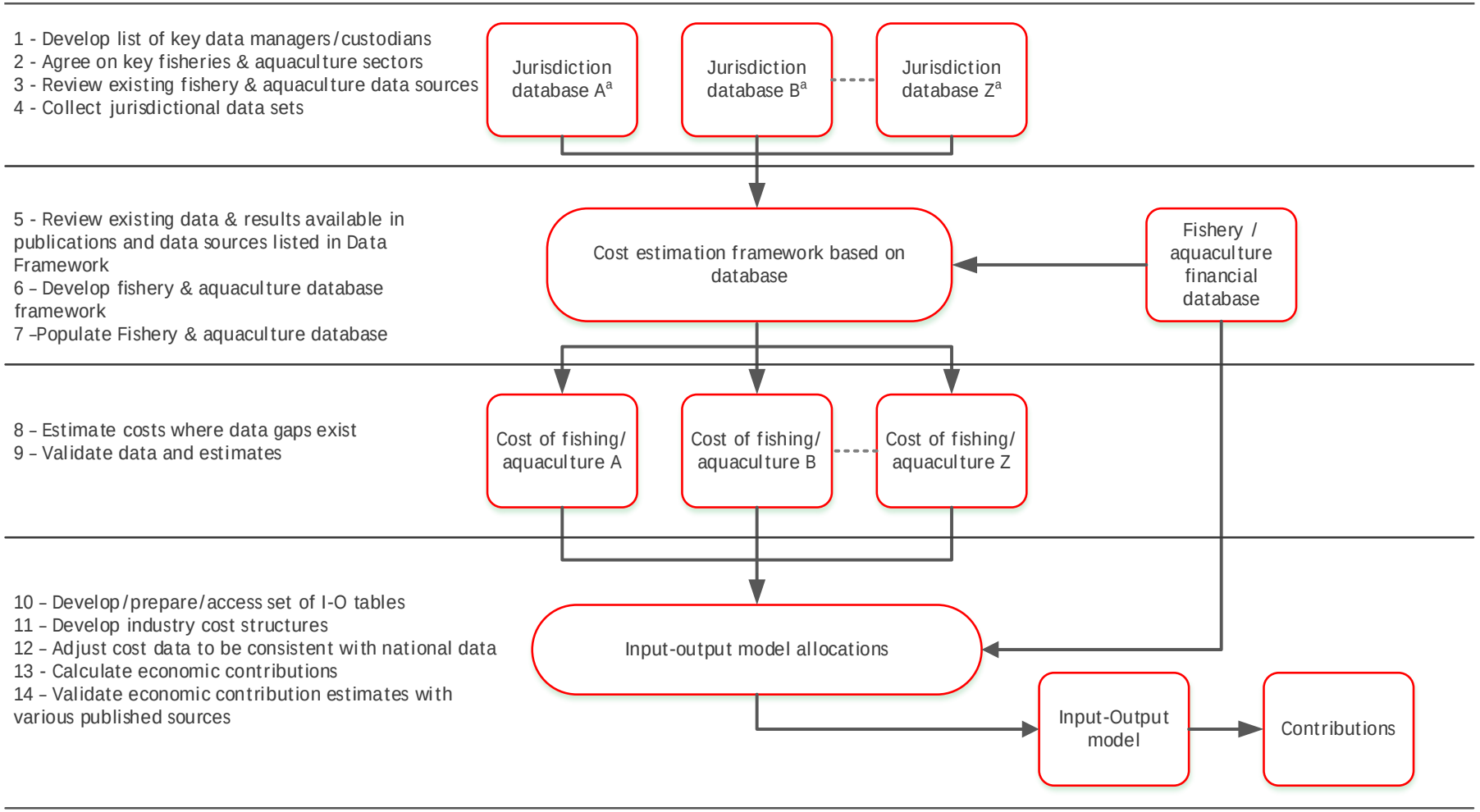
7. CONTRIBUTION ESTIMATION PROCESS

7.1. General Approach

This section summarises the approach used for estimating economic contributions in the NSCP. The process for estimating economic contributions is illustrated in Figure 7-1 and is consistent with the steps described in BDO EconSearch's *Recommendations about the Preferred Research Design for the National Contributions Study: Working Paper 3* (2018c) and a readily adapted to conducting contributions studies with other design and scope features (Section 3). In keeping with WP3, the main steps are:

1. Develop/update the list of key data managers/custodians in each of the relevant jurisdictions. *Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions 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. *Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Data Summary and Framework* (BDO EconSearch 2019b) 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 (completion of this step produces a database for each jurisdiction, as shown in Figure 7-1).
5. Review existing data and results available in the publications and data sources listed in *Australian Fisheries and Aquaculture Industry 2017/18: Economic Contributions Data Summary and Framework* (BDO EconSearch 2019b) and through additional research/consultation.
6. Develop a database framework on a regional/jurisdictional basis (shown as the "Cost estimation framework" in Figure 7-1 and through example in Appendix 5) 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, CPI in relevant jurisdiction, wage price index
    g. Export data
    h. Employment data.

