

The Economic Impact of Aquaculture on the South Australian State and Regional Economies, 2007/08

A report prepared for
PIRSA Aquaculture

Prepared by



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Abbreviations

ABARE	Australian Bureau of Agricultural and Resource Economics
AFMA	Australian Fisheries Management Authority
fte	full-time equivalent
PIRSA	Primary Industries and Resources South Australia
SA	South Australia
SARDI	South Australian Research and Development Institute
GRP	gross regional product
GSP	gross state product

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Executive Summary

The aim of this study was to estimate the economic impact of aquaculture activity in South Australia in 2007/08. The results reported here update and expand on those provided in previous studies (EconSearch 1997, 1998, 1999, 2001, 2002a, 2003, 2004, 2006a, 2006b, 2007 and 2008). This report provides estimates of economic impact for 2007/08 by aquaculture sector (tuna, oysters, mussels, abalone, freshwater finfish, marine finfish, marron/yabbies farming and other aquaculture enterprises) at the state and regional (Eyre Peninsula and balance of South Australia) levels.

The results of this study illustrate clearly the significance of aquaculture in South Australia in terms of business activity, household income and contribution to the state's growth and employment levels.

Some previous studies have only included the first level of processing, marketing or handling of aquaculture production in the overall economic impact (EconSearch 1997, 1998, 1999, 2001 and 2002a). However, for the purpose of this, the previous six (EconSearch 2003, 2004, 2006a, 2006b, 2007 and 2008) and future analyses, the following stages in the marketing chain are included in the quantifiable economic impact:

- the farm gate value of production;
- the net value of local (SA) processing;
- the net value of local retail and food service trade; and
- the value of local transport services at all stages of the marketing chain.

In addition, other facets of regional economic development associated with the aquaculture industry are qualitatively assessed.

The results of the analysis, at the state level, are summarised in Table E.1. The **direct impact** measures on-farm and aquaculture related downstream activities (fish processing, transport, retail and food services). The **flow-on impact** measures the economic effects in other sectors of the economy (trade, transport, etc) generated by the aquaculture industry, that is, the ripple or multiplier effects.

Value of output is a measure of the business turnover or gross revenue of an activity. **Direct output** equates to the **PIRSA Scorecard** estimate of **net food revenue**, estimated to be \$335m (\$264m on-farm and \$71m in downstream activities) in 2007/08 (Table E.1). **Total output** (\$657m) needs to be used with care as it includes elements of double counting. Approximately 68 per cent of the output impact was generated in regional South Australia (Table E.2).

Contribution to gross state or regional product (GSP/GRP) is measured as value of output less the cost of goods and services (including imports) used in producing the output. As such, it provides an estimate of the net contribution of aquaculture to the state's economy. In 2007/08, aquaculture's **total contribution to GSP** (\$333m) (Table E.1) represented 0.45 per cent of the total GSP for South Australia (\$73,262m)¹. Approximately 71 per cent of the contribution to GSP was generated in regional South Australia (Table E.2). Contribution to GSP/GRP, as a measure of economic impact, avoids the problem of double counting that arises from using output for this purpose.

¹ ABS (2008).

Table E.1 The economic impact of aquaculture in South Australia, 2007/08

	Tuna	Marine Finfish	Oysters	Mussels	Abalone	Freshwater Finfish	Marron and Yabbies	Other ^a	Total
Output (\$m)									
Direct									
<i>On-farm</i>	186.7	17.7	31.6	2.6	5.2	4.5	0.6	14.8	263.6
<i>Downstream</i>	17.8	9.4	39.6	2.9	0.2	1.1	0.3	0.0	71.2
Total Direct	204.5	27.0	71.2	5.4	5.4	5.6	0.8	14.8	334.8
Total Flow-on	178.7	30.5	81.5	8.3	11.0	5.3	0.5	6.3	322.2
Total ^b	383.2	57.6	152.8	13.7	16.4	10.9	1.3	21.1	656.9
Contribution to GSP (\$m)									
Direct									
<i>On-farm</i>	90.3	5.6	22.4	1.8	1.3	2.4	0.5	7.7	131.9
<i>Downstream</i>	6.0	3.8	16.4	1.2	0.1	0.5	0.1	0.0	28.1
Total Direct	96.4	9.4	38.8	2.9	1.4	2.8	0.6	7.7	160.0
Total Flow-on	102.4	14.6	41.0	4.3	4.6	2.7	0.2	3.2	173.1
Total	198.8	24.0	79.8	7.2	6.0	5.5	0.8	10.9	333.0
Employment (fte)									
Direct									
<i>On-farm</i>	269	84	468	81	43	52	42	38	1,077
<i>Downstream</i>	64	52	236	17	1	6	2	0	377
Total Direct	333	136	704	98	44	58	44	38	1,454
Total Flow-on	895	151	401	50	68	28	2	32	1,628
Total	1,229	287	1,105	148	112	86	46	70	3,083
Household income (\$m)									
Direct									
<i>On-farm</i>	16.6	3.4	12.0	1.8	1.3	1.4	0.0	1.5	38.0
<i>Downstream</i>	3.9	2.3	9.8	0.7	0.1	0.3	0.1	0.0	17.1
Total Direct	20.5	5.7	21.7	2.5	1.4	1.6	0.1	1.5	55.1
Total Flow-on	49.7	8.1	22.1	2.4	3.0	1.5	0.1	1.8	88.6
Total	70.2	13.8	43.9	4.9	4.3	3.1	0.2	3.3	143.7

^a Other aquaculture is comprised predominantly of ornamental fish and algae production.

^b Note there is double counting in the total output impact.

Source: EconSearch analysis.

Employment is a measure of the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent (fte) jobs. Direct employment was estimated to be over 1,450 fte (1,077 on-farm and 377 in downstream activities) in 2007/08 with over 1,600 flow-on jobs, giving **total employment** of 3,083 fte (Table E.1). Approximately 66 per cent of these jobs were generated in regional South Australia (Table E.2).

Household income is a measure 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. Direct household income was estimated to be around \$55m in 2007/08 and flow-on income approximately \$89m, giving a **total household income** impact of almost \$144m (Table E.1). Approximately 62 per cent of the household income impact was generated in regional South Australia (Table E.2).

In regional areas, the impact of the aquaculture industry in 2007/08 was concentrated in the Eyre Peninsula region, reflecting the dominance of tuna farming in the total (Table E.2).

Table E.2 The total regional economic impact (direct and flow-on) of aquaculture in South Australia, 2007/08

Sector	Output ^a		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Eyre Peninsula	412.4	92%	219.9	93%	1,792	89%	81.8	93%
Balance of SA	33.9	8%	16.8	7%	231	11%	6.6	7%
Total Regional Impact	446.3	100%	236.8	100%	2,023	100%	88.4	100%
Regional Impact as a Proportion of Total	-	68%	-	71%	-	66%	-	62%

^a Note there is double counting in the total output impact.

Source: EconSearch analysis.

Respondents to the survey of aquaculture licence holders undertaken by PIRSA for 2007/08 provided projections of their production and employment over the three year period, 2008/09 to 2010/11. The projections for each sector are summarised in Table E.3².

Based on two sets of price assumptions, namely a 'no price' response and a 'generic small but negative price' effect, high and low projections of gross value of aquaculture production (GVP) for the period 2008/09 to 2010/11 have been imputed from the production projections. These GVP projections are presented in Table E.4.

The low estimate of GVP is based on a small but negative price effect for that proportion of the growth that is likely to be supplied to the South Australian domestic market. It was assumed that 100 per cent of the growth in tuna and abalone production would be exported to interstate and overseas markets (i.e. low and high estimates of GVP identical) and 50 per cent of the growth in other sectors would be exported. The high estimate of GVP is based on no price response over the projection period (i.e. prices remain at 2007/08 levels).

² These estimates were based on survey responses only and could, therefore, be subject to some sample bias.

Table E.3 Projected growth in South Australian aquaculture production and employment, 2008/09 to 2010/11^a

	Estimated cumulative change relative to 2007/08					
	Production			Employment		
	2008/09	2009/10	2010/11	2008/09	2009/10	2010/11
Tuna ^b	8%	9%	11%	1%	1%	4%
Marine Finfish ^c	23%	23%	23%	9%	11%	12%
Oysters	8%	12%	14%	2%	5%	9%
Mussels	39%	53%	100%	12%	22%	23%
Abalone	41%	88%	100%	9%	11%	13%
Freshwater Finfish ^d	8%	21%	26%	1%	8%	15%
Marron and Yabbies	3%	14%	15%	0%	1%	1%
Other ^e	1%	5%	7%	2%	4%	7%

^a Based on an analysis of PIRSA Aquaculture's 2007/08 survey responses.

^b Projected growth in tuna production relates to wild catch only.

^c Predominantly Yellowtail Kingfish and Mulloway production.

^d Predominantly Barramundi and Rainbow Trout production.

^e Predominantly ornamental fish and algae production.

Table E.4 Projected growth in South Australian aquaculture value of production, 2008/09 to 2010/11^a

	Actual GVP (\$m)	Low GVP Forecast (\$m)			High GVP Forecast (\$m)		
	2007/08	2008/09	2009/10	2010/11	2008/09	2009/10	2010/11
Tuna	186.7	201.5	203.2	208.1	201.5	203.2	208.1
Marine Finfish	17.7	20.5	20.5	20.5	21.8	21.8	21.8
Oysters ^b	30.1	31.9	32.7	33.2	32.5	33.7	34.4
Mussels	2.6	3.3	3.4	3.9	3.6	4.0	5.2
Abalone	5.2	7.2	9.7	10.3	7.2	9.7	10.3
Freshwater Finfish	4.5	4.8	5.2	5.3	4.9	5.5	5.7
Marron and Yabbies	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Other	14.8	14.9	15.3	15.5	15.0	15.4	15.8
Total	262.1	284.7	290.6	297.4	287.1	293.9	301.9

^a All estimates are in 2008 dollars.

^b Adult oysters only (i.e. excludes spat).

1. Introduction

The aim of this study was to estimate the economic impact of aquaculture activity in South Australia in 2007/08. The results reported here update and expand on those provided in previous studies (EconSearch 1997, 1998, 1999, 2001, 2002a, 2003, 2004, 2006a, 2006b, 2007 and 2008). Estimates of the economic impact of aquaculture activity in South Australia in 2007/08 are provided for the following aquaculture sectors:

- tuna;
- marine finfish³;
- oysters;
- mussels;
- abalone;
- freshwater finfish⁴;
- marron and yabbies; and
- other aquaculture⁵.

The impacts of these sectors are presented at both the regional and state levels. Regional impacts are based on the following disaggregation:

- Eyre Peninsula; and
- the balance of SA.

The report is structured as follows.

- Section 2: The general approach to the study is outlined.
- Section 3: A summary of aquaculture production in South Australia.
- Sections 4 to 7: The economic impacts of each aquaculture sector are presented at the state and regional levels.
- Section 8: Other facets of regional economic development associated with aquaculture activity in SA are presented.
- Section 9: Summary of the results.

³ Predominantly Yellowtail Kingfish and Mulloway production.

⁴ Predominantly Barramundi and Rainbow Trout production.

⁵ Predominantly ornamental fish and algae production.

2. Study Approach

2.1 Method of Analysis

The presence of a large industry or set of enterprises has considerable effects on the character of the local economy in which it is embedded. In the case of an aquaculture development, the enterprise, to support its own activities, makes purchases of spat or fingerlings, feedstuffs, farming equipment, other material inputs, labour, energy and services. Much of the expenditure goes to persons and companies situated in the local region.

The principle of this expenditure dependence is clearly defined. If aquaculture activity were to cease, there would be consequent reductions in the gross revenues of other sectors in the region. Conversely, if aquaculture activity were to increase, there would be increases in the gross revenues of other sectors. The extent of this type of economic impact can be measured through input-output modelling. This study applies input-output analytical procedures to measure the impact of aquaculture development on the South Australian state and regional economies.

Economic impacts at the state and regional levels were based on input-output models prepared for the Department of Trade and Economic Development (EconSearch 2009a and 2009b). For a technical description of the input-output modelling procedure refer to Appendix 1 and for a glossary of input-output terminology refer to Appendix 2.

