ECONOMIC IMPACT OF VICTORIAN COMMERCIAL FISHERIES AND AQUACULTURE

University of Technology, University of Wollongong

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Introduction

The University of Technology Sydney (UTS), in conjunction with the University of Wollongong (UoW), were funded by the Fisheries Research and Development Corporation (FRDC) to undertake an economic valuation of Victoria's wild-catch fisheries and aquaculture industries.

This research is being completed in conjunction with the Australian National Centre for Ocean Resources and Security (ANCORS).

As part of this project, UTS has commissioned the Western Research Institute (WRI) to undertake research on the economic impact of commercial fisheries on regional economies within Victoria.

Economic modelling undertaken by WRI utilised operational and financial data, collected from surveys with commercial fishing operators (provided by ANCORS) to estimate the economic impacts of commercial fishing including aquaculture on regional economies and at the Victorian State level.

Modelling was undertaken for the financial year 2016-17.

The region for economic impact analysis were created in accordance with the project coordinator at UoW using ABS statistical geography.

Regions included were as follows:

- Inland aquaculture region
- Coastal aquaculture region
- 5 separate commercial fishery regions along the Victorian coastline including: South West, Near West, Melbourne-Port Phillip Bay, Near East, and Far East.

For the commercial fisheries, economic analysis was undertaken for both Victorian fishing vessels, and Commonwealth fishing vessels.

Reporting

The economic impact of aquaculture and commercial fisheries in Victoria has been reported as a sum of:

- Initial impacts: defined as the value of the immediate changes in the respective region as a result of aquaculture and commercial fisheries
  and
- Flow-on impacts: defined as the value of changes in the regional economy in the course of an additional round of spending after the initial impact occurred.

The economic impact of aquaculture and commercial fisheries was estimated in terms of:

- **Output** is the value of goods and services that are produced within an establishment that become available for use outside that establishment, plus any goods and services produced for the organisation's own final use. Output is equal to total revenue plus any internal consumption.

- **Value added** is the amount by which the value of an article is increased at each step of its production, exclusive of its initial cost. Value added is equal to gross output minus intermediate inputs and is equivalent to the contribution to gross regional product (GRP - the local equivalent of gross domestic product). That is, value added is the difference between the costs of production (excluding the costs of employees, gross operating surplus, taxes and imports) and the value of sales turnover. Value added sums the value added components of production through the supply chain. Value added is the most reliable measure of the actual value of production.
- **Household Income** consists of all current receipts, whether monetary or in kind, that are received by the household or by individual members of the household, and which are available for, or intended to support, current consumption.[1] Examples include employee wages and salaries, salary sacrificed income, non-cash benefits, bonuses and termination payments, government pensions and allowances, profit/loss from own unincorporated business, investment income, superannuation, workers' compensation, income from annuities, child support, etc.[2]
- **Full-time equivalent employment** is measure of the workload of an employed person in a location that makes workloads comparable across different types of employment (part-time and full time) by measuring hours worked and equating to how many full time positions the hours make up.

For more information on economic impact analysis see Appendix 1.

[1] ABS Release No. 6523.0 - Household Income and Wealth, Australia, 2015-16.
[2] ibid.

Results

The economic impact analysis was conducted for aquaculture, commercial fishery operations by Victorian vessels and commercial fishery operations by Commonwealth vessels. Aquaculture was divided into coastal and inland regions while commercial fisheries were divided into 5 separate regions.

Aquaculture

Aquaculture Inland

Total expenditure in the Inland region on aquaculture was $22.28 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $74.97 million.
- Value added initial impact was $7.44 million with a total impact of $32.99 million.
- Household income initial impact was $5.09 million with a total impact of $15.69 million.
- Initial Full Time Equivalent (FTE) employment generated was 145 with total employment generated at 285 FTE jobs for the regional economy.

Aquaculture Inland				
Total Expenditure ($ million)	22.28			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	24.64	7.44	5.09	145
Flow-on	50.33	25.54	10.60	140
Total	74.97	32.99	15.69	285
Percent of region	0.01%	0.01%	0.01%	0.02%

Note: Totals may not add due to rounding.

Care should be taken when using flow-on and total figures for output due to potential double-counting. An example of potential double counting would be for fuel inputs counted in calculating direct output for fish catching, then also being counted in the production side of the industry flow-ons. This would likely exceed the output less intermediate inputs which indicates value added.