Figure 7-1 Illustration of estimation approch



[a] Includes catch/production, GVP, boat length and effort 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. Appropriate methods are described in more detail in Section 5.1.3. A worked example is provided in Appendix 2.
9. Validate fishery/sector matching and allocation of confidential data to fisheries with data custodians (completion of this step produces fishing and aquaculture production cost data for each jurisdiction, as shown in Figure 7-1).
10. Develop/prepare/access set of I-O tables appropriately specified for the agreed spatial definitions for the study (shown as the "Input-Output model" in Figure 7-1. This is described in more detail in Section 6.1).
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[10], 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. This, with the previous step, is shown as "Input-output model allocations" in Figure 7-1.
13. Calculate economic contributions using the 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.

7.2. Approach for Downscaling an Existing Contributions Study

7.2.1. What is downscaling and when can it be used?

If a practitioner wishes to prepare a set of economic contribution estimates for a particular fishery/aquaculture sector or region and a higher level study has already been undertaken (generally at a larger spatial scale), there is a method for downscaling the higher level study results to the lower level target region. 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 (Section 7.1). There are two main circumstances under which this could happen:

[10] For items such as rent, interest and leasing, a margin is allocated to the appropriate industry sector that is providing the "broking" service (e.g. real estate services for rent) and the balance, which represents a return to the owners of the capital, is allocated to direct value added.

- the higher-level study is focussed on an individual fishery or aquaculture sector at, for example, the state or territory level, and the lower level study is concerned with that same fishery or aquaculture sector but at a smaller spatial scale, e.g. at a regional (sub-state) level
- the higher-level study includes estimates of economic contribution for a group of fisheries or aquaculture sectors, e.g. for a state or territory, and the analyst is tasked with preparing estimates for a group of fisheries or aquaculture sectors at a smaller scale of analysis, e.g. at a regional (sub-state) level.

A practitioner may hope to use downscaling for a third scenario (the higher-level study is for a group of fisheries/ sectors and the lower level study a sub-set or single fishery/sector from that group) but this is not recommended. Downscaling takes the average production function from the higher scale, makes some broad adjustments to it, and applies it to a lower scale. This is appropriate where the analyst expects the production functions to be similar between the high and low scales. If this can't reasonably be expected then more information about how the production functions differ is needed (i.e. a cost structure). If a cost structure and other data necessary to downscale are available, then the economic contribution should be estimated directly using I-O analysis, avoiding the need to downscale.

The downscaling method described below takes multipliers from one context (region) and applies them to another, with some important interim steps. Without these interim steps, the application of multipliers from one context to another is discouraged as it ignores the differences in business and economic structures (see Section 6.3.1). The interim steps in the downscaling method adjust the multipliers based on high-level business structure data (such as relative effort and boat length) and an assumed difference in economic structures (regional adjustment factor). Further, it reduces the risk of error by restricting the application of the method to similar contexts. The below points should be considered when determining whether downscaling is appropriate for a particular case. Downscaling will produce more accurate results if:

- the lower level region represents a large proportion of the higher-level catch and GVP
- the mix of fishery or aquaculture activity in the lower level region is similar to that of the higher-region
- the lower level region represents a large proportion of the higher level aggregate economic activity
- the higher-level study is robust, recent, draws on primary data, and is accompanied by appropriate explanation of methodology and results to establish these characteristics.

The more similar the contexts in terms of fishing/aquaculture business and regional economic structures, the more reliable the results will be. If the contexts are not considered similar then economic contribution should instead be modelled directly using primary data.

7.2.2. Downscaling approach

The following steps describe an approach for estimating the economic contribution of the lower level region which draws on the higher-level study.

1. Determine whether downscaling is appropriate for the case in question (see Section 7.2.1).
2. As with the general approach, the analysis needs to be carefully designed and scoped (Section 3) and the key data sources identified. This is essentially a compression of steps 1 and 2 described in the general approach (Section 7.1).
    a. Define the fisheries, aquaculture sectors and economic regions that will be included in the analysis. As discussed in Section 3 an analysis of regional flow-on effects to be meaningful the region for analysis needs to include the direct activity (fishing or aquaculture) as well as most of the day to day suppliers of those businesses (such as labour, fuel, repairs and maintenance, ice, bait, provisions etc.). This means a local government area may be big enough for some isolated self-sufficient communities. For communities that are better connected with neighbouring ones, the appropriate region would be larger. For example, most suppliers of the SA Mussel industry are located in towns on the Eyre Peninsula so the Eyre Peninsula region is an appropriate region for a downscale analysis of flow-on

effects of the industry, noting that some effects would still be missed. On the other hand, downscaling to an individual town on the Eyre Peninsula where Mussel operations occur would miss much of the day to day transactions that take place in the industry as the region is too small.

b. Identify the key data managers/custodians in the relevant jurisdiction(s).

3. Compile all available data. This brings together steps 3-5 from the general approach:

    a. Review data and data sources used in the higher-level study. Update key data if more recent information is available. Importantly, this will include data that can be matched with corresponding data from the lower level fishery/aquaculture sector such as catch/production, number of active boats/operators, effort, average boat length, direct employment, price and GVP.

    b. Collect corresponding key data for the target fishery/aquaculture sector or region. Where the analysis concerns a group of fisheries or aquaculture sectors, these data will need to be collected for each of the individual sectors. Note that all data items listed (Table 7-1) may not be available for the target fishery/aquaculture sector. For example, boat length data may not be available in which case either the analyst's best estimate could be used or, in the absence of any information, an assumption made that the average boat length is the same as in the higher level fishery/aquaculture sector. This item (boat length) won't be relevant for aquaculture sectors, in which case alternative measures of business scale may be used, e.g. average lease area (in hectares) per operator in an oyster sector.

    c. Compile the economic contribution indicators from the higher-level study, such as direct and indirect gross value added and direct and indirect household income.