In terms of scope, some previous studies (EconSearch 1997, 1998, 1999, 2001 and 2002a) have only included the first level of processing, marketing or handling of aquaculture production in the overall economic impact. Estimates of the economic impact of aquaculture presented in this report (i.e. for 2007/08) and for the period 2001/02 to 2006/07 (EconSearch 2003, 2004, 2006a, 2006b, 2007 and 2008) are consistent with the 'message' and method in⁶:

- South Australian Aquaculture Council (2002), *State Aquaculture Action Plan*;
- PIRSA's *Food for the Future* value chain analysis 2007/08 (Seafood Scorecard); and
- the overview of PIRSA Aquaculture's strategic direction for South Australian marine and land based aquaculture industries.

To this end, the following stages in the marketing chain have been included in the quantifiable economic impact:

- the farm gate value of production⁷;
- the net value of local (SA) processing;
- the net value of local retail and food service trade; and
- the value of local transport services at all stages of the marketing chain.

⁶ As discussed at the State Aquaculture Plan Working Group meeting at the Hilton Hotel on 19 November 2002.

⁷ For tuna this will include the net value of farm gate production and the gross value of tuna fishing.

In addition, other facets of regional economic development associated with the aquaculture industry were qualitatively assessed. The table below illustrates the change in scope of the economic impact assessment.

Table 2.1 Change in scope of the economic impact assessment

Stage in Market Chain	Scope of Impact Analysis In Earlier Studies ^a	Scope of Impact Analysis in Recent and Future Studies ^b
Farm gate production	Yes	Yes
Processing	Yes	Yes
Retail	No	Yes
Food Service	No	Yes
Transport between stages	Part	Yes
Other aspects of the economic impact of aquaculture		
Regional investment	Yes (tuna only)	Yes – qualitative only
Tourism	No	Yes – qualitative only
Education and training	No	Yes – qualitative only

^a For the years 1996/97 to 2000/01 (EconSearch 1997, 1998, 1999, 2001 and 2002a).

^b For the years 2001/02 to 2006/07 (EconSearch 2003, 2004, 2006a, 2006b, 2007 and 2008).

As with previous reports, estimates of direct and flow-on economic impact are presented in terms of the following indicators:

- output;
- contribution to gross state or regional product⁸;
- employment; and
- household income.

(Value of) Output is a measure of the gross revenue of goods and services produced by commercial organisations (e.g. farm-gate value of tuna production) and gross expenditure by government agencies. Total output needs to be used with care as it includes elements of double counting (e.g. the value of tuna farm output includes the gross value of tuna fishing).

Contribution to gross state or regional product (GSP or GRP) is a measure of the net contribution of an activity to the state or regional economy. Contribution to GSP/GRP is measured as value of output less the cost of goods and services (including imports) used in producing the output. In other words, it can be measured as household income plus other value added (gross operating surplus and all taxes, less subsidies). It represents payments to the primary inputs of production (labour, capital and land). Using contribution to GRP/GSP as a measure of economic impact avoids the problem of double counting that may arise from using value of output for this purpose.

⁸ The terminology 'contribution to gross state or regional product' and 'value added' can be used interchangeably. 'Value added' was used in some previous reports (EconSearch 1997 to 2004).

Employment is a measure of the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent (fte) jobs.

Household income is a component of GSP/GRP and is a measure 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.

Estimates of economic impact are presented in terms of

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

Direct impacts are the initial round of output, employment and household income generated by an economic activity. Estimates of the direct economic impact of aquaculture on the South Australian state and regional economies are consistent with the method employed in PIRSA's *Food for the Future* value-chain analysis, 2007/08, as outlined above⁹.

Flow-on (or indirect) impacts are the sum of production-induced effects and consumption-induced effects. Production-induced effects are additional output, 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 effects are additional output, employment and household income resulting from re-spending by households that receive income from employment in direct and indirect activities.

Total impacts are the sum of direct and flow-on impacts.

2.2 Data

Survey-based value of output and production estimates for South Australian aquaculture for 2007/08 were provided by PIRSA Aquaculture¹⁰. Representative cost structures and other relevant information for enterprises operating in individual sectors of the aquaculture and fishing industries¹¹ were updated from 2002/03 to 2007/08 using a range of indicators, including data derived from the survey undertaken by PIRSA Aquaculture. These data, included:

- number of employees and unpaid individuals (including owner-operator) - average per enterprise;
- proportion of stock (i.e. spat or fingerlings) sourced from local region, other SA or interstate - average per enterprise; and
- proportion of feed sourced from local region, other SA or interstate - average per enterprise

⁹ Note that direct output equates to the PIRSA Seafood Scorecard estimate of net food revenue.

¹⁰ EconSearch coordinated the compilation, analysis and validation of these survey data.

¹¹ These original data were obtained from consultation with key industry contacts in 2003 (EconSearch 2003) and from EconSearch (2002b and 2002c).

The representative cost structures were applied to industry value of output estimates to obtain estimates of aggregate expenditures on a regional and state basis.

Estimates of the net value of local (SA and regional) processing margins, the net value of local retail and food service trade margins and the value of local transport margins at all stages of the marketing chain were imputed for each aquaculture sector on the basis of discussions with a range of relevant industry contacts in each sector (EconSearch 2006a). For the years 2001/02 and 2002/03, these margins were based on estimates presented in PIRSA's Seafood Scorecard.

3. Aquaculture Production in South Australia

3.1 Production and Value of Production

Estimates of tuna, oyster and other aquaculture production and value of production from SARDI Aquatic Sciences and PIRSA Aquaculture for the six-year period, 2002/03 to 2007/08, are provided in Table 3.1. Some description of these data is provided below. Similar data for the period 1994/95 to 2007/08 are provided in Appendix 1 of the report.

Table 3.1 Aquaculture production and value of production, South Australia, 2002/03 to 2007/08

	2002/03		2003/04		2004/05		2005/06		2006/07		2007/08	
	Weight ('000kg)	Value (\$m)	Weight ('000kg)	Value (\$m)	Weight ('000kg)	Value (\$m)	Weight ('000kg)	Value (\$m)	Weight ('000kg)	Value (\$m)	Weight ('000kg)	Value (\$m)
Tuna	9,102	266.907	9,290	151.000	7,458	139.955	8,806	155.795	7,486	137.650	9,757	186.742
Marine Finfish	na	na	na	na	na	na	na	na	na	na	2,074	17.674
Oysters												
adult ^a	3,865	15.116	4,644	19.959	4,650	19.995	5,397	23.879	7,720	37.841	5,448	30.132
spat	-	1.002	-	1.193	-	1.195	-	0.957	-	1.143	-	1.469
Mussels	254	0.466	400	0.697	377	0.657	469	0.950	1,032	1.914	1,369	2.591
Abalone	59	3.080	105	3.155	177	5.318	250	8.222	196	7.155	167	5.151
Freshwater Finfish	489	6.322	256	2.585	283	2.810	453	3.726	423	4.019	421	4.513
Marron and Yabbies	29	0.626	28	0.633	42	0.893	12	0.318	29	0.721	22	0.559
Other ^b	1,077	8.769	894	7.533	2,019	17.015	2,148	17.591	1,953	18.514	1,727	14.765
Total	14,875	302.288	15,617	186.755	15,006	187.838	17,535	211.438	18,838	208.957	20,984	263.597

^a The weight for adult oysters is an approximation on the basis that a dozen oysters weighs one kilogram.

^b Other aquaculture production in 2007/08 was comprised predominantly of ornamental fish and algae production. In previous years it included Rainbow Trout (now included in freshwater finfish) and marine finfish production (now separately specified).

Source: SARDI Aquatic Sciences, PIRSA Aquaculture.

- The value of tuna farm output increased by 36 per cent between 2006/07 and 2007/08, a function of the 30 per cent increase in the volume of tuna farm output and a 4 per cent increase in the per unit value of farmed tuna. The significant increase the volume of tuna farm output over this period was attributable to the longer grow-out before harvest, a consequence of extended price negotiations (Brain Jeffriess, Australian Southern Bluefin Tuna Industry Association, pers. comm.). However, gross value of production over the period 2003/04 to 2007/08 was well below the values recorded in 2002/03 due to a combination of increased supplies of farmed tuna from Mediterranean countries being sold on the Japanese market and an appreciation of the Australian dollar against the Japanese yen.
- Given the significant historical and projected growth in production and employment in the marine finfish sector and its increasing relative importance within the aquaculture industry in South Australia, production and value of production estimates for 2007/08 for this sector have been published for the first time. Confidentiality requirements prevented the publication of these data in earlier years.

- The gross value of adult oyster production has increased at an average rate of 18 per cent per annum over the six-year period 2002/03 to 2007/08, despite a 20 per cent decrease between 2006/07 and 2007/08. This latter change was comprised of a 29 per cent reduction in adult oyster production and a 13 per cent increase in the per unit value of oysters. There is some possibility, however, that adult oyster production was overestimated in 2006/07, possibly as a consequence of sampling variability and/or response error.
- Significant growth in production and value of production was experienced in the mussels sector between 2006/07 to 2007/08 whilst declines were experienced in the abalone and marron/yabbies sectors. Freshwater finfish production over this period was virtually unchanged whilst value of production (total and per unit) declined by 12 per cent.
- As a consequence of changes to the specification of the 'other aquaculture' sector, the 2007/08 dataset is not comparable with data published for previous years.

3.2 Projected Growth in Production and Employment

Respondents to the survey of aquaculture licence holders undertaken by PIRSA for 2007/08 provided projections of their production and employment over the three year period, 2008/09 to 2010/11 (Table 3.2), relative to 2007/08¹². The projections for each sector for the can be summarised as follows:

- Tuna - modest production (11 per cent) and low employment (4 per cent) growth between 2007/08 and 2010/11;
- Marine finfish - notable production (23 per cent) and modest employment (12 per cent) growth;
- Oysters - modest production (14 per cent) and employment (9 per cent) growth;
- Mussels - significant production (100 per cent) and employment (23 per cent) growth;
- Abalone - significant production (100 per cent) and modest employment (13 per cent) growth;
- Freshwater finfish - notable production (26 per cent) and modest employment (15 per cent) growth;
- Marron and yabbies - modest production (15 per cent) and low employment (1 per cent) growth; and
- Other aquaculture - modest production and employment (both 7 per cent) growth.

¹² These estimates were based on survey responses only (i.e. no 'validation' with industry representatives) and could, therefore, be subject to some sample bias.

Table 3.2 Projected growth in South Australian aquaculture production and employment, 2008/09 to 2010/11 ^a

	Estimated cumulative change relative to 2007/08					
	Production			Employment		
	2008/09	2009/10	2010/11	2008/09	2009/10	2010/11
Tuna ^b	8%	9%	11%	1%	1%	4%
Marine Finfish ^c	23%	23%	23%	9%	11%	12%
Oysters	8%	12%	14%	2%	5%	9%
Mussels	39%	53%	100%	12%	22%	23%
Abalone	41%	88%	100%	9%	11%	13%
Freshwater Finfish ^d	8%	21%	26%	1%	8%	15%
Marron and Yabbies	3%	14%	15%	0%	1%	1%
Other ^e	1%	5%	7%	2%	4%	7%

^a Based on an analysis of PIRSA Aquaculture's 2007/08 survey responses.

^b Projected growth in tuna production relates to wild catch only.

^c Predominantly Barramundi and Rainbow Trout production.

^d Predominantly Yellowtail Kingfish and Mulloway production.

^e Predominantly ornamental fish and algae production.

Under the assumption that aquaculture producers in the state are price takers and that changes in industry supply will have little effect on prices received, then the effect of the projected production changes (Table 3.2) could be translated directly into changes in gross value of production (GVP). Even if a negative price response were to arise from production increases, it could be argued that consumer demand pressures for seafood will have an offsetting, positive impact on price. Indeed, in a comprehensive analysis (Delgado et al. 2003) of the global seafood market it was forecast under baseline (most likely) assumptions that, while global aquaculture production would increase by 84 per cent over the period 1997 to 2020 (19 per cent increase in wild catch), real prices are expected to increase by around 15 per cent for crustaceans and high-value finfish and by 4-6 per cent for molluscs and low value food fish.