Key sectors impacted by flow-on employment for the Inland region by aquaculture included:

- Agriculture, Forestry and Fishing
- Finance and Insurance Services
- Professional, Scientific and Technical Services
- Retail Trade
- Wholesale Trade

Aquaculture Coastal

Initial expenditure in the Coastal region on aquaculture was $17.51 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $46.15 million.
- Value added initial impact was $6.96 million with a total impact of $22.53 million.
- Household income initial impact was $5.45 million with a total impact of $10.71 million.
- Initial FTE employment generated was 189 with total employment generated at 272 FTE jobs for the regional economy.

Aquaculture Coastal				
Total Expenditure ($ million)	17.51			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	19.02	6.96	5.45	189
Flow-on	27.13	15.57	5.27	83
Total	46.15	22.53	10.71	272
Percent of region	0.06	0.05%	0.06%	0.11%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the Coastal region by aquaculture included:

- Agriculture, Forestry and Fishing
- Retail Trade
- Automotive and Other Repair Services
- Finance and Insurance Services
- Wholesale Trade

Total Aquaculture Victoria

Total initial expenditure in Victoria on aquaculture was $39.79 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for Victoria was $143.01 million.
- Value added initial impact was $14.41 million with a total impact of $63.77 million.
- Household income initial impact was $10.54 million, with total impact of $32.08 million.
- Initial FTE employment generated is 334 with total employment generated at 629 FTE for the State economy.

Aquaculture Victoria				
Total Expenditure ($ million)	39.79			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	43.66	14.41	10.54	334
Flow-on	99.35	49.37	21.54	295
Total	143.01	63.77	32.08	629
Percent of region	0.02%	0.01%	0.02%	0.02%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

It should be noted that the flow-on impacts when assessed for Victoria as a whole are greater than for the sum of the regions as a result of inter-regional flow-on impacts not captured in the individual regions tables.
Key sectors impacted by flow-on employment for Victoria by aquaculture included:

- Agriculture, Forestry and Fishing
- Retail Trade
- Professional, Scientific and Technical Services

- Finance and Insurance Services
- Wholesale Trade

Victorian commercial fisheries

Region 1 South West[3]

Initial expenditure in the South West fishery region by Victorian commercial fishing vessels was $10.96 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $39.95 million.
- Value added initial impact was $7.71 million with a total impact of $18.24 million.
- Household income initial impact was $2.97 million with total impact of $7.63 million.
- Initial FTE employment generated was 64 with total employment generated at 133 FTE jobs for the regional economy.

Victorian Commercial Fisheries Region 1 South West				
Total Expenditure ($ million)	10.96			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	15.70	7.71	2.97	64
Flow-on	24.25	10.53	4.66	69
Total	39.95	18.24	7.63	133
Percent of region	0.53%	0.55%	0.48%	0.56%

Note: Totals may not add due to rounding.

Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the South West region by Victorian commercial fisheries included:

- Agriculture, Forestry and Fishing
- Rental, Hiring and Real Estate
- Retail Trade
- Accommodation and Food Services
- Professional, Scientific and Technical Services

Region 2 Near West

Initial expenditure in the Near West fishery region by Victorian commercial fishing vessels was $5.13 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region is $15.19 million.
- Value added initial impact was $4.40 million with a total impact of $8.70 million.
- Household income initial impact was $1.75 million with total impact of $3.18 million.
- Initial FTE employment generated was 54 with total employment generated at 76 FTE jobs for the regional economy.

[3] The geographic definition of the regions is provided in the Methodology section below.

Victorian Commercial Fisheries Region 2 Near West				
Total Expenditure ($ million)	5.13			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	7.77	4.40	1.75	54
Flow-on	7.42	4.30	1.44	21
Total	15.19	8.70	3.18	76
Percent of region	0.31%	0.26%	0.29%	0.45%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the Near West region by Victorian commercial fisheries included:

- Rental, Hiring and Real Estate
- Agriculture, Forestry and Fishing
- Accommodation and Food Services
- Professional, Scientific and Technical Services
- Retail Trade

Region 3 Melbourne-Port Phillip Bay

Initial expenditure in the Melbourne-Port Phillip Bay fishery region by Victorian commercial fishing vessels was $3.05 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $12.76 million.
- Value added initial impact was $2.82 million with a total impact of $6.89 million.
- Household income initial impact was $1.37 million with total impact of $3.42 million.
- Initial FTE employment generated was 40 with total employment generated at 63 FTE jobs for the regional economy.