    The list of relevant data items from the higher level study and the data and contribution indicators that need to be either compiled or estimated for the target fishery/aquaculture sector (lower level study) are provided in Table 7-1.

4. Estimate the direct eonomic indicators for the target fishery/aquaculture sector. The formulae for the five key indicators are provided in Table 7-2. The formulae in this table relate to the circumstances where the downscaling process is applied to a single fishery or aquaculture sector[11].

    a. Gross value of production (GVP^L): it is assumed that catch/production in the target fishery/aquaculture sector is known. If price is known, GVP^L is a simple price x quantity calculation. If price is unknown, average price from the higher level study can be used to estimate GVP.

[11] The formulae relevant for a group of fisheries/sectors is presented in Tables 7-4 and 7-5

Table 7-1 Fishery/aquaculture sector data items for high level and target (low level) studies

Data Item	Unit	Data Notation	
		High Level	Low Level
Physical Measures:			
Catch/Production	tonnes	C^H	C^L
No. Active Boats/Operators	number	A^H	A^L
Average Effort per Boat/Operator per annum	days, pot lifts, etc.	E^H	E^L
Average Boat Length	metres	L^H	L^L
Direct Employment	fte	N^{HD}	N^{LD}
Indirect Employment	fte	N^{HI}	N^{LI}
Financial and Economic Measures:			
Average Price	$/kg	P^H	P^L
Gross Value of Production (GVP)	$m	GVP^H	GVP^L
Direct Household Income	$m	HH^{HD}	HH^{LD}
Indirect Household Income	$m	HH^{HI}	HH^{LI}
Direct Gross Value Added	$m	GVA^{HD}	GVA^{LD}
Indirect Gross Value Added	$m	GVA^{HI}	GVA^{LI}
Direct Gross Domestic Product[a]	$m	GDP^{HD}	GDP^{LD}
Indirect Gross Domestic Product[a]	$m	GDP^{HI}	GDP^{LI}

[a] Or gross state product/gross regional product as relevant to the study region.

Table 7-2 Downscaling indicators of direct contribution for a single fishery/aquaculture sector a

Direct Economic Contribution Indicator	Unit	Symbol	Downscaling Formula
GVP (if price unknown)	$m	GVP^L	$\frac{P^H C^L}{1000}$
Direct Employment	Fte	N^{LD}	$N^{HD}\left(\frac{A^L}{A^H}\right)\left(\frac{E^L}{E^H}\right)\left(\frac{L^L}{L^H}\right)$
Direct Gross Value Added	$m	GVA^{LD}	$GVA^{HD}\left(\frac{GVP^L}{GVP^H}\right)\left(\frac{E^H}{E^L}\right)\left(\frac{L^L}{L^H}\right)$
Direct Household Income	$m	HH^{LD}	$HH^{HD}\left(\frac{N^{LD}}{N^{HD}}\right)\left(\frac{E^H}{E^L}\right)\left(\frac{\left(\frac{GVP^L}{A^L}\right)}{\left(\frac{GVP^H}{A^H}\right)}\right)$
Direct Gross Domestic Product	$m	GDP^{LD}	$GDP^{HD}\left(\frac{GVP^L}{GVP^H}\right)\left(\frac{E^H}{E^L}\right)\left(\frac{L^L}{L^H}\right)$

[a] Relative boat length $\left(\frac{L_i^L}{L_i^H}\right)$ can be replaced by another measure of operating scale, for example relative production per business $\left(\frac{(C^L/A^L)}{(C^H/A^H)}\right)$, as boat length is generally not a relevant measure of scale in aquaculture.

b. Direct employment (N^{LD}): if direct employment is unknown, it can be estimated by adjusting the higher level value for the number of active boats/businesses $\left(\frac{A^L}{A^H}\right)$, the relative effort per boat/operator per annum $\left(\frac{E^L}{E^H}\right)$ and the relative size of the average boat/business $\left(\frac{L^L}{L^H}\right)$.

c. Direct gross value added (GVA^{LD}): the higher level value is adjusted for the relative size of GVP $\left(\frac{GVP^L}{GVP^H}\right)$, the relative effort per boat/business per annum $\left(\frac{E^H}{E^L}\right)$ and the relative size of the average boat/business $\left(\frac{L^L}{L^H}\right)$.

d. Direct household income (HH^{LD}): the higher level value is adjusted for the relative job numbers $\left(\frac{N^{LD}}{N^{HD}}\right)$, the relative effort per boat/business per annum $\left(\frac{E^H}{E^L}\right)$ and the relative GVP per active boat/business $\left(\frac{(GVP^L/A^L)}{(GVP^H/A^H)}\right)$.

e. Direct gross domestic product (GDP^{LD}): as above for GVA, the higher level value is adjusted for the relative size of GVP $\left(\frac{GVP^L}{GVP^H}\right)$, the relative effort per boat/business per annum $\left(\frac{E^H}{E^L}\right)$ and the relative size of the average boat/business $\left(\frac{L^L}{L^H}\right)$.