Nevertheless, the projected production increases summarised in Table 3.2 are significant in some sectors and, other things being equal, the prices received would tend to decrease as the quantity supplied increases. This relationship can be measured using a price flexibility coefficient, that is, the percentage change in price given a one percent change in the quantity supplied. This can, in turn, be approximated using the reciprocal of the price elasticity of demand¹³.

Short-run elasticities of demand for primary products are generally relatively price inelastic¹⁴. In the longer run, however, with opportunities for exports and substitution with other products, elasticities of demand for primary products are generally relatively price elastic (i.e. less than -1.0). In the absence of empirically estimated elasticities for

¹³ The percentage change in the quantity demanded resulting from a 1 per cent increase in price (Pindyck and Rubinfeld 1995).

¹⁴ As used in the Monash General Equilibrium Model of the Australian economy, for example (Glyn Wittwer, Centre of Policy Studies, Monash University, pers. comm.).

aquaculture products, it was assumed for the purpose of this analysis that the medium-run price elasticity of demand for aquacultural products is -2.0 and the reciprocal, the price flexibility coefficient, is -0.5 ¹⁵.

It is likely that a price response of this magnitude would apply only to that proportion of the growth in aquaculture production that is supplied to the South Australian domestic market. For the purpose of this analysis it was assumed that 100 per cent of the growth in tuna and abalone production would be exported to interstate and overseas markets and 50 per cent of the growth in other sectors would be exported. For that proportion of production growth that is exported from the state to interstate or overseas markets, it was assumed that the producers are price takers and that changes in industry supply will have little effect on prices received.

These two sets of price assumptions, namely a 'no price' response and a 'generic small but negative price' effect, were used as the basis for high and low projections of gross value of aquaculture production for the period 2008/09 to 2010/11. These projections are presented in Table 3.3.

Table 3.3 Projected growth in South Australian aquaculture value of production, 2008/09 to 2010/11 ^a

	Actual GVP (\$m)	Low GVP Forecast (\$m) ^b			High GVP Forecast (\$m) ^c		
	2007/08	2008/09	2009/10	2010/11	2008/09	2009/10	2010/11
Tuna	186.7	201.5	203.2	208.1	201.5	203.2	208.1
Marine Finfish	17.7	20.5	20.5	20.5	21.8	21.8	21.8
Oysters ^d	30.1	31.9	32.7	33.2	32.5	33.7	34.4
Mussels	2.6	3.3	3.4	3.9	3.6	4.0	5.2
Abalone	5.2	7.2	9.7	10.3	7.2	9.7	10.3
Freshwater Finfish	4.5	4.8	5.2	5.3	4.9	5.5	5.7
Marron and Yabbies	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Other	14.8	14.9	15.3	15.5	15.0	15.4	15.8
Total	262.1	284.7	290.6	297.4	287.1	293.9	301.9

^a All estimates are in 2008 dollars.

^b The low estimate of gross value of production (GVP) is based on a small but negative price effect for that proportion of the growth that is likely to be supplied to the SA domestic market. It was assumed that 100 per cent of the growth in tuna and abalone production would be exported to interstate and overseas markets (i.e. low and high estimates of GVP identical) and 50 per cent of the growth in other sectors would be exported.

^c The high estimate of GVP is based on no price response over the projection period (i.e. prices remain at 2007/08 levels).

^d Adult oysters only (i.e. excludes spat).

¹⁵ That is, there would be a 0.5 per cent decrease in price given a one per cent increase in the quantity supplied.

3.3 The Value of Aquaculture and Wild Catch Fisheries in South Australia

In aggregate, tuna is the largest single sector in the state's aquaculture industry, accounting for approximately 71 per cent of the state's gross value of aquaculture production in 2007/08 (Table 3.4). The state's total value of seafood production (landed) in 2007/08 was almost \$471 million. Of this, tuna farming contributed approximately 40 per cent and aquaculture as a whole, 56 per cent (Table 3.4).

Table 3.4 Value of aquaculture production and wild fisheries catch, South Australia, 2007/08

	Production or catch ('000kg)	Value of production or catch (\$m)	Contribution to aquaculture value of production	Contribution to total seafood value of production or catch
Aquaculture				
Tuna	9,757	186.742	70.8%	39.7%
Marine FinFish	2,074	17.674	6.7%	3.8%
Oysters	5,448	31.601	12.0%	6.7%
Mussels	1,369	2.591	1.0%	0.6%
Abalone	167	5.151	2.0%	1.1%
Freshwater Finfish	421	4.513	1.7%	1.0%
Marron and Yabbies	22	0.559	0.2%	0.1%
Other ^a	1,727	14.765	5.6%	3.1%
Total Aquaculture	20,984	263.597	100.0%	56.0%
Wild Catch Fisheries ^b				
Rock Lobster	2,309	91.666	-	19.5%
Abalone	889	31.044	-	6.6%
Prawns	2,317	35.874	-	7.6%
Sardines	29,692	16.331	-	3.5%
Other Marine Fisheries	3,671	26.348	-	5.6%
Inland Water Fisheries	2,146	5.898	-	1.3%
Total Wild Catch	41,024	207.161	-	44.0%
Total Seafood	62,008	470.758	-	100.0%

^a Other aquaculture production is comprised predominantly of ornamental fish and algae production.

^b Excludes catch from the Commonwealth managed fisheries and the charter boat fishery. SARDI Aquatic Sciences estimates.

Source: SARDI Aquatic Sciences and PIRSA Aquaculture.

4. The Economic Impact of Aquaculture in South Australia, 2007/08

Estimates of the direct economic impact of aquaculture production, aquaculture processing, the transport of aquaculture products and the sale of aquaculture products to the retail and food service sectors in South Australia in 2007/08 are provided in this section of the report. Complementary estimates of the flow-on effects generated by these activities through the purchase of materials, services and labour are also provided.

4.1 The Economic Impact of Tuna Farming in South Australia, 2007/08

Estimates of the economic impact generated by the tuna farming industry in SA on a sector-by-sector basis for 2007/08 are provided in Table 4.1 and Figures 4.1 to 4.4. Impacts are measured in terms of value of output, contribution to gross state product (GSP), employment and household income.

Table 4.1 The economic impact of tuna farming in South Australia, 2007/08

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Tuna farming	186.7	49%	90.3	45%	269	22%	16.6	24%
Processing	15.1	4%	4.9	2%	53	4%	3.2	5%
Transport	2.7	1%	1.2	1%	11	1%	0.7	1%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	0%	0.0	0%	0	0%	0.0	0%
Total Direct	204.5	53%	96.4	48%	333	27%	20.5	29%
Flow-on effects								
Tuna fishing	36.9	10%	29.6	15%	222	18%	9.0	13%
Property and business serv.	28.2	7%	18.1	9%	75	6%	6.0	9%
Manufacturing	24.6	6%	7.9	4%	87	7%	5.3	8%
Trade	21.5	6%	10.1	5%	177	14%	6.9	10%
Sardines	15.5	4%	8.9	4%	60	5%	6.4	9%
Transport	8.3	2%	3.6	2%	34	3%	2.1	3%
Finance	10.1	3%	6.3	3%	36	3%	3.3	5%
Other Sectors	33.6	9%	18.0	9%	204	17%	10.7	15%
Total Flow-on	178.7	47%	102.4	52%	895	73%	49.7	71%
Total ^a	383.2	100%	198.8	100%	1,229	100%	70.2	100%
Total/Direct	1.87		2.06		3.69		3.42	

^a Note there is double counting in the total output impact.

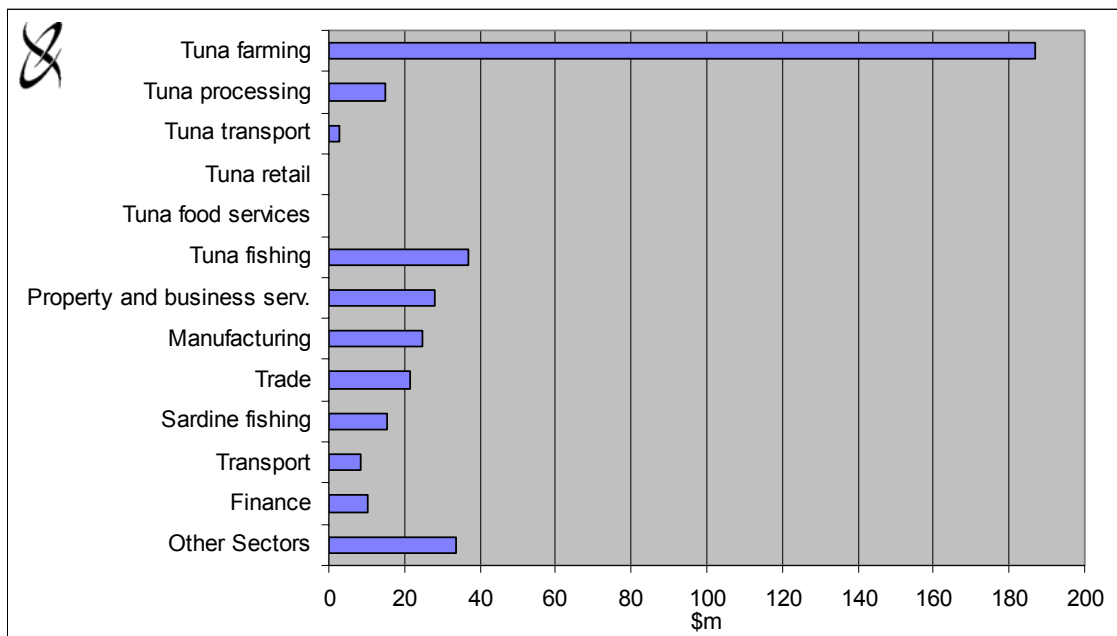
Source: EconSearch analysis.

Output impacts...

There are substantial economic impacts from the tuna farming industry in South Australia. Direct output (business turnover) generated in South Australia by tuna farms summed to \$187 million and in other sectors (processing and transport), \$18 million in 2007/08. Flow-on output in other sectors of the state economy summed to \$179 million (Table 4.1). The sectors most affected were the tuna fishing (tuna capture), sardine fishing, manufacturing, trade, business and property services, transport and finance sectors (Figure 4.1).

The bottom row of Table 4.1 gives the total impact/direct impact ratio for each economic indicator. For output, the ratio of 1.87 indicates that for each dollar of sales generated by the tuna industry (farming and downstream) there was a total of \$1.87 of in output generated by businesses throughout the state, \$1.00 in the tuna industry (farming and downstream) and \$0.87 in other sectors of the economy.

Figure 4.1 Tuna farming in South Australia, output impacts by sector, 2007/08 ^a



^a Note there is double counting in the output impacts.

Source: EconSearch analysis.

Contribution to gross state product...