Victorian Commercial Fisheries Region 3 Melbourne-Port Phillip Bay				
Total Expenditure ($ million)	3.05			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	4.50	2.82	1.37	40
Flow-on	8.26	4.07	2.05	23
Total	12.76	6.89	3.42	63
Percent of region	0.00%	0.00%	0.00%	0.01%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the Melbourne-Port Phillip Bay region by Victorian commercial fisheries included:

- Professional, Scientific and Technical Services
- Finance and Insurance Services

- Retail Trade
- Accommodation and Food Services
- Health Care and Social Assistance

Region 4 Near East

Initial expenditure in the Near East fishery region by Victorian commercial fishing vessels was $4.12 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $12.44 million.
- Value added initial impact was $4.96 million with a total impact of $8.17 million.
- Household income initial impact was $2.08 million with total impact of $3.19 million.
- Initial FTE employment generated was 61 with total employment generated at 78 FTE jobs for the regional economy.

Victorian Commercial Fisheries Region 4 Near East				
Total Expenditure ($ million)	4.12			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	7.01	4.96	2.08	61
Flow-on	5.43	3.21	1.11	17
Total	12.44	8.17	3.19	78
Percent of region	0.08%	0.08%	0.09%	0.14%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the Near East region by Victorian commercial fisheries included:

- Retail Trade
- Agriculture, Forestry and Fishing
- Accommodation and Food Services
- Professional, Scientific and Technical Services
- Rental, Hiring and Real Estate

Region 5 Far East

Initial expenditure in the Far East fishery region by Victorian commercial fishing vessels was $8.32 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $32.42 million.
- Value added initial impact was $12.03 million with a total impact of $19.63 million.
- Household income initial impact was $4.79 million with total impact of $8.28 million.
- Initial FTE employment generated was 126 with total employment generated at 177 FTE jobs for the regional economy.

Victorian Commercial Fisheries Region 5 Far East				
Total Expenditure ($ million)	8.32			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	15.56	12.03	4.79	126
Flow-on	16.86	7.60	3.49	50
Total	32.42	19.63	8.28	177
Percent of region	0.67%	0.85%	0.76%	1.19%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the Far East region by State commercial fisheries included:

- Retail Trade
- Accommodation and Food Services
- Agriculture, Forestry and Fishing
- Health Care and Social Assistance
- Food and Beverage Manufacturing

Total commercial fisheries Victoria

Total initial expenditure in Victoria from Victorian commercial fishing was $31.58 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for Victoria was $128.84 million.
- Value added Product initial impact was $31.92million with a total impact of $71.04 million.
- Household income initial impact was $12.96 million with total impact of $31.32 million.
- Initial FTE employment generated was 346 with total employment generated at 579 FTE jobs for the State economy.

State Commercial Fisheries Victoria				
Total Expenditure ($ million)	31.58			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	50.55	31.92	12.96	346
Flow-on	78.29	39.12	18.37	233
Total	128.84	71.04	31.32	579
Percent of region	0.02%	0.02%	0.01%	0.02%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

It should be noted that the flow-on impacts when assessed for Victoria as a whole are greater than for the sum of the regions as a result of inter-regional flow-on impacts not captured in the individual region tables.

Key sectors impacted by flow-on employment for Victoria by State commercial fisheries included:

- Retail Trade
- Professional, Scientific and Technical Services
- Accommodation and Food Services
- Rental, Hiring and Real Estate
- Finance and Insurance Services

Commonwealth commercial fisheries

The landed value of the catch from Commonwealth licensed vessels in each region was obtained from ABARES by a specific data request. The data for Commonwealth and State fisheries were estimated separately for the state commercial fishing in each region.

Region 1 South West

Initial expenditure in the South West fishery region by Commonwealth commercial fishing vessels was $5.97 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $19.26 million.
- Value added initial impact was $2.69 million with a total impact of $8.35 million.
- Household income initial impact was $2.39 million with total impact of $5.07 million.
- Initial FTE employment generated was 51 with total employment generated at 91 FTE jobs for the regional economy.

Commonwealth Commercial Fisheries Region 1 South West				
Total Expenditure ($ million)	5.97			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	6.27	2.69	2.39	51
Flow-on	12.99	5.66	2.68	39
Total	19.26	8.35	5.07	91
Percent of region	0.26%	0.25%	0.32%	0.38%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the South West region by Commonwealth commercial fisheries included:

- Agriculture, Forestry and Fishing
- Transport, Postal and Warehousing
- Retail Trade
- Accommodation and Food Services
- Wholesale Trade

Region 2 Near West

Initial expenditure in the Near West fishery region by Commonwealth commercial fishing vessels was $2.45 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $5.85 million.
- Value added initial impact was $1.10 million with a total impact of $3.04 million.
- Household income initial impact was $1.07 million with total impact of $1.76 million.
- Initial FTE employment generated was 33 with total employment generated at 43 FTE jobs for the regional economy.