5. Compile data to enable downscaling of the indirect effects reported in the high-level study. This process assumes that estimates of indirect effects are available in the higher-level study. These indicators would normally include employment, GVA, household income and GDP[12]. For each higher-level indicator there are two factors that can be applied in the downscaling calculation.

[12] Indirect GVP (output) is not included due to issues of double counting and overstatement of economic activity.

a. Relative size of the direct effects. For employment, for example, this is the ratio of direct employment in the target fishery/aquaculture sector and direct employment in the higher-level study, i.e. $\left(\frac{N^{LD}}{N^{HD}}\right)$. Both values in the ratio will have been either compiled or estimated in Steps 1-4 above.

b. The regional adjustment factor (RAF) which represents the level of expenditure of the target fisheries/aquaculture sectors compared to the higher-level studies and, particularly, the extent of local sourcing of inputs, i.e. the connectivity of the fisheries/aquaculture sectors with the local economy. A proxy for this is the proportion of total intermediate expenditure (total expenditure excluding wages and capital items) that is imported to the regional economy.

   Ideally, the regional adjustment factors would be calculated by comparing I-O models for the target region and the higher-level study. Since these are unlikely to be available, BDO EconSearch used available in-house data from national, state and regional South Australian input-output models developed separately to the NSCP, to develop a set of "rules-of-thumb" ranges (Table 7-4) downscaling from larger economies (used in higher level studies) to smaller economies (the relevant economy for target (lower level) assessments). Because of the uncertainty around the appropriate level of adjustment that would be required for any particular application, a range of values has been provided for each downscaling range (nation to state/territory, etc.). It is recommended that a range of values be reported and, if the analyst has some knowledge of the target economy, commentary provided around the most likely. As a guide, a 'low adjustment' should be used where the target region is quite self-sufficient and a limited amount of imports to the region can be expected (i.e. the target is a greater capital city area and high-level study is for the State), a 'high adjustment' should be used for quite isolated economies where businesses tend to source supplies from outside the region (i.e. the target is a rural town and the high-level study is for the State).

Table 7-3 Indicative regional adjustment factors (RAF) for downscaling indirect economic contribution

Downscaling Range	Low Adjustment	Moderate Adjustment	High Adjustment
Nation to State/Territory	0.90	0.85	0.80
State/Territory to Region	0.90	0.80	0.65
Nation to Region	0.80	0.70	0.55

Source: BDO EconSearch estimates

6. Calculate the indirect economic indicators for the target fishery(s)/aquaculture sector(s). Using the data compiled in Step 5 together with the estimates of indirect effects from the higher-level study, the indirect economic indicators for the target fishery(s)/aquaculture sector (s) can be calculated. The formula for these downscaling estimates is provided in Table 7-4.

Table 7-4 Downscaling indicators of indirect contribution for fisheries/aquaculture sectors [a]

Economic Contribution Indicator	Unit	Symbol	Downscaling Formula
Indirect Employment	fte	N^{LI}	$N^{HI}\left(\frac{N^{LD}}{N^{HD}}\right)RAF$
Indirect Gross Value Added	$m	GVA^{LI}	$GVA^{HI}\left(\frac{GVA^{LD}}{GVA^{HD}}\right)RAF$
Indirect Household Income	$m	HH^{LI}	$HH^{HI}\left(\frac{HH^{LD}}{HH^{HD}}\right)RAF$
Indirect Gross Domestic Product	$m	GDP^{LI}	$GDP^{HI}\left(\frac{GDP^{LD}}{GDP^{HD}}\right)RAF$

[a] BDO EconSearch estimates

7. Calculate the total contribution indicators for the target fishery(s)/aquaculture sector(s). Using the estimates of direct contribution calculated in Steps 3 and 4 together with the estimates of indirect effects calculated in Step 6, the total economic indicators for the target fishery(s)/aquaculture sector(s) can be calculated. The formula for each of the four indicators are provided in Table 7-5.

8. Finally, as with the general approach, review contribution estimates with other published data sources and studies to check validity of results.

Table 7-5 Downscaling indicators of total economic contribution

Economic Contribution Indicator	Unit	Symbol	Formula
Total Employment	fte	N^{LT}	$N^{LD}+N^{LI}$
Total Gross Value Added	$m	GVA^{LT}	$GVA^{LD}+GVA^{LI}$
Total Household Income	$m	HH^{LT}	$HH^{LD}+HH^{LI}$
Total Gross Domestic Product	$m	GDP^{LT}	$GDP^{LD}+GDP^{LI}$

8. PRESENTATION AND INTERPRETATION OF THE RESULTS

Various organisations and community groups are potentially audiences for the results of a seafood contributions study. They include:

- Businesses and business associations within the seafood industry
- Government and government agencies
- Community groups and members of the local communities where the seafood industry operates
- Seafood industry investors
- Universities and other research institutions.

The results of a seafood contributions study should be reported in a format that meets the requirements of the intended audience. This may mean more than one format for different audiences and could include outward looking products that include key messages and graphics. All reports and communication products should be written in a clear style and the content should be easily understood by the intended audience, facilitating correct interpretation of results.

All contribution studies should include a report detailing information on the methods, data and assumptions used to derive the estimates of contribution (which may require technical appendices or separate technical reports). Transparency is a key requirement as readers should be able to assess the rigour of the estimates and there should be sufficient detail to allow the study to be repeated at a future date.