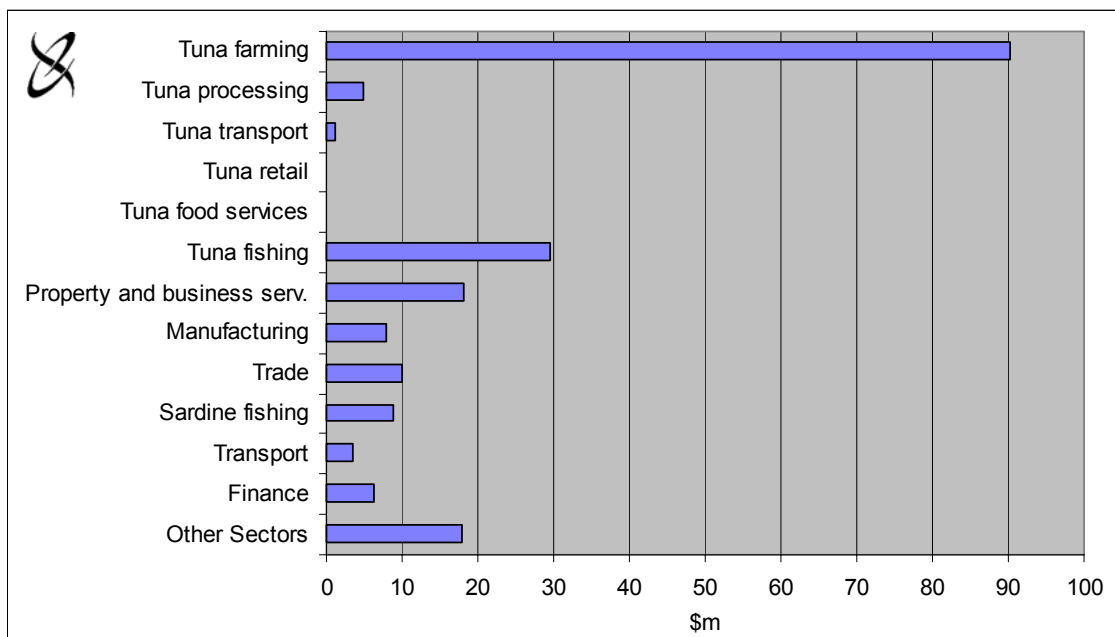
Contribution to gross state product (GSP) is calculated as the value of output less the cost of goods and services used in producing the output. GSP provides an assessment of the net contribution to state economic growth of a particular enterprise or activity¹⁶.

¹⁶ The use of 'contribution to GSP' (or GRP) as a measure of economic impact overcomes the problem of double counting that arises from using 'value of output' for this purpose.

The direct contribution to GSP by the tuna industry (i.e. farming, processing and transport) was approximately \$96 million in 2007/08. Associated with this was flow-on GSP in the other sectors of the state economy of \$102 million (Table 4.1).

The flow-ons were greatest in the tuna fishing (\$30m), property and business services (\$18m), sardine fishing (\$9m), trade (\$10m), manufacturing (\$8m), and finance (\$6m) sectors (Figure 4.2). The bottom row in Table 4.1 shows that for each one dollar contribution to GSP by the tuna industry there was an additional \$1.06 (\$2.06 in total) contribution to GSP in other sectors of the state economy.

Figure 4.2 Tuna farming in South Australia, contribution to GSP by sector, 2007/08



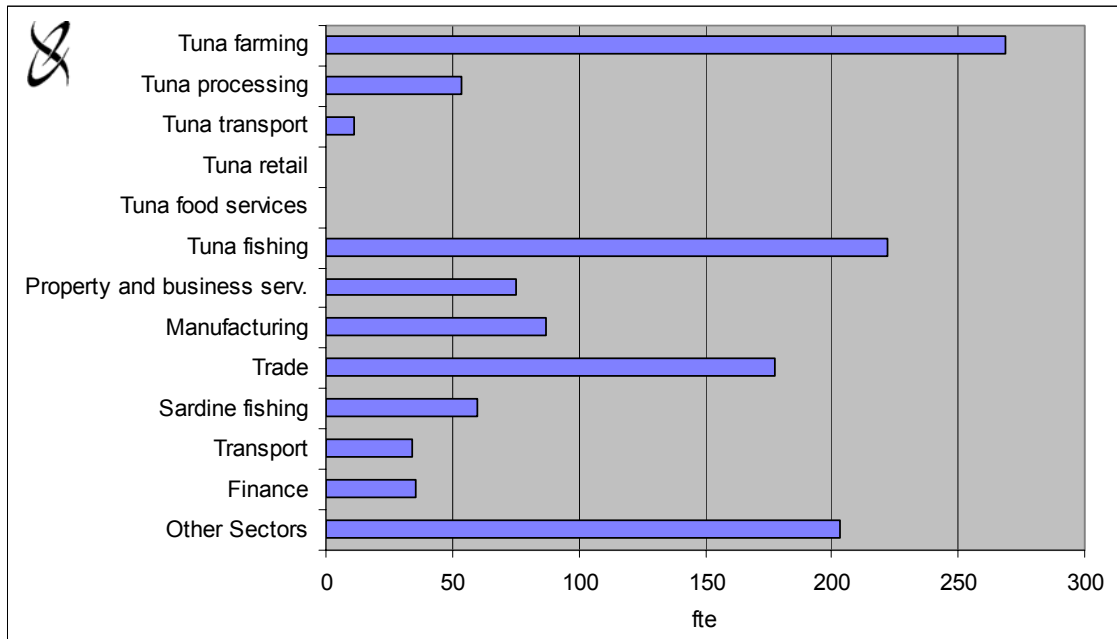
Source: EconSearch analysis.

Employment and household income...

A significant number of jobs were created as a result of the flow-on business activity associated with tuna farming, processing and transport. The tuna farms were responsible for the direct employment of approximately 270 full-time equivalents (fte) and, through associated processing and transport activities, another 64 fte in 2007/08 (Table 4.1). Flow-on business activity was estimated to generate a further 895 fte to give total employment of approximately 1,230 fte in the state. The sectors of the economy with employment flow-ons from tuna farming, processing and transport include the tuna fishing (222 fte), trade (177), manufacturing (87), property and business services (75), sardine fishing (60), finance (36) and transport (34) sectors (Figure 4.3).

The bottom row in Table 4.1 shows that for each fte job generated directly in tuna farming, processing and transport there were an additional 2.69 jobs (3.69 jobs in total) in the rest of the state.

Figure 4.3 Tuna farming in South Australia, employment impacts by sector, 2007/08

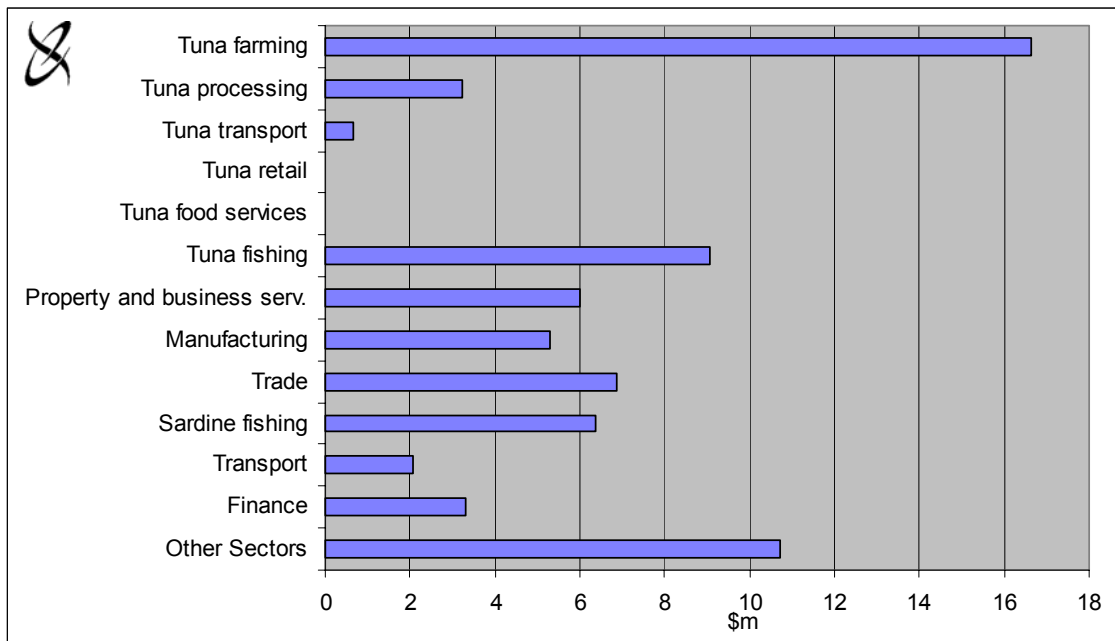


Source: EconSearch analysis.

It was estimated that personal income of approximately \$17 million was earned in the tuna farming sector in 2007/08, comprising both wages by employees and drawings by owner/operators. An additional \$9 million was earned by licence holders and crew in the tuna fishing sector and a further \$45 million by wage and salary earners in all other sectors of the state economy (Figure 4.4).

For each \$1.00 of household income generated directly by tuna farming, processing and transport in 2007/08 there was an additional 2.42 (\$3.42 in total) generated in other sectors of the state economy (Table 4.1).

Figure 4.4 Tuna farming in South Australia, household income impacts by sector, 2007/08



Source: EconSearch analysis.

4.2 The Economic Impact of Oyster Farming in South Australia, 2007/08

Table 4.2 provides estimates of the economic impact generated by oyster farming in South Australia on a sector-by-sector basis in 2007/08. As for tuna in the previous section, impacts are measured in terms of output (business turnover), contribution to GSP, employment and household income.

Output impacts...

Direct output (business turnover) generated in SA by oyster farming enterprises summed to \$32 million in 2007/08 while output generated in SA by associated downstream activities (processing, transport, retail and food service) summed to \$40 million. Flow-ons to other sectors of the state economy added another \$82 million in output in 2007/08. The sectors most affected were the trade, manufacturing and property and business services sectors.

Contribution to gross state product...

As noted above, contribution to GSP is calculated as the value of output less the cost of goods and services used in producing the output. In 2007/08, total oyster farming-related contribution to GSP in South Australia was almost \$80 million, \$22 million generated by oyster farming directly, \$16 million generated directly by downstream activities and \$41 million generated in other sectors of the state economy.

Table 4.2 The economic impact of oyster farming in South Australia, 2007/08 ^a

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Oyster farming ^b	31.6	21%	22.4	28%	468	42%	12.0	27%
Processing	6.8	4%	2.2	3%	24	2%	1.5	3%
Transport	6.4	4%	2.8	3%	26	2%	1.6	4%
Retail	0.4	0%	0.2	0%	4	0%	0.1	0%
Food services	26.0	17%	11.2	14%	182	16%	6.6	15%
Total Direct	71.2	47%	38.8	49%	704	64%	21.7	50%
Flow-on effects								
Property and business serv	18.6	12%	11.8	15%	51	5%	4.1	9%
Manufacturing	17.0	11%	5.5	7%	60	5%	3.7	8%
Trade	13.5	9%	6.4	8%	112	10%	4.3	10%
Transport	4.2	3%	1.8	2%	17	2%	1.0	2%
Finance	5.7	4%	3.5	4%	20	2%	1.9	4%
Other Sectors	22.5	15%	12.0	15%	140	13%	7.1	16%
Total Flow-on	81.5	53%	41.0	51%	401	36%	22.1	50%
Total ^c	152.8	100%	79.8	100%	1,105	100%	43.9	100%
Total/Direct	2.14		2.06		1.57		2.02	

^a Constitutes an upper estimate of the flow-on effects given the likelihood of some double counting of consumption induced effects in the retail and food services margins.

^b Includes sales of spat.

^c Note there is double counting in the total output impact.

Source: EconSearch analysis.

Employment and household income...

In 2007/08, SA oyster farming was responsible for the direct employment of around 470 fte and downstream activities created employment for around 240 fte. Flow-on business activity was estimated to generate a further 400 fte. These jobs were concentrated in the trade (112), manufacturing (60) and property and business services (51) sectors.

Personal income of approximately \$12 million was earned in the oyster farming sector and another \$10 million in downstream activities. This comprised both wages by employees and estimated drawings by owner/operators. An additional \$22 million of household income was earned in other businesses in the state as a result of oyster farming and downstream activities. The total household income impact was approximately \$44 million.

4.3 The Economic Impact of Other Aquaculture in South Australia, 2007/08

The economic impacts of other aquaculture sectors in South Australia in 2007/08 (marine finfish, mussels, abalone, freshwater finfish, marron/yabbies and other aquaculture) are reported in Tables to 4.3 to 4.8, respectively.

These results are reported without comment, as the interpretation is identical to that for oysters and tuna farming described in the previous sections.

For some of the other aquaculture sectors, the impacts in terms of flow-on employment and household income are relatively low. As these sectors grow and sales increase, household income and flow-on employment impacts generated by recurrent expenditure are expected to increase as well. The flow-on effects constitute an upper estimate given the likelihood of some double counting of consumption-induced effects in the retail and food services margins.