Commonwealth Commercial Fisheries Region 2 Near West				
Total Expenditure ($ million)	2.45			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	2.48	1.10	1.07	33
Flow-on	3.37	1.94	0.68	10
Total	5.85	3.04	1.76	43
Percent of region	0.12%	0.09%	0.16%	0.26%

Note: Totals may not add due to rounding.

Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the Near West region by Commonwealth commercial fisheries included:

- Rental, Hiring and Real Estate
- Accommodation and Food Services
- Transport Equipment Manufacturing
- Retail Trade
- Agriculture, Forestry and Fishing

Region 3 Melbourne-Port Phillip Bay

Initial expenditure in the Melbourne-Port Phillip Bay fishery region by Commonwealth commercial fishing vessels was $5.90 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $22.54 million.
- Value added initial impact was $2.66 million with a total impact of $10.66 million.
- Household income initial impact was $2.33 million with total impact of $6.42 million.
- Initial FTE employment generated was 67 with total employment generated at 113 FTE jobs for the regional economy.

Commonwealth Commercial Fisheries Region 3 Melbourne-Port Phillip Bay				
Total Expenditure ($ million)	5.90			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	6.22	2.66	2.33	67
Flow-on	16.32	8.00	4.08	45
Total	22.54	10.66	6.42	113
Percent of region	0.01%	0.01%	0.01%	0.01%

Note: Totals may not add due to rounding.

Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the Melbourne-Port Phillip region by Commonwealth commercial fisheries included:

- Professional, Scientific and Technical Services
- Finance and Insurance Services
- Retail Trade
- Transport, Postal and Warehousing
- Accommodation and Food Services

Region 4 Near East

Initial expenditure in the Near East fishery region by Commonwealth commercial fishing vessels was $6.88 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region is $16.47 million.
- Value added initial impact was $3.09 million with a total impact of $8.65 million.
- Household income initial impact was $2.87 million with total impact of $4.86 million.
- Initial FTE employment generated was 84 with total employment generated at 112 FTE jobs for the regional economy.

Commonwealth Commercial Fisheries Region 4 Near East				
Total Expenditure ($ million)	6.88			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	7.10	3.09	2.87	84
Flow-on	9.37	5.56	1.99	29
Total	16.47	8.65	4.86	112
Percent of region	0.10%	0.08%	0.13%	0.20%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the Near East region by Commonwealth commercial fisheries included:

- Retail Trade
- Rental, Hiring and Real Estate
- Transport, Postal and Warehousing
- Accommodation and Food Services
- Professional, Scientific and Technical Services

Region 5 Far East

Initial expenditure in the Far East fishery region by Commonwealth commercial fishing was $20.58 million. Total impacts, including initial and flow-on impacts, were as follows:

- Total output for the region was $64.97 million.
- Value added initial impact was $9.26 million with a total impact of $28.64 million.
- Household income initial impact was $8.28 million with total impact of $17.27 million.
- Initial FTE employment generated is 217 with total employment generated at 339 FTE jobs for the regional economy.

Commonwealth Commercial Fisheries Region 5 Far East				
Total Expenditure ($ million)	20.58			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	21.55	9.26	8.28	217
Flow-on	43.22	19.38	8.99	122
Total	64.97	28.64	17.27	339
Percent of region	1.34%	1.23%	1.59%	2.29%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

Key sectors impacted by flow-on employment for the Far East region by Commonwealth commercial fisheries included:

- Retail Trade
- Transport, Postal and Warehousing
- Accommodation and Food Services
- Agriculture, Forestry and Fishing
- Health Care and Social Assistance

Total Commonwealth commercial fisheries Victoria

Total initial expenditure in Victoria by Commonwealth commercial fishing was $41.78 million. Total impacts, including initial and flow-on impacts were as follows:

- Total output for the State was $147.53 million.
- Value added initial impact was $18.80 million with a total impact of $70.58 million.
- Household income initial impact was $16.95 million with total impact of $42.02 million.
- Initial FTE employment generated was 452 with total employment generated at 767 FTE jobs for the Victorian economy.