The structure of a report for a seafood contributions study will be influenced by the terms of reference and by the requirements of the intended audience. However, the report should generally include:

- An executive summary that presents the main findings
- An overview of the seafood sector in question
- A clear description of the method used to estimate economic contribution and an explanation of what economic contribution analysis is
- A description of the purpose and intended audience(s) of the study, and of the scope of the analysis including the sectors and regions analysed
- A description of the major data and assumptions used in the study
- An overview of the process used to obtain multipliers (including the input-output tables and how they were modified)
- Separate estimates of the direct effects, flow-on effects and total contribution
- Disaggregated contribution estimates (as specified by the terms of reference)
- Information to facilitate the correct interpretation of results.

In many cases, a draft report should be circulated to key stakeholders for comment. This provides an opportunity to check the accuracy of the material presented and can help inform correct interpretation of the results.

It will often be appropriate to provide a broader context for the study results. For example, the value-added and employment associated with the seafood sector being analysed can be compared with the corresponding totals for these contribution indicators in other jurisdictions.

Comparisons of contributions estimates can also be made with other productive industries (for example, beef or sheep). These comparisons will generally be less reliable due to differences in the number of sectors included, data availability

and quality, and modelling across various studies. Where a contribution study has been repeated periodically, trends in the size of the various indicators can be monitored and compared.

As mentioned previously, the use of contributions study estimates alone s to predict the impact of changes in the level of activity of the 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

The use of estimates of economic contributions to highlight the possible effect on a state or territory economy of changes in resource allocation between commercial and recreational fisheries can complement economic benefit or efficiency analysis. However, prediction of impact will require further knowledge to determine how, for example, 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.

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 input-output 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.

A seafood contributions study indicates the general magnitude of the effects associated with the seafood sector being analysed. It does not provide precise estimates, as only approximate data are available for parts of the analysis and the use of input-output tables (which provide a picture of the typical relationships between sectors) involves an element of judgement by the analyst. The results should be presented as such, e.g. by referring to results as ‘estimates’ and by appropriate rounding of estimates that reflect the margin of potential error. It is important that the analyst is clear in the way the study has been undertaken, the scope of work and the key assumptions that have been made, particularly those that can have a significant effect on the magnitude of the estimates.

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APPENDIX 1: Fishing and Aquaculture Sectors – Primary Activities Defined

Appendix Table 1-1 Aquaculture activity defined

Class	Primary Activities
0201: Offshore Longline and Rack Aquaculture	Mussel farming (longline) Offshore longline or rack aquaculture Oyster farming (rack) Paua farming (longline or rack) Pearl oyster farming (rack) Seaweed farming (longline or rack)
0202: Offshore Caged Aquaculture	Finfish farming (caged) Salmon farming (caged) Trout farming (caged) Tuna farming (caged)
0203: Onshore Aquaculture	Crustacean or mollusc breeding or farming (pond or tank) Fish breeding or farming (pond or tank) Fish hatchery operation Ornamental fish farming Paua farming (pond) Prawn farming (pond) Salmon farming (pond or tank) Trout farming (pond or tank) Tuna farming (pond or tank) Yabby farming (pond or tank)
0529 Other Agriculture and Fishing Support Services (part)	Aquaculture support service

Source: ABS (2006)

Appendix Table 1-2 Fishing activity defined

Class	Primary Activities
0411: Rock Lobster and Crab Potting	Crab fishing or potting
	Rock lobster fishing or potting
	Saltwater crayfish fishing
0412: Prawn Fishing	Prawn fishing
	Scampi fishing
0413: Line Fishing	Bottom long line fishing
	Line fishing
	Ocean trolling
	Squid jigging
	Surface long line fishing
0414: Fish Trawling, Seining and Netting	Beach seining, fishing
	Bottom gill netting, fishing
	Danish seining, fishing
	Finfish trawling
	Pair trawling
	Purse seining
	Set netting, fishing
	Surface netting, fishing
0419: Other Fishing	Abalone/paua fishing
	Freshwater eel fishing
	Freshwater fishing n.e.c.
	Marine water fishery product gathering
	Oyster catching (except from cultivated oyster beds)
	Pearling (except pearl oyster farming)
	Seaweed harvesting
	Spat catching
	Turtle hunting
0529 Other Agriculture and Fishing Support Services (part)	Fishing support service

Source: ABS (2006)

Appendix Table 1-3 Fishing and aquaculture downstream activity defined

Class	Primary Activities
1120: Seafood Processing	Crustacean, processed, manufacturing (including cooked and/or frozen) n.e.c.
	Fish cleaning or filleting
	Fish fillet manufacturing
	Fish loaf or cake manufacturing
	Fish paste manufacturing
	Fish pate manufacturing
	Fish, canned, manufacturing
	Fish, dried or smoked, manufacturing
	Mollusc, processed, manufacturing (including shelled)
	Oyster, shelling, freezing or bottling in brine
	Scallop, preserved, manufacturing
	Seafood, canned, manufacturing
	Seafood, preserved, manufacturing
	Whole fin fish freezing
3604: Fish and Seafood Wholesaling	Crustacean wholesaling (including processed, except canned)
	Fish wholesaling
	Mollusc wholesaling (including processed, except canned)
	Seafood, fresh or frozen, wholesaling
4121: Fresh Meat, Fish and Poultry Retailing (part)	Fish, fresh, retailing
	Seafood, fresh, retailing