Table 4.3 The economic impact of marine finfish farming in South Australia, 2007/08

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Marine finfish farming	17.7	31%	5.6	23%	84	29%	3.4	25%
Processing	2.3	4%	0.7	3%	8	3%	0.5	4%
Transport	2.3	4%	1.0	4%	9	3%	0.6	4%
Retail	0.6	1%	0.3	1%	5	2%	0.2	1%
Food services	4.2	7%	1.8	8%	30	10%	1.1	8%
Total Direct	27.0	47%	9.4	39%	136	47%	5.7	41%
Flow-on effects								
Property and business serv	5.8	10%	3.7	15%	16	6%	1.3	9%
Manufacturing	5.1	9%	1.7	7%	18	6%	1.1	8%
Trade	5.0	9%	2.4	10%	41	14%	1.6	12%
Transport	1.3	2%	0.6	2%	5	2%	0.3	2%
Finance	1.9	3%	1.1	5%	7	2%	0.6	4%
Other Sectors	11.4	20%	5.1	21%	64	22%	3.1	23%
Total Flow-on	30.5	53%	14.6	61%	151	53%	8.1	59%
Total ^a	57.6	100%	24.0	100%	287	100%	13.8	100%
Total/Direct	2.13		2.55		2.11		2.41	

^a Note there is double counting in the total output impact.

Source: EconSearch analysis.

Table 4.4 The economic impact of mussel farming in South Australia, 2007/08

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Mussel farming	2.6	19%	1.8	24%	81	55%	1.8	36%
Processing	0.7	5%	0.2	3%	3	2%	0.2	3%
Transport	0.4	3%	0.2	3%	2	1%	0.1	2%
Retail	0.4	3%	0.2	2%	3	2%	0.1	2%
Food services	1.3	10%	0.6	8%	9	6%	0.3	7%
Total Direct	5.4	40%	2.9	41%	98	66%	2.5	51%
Flow-on effects								
Property and business serv	1.8	13%	1.2	17%	5	3%	0.4	8%
Manufacturing	1.6	12%	0.5	7%	6	4%	0.3	7%
Trade	1.3	10%	0.6	9%	11	7%	0.4	9%
Transport	0.4	3%	0.2	2%	2	1%	0.1	2%
Finance	0.6	4%	0.4	5%	2	1%	0.2	4%
Other Sectors	2.5	18%	1.4	19%	25	17%	1.0	20%
Total Flow-on	8.3	60%	4.3	59%	50	34%	2.4	49%
Total ^a	13.7	100%	7.2	100%	148	100%	4.9	100%
Total/Direct	2.52		2.46		1.52		1.97	

^a Note there is double counting in the total output impact.

Source: EconSearch analysis.

Table 4.5 The economic impact of abalone farming in South Australia, 2007/08

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Abalone farming	5.2	31%	1.3	22%	43	38%	1.3	30%
Processing	0.2	1%	0.1	1%	1	1%	0.0	1%
Transport	0.0	0%	0.0	0%	0	0%	0.0	0%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	0%	0.0	0%	0	0%	0.0	0%
Total Direct	5.4	33%	1.4	23%	44	39%	1.4	31%
Flow-on effects								
Property and business serv	1.7	10%	1.1	18%	4	4%	0.4	8%
Manufacturing	1.1	7%	0.4	6%	4	4%	0.2	6%
Trade	1.2	7%	0.6	9%	10	9%	0.4	9%
Transport	0.3	2%	0.1	2%	1	1%	0.1	2%
Finance	0.5	3%	0.3	5%	2	2%	0.2	4%
Other Sectors	6.2	38%	2.2	37%	47	42%	1.8	41%
Total Flow-on	11.0	67%	4.6	77%	68	61%	3.0	69%
Total ^a	16.4	100%	6.0	100%	112	100%	4.3	100%
Total/Direct	3.04		4.36		2.56		3.19	

^a Note there is double counting in the total output impact.

Source: EconSearch analysis.

Table 4.6 The economic impact of freshwater finfish farming in South Australia, 2007/08

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Freshwater finfish farming	4.5	42%	2.4	43%	52	61%	1.4	44%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.6	6%	0.3	5%	2	3%	0.1	5%
Retail	0.1	1%	0.0	1%	1	1%	0.0	1%
Food services	0.4	4%	0.2	3%	3	3%	0.1	3%
Total Direct	5.6	51%	2.8	51%	58	68%	1.6	53%
Flow-on effects								
Property and business serv	1.2	11%	0.8	14%	3	3%	0.2	8%
Manufacturing	0.9	8%	0.3	5%	3	4%	0.2	6%
Trade	1.0	9%	0.5	8%	8	10%	0.3	10%
Transport	0.2	2%	0.1	2%	1	1%	0.1	2%
Finance	0.4	4%	0.2	4%	1	2%	0.1	4%
Other Sectors	1.6	15%	0.9	15%	11	13%	0.5	17%
Total Flow-on	5.3	49%	2.7	49%	28	32%	1.5	47%
Total ^a	10.9	100%	5.5	100%	86	100%	3.1	100%
Total/Direct	1.94		1.95		1.48		1.89	

^a Note there is double counting in the total output impact.

Source: EconSearch analysis.

Table 4.7 The economic impact of marron/yabbies farming in South Australia, 2007/08

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Marron/yabbies farming	0.6	43%	0.5	57%	42	91%	0.0	16%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.0	2%	0.0	1%	0	0%	0.0	3%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.2	17%	0.1	12%	2	3%	0.1	23%
Total Direct	0.8	62%	0.6	70%	44	95%	0.1	43%
Flow-on effects								
Property and business serv	0.1	9%	0.1	8%	0	1%	0.0	11%
Manufacturing	0.1	8%	0.0	4%	0	1%	0.0	10%
Trade	0.1	7%	0.0	5%	1	2%	0.0	11%
Transport	0.0	2%	0.0	1%	0	0%	0.0	2%
Finance	0.0	3%	0.0	3%	0	0%	0.0	5%
Other Sectors	0.1	11%	0.1	9%	1	2%	0.0	18%
Total Flow-on	0.5	38%	0.2	30%	2	5%	0.1	57%
Total ^a	1.3	100%	0.8	100%	46	100%	0.2	100%
Total/Direct	1.61		1.43		1.06		2.32	

^a Note there is double counting in the total output impact.

Source: EconSearch analysis.

Table 4.8 The economic impact of other aquaculture in South Australia, 2007/08 ^a

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Other aquaculture	14.8	70%	7.7	71%	38	54%	1.5	46%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.0	0%	0.0	0%	0	0%	0.0	0%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	0%	0.0	0%	0	0%	0.0	0%
Total Direct	14.8	70%	7.7	71%	38	54%	1.5	46%
Flow-on effects								
Property and business serv	1.4	6%	0.9	8%	4	5%	0.3	9%
Manufacturing	1.1	5%	0.4	3%	4	6%	0.2	7%
Trade	1.3	6%	0.6	6%	11	15%	0.4	12%
Transport	0.3	1%	0.1	1%	1	1%	0.1	2%
Finance	0.5	2%	0.3	3%	2	2%	0.2	5%
Other Sectors	1.8	9%	1.0	9%	11	16%	0.6	19%
Total Flow-on	6.3	30%	3.2	29%	32	46%	1.8	54%
Total ^b	21.1	100%	10.9	100%	70	100%	3.3	100%
Total/Direct	1.43		1.42		1.85		2.16	

^a Other aquaculture production is comprised predominantly of ornamental fish and algae production.

^b Note there is double counting in the total output impact.

Source: EconSearch analysis.

5. The Economic Impact of Aquaculture in the Eyre Peninsula Region, 2007/08

5.1 The Economic Impact of Tuna Farming in the Eyre Peninsula Region, 2007/08

Estimates of the economic impact of tuna farming in the Eyre Peninsula region¹⁷ of South Australia in 2007/08 are reported in Table 5.1. The interpretation of these results is identical to the state-level impacts described in Section 4 of the report.

Table 5.1 The economic impact of tuna farming in the Eyre Peninsula Region, 2007/08

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Tuna farming ^a	186.7	55%	90.3	51%	269	26%	16.6	29%
Processing	15.1	72%	4.7	41%	42	30%	3.2	44%
Transport	2.7	13%	1.2	10%	12	8%	0.7	10%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	0%	0.0	0%	0	0%	0.0	0%
Total Direct	204.5	140%	96.2	102%	323	64%	20.5	83%
Flow-on effects								
Tuna fishing	36.9	11%	29.6	17%	222	22%	9.0	16%
Property and business serv.	18.7	6%	12.5	7%	45	4%	3.1	5%
Manufacturing	14.2	4%	4.4	2%	40	4%	3.0	5%
Trade	15.9	5%	7.6	4%	142	14%	5.2	9%
Sardines	15.5	5%	8.9	5%	60	6%	6.4	11%
Transport	7.1	2%	3.1	2%	31	3%	1.8	3%
Finance	4.6	1%	3.1	2%	20	2%	1.3	2%
Other Sectors	21.0	6%	11.4	6%	141	14%	7.2	13%
Total Flow-on	133.9	40%	80.6	46%	701	68%	37.1	64%
Total ^a	338.4	179%	176.8	148%	1,024	133%	57.6	147%
Total/Direct	1.65		1.84		3.17		2.81	

^a Note there is double counting in the total output impact.

Source: EconSearch analysis.

¹⁷ Defined as the Eyre Statistical Division which is comprised of the following Statistical Local Areas: Ceduna (DC), Cleve (DC), Elliston (DC), Franklin Harbour (DC), Kimba (DC), Le Hunte (DC), Lower Eyre Peninsula (DC), Port Lincoln (C), Streaky Bay (DC), Tumby Bay (DC), Unincorp. Lincoln and Unincorp. West Coast.

Output impacts...

Direct output (business turnover) generated locally by tuna farms summed to \$187 million and in other sectors (processing and transport), \$18 million in 2007/08. Flow-on output in other sectors summed to \$134 million. The sectors most affected were the tuna fishing (tuna capture), sardine fishing, manufacturing, trade, property and business services, transport, and finance sectors (Table 5.1).

The bottom row of Table 5.1 gives the total impact/direct impact ratio for each economic indicator. For output, the ratio of 1.65 indicates that for each dollar of sales generated directly by tuna farming, processing and transport there was a total of \$1.65 of output generated by businesses throughout the Eyre Peninsula region, \$1.00 in tuna farming, processing and transport and \$0.65 in other sectors of the regional economy.

Contribution to gross regional product...

The direct contribution to gross regional product (GRP) in the Eyre Peninsula region by tuna farming, processing and transport was approximately \$96 million in 2007/08. Flow-on GRP generated in the other sectors of the regional economy was approximately \$81 million in 2007/08. The flow-ons were greatest in the tuna fishing (\$30m), property and business services (\$13m), sardine fishing (\$9m), trade (\$8m) and manufacturing (\$4m) sectors.

The bottom row in Table 5.1 shows that for each dollar of GRP generated directly in tuna farming, processing and transport there was an additional \$0.84 (\$1.84 in total) generated in other sectors of the regional economy.

Employment and household income...

A significant number of jobs are created as a result of the flow-on business activity. The tuna farms were responsible for the direct employment of around 270¹⁸ fte and associated processing and transport, approximately 54 fte in the Eyre Peninsula region in 2007/08. Flow-on business activity was estimated to have generated a further 700 fte jobs locally to give total employment of over 1,000 fte in the region. The sectors of the local economy with employment flow-ons from tuna farming, processing and transport included the tuna fishing (222 fte), sardine fishing (60), trade (142), manufacturing (40), property and business services (45) and transport (31) sectors.

The bottom row in Table 5.1 shows that for each job generated directly in tuna farming, processing and transport there was an additional 2.17 jobs (3.17 jobs in total) in the rest of the region.

It was estimated that personal income of \$17 million was earned directly in the tuna farming sector in 2007/08, comprising both wages by employees and drawings by owner/operators. An additional \$9 million of household income was earned by licence holders and crew in the tuna fishing sector and a further \$32 million in other sectors of the regional economy. For each \$1.00 of household income generated directly by tuna farming, processing and transport in 2007/08 there was an additional \$1.81 (\$2.81 in total) generated in other sectors of the Eyre Peninsula regional economy.