Commonwealth Commercial Fisheries Victoria				
Total Expenditure ($ million)	41.78			
	Output ($m)	**Value added ($m)**	**Household income ($m)**	**Employment (FTE)**
Initial	43.63	18.80	16.95	452
Flow-on	103.91	51.78	25.06	315
Total	147.53	70.58	42.02	767
Percent of region	0.02%	0.02%	0.02%	0.03%

Note: Totals may not add due to rounding.
Care should be taken when using flow-on and total figures for output due to potential double-counting.

It should be noted that the flow-on impacts when assessed for Victoria as a whole are greater than for the sum of the regions as a result of inter-regional flow-on impacts not captured in the individual region tables.

Key sectors impacted by flow-on employment for Victoria by Commonwealth commercial fisheries included:

- Retail Trade
- Professional, Scientific and Technical Services
- Transport, Postal and Warehousing
- Accommodation and Food Services
- Finance and Insurance Services

Conclusion

Victorian aquaculture and fishery operations are estimated to contribute significantly to the Victorian and the regional economies in which they operate.

At the Victorian level, aquaculture contributed approximately $143.01 million in output, $63.77 million in value added and generated $32.07 million in household income and total FTE employment of 629. The results include both direct and flow-on effects.

Victorian fisheries contributed approximately $128.84 million in output, $71.04 million in value added, $31.32 million to household income and total FTE employment of 579, while Commonwealth fisheries contributed $147.53 million in output, $70.58 million in value added, $42.02 million to household income and total FTE employment of 767.

	Aquaculture Victoria	State Commercial Fisheries Victoria	Commonwealth Commercial Fisheries Victoria
Initial Expenditure ($m)	39.79	31.58	41.78
Output ($m)	143.01	128.84	147.53
Value added ($m)	63.77	71.04	70.58
Household income ($m)	32.07	31.32	42.02
Employment (FTE)	629	579	767

Care should be taken when total figures for output due to potential double-counting.

Methodology

The economic impacts were assessed at state regional levels. Regions were constructed in accordance with advice from the project coordinator at UoW who defined the territories, using ABS statistical geography.

Modelling was undertaken through input-output analysis which provides a detailed picture of the structure of an economy at a point in time and can be used to estimate the contribution or impact of a sector of the economy or an individual organisation including flow-on or multiplier effects.

The impacts are measured in terms of value-added, household income and full-time equivalent (FTE) jobs. All impacts are expressed in either dollar terms or FTE employment terms and as a percentage of the state or regional economy.

Constructing the tables

The input output tables for this project were based on the national table published by the Australian Bureau of Statistics (ABS) for 2015-16 which was adjusted to reflect 2016-17 and subsequently modified to reflect the Victorian economy in the same year.

That Victorian table was then used to create the relevant regional tables as outlined in Appendix 1. The regional tables contain industry structure for fisheries and aquaculture only. The Victorian and national tables hve these sectors buried in the agriculture, forestry and fishing industry aggregation . Further details regarding the construction of the input output tables is provided in Appendix 1.

Geographical scope

The economic impacts from Victorian aquaculture and commercial fishery operations including the State and Commonwealth fishing industry were assessed at the Victorian level and at the regional level.

Regions were defined in conjunction with the project coordinator at UoW and are aggregations of SA2, SA3 and SA4 regions from the Australian Statistical Geographical Standard.

The table below outlines the regions included in this report, and their corresponding ABS geography.

Broader Region	Region	Statistical Area Level
Aquaculture Coastal Region	Geelong	SA4
	Mornington Peninsula	SA4
	Warrnambool and South West	SA4
	Cardinia	SA3
	Gippsland- South West	SA3
	Casey- South	SA3
Aquaculture Inland Region*	Ballarat	SA4
	Bendigo	SA4
	Hume	SA4
	Melbourne- Inner	SA4
	Melbourne- Inner East	SA4
	Melbourne- Inner South	SA4
	Melbourne- North East	SA4
	Melbourne- North West	SA4
	Melbourne- Outer East	SA4
	Melbourne- West	SA4
	Shepparton	SA4
	North West	SA4
	Baw Baw	SA3
	Gippsland-East	SA3
	Latrobe Valley	SA3
	Wellington	SA3
	Casey- North	SA3
	Dandenong	SA3
	Monash	SA3
Commercial Fisheries Region 1 South West	Warrnambool	SA3
	Glenelg (Vic.)	SA2
	Portland	SA2
Commercial Fisheries Region 2 Near West	Surf Coast- Bellarine	SA3
	Corangamite- South	SA2
	Otway	SA2
Commercial Fisheries Region 3 Melbourne-Port Phillip Bay	Melbourne- West	SA4
	Melbourne- Inner	SA4
	Melbourne- Inner South	SA4
	Frankston	SA3
	Geelong	SA3
Commercial Fisheries Region 4 Near East	Mornington Peninsula	SA3
	Gippsland- South West	SA3
	Yarram	SA2
Commercial Fisheries Region 5 Far East	Gippsland- East	SA3
	Longford- Loch Sport	SA2

*Note: The inland aquaculture area includes the city of Melbourne influencing regional results.