Source: ABS (2006)

APPENDIX 2: Example of Imputing Fishing Costs Using a 'Matched' Fishery

Data Items	Source Fishery SA MSF - Net Sector (average per vessel)	Matched Fishery (fishery total)	Data source/formula for matched fishery
Matching Data			
Fishing method	Net & line	Gill nets	Data custodian jurisdiction
(1) Gross value of production	$161,197	$4,064,791	Data custodian jurisdiction
(2) Number of active vessels	1	14	Data custodian jurisdiction
(3) Average days fished (per active vessel)	161	135	Data custodian jurisdiction
(4) Share of days in fishery (%)	100%	95%	Data custodian jurisdiction
(5) Average boat length (m)	6	14	Data custodian jurisdiction
(6) Management costs / licence fees	$12,032	$52,920	Data custodian jurisdiction
Adjustment factors			
(7) Average days fished (%)		84%	$(3)_{NT}/(3)_{SA}$
(8) Average boat length (%)		227%	$(5)_{NT}/(5)_{SA}$
(9) Crew share of revenue (%)		34%	$(12)_{SA}/(1)_{SA}$
(10) Freight share of revenue (%)		8%	$(13)_{SA}/(1)_{SA}$
Cost data & estimates			
Variable costs			
(11) Fuel cost	$12,592	$317,992	$(2)_{NT}*(4)_{NT}*(7)_{NT}*(8)_{NT}*(11)_{SA}$
(12) Crew costs	$54,087	$1,363,871	$(1)_{NT}*(9)_{NT}$
(13) Freight costs	$12,416	$313,092	$(1)_{NT}*(10)_{NT}$
(14) Bait & ice	$2,878	$72,678	$(2)_{NT}*(4)_{NT}*(7)_{NT}*(8)_{NT}*(14)_{SA}$
(15) Fishing tackle & gear costs	$2,525	$63,764	$(2)_{NT}*(4)_{NT}*(7)_{NT}*(8)_{NT}*(15)_{SA}$
(16) Provisions	$2,731	$68,971	$(2)_{NT}*(4)_{NT}*(7)_{NT}*(8)_{NT}*(16)_{SA}$
(17) Slipping, mooring & boat survey	$588	$14,841	$(2)_{NT}*(4)_{NT}*(7)_{NT}*(8)_{NT}*(17)_{SA}$
(18) Protective clothing	$1,123	$28,354	$(2)_{NT}*(4)_{NT}*(7)_{NT}*(8)_{NT}*(18)_{SA}$
(19) Other direct costs	$3,250	$82,072	$(2)_{NT}*(4)_{NT}*(7)_{NT}*(8)_{NT}*(19)_{SA}$
(20) Repairs & maintenance (boat & equip.)	$13,308	$336,052	$(2)_{NT}*(4)_{NT}*(7)_{NT}*(8)_{NT}*(20)_{SA}$
Fixed costs			
(21) Insurances	$2,849	$85,751	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(21)_{SA}$
(22) Legal & accounting	$1,852	$55,742	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(22)_{SA}$
(23) Communication costs	$1,807	$54,378	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(23)_{SA}$
(24) Power	$1,903	$57,269	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(24)_{SA}$
(25) Repairs & maintenance (buildings)	$1,031	$31,036	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(25)_{SA}$
(26) Repairs & maintenance (vehicles)	$2,841	$85,496	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(26)_{SA}$
(27) Rates & rents	$3,030	$91,190	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(27)_{SA}$
(28) Interest	$4,350	$130,929	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(28)_{SA}$
(29) Travel & accommodation	$1,194	$35,939	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(29)_{SA}$
(30) Membership & association expenses	$295	$8,872	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(30)_{SA}$
(31) Other expenses	$574	$17,272	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(31)_{SA}$
(32) Imputed unpaid labour	$12,192	$366,954	$(2)_{NT}*(4)_{NT}*(8)_{NT}*(32)_{SA}$
(33) Licence fees	$12,032	$52,920	$(6)_{NT}$

APPENDIX 3: Sample Economic Survey Questionnaire - Fishery

Please read this first:

- Please only include the amounts that can be attributed to your X fishing business for the YYYY financial year
- If exact figures are not available, please provide careful estimates.

PART A GENERAL INFORMATION

1. Please describe the length, engine size and boat survey class of your boat(s) in the table below:

	Boat One	Boat Two	Boat Three	Boat Four
How long is your boat?				
What is the engine size of your boat?				
What is your boat survey class?				

PART B CAPITAL

1. In the following table, please include a list of all fishing gear and equipment that you use for fishing in the X fishery, including electronic equipment, sheds, trailers and motor vehicles (please give values *exclusive* of GST).

Item	**Age (yrs)**	**Current value $**	**Replacement cost $**
Boat engine			
Boat (without engine)			
Electronic Equipment			
Fishing Gear (specify)			
Sheds/buildings			
Motor vehicles			
Trailers			
Other equipment (specify)			

2. If this capital is not solely used for the X fishery, what is the percentage of the your capital used for the X fishery?_____%

3. If your capital has other uses, what are these uses?

_____

_____

4. What is your estimation of the current market value of your fishing licence?

$_____/unit or $_____total value of fishing licence

PART C YOUR INVESTMENT INTENTIONS

1. In the table below, please indicate if any of your equipment will be likely to require replacement, significant repair or upgrade in the next three financial years. Please indicate the nature of the replacement, repair or upgrade and the indicative cost (i.e. engine reconditioning $40,000).