¹⁸ Note that this estimate is significantly less than that for 2005/06 (502 fte). Whilst there may have been some productivity improvements in the sector, it is likely that the majority of this difference is a function of improvements in the quality of the PIRSA Aquaculture survey data. It is probable that direct employment in tuna farming in 2005/06 and previous years has been overestimated.

5.2 The Economic Impact of Oyster Farming in the Eyre Peninsula Region, 2007/08

Estimates of the economic impact of oyster farming in the Eyre Peninsula region in 2007/08 are reported in Table 5.2. The interpretation of these results is identical to the state-level impacts described in Section 4 of the report.

Output impacts...

Direct output (business turnover) generated by oyster enterprises in the Eyre Peninsula region summed to approximately \$31 million in 2007/08 while output generated in the Eyre Peninsula region by associated downstream activities (processing, transport, retail and food service) summed to \$9 million. Flow-ons to other sectors of the regional economy added another \$22 million in output in 2007/08. The sectors most affected were the trade, transport, manufacturing and property and business services sectors (Table 5.2).

Table 5.2 The economic impact of oyster farming in the Eyre Peninsula region, 2007/08 ^a

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Oyster farming ^b	30.9	50%	21.9	58%	457	74%	11.7	59%
Processing	1.7	3%	0.5	1%	5	1%	0.4	2%
Transport	6.2	10%	2.7	7%	27	4%	1.6	8%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	1.3	2%	0.5	1%	9	2%	0.3	2%
Total Direct	40.1	65%	25.7	68%	499	80%	14.0	70%
Flow-on effects								
Property and business serv.	5.5	9%	3.9	10%	11	2%	0.8	4%
Manufacturing	2.8	5%	0.9	2%	8	1%	0.6	3%
Trade	4.8	8%	2.3	6%	43	7%	1.6	8%
Transport	1.3	2%	0.6	2%	6	1%	0.3	2%
Finance	1.0	2%	0.7	2%	4	1%	0.3	1%
Other Sectors	6.2	10%	3.5	9%	50	8%	2.3	12%
Total Flow-on	21.6	35%	11.8	32%	122	20%	5.9	30%
Total ^c	61.7	100%	37.5	100%	621	100%	19.9	100%
Total/Direct	1.59		1.49		1.27		1.45	

^a Constitutes an upper estimate of the flow-on effects given the likelihood of some double counting of consumption-induced effects in the retail and food services margins.

^b Includes sales of spat.

^c Note there is double counting in the total output impact.

Source: EconSearch analysis.

Contribution to gross regional product...

Total oyster farming-related contribution to GRP in the Eyre Peninsula region was almost \$38 million in 2007/08, \$22 million generated by oyster farming directly, \$4 million generated by downstream activities and almost \$12 million generated in other sectors of the regional economy.

Employment and household income...

In 2007/08 in the Eyre Peninsula region, oyster farming was responsible for the direct employment of approximately 460 fte and associated downstream activities created employment for an additional 41 fte. Flow-on business activity was estimated to generate a further 122 fte. The total employment impact was over 600 fte.

In 2007/08, personal income of over \$14 million was earned in oyster farming and downstream activities in the Eyre Peninsula region comprising both wages by employees and estimated drawings by owner/operators. An additional \$6 million of household income was earned in other local businesses as a result of oyster industry operations. The total household income impact was almost \$20 million.

5.3 The Economic Impact of Other Aquaculture in the Eyre Peninsula Region, 2007/08

The economic impacts of other aquaculture sectors in the Eyre Peninsula region in 2007/08 (i.e. marine finfish, mussel and abalone farming) are reported in aggregate in Table 5.3. These results are reported without comment, as the interpretation is identical to that for oysters and tuna farming described in the previous sections.

Note that for most of the other aquaculture sectors, the impacts in terms of flow-on employment and household income are relatively low. As these sectors grow and sales increase, household income and flow-on employment impacts generated by recurrent expenditure are expected to increase as well. The flow-on effects constitute an upper estimate given the likelihood of some double counting of consumption-induced effects in the retail and food services margins.

Table 5.3 The economic impact of other aquaculture ^a in the Eyre Peninsula region, 2007/08 ^b

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Other aquaculture	22.2	47%	7.7	41%	180	57%	5.6	47%
Processing	3.0	6%	0.9	5%	8	3%	0.6	5%
Transport	2.6	6%	1.1	6%	11	4%	0.7	6%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.3	1%	0.1	1%	2	1%	0.1	1%
<i>Total Direct</i>	<i>28.0</i>	<i>59%</i>	<i>9.9</i>	<i>52%</i>	<i>202</i>	<i>64%</i>	<i>7.0</i>	<i>59%</i>
Flow-on effects								
Property and business serv.	3.3	7%	2.3	12%	7	2%	0.5	4%
Manufacturing	2.0	4%	0.6	3%	6	2%	0.4	4%
Trade	3.7	8%	1.8	9%	33	11%	1.2	10%
Transport	0.9	2%	0.4	2%	4	1%	0.2	2%
Finance	0.6	1%	0.4	2%	3	1%	0.2	1%
Other Sectors	8.7	18%	3.6	19%	62	20%	2.5	21%
<i>Total Flow-on</i>	<i>19.2</i>	<i>41%</i>	<i>9.1</i>	<i>48%</i>	<i>114</i>	<i>36%</i>	<i>5.0</i>	<i>41%</i>
Total ^c	47.2	100%	19.0	100%	316	100%	12.0	100%
Total/Direct	1.70		1.94		1.58		1.72	

^a Includes marine finfish, mussel and abalone farming.

^b Constitutes an upper estimate of the flow-on effects given the likelihood of some double counting of consumption-induced effects in the retail and food services margins.

^c Note there is double counting in the total output impact.

Source: EconSearch analysis.

6. The Economic Impact of Aquaculture in the Balance of South Australia, 2007/08

Estimates of the economic impact of aquaculture in the balance of SA¹⁹ in 2007/08 (i.e. oysters, mussels, abalone, freshwater finfish, marine finfish, marron/yabbies farming and other aquaculture enterprises) are reported in aggregate in Table 6.1.

Note that for some of the aquaculture sectors in the balance of SA, the impacts in terms of flow-on employment and household income are relatively low. As these sectors grow and sales increase, household income and flow-on employment impacts generated by recurrent expenditure are expected to increase as well. The flow-on effects constitute an upper estimate given the likelihood of some double counting of consumption-induced effects in the retail and food services margins.

Table 6.1 The economic impact of aquaculture^a in the balance of SA, 2007/08^b

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(jobs)		(\$m)	
Direct effects								
Aquaculture	23.8	70%	12.0	71%	169	73%	4.0	61%
Processing	0.3	1%	0.1	1%	1	0%	0.1	1%
Transport	0.9	3%	0.4	2%	4	2%	0.2	3%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.1	0%	0.0	0%	1	0%	0.0	0%
<i>Total Direct</i>	<i>25.1</i>	<i>74%</i>	<i>12.5</i>	<i>74%</i>	<i>175</i>	<i>76%</i>	<i>4.3</i>	<i>65%</i>
Flow-on effects								
Property and business serv.	1.8	5%	1.2	7%	3	2%	0.2	4%
Manufacturing	1.1	3%	0.3	2%	4	2%	0.2	3%
Trade	1.9	6%	0.9	5%	19	8%	0.6	10%
Transport	0.4	1%	0.2	1%	2	1%	0.1	2%
Finance	0.3	1%	0.2	1%	1	1%	0.1	2%
Other Sectors	3.3	10%	1.5	9%	26	11%	1.0	15%
<i>Total Flow-on</i>	<i>8.8</i>	<i>26%</i>	<i>4.4</i>	<i>26%</i>	<i>56</i>	<i>24%</i>	<i>2.3</i>	<i>35%</i>
Total^c	33.9	100%	16.8	100%	231	100%	6.6	100%
Total/Direct	1.35		1.35		1.33		1.54	

^a Includes oysters, marine finfish, mussels, abalone, freshwater finfish, marron/yabbies farming and other aquaculture enterprises.

^b Constitutes an upper estimate of the flow-on effects given the likelihood of some double counting of consumption-induced effects in the retail and food services margins.

^c Note there is double counting in the total output impact.

Source: EconSearch analysis.

¹⁹ Defined as South Australia net of the Eyre Peninsula region.

Output impacts...

Direct output (business turnover) generated by aquaculture summed to almost \$24 million and associated downstream activities, \$1.3 million in the balance of SA in 2007/08. Flow-on output in other sectors of the regional economy summed to \$8.8 million in 2007/08. The sectors most affected were the manufacturing, trade and property and business services sectors (Table 6.1).

Contribution to gross regional product...

Total aquaculture-related contribution to gross regional product in the balance of SA was \$16.8 million in 2007/08, \$12 million generated by aquaculture directly, \$0.5 million generated in associated downstream activities and \$4.4 million generated in other sectors of the regional economy.

Employment and household income...

Aquaculture and downstream activities were responsible for the direct employment of 175 fte in 2007/08 in the balance of SA. Flow-on business activity was estimated to generate a further 56 fte.

In 2007/08, personal income of \$4.3 million was earned in aquaculture and downstream activities in the balance of SA comprising both wages by employees and estimated drawings by owner/operators. An additional \$2.3 million of household income was earned in other local businesses as a result of aquaculture industry operations.

7. Other Facets of Regional Economic Development Associated with Aquaculture Activity in South Australia

In addition to the quantifiable economic impacts outlined above there are a number of other facets of regional economic development associated with aquaculture activity in South Australia.

Increasing the diversity and complexity of regional economies

Many of the small regional towns in South Australia are characterised by a heavy reliance on one or a small number of major industries, combined with a set of other "fundamental" activities that provide basic services and infrastructure to those industries. They lack the diversity and complexity of larger economic units.

The aquaculture industry has developed rapidly in recent years. Through its relatively large requirement for labour and material inputs, the industry has shown the potential to increase the complexity and diversity of local economies. The demand for local labour, goods and services assists in offsetting the contraction of other local industry and may help avoid a range of other economic and social pressures associated with declining regional economies.

Re-investment of profits in local enterprises

In addition to the regional impacts generated by recurrent expenditures in the aquaculture sector, further economic impacts are generated by the investment of profits in new or under-resourced local ventures by aquaculture operators.

For example, the current profitability in the tuna farming sector underpins the very substantial local investment by tuna farmers in the local cannery, shipyard, marinas, property (e.g. hotels) and other industries (e.g. yellowtail kingfish aquaculture and viticulture) (Brian Jeffries, pers. comm.)

Tourism

Tourism activities associated with the aquaculture sector (e.g. recreational fishing and farm tours) provide a further source of income and employment for regional economies with a well-developed aquaculture sector (e.g. the Eyre Peninsula region).

Education and Research

The aquaculture sector, particularly the tuna industry, is characterised by a high level of innovation. These innovative ideas have been directed towards value adding opportunities in the tuna industry itself (e.g. fresh fish direct marketed to Japan) and to the development of new aquaculture industries (e.g. yellowtail kingfish farming).

The success of the tuna industry, in particular, has been a catalyst for the development of significant research (e.g. CRC for Sustainable Aquaculture of Finfish) and education resources (e.g. the Marine Science Centre at Port Lincoln) within South Australia.

8. Summary

8.1 Economic Impact of Aquaculture in SA, 2007/08

Estimates of the economic impact of aquaculture activity in South Australia in 2007/08 are summarised in Table 8.1. The **direct impact** measures on-farm and aquaculture related downstream activities (fish processing, transport, retail and food services). The **flow-on impact** measures the economic effects in other sectors of the economy (trade, transport, etc) generated by the aquaculture industry, that is, the ripple or multiplier effects.

Value of output is a measure of the business turnover or gross revenue of an activity. **Direct output** equates to the **PIRSA Scorecard** estimate of **net food revenue**, estimated to be \$335m (\$264m on-farm and \$71m in downstream activities) in 2007/08 (Table 8.1). **Total output** (\$657m) needs to be used with care as it includes elements of double counting. Approximately 68 per cent of the output impact was generated in regional South Australia (Table 8.2).