Data collection

In order to estimate the economic contribution of aquaculture and commercial fisheries in Victoria, WRI used financial data provided by UoW.

Expenditure data for inland and coastal aquaculture, and Victorian and Commonwealth fishing vessels was allocated by industry sector based on the expense categories listed in Appendix 2.

Assumptions

In the case of economic impacts by aquaculture and commercial fisheries, the expenditure modelled includes:

- Fixed and variable costs by aquaculture and commercial fisheries (depreciation allowances for operators are not considered).
- Revenues generated within each regional economy from the relevant operation were assessed based on the distribution derived from the input-output table for the region being examined, or Victoria as a whole for the State economy.
- Full time equivalent employment was unknown, therefore each region's FTE was calculated using the Labour Paid component of expenditure and dividing by the Compensation of Employees output generated for either the Aquaculture or Fishing, Hunting and Trapping sector within the input output tables to find the average Compensation of Employees per Full Time Equivalent.

Appendix 1: Input output analysis

Inter-industry models can be used for economic impact analysis, to estimate the benefits or costs generated by new initiatives on each sector of an economy. For example, if there is a change in the purchasing or sales pattern of any industry, the flow-on or multiplier effects on upstream industries can be calculated.

Input-output modelling is one method of inter-industry modelling.

Constructing the Tables

Australia 2016-17

The latest national input-output table (2015-16) published by the Australian Bureau of Statistics (ABS)[4] was utilised as the base table.

The steps involved in updating that table to reflect the financial year of 2017-18 included:

- Data from the 2016 Census relating to employment by industry sector was analysed in conjunction with data from the Labour Force Survey (ABS Cat. No. 6291.0.55.003) to determine the number of full time equivalent employees by industry sector in both 2015-16 and 2016-17. It should be noted that the national input output table published by the ABS comprises 114 industry sectors whilst the Labour Force Survey for Australia is disaggregated to 88 sectors, including sub-sectors of ANZSIC Level 1 classifications denoted as "not further defined". Census data relating to employment by Place of Work at ANZSIC Level 4 is utilised to further disaggregate data from the Labour Force Survey into the industry sectors incorporated in the national input output table. In converting to full-time equivalent (FTE) jobs, the ABS convention of assuming 1 part time employee is equivalent to 0.5 FTE was adopted.
- The above data was used to calculate output by industry sector, in 2015-16 dollar values utilising changes in FTE employment numbers between 2015-16 and 2016-17. The table was then inflated by the Consumer Price Index (ABS Cat. No. 6401.0) to convert the table to 2016-17 values.
- Data from the Australian System of National Accounts (ABS Cat. No. 5204.0) for 2016-17 relating to Compensation of Employees and Gross Operating Surplus by industry sector was used to inflate the

[4] ABS Cat. No. 5209.0.55.001

relevant rows in the input output table. Similarly, data from the same publication relating to Final Demand was used to inflate the relevant Final Demand columns in the input output table.

- The table was balanced and checked for accuracy against data from the Australian System of National Accounts including a comparison of the derived Gross Domestic Product and its components and Gross Industry Value Added by industry sector at ANZSIC Level 1.

Victoria 2016-17

The national input output table derived for 2016-17 was used to generate the input output table for the same year for Victoria. The steps involved in developing the State table included:

- Data from the 2016 Census regarding employment by industry sector by place of employment was analysed in conjunction with data from the Labour Force Survey for Victoria to estimate the number of FTE employees by industry sector in 2017-18. It should be noted that data from the Labour Force Survey by State or Territory is only provided at ANZSIC Level 1 (19 industry sectors). Accordingly, Census data by Place of Work was used to further disaggregate that data. The resultant estimates of FTE numbers for Victoria were used to estimate output by industry sector at the 114 sector level.
- Data from the Australian National Accounts: State Accounts (ABS Cat. No. 5220.0) for 2017-18 was used to extract information on Compensation of Employees, Gross Operating Surplus and the various final demand sectors. Data from the 2016 Census regarding personal income by industry sector at ANZSIC Level 4 was used to disaggregate Compensation of Employees by input output category whilst ensuring that the totals at ANZSIC Level 1 coincided with the data published in the State Accounts.
- The above data were incorporated into the Generation of Regional Input Output Tables (GRIT) file incorporated in the IO9 software used in this analysis. The GRIT technique, developed by Professors West and Jensen of the University of Queensland, uses allocation methods and location quotients as a hybrid method of deriving state and regional input-output tables from the national input-output table while allowing for the insertion of superior data at various stages in the construction of the tables (Jensen et al. 1979; West 1980). It is the most widely used method of constructing input output tables in Australia and is also commonly employed in Europe and America.
- The resultant tables were balanced using the RAS methodology (Lindner et al.2012). The RAS technique is a bi- proportional iterative adjustment method designed to modify a base input output matrix to fit new row and column totals (Dietzenbacher and Miller 2009). The rows and columns are adjusted proportionally to the new row and column totals in turn, and the cycle repeated until the actual row and column totals converge to the specified values. This may require some adjustment to the tolerances of individual sectors to enable the table to converge.
- The balanced tables were then checked for accuracy against data from the Australian National Accounts: State Accounts including the comparing the derived Gross State Product and its components and Gross Industry Value Added by industry at ANZSIC Level 1.

Regions 2016-17

The regional input output tables were derived from the 2016-17 input output table for Victoria.

The key variation between creating the input output table for a region and that for Victoria as a whole is that there is no published data for a Region to enable cross-checking such as total Gross Regional Product, the various Final Demand components, Compensation of Employees or Gross Operating Surplus. Consequently, the development of the input output table for the regions relies primarily on the use of ratio analysis using a range of data from the 2016 Census.

The steps involved in developing the region table included:

- The regions were analysed in terms of total employment by industry sector at ANZSIC Level 4 and by status in the labour force (full-time or part-time) by Place of Work to determine estimates of FTE employment at the time of the 2016 Census. Changes in employment by industry sector (ANZSIC Level 1) to 2016-17 were assessed using data from the Labour Force Survey by labour market region. The resultant estimates of FTE employment by input output industry sector were used to estimate output for the regions in 2016-17.
- Data from the 2016 Census relating to personal weekly income by industry sector was extracted and compared with the average personal weekly income by industry sector for Victoria. The resultant ratio was used to adjust State level Compensation of Employees by full time equivalent by industry sector for the regions.
- Average weekly income per capita for persons residing in the regions was calculated from data from the 2016 Census and compared with the Victorian average. The resultant ratio was used to adjust State level Household Final Consumption Expenditure, Government Final Consumption Expenditure and Ownership of Dwellings per capita for 2017-18 to the regional level.
- The above data were incorporated into the GRIT file and the resultant table balanced using the RAS methodology. The balanced table was checked for reasonableness by comparing Gross Regional Product per capita and per full time equivalent employee with the State average.

Industry Significance

Input-output tables are frequently used to provide estimates of the significance of a particular industry or organisation in terms of its contribution to the economy.

This is done by examining the effects of the organisation shutting down and ceasing all economic activities. This method provides an estimate of the level of economic activity that can be attributed to that particular organisation, in this case aquaculture and wild-catch commercial fishing industries. The industry significance approach was used to model the operations of aquaculture and commercial fishing.

Operational data was used to construct a new sector in the input-output table representing the aquaculture and commercial fishing operations in the respective regional economies and within the Victorian economy.

Appendix 2: Allocation of expenditure items

Expenditure Item	Proportion allocated	Allocation to Industry
Cooperative Commission	33.3% 33.3% 33.3%	Agriculture, Forestry and Fishing Wholesale Trade Food and Beverage Manufacturing
Bait	100%	Agriculture, Forestry and Fishing
Boat fuel	100%	Wholesale Trade
Repairs and maintenance	70% 30%	Transport Equipment Manufacturing Repair Services
Gear replacement	50% 50%	Other Manufacturing Transport Equipment Manufacturing
Protective clothing	100%	Textile, Clothing, Footwear and Leather Manufacturing
Vehicle fuel	100%	Wholesale Trade
Freight	100%	Transport, Postal and Warehousing
Boat registration	100%	Public Administration and Safety
Brokerage	100%	Finance and Insurance
Vehicle registration	100%	Public Administration and Safety
Insurance	100%	Finance and Insurance
Management costs	75% 25%	Professional, Scientific and Technical Services Finance and Insurance
Licence fees	100%	Public Administration and Safety
Accounting and legal	100%	Professional, Scientific and Technical Services
Litigation	100%	Professional, Scientific and Technical Services
Telephone etc.	100%	Information, Media and Communications
Power	100%	Electricity, Gas and Water Supply
Rates and Rent	80% 20%	Rental, Hiring, and Real Estate Services Public Administration and Safety
Bank charges	100%	Finance and Insurance
Building/plant repair	100%	Construction