	Year YYYY+1	**Year YYYY+2**	**Year YYYY+3**
Boat			
Engine			
Boat Gear (e.g. Electronic equipment)			
On Shore Gear (e.g. fridges and freezers)			

2. How likely is it that you will make these investments?

Extremely unlikely				**Unsure**					**Very Likely**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

3. If you chose 9 or less in the previous question, please explain which factors are contributing to your uncertainty. (e.g. uncertainty about necessity of replacement/ upgrade, uncertainty

about fishing entitlements, uncertainty about future catch rates, uncertainty about price of fish).

PART D EXPENDITURE

1. Please provide estimates of your direct costs and administrative costs associated with fishing in the X fishery for the whole of the YYYY financial year. For your administrative costs, only include the amount that can be attributed to X fishing (please provide values *exclusive* of GST).

Direct Fishing Costs (YYYY)	**$**
Boat Fuel & Lubricants	
Ice	
Skipper Fees	
Crew Wages	
Provisions	
Fishing licence fees	
Repairs and maintenance to boat and equipment	
Slipping/mooring/boat survey	
Protective Clothing	
Freight and Marketing	
Other fishing costs (provide details)	

Administrative Costs (YYYY)	**$**
Insurances – vessels	
Insurances – other	
Legal & Accounting	
Communication –telephone, email	
Power	
Repairs and maintenance to Buildings/Plant	
Repairs and maintenance to Motor Vehicles	
Rates	
Rents	
Leasing Charges and Fees	
Interest and borrowing costs	
Travel, accommodation	
Membership, association expenses	
Other expenses (specify)	

PART E EMPLOYMENT

1. How many people are employed in your X fishing activity (average for financial year YYYY, including yourself, paid employees and unpaid family helpers involved in running the fishing business, whether they are involved in actual fishing time, maintenance of fishing equipment, or the management (e.g. bookkeeping, negotiating with processors, attending meetings) of the fishing operations)?

Year	**Full-Time**	**Part Time**	
		No of Persons	**Full Time Equivalent**
YYYY			
YYYY+1 (estimate)			

2. Please estimate the number of days in YYYY that were spent on these activities by people who were not paid a wage (assuming an average of 8 hours per business day).

	Fishing (boat time) (days)	Repairs & Maintenance (days)	Management & Administration (days)
You (licence holder)			
Family (unpaid)			
Other unpaid labour			

PART F SALES

1. Estimate the net value of the fish that you caught and sold during **YYYY**, that is, the income you received from fish sales **after** marketing costs (commission, freight, packing, etc.) were deducted.

Species	Total Sales ($)	Weight (tonnes)	Primary Market Destination

2. Number of fishing days [or unit of effort] for YYYY _____

PART G VALUE ADDING

1. Please describe any value adding you undertake in the table below:

Species	Nature of Value-Adding Activity (e.g. freezing, filleting)	Proportion of Catch Processed (%)	Value Adding Costs ($/kg)[2]	Value Adding Price Premium ($/kg)[2]

[2] $/kg of whole weight (i.e. before processing).

PART H FURTHER COMMENTS

Please provide any additional comments that could assist in preparing the economic indicators report.

Thank you for completing this survey

APPENDIX 4: Downscaling Formulae for Multiple Fisheries

Calculate the direct economic indicators for the target fisheries/aquaculture sector(s). If the downscaling study involves a group of fisheries or aquaculture sectors, then the formulae provided in Table 7-2 need to be modified to reflect the multi-fishery/sector nature of the analysis. The modified formulae for the five key indicators are provided in Appendix Table 4-1. For the estimation of direct employment and direct GVA, this has meant each of the variables in the equation have been weighted by the GVP of the fisheries/aquaculture sectors that comprise the lower level group.

Appendix Table 4-1 Downscaling indicators of direct contribution for group of fisheries/aquaculture sectors [a] [b]

Direct Economic Contribution Indicator	Unit	Symbol	Downscaling Formula
Gross Value of Production (price unknown)	$m	GVP^L	$\Sigma_{i=1}^{n}(\frac{P_i^H C_i^L}{1000})$
Direct Employment	fte	N^{LD}	$N^{HD}\Sigma_{i=1}^{n}\left(\left(\frac{A_i^L}{A_i^H}\right)\left(\frac{GVP_i^L}{GVP^L}\right)\right)\Sigma_{i=1}^{n}\left(\left(\frac{E_i^L}{E_i^H}\right)\left(\frac{GVP_i^L}{GVP^L}\right)\right)\Sigma_{i=1}^{n}\left(\left(\frac{L_i^L}{L_i^H}\right)\left(\frac{GVP_i^L}{GVP^L}\right)\right)$
Direct Gross Value Added	$m	GVA^{LD}	$GVA^{HD}\left(\frac{GVP^L}{GVP^H}\right)\Sigma_{i=1}^{n}\left(\left(\frac{E_i^H}{E_i^L}\right)\left(\frac{GVP_i^L}{GVP^L}\right)\right)\Sigma_{i=1}^{n}\left(\left(\frac{L_i^L}{L_i^H}\right)\left(\frac{GVP_i^L}{GVP^L}\right)\right)$
Direct Household Income	$m	HH^{LD}	$HH^{HD}\left(\frac{N^{LD}}{N^{HD}}\right)\Sigma_{i=1}^{n}\left(\left(\frac{E_i^H}{E_i^L}\right)\left(\frac{GVP_i^L}{GVP^L}\right)\right)\Sigma_{i=1}^{n}\left(\frac{\left(\frac{GVP_i^L}{A_i^L}\right)}{\left(\frac{GVP_i^H}{A_i^H}\right)}\left(\frac{GVP_i^L}{GVP^L}\right)\right)$
Direct Gross Domestic Product	$m	GDP^{LD}	$GDP^{HD}\left(\frac{GVP^L}{GVP^H}\right)\Sigma_{i=1}^{n}\left(\left(\frac{E_i^H}{E_i^L}\right)\left(\frac{GVP_i^L}{GVP^L}\right)\right)\Sigma_{i=1}^{n}\left(\left(\frac{L_i^L}{L_i^H}\right)\left(\frac{GVP_i^L}{GVP^L}\right)\right)$