Contribution to gross state or regional product (GSP/GRP) is measured as value of output less the cost of goods and services (including imports) used in producing the output. As such, it provides an estimate of the net contribution of aquaculture to the state's economy. In 2007/08, aquaculture's **total contribution to GSP** (\$333m) (Table 8.1) represented 0.45 per cent of the total GSP for South Australia (\$73,262m)²⁰. Approximately 71 per cent of the contribution to GSP was generated in regional South Australia (Table 8.2). Contribution to GSP/GRP, as a measure of economic impact, avoids the problem of double counting that arises from using output for this purpose.

Employment is a measure of the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent (fte) jobs. Direct employment was estimated to be over 1,450 fte (1,077 on-farm and 377 in downstream activities) in 2007/08 with over 1,600 flow-on jobs, giving **total employment** of 3,083 fte (Table 8.1). Approximately 66 per cent of these jobs were generated in regional South Australia (Table 8.2).

Household income is a measure 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. Direct household income was estimated to be around \$55m in 2007/08 and flow-on income approximately \$89m, giving a **total household income** impact of almost \$144m (Table 8.1). Approximately 62 per cent of the household income impact was generated in regional South Australia (Table 8.2).

In regional areas, the impact of the aquaculture industry in 2007/08 was concentrated in the Eyre Peninsula region, reflecting the dominance of tuna farming in the total (Table 8.2).

²⁰ ABS (2008).

Table 8.1 The economic impact of aquaculture in South Australia, 2007/08

	Tuna	Marine Finfish	Oysters	Mussels	Abalone	Freshwater Finfish	Marron and Yabbies	Other ^a	Total
Output (\$m)									
Direct									
<i>On-farm</i>	186.7	17.7	31.6	2.6	5.2	4.5	0.6	14.8	263.6
<i>Downstream</i>	17.8	9.4	39.6	2.9	0.2	1.1	0.3	0.0	71.2
Total Direct	204.5	27.0	71.2	5.4	5.4	5.6	0.8	14.8	334.8
Total Flow-on	178.7	30.5	81.5	8.3	11.0	5.3	0.5	6.3	322.2
Total ^b	383.2	57.6	152.8	13.7	16.4	10.9	1.3	21.1	656.9
Contribution to GSP (\$m)									
Direct									
<i>On-farm</i>	90.3	5.6	22.4	1.8	1.3	2.4	0.5	7.7	131.9
<i>Downstream</i>	6.0	3.8	16.4	1.2	0.1	0.5	0.1	0.0	28.1
Total Direct	96.4	9.4	38.8	2.9	1.4	2.8	0.6	7.7	160.0
Total Flow-on	102.4	14.6	41.0	4.3	4.6	2.7	0.2	3.2	173.1
Total	198.8	24.0	79.8	7.2	6.0	5.5	0.8	10.9	333.0
Employment (fte)									
Direct									
<i>On-farm</i>	269	84	468	81	43	52	42	38	1,077
<i>Downstream</i>	64	52	236	17	1	6	2	0	377
Total Direct	333	136	704	98	44	58	44	38	1,454
Total Flow-on	895	151	401	50	68	28	2	32	1,628
Total	1,229	287	1,105	148	112	86	46	70	3,083
Household income (\$m)									
Direct									
<i>On-farm</i>	16.6	3.4	12.0	1.8	1.3	1.4	0.0	1.5	38.0
<i>Downstream</i>	3.9	2.3	9.8	0.7	0.1	0.3	0.1	0.0	17.1
Total Direct	20.5	5.7	21.7	2.5	1.4	1.6	0.1	1.5	55.1
Total Flow-on	49.7	8.1	22.1	2.4	3.0	1.5	0.1	1.8	88.6
Total	70.2	13.8	43.9	4.9	4.3	3.1	0.2	3.3	143.7

^a Other aquaculture is comprised predominantly of ornamental fish and algae production.

^b Note there is double counting in the total output impact.

Source: EconSearch analysis.

Table 8.2 The total regional economic impact (direct and flow-on) of aquaculture in South Australia, 2007/08

Sector	Output ^a		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Eyre Peninsula	412.4	92%	219.9	93%	1,792	89%	81.8	93%
Balance of SA	33.9	8%	16.8	7%	231	11%	6.6	7%
Total Regional Impact	446.3	100%	236.8	100%	2,023	100%	88.4	100%
Regional Impact as a Proportion of Total	-	68%	-	71%	-	66%	-	62%

^a Note there is double counting in the total output impact.

Source: EconSearch analysis.

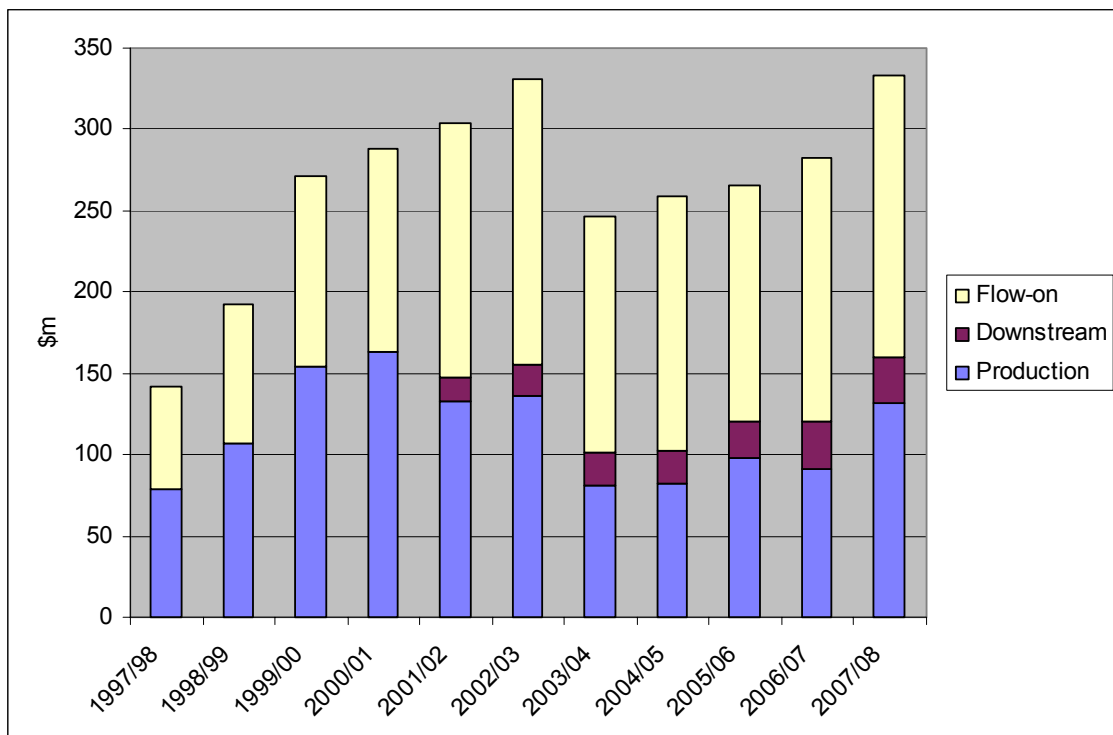
8.2 Economic Impact of Aquaculture in SA, Time Series, 1997/98 to 2007/08

Estimates of the economic impact of aquaculture on the South Australian economy for the period 1997/98 to 2007/08, in terms of contribution to GSP and employment, are provided in Figures 8.1 and 8.2, respectively.

It is important to note that some of the variability in the GSP and employment impacts of SA aquaculture over the period 1997/98 to 2007/08 is a function of changes in methodology. Most significantly, as discussed in Section 2.1 of the report, estimates for the period 1997/98 to 2000/01 exclude some of the downstream impacts associated with aquaculture activity in SA²¹. Other methodological and data-related influences include:

- the use of revised input-output tables;
- updates of the representative cost structures for individual aquaculture sectors;
- revisions to the processing, transport, retail and food service trade margins used in the analysis; and
- improvements in the quality of PIRSA Aquaculture's survey data.

Figure 8.1 Total GSP impact of aquaculture in SA, 1997/98 to 2007/08 ^a



^a Total GSP impacts for the period 1997/98 to 2000/01 exclude some downstream activities (including some transport and all retail and food services).

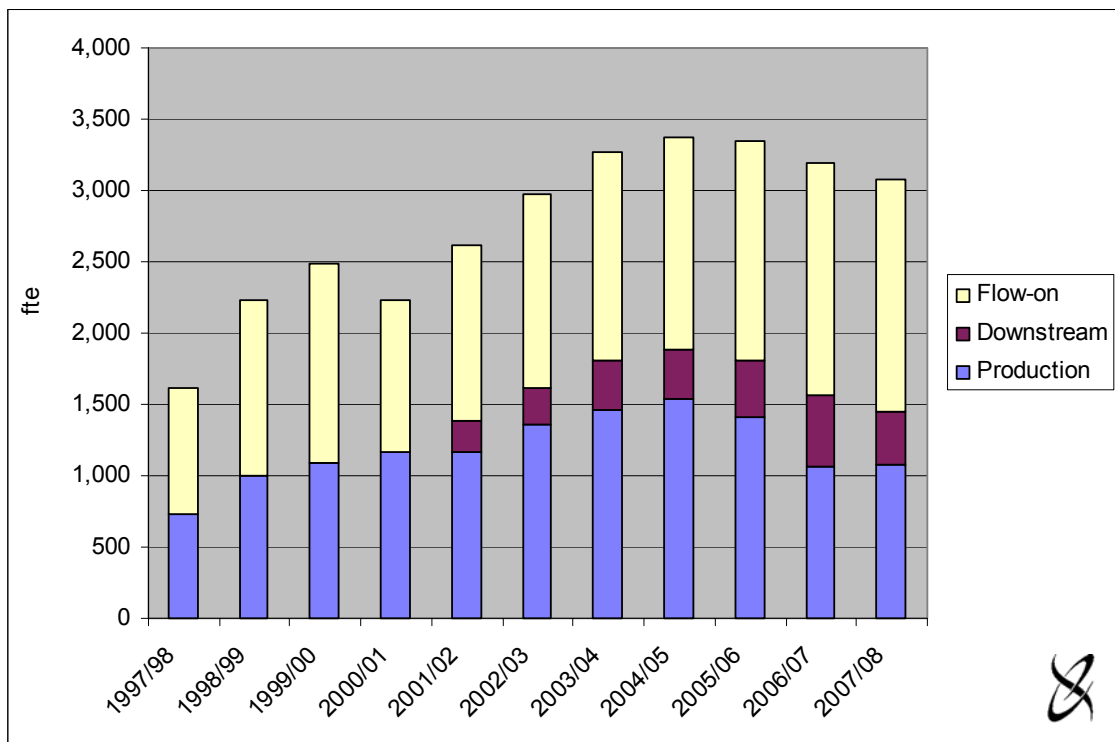
Source: EconSearch (1997, 1998, 1999, 2001, 2002a, 2003, 2004, 2006a, 2006b, 2007 and 2008) and Table 8.1.

²¹ See Table 2.1 for further details.

Total contribution to GSP attributable to aquaculture in SA exhibited a rising trend over the period 1997/98 to 2002/03 (Figure 8.1). The significant reduction in the GSP impact between 2002/03 and 2003/04 is primarily a function of the decline in the per unit value of farmed tuna (45 per cent) over this period. Total contribution to GSP since 2003/04 has continued its rising trend.

The total employment impact attributable to aquaculture in SA exhibited a rising trend over the period 1997/98 to 2004/05, reflecting an expansion in capacity and production growth across most aquaculture sectors over this period (Figure 8.2). The reduction in direct employment in farming (i.e. production) activities between 2004/05 and 2007/08 is likely to be a function of improvements in on-farm labour productivity as well as a reflection of the improved quality of PIRSA Aquaculture’s survey data.

Figure 8.2 Total employment impact of aquaculture in SA, 1997/98 to 2007/08 ^a



^a Total employments impacts for the period 1997/98 to 2000/01 exclude some downstream activities (including some transport and all retail and food services).