Expenditure Item	Proportion allocated	Allocation to Industry
Vehicle repair	100%	Personal and Other Services
Travel	50% 50%	Accommodation and Food Services Transport, Postal and Warehousing
Memberships	100%	Professional, Scientific and Technical Services
Interest	100%	Finance and Insurance
Leasing	100%	Rental, Hiring, and Real Estate Services
Other	-%	Apportioned across 33 sectors

Referenced material

ABS (2017) Labour Force Survey (ABS Cat. No. 6291.0.55.003)

ABS (2017) Australian System of National Accounts 2016-17 (ABS Cat. No. 5204.0)

ABS (2018) Australian National Accounts: Input-Output Tables, 2016-17. ABS Cat. No. 5209.0.55.001

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Ms Kathy Woolley – Chief Executive Officer, WRI

GAICD, MIIA, Change Management Qualification (AGSM), BComm (Economics- with merit - UWO), Public Participation Certificate (IAP^2), Cert. IV Workplace training and assessment (TAFE)

For a number of years Kathy also ran a consultancy specialising in services for not for profit entities, focusing on best practice techniques in management and governance.

With formal qualifications in change management, company directorship, community engagement, economics and training and well developed skills in human resources, information technology, finance and economic development, Kathy offers a unique skill set to assist with most business needs.

She worked in local government for 16 years at the General Manger/Director level. Her experience in land use management, land sales and development, regional economic development, finance, information technology, human resources, legal and governance, insurance, process improvement, business opportunity analysis, tourism and land use planning at the strategic and operational level provide a unique skill set.

She has coupled her change management qualifications and experience with internal audit program development and is a member of the Australian Institute of Internal Auditors.

Ms Lesley Arthur - Director, RedeConsult Pty Ltd

B.Sc. (Hons) Biological Science, M.Sc. Technological Economics

Lesley is an experienced researcher with particular expertise in the areas of inter-industry modelling, including input output analysis, cost benefit analysis, statistical analysis, market analysis and forecasting. She has extensive experience in undertaking economic impact assessments at the regional level. These have included evaluating the regional economic benefit of the red meat processing sector, the dairy industry, seafood processing, pig production and processing, other components of the manufacturing sector, various higher and tertiary education institutions and a wide variety of projects for a range of Local, State and Federal Government bodies

Mr Alistair Maclennan – Senior Research Consultant, WRI

BA Political Economy, First Class Honours (UNE)

Having served in a variety of parliamentary, public service and private sector roles, Alistair brings a wealth of research experience to WRI. Alistair has well developed skills in data analysis, economics and business, and has a wide understanding of government. In addition, Alistair also has experience in policy development in the energy sector, where he engaged with industry, government agencies and NGOs to inform policy. Alistair's experience in engaging with clients, stakeholders and the public assists WRI to fully understand its client's needs and provide tailored research.

Mr Chris Mullen – Research Officer, WRI

BEcon (UNE)

Chris is an Economics graduate from the University of New England, currently undertaking a Master of Economics course. Chris has a great interest and passion for macro and microeconomics, policy analysis, and development economics. Throughout his degree, Chris has gained skills in benefit-cost analysis, business statistics, and economic modelling. Having grown up on a property on the mid-north coast, Chris has a strong understanding of life in regional Australia and the issues rural communities face.

Ms Dale Curran – Executive Officer, WRI

BA (ANU)

Dale is responsible for all administrative processes at WRI including executive support, finance, management of the Board of Directors and maintenance of policies. Dale has worked in a variety of roles at WRI, including Fieldwork Supervisor and Research Assistant, and has worked on several community and business surveys. As a result, she brings a strong understanding of research processes to her administrative role. Dale brings a high level of organisational skill and efficiency to her role as Executive Officer.

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Ms Heather Waters - Administration Officer, WRI

Heather joined WRI in October 2018 and brings strong skills in customer service from her experience working in the retail industry. Heather is passionate about building strong rural communities.

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