[a] n = number of fisheries/aquaculture sectors in the target region.

[b] Relative boat length $\left(\frac{L_i^L}{L_i^H}\right)$ can be replaced by another output measure, for example relative production per business $\left(\frac{(C^L/A^L)}{(C^H/A^H)}\right)$.

APPENDIX 5: Example Database Framework

Region name	***Example State A***	***Example State A***
Fishery/sector name	***Example Fishery A***	***Example Aquaculture Sector B***
Year	***2017/18***	***2017/18***
Effort and method		
Methods (description)	*Line and net*	*Ponds*
Number of active vessels/operators (count)	*100*	*10*
Total production area (Ha)	-	*400*
Average boat length (m)	*8*	-
Average days fished (days)	*150*	-
Share of days in fishery (%)	*90%*	-
Cost of management ($)	*$750,000*	*$750,000*
Production and export		
Catch/production (kg)	*1,200,000*	*1,000,000*
Average price ($/kg)	*$9.20*	*$8.50*
GVP ($)	*$11,040,000*	*$8,500,000*
Export (t)	*170,000*	*500,000*
Export ($)	*$2,000,000*	*$5,000,000*
Employment		
Employment (fte)	*80*	*50*
Employment (total)	*90*	*50*
Cash costs – variable		
Fuel cost ($)	*$xxx,xxx*	*$xxx,xxx*
Labour costs (variable) ($)	*$xxx,xxx*	*$xxx,xxx*
Labour costs (variable) (% share of revenue)	*$xxx,xxx*	*$xxx,xxx*
Freight costs ($)	*$xxx,xxx*	*$xxx,xxx*
Freight costs (% share of revenue)	*$xxx,xxx*	*$xxx,xxx*
Bait and ice ($)	*$xxx,xxx*	-
Fishing tackle ($)	*$xxx,xxx*	-
Provisions ($)	*$xxx,xxx*	*$xxx,xxx*
Protective clothing ($)	*$xxx,xxx*	*$xxx,xxx*
Refrigeration gas ($)	*$xxx,xxx*	*$xxx,xxx*
Refrigeration maintenance ($)	*$xxx,xxx*	*$xxx,xxx*
Repairs and maintenance (unscheduled) ($)	*$xxx,xxx*	*$xxx,xxx*
Power (variable) ($)	*$xxx,xxx*	*$xxx,xxx*
Feed ($)	-	*$xxx,xxx*
Fingerlings/Spat ($)	-	*$xxx,xxx*
Other direct costs ($)	*$xxx,xxx*	*$xxx,xxx*
Cash costs – fixed		
Slipping, mooring and boat survey ($)	*$xxx,xxx*	-
Insurance ($)	*$xxx,xxx*	*$xxx,xxx*
Legal and accounting ($)	*$xxx,xxx*	*$xxx,xxx*
Communications ($)	*$xxx,xxx*	*$xxx,xxx*
Power (fixed) ($)	*$xxx,xxx*	*$xxx,xxx*
Repairs and Maintenance (buildings) ($)	*$xxx,xxx*	*$xxx,xxx*
Repairs and Maintenance (vehicles) ($)	*$xxx,xxx*	*$xxx,xxx*
Rates (energy/government) ($)	*$xxx,xxx*	*$xxx,xxx*
Leasing of licence ($)	*$xxx,xxx*	*$xxx,xxx*
Rent and lease (other) ($)	*$xxx,xxx*	*$xxx,xxx*
Interest costs ($)	*$xxx,xxx*	*$xxx,xxx*
Travel and accommodation ($)	*$xxx,xxx*	*$xxx,xxx*
Training ($)	*$xxx,xxx*	*$xxx,xxx*
Membership and association expenses ($)	*$xxx,xxx*	*$xxx,xxx*
Export fees ($)	*$xxx,xxx*	*$xxx,xxx*
Office administration ($)	*$xxx,xxx*	*$xxx,xxx*
Labour cost (fixed) ($)	*$xxx,xxx*	*$xxx,xxx*
Licence fees ($)	*$xxx,xxx*	*$xxx,xxx*
Total Cash Costs ($)	***$xxx,xxx***	***$xxx,xxx***
Gross Operating Surplus ($)	***$xxx,xxx***	***$xxx,xxx***

More at
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