Source: EconSearch (1997, 1998, 1999, 2001, 2002a, 2003, 2004, 2006a, 2006b, 2007 and 2008) and Table 8.1.

8.3 Projections for Production and Employment, 2008/09 to 2010/11

Respondents to the survey of aquaculture licence holders undertaken by PIRSA for 2007/08 provided projections of their production and employment over the three year period, 2008/09 to 2010/11. The projections for each sector are summarised in Table 8.3²².

Based on two sets of price assumptions, namely a 'no price' response and a 'generic small but negative price' effect, high and low projections of gross value of aquaculture production (GVP) for the period 2007/08 to 2009/10 have been imputed from the production projections. These GVP projections are presented in Table 8.4.

The low estimate of GVP is based on a small but negative price effect for that proportion of the growth that is likely to be supplied to the South Australian domestic market. It was assumed that 100 per cent of the growth in tuna and abalone production would be exported to interstate and overseas markets (i.e. low and high estimates of GVP identical) and 50 per cent of the growth in other sectors would be exported. The high estimate of GVP is based on no price response over the projection period (i.e. prices remain at 2007/08 levels).

Table 8.3 Projected growth in South Australian aquaculture production and employment, 2008/09 to 2010/11 ^a

	Estimated cumulative change relative to 2007/08					
	Production			Employment		
	2008/09	2009/10	2010/11	2008/09	2009/10	2010/11
Tuna ^b	8%	9%	11%	1%	1%	4%
Marine Finfish ^c	23%	23%	23%	9%	11%	12%
Oysters	8%	12%	14%	2%	5%	9%
Mussels	39%	53%	100%	12%	22%	23%
Abalone	41%	88%	100%	9%	11%	13%
Freshwater Finfish ^d	8%	21%	26%	1%	8%	15%
Marron and Yabbies	3%	14%	15%	0%	1%	1%
Other ^e	1%	5%	7%	2%	4%	7%

^a Based on an analysis of PIRSA Aquaculture's 2007/08 survey responses.

^b Projected growth in tuna production relates to wild catch only.

^c Predominantly Yellowtail Kingfish and Mulloway production.

^d Predominantly Barramundi and Rainbow Trout production.

^e Predominantly ornamental fish and algae production.

²² These estimates were based on survey responses only and could, therefore, be subject to some sample bias.

Table 8.4 Projected growth in South Australian aquaculture value of production, 2008/09 to 2010/11 ^a

	Actual GVP (\$m)	Low GVP Forecast (\$m)			High GVP Forecast (\$m)		
	2007/08	2008/09	2009/10	2010/11	2008/09	2009/10	2010/11
Tuna	186.7	201.5	203.2	208.1	201.5	203.2	208.1
Marine Finfish	17.7	20.5	20.5	20.5	21.8	21.8	21.8
Oysters ^b	30.1	31.9	32.7	33.2	32.5	33.7	34.4
Mussels	2.6	3.3	3.4	3.9	3.6	4.0	5.2
Abalone	5.2	7.2	9.7	10.3	7.2	9.7	10.3
Freshwater Finfish	4.5	4.8	5.2	5.3	4.9	5.5	5.7
Marron and Yabbies	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Other	14.8	14.9	15.3	15.5	15.0	15.4	15.8
Total	262.1	284.7	290.6	297.4	287.1	293.9	301.9

^a All estimates are in 2008 dollars.

^b Adult oysters only (i.e. excludes spat).

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Appendix 1 Input-Output Methodology

Overview of Input-Output Analysis

Input-output analysis provides a comprehensive economic framework that is extremely useful in the resource planning process. Broadly, there are two ways in which the input-output method can be used.

First, the input-output table provides a numerical picture of the size and shape of the economy and its essential features. The input-output transactions table can be used to describe some of the important features of an economy, the interrelationships between sectors, and the relative importance of the individual sectors.

Second, input-output analysis provides a standard approach for the estimation of the economic impact of a particular activity. The input-output model is used to calculate industry multipliers that can then be applied to various development scenarios.

Linkages between sectors

The standard approach for the estimation of the regional economic impact of a particular activity, such as wine production, is to employ *input-output analysis*. The input-output model conceives the economy of the region as being divided up into a number of sectors, and this allows the analyst to trace expenditure flows.

To illustrate this, consider the example of a winery that, in the course of its operation, purchases goods and services from other sectors. These goods and services would include grapes, bottles, and corks and, of course, labour. The direct employment created is regarded in the model as an expenditure flow into the household sector, which is one of several non-industrial sectors recognised in the input-output model.

Upon receiving expenditure by the winery, the other sectors in the state economy engage in their own expenditures. For example, as a consequence of winning a contract for work with a winery, a bottle manufacturer buys materials from its suppliers and labour from its own employees. Suppliers and employees in turn engage in further expenditure, and so on. These *indirect effects*, as they are called, are part of the impact of the winery on the regional or state economy. They must be added to the *direct effects* (which are expenditures made in immediate support of the winery itself) in order to arrive at a measure of the total impact of the winery.

It may be thought that these indirect effects go on indefinitely, and that their amount adds up without limit, the presence of *leakages*, however, prevents this from occurring. In the context of the impact on a *regional or state* economy, an important leakage is expenditure on imports, that is, products or services that originate from *outside the region, state or country* (e.g. French oak barrels).

Thus some of the expenditure for imports to the region is lost to the local economy. Consequently, the indirect effects get smaller and smaller in successive expenditure rounds, due to this and other leakages. Hence the total expenditure created in the local economy is limited in amount, and so (in principle) it can be measured.

The performance of the input-output analysis calculations require a great deal of information. The analyst needs to know the magnitude of various expenditures and where they occur. Also needed is information on how the sectors that receive this expenditure share *their* expenditures among the various sectors from whom they buy, and so on for the further expenditure rounds.

In applying the input-output model, the standard procedure is to determine the direct or first-round expenditures only. No attempt is made to pursue such inquiries on expenditure in subsequent rounds, not even (for example) to trace the effects in the local economy on household expenditures by winery employees on food, clothing, entertainment, and so on, as it is impracticable to measure these effects for an individual case, here the winery.

The input-output model is instead based on a set of assumptions about constant and uniform proportions of expenditure. If households in general in the local economy spend (say) 13.3 per cent of their income on food and non-alcoholic beverages, it is assumed that those working in wineries do likewise. Indeed, the effects of all expenditure rounds after the first are calculated by using such standard proportions (*multiplier* calculations).

Multipliers

Multipliers are an indication of the strength of the linkages between a particular sector and the rest of the regional economy. As well, they can be used to estimate the impact of a change in that particular sector on the rest of the economy. As noted above, detailed explanations on calculating input-output multipliers (and the underlying assumptions) are provided in any regional economics or input-output analysis textbook (see for example Hewings (1985), Jensen and West (1986), Midmore and Harrison-Mayfield (1996), Powell et al. (1985), and West (1993)). Suffice to note that they are calculated through a routine set of mathematical operations based on coefficients derived from the input-output transactions table.

Input-output transactions table

The structure and linkages of a local economy can be described with the aid of input-output analysis. 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 input-output transactions table is a convenient way to illustrate the purchases and sales of goods and services taking place in an economy at a given time.

Input-output tables provide a numerical picture of the size and shape of the economy and its essential features. Products produced in the economy are aggregated into a number of groups of industries and the transactions between them recorded in the transactions table. The rows and columns of the input-output table can be interpreted in the following way:

- The rows of the input-output table illustrate sales for intermediate usage (to other firms) and for final demand (consumers, exports, capital formation).

- The columns show the origin of the inputs and hence the purchases made at that time (labour, capital and intermediate inputs).
- Each item is shown as a purchase by one sector and a sale by another, thus constructing two sides of a double accounting schedule.

In summary, the input-output transactions table can be used to describe some of the important features of a regional economy, the interrelationships between sectors, and the relative importance of the individual sectors. The table is also used for the calculation of sector multipliers and the estimation of economic impacts arising from some change in the local economy.

Appendix 2 Glossary of Input-Output Terminology

Basic value is the price received for a good or service by the producer. It is also known as *producers' price*. It excludes indirect taxes and transport, trade and other margins.

Consumption-induced effects are additional output, employment and income resulting from re-spending by households that receive income from employment in direct and indirect activities. Consumption-induced effects are sometimes referred to as "induced effects".

Contribution to gross state/regional product is calculated as the value of output less the cost of goods and services (including imports) used in producing the output. It represents payments to the primary inputs of production (labour, capital and land). Contribution to GSP/GRP is consistent with standard measures of economic activity, such as gross domestic, State or regional product and it provides an assessment of the net contribution to regional economic growth of a particular enterprise or activity.

Direct effects are the initial round of output, employment and income generated by an economic activity.

Employment is the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent jobs.

Exports refers to the sale of goods and services to final consumers outside the region of interest. In a state input-output table, exports refers to the sale of goods and services interstate and overseas. In a regional input-output table exports refers to the sale of goods and services interstate, overseas and to other regions within the state.

Flow-on effects are the sum of the production-induced effects and the consumption-induced effects.

Household income is a measure 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.

Input-output analysis is an accounting system of inter-industry transactions based on the notion that no industry exists in isolation.

Input-output table is a transactions table that illustrates and quantifies the purchases and sales of goods and services taking place in an economy at a given point in time. It provides a numerical picture of the size and shape of the economy and its essential features. Each item is shown as a purchase by one sector and a sale by another, thus constructing two sides of a double accounting schedule.

Multiplier is an index (ratio) indicating the overall change in the level of activity that results from an initial change in economic activity. They are an indication of the strength of the linkages between a particular sector and the rest of the regional economy. They can be used to estimate the impact of a change in that particular sector on the rest of the economy.

Other Final Demand includes government expenditure, private and public sector investment (gross fixed capital formation) and change in stocks (inventories).

Other Value Added includes gross operating surplus and all taxes, less subsidies.

Output is gross revenue of goods and services produced by commercial organisations plus gross expenditure by government agencies.

Purchasers' price is the price paid for a good or service paid by the purchaser. It includes indirect taxes and transport, trade and other margins.

Production-induced effects are additional output, employment and income resulting from re-spending by firms that receive income from the sale of goods and services to firms undertaking, for example, agricultural activities. Production-induced effects are sometimes referred to as "indirect effects".

Total impact is the sum of the direct effects and the flow-on effects.

Type I multiplier is calculated as $(\text{direct effects} + \text{production-induced effects}) / \text{direct effects}$.

Type II multiplier is calculated as $(\text{direct effects} + \text{production-induced effects} + \text{consumption-induced effects}) / \text{direct effects}$.

Appendix 3 Aquaculture Production and Value of Production, South Australia, 1994/95 to 2007/08

Appendix Table 3.1 Farmed tuna production, South Australia, 1995/96 to 2007/08

	Into Farms		Farm Output
	Whole Weight	Processed Weight	Farm Gate Value
	'000kg	'000kg	\$m
1995/96	3,362	1,170	29.3
1996/97	2,498	4,069	91.5
1997/98	3,610	4,927	120.7
1998/99	4,991	6,805	166.7
1999/00	5,133	7,750	240.0
2000/01	5,282	9,051	263.8
2001/02	5,296	9,245	260.5
2002/03	5,409	9,102	266.9
2003/04	5,080	9,290	151.0
2004/05	5,421	7,458	140.0
2005/06	5,220	8,806	155.8
2006/07	5,351	7,486	137.7
2007/08	n.a. ^a	9,757	186.7

^a Not available until publication of ABARE's *Australian Fisheries Statistics 2008* report (ABARE, pers. comm.).

Source: SARDI Aquatic Sciences and PIRSA Aquaculture.

Appendix Table 3.2 Oyster production, South Australia, 1995/96 to 2007/08 ^a

	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Production (adult only):														
Weight ('000 kg)	855	976	1,359	na	na	na	na	na	na	na	na	na	na	na
Number ('000 doz.)	na	na	1,336	1,298	1,441	2,516	2,936	3,464	3,865	4,644	4,650	5,397	7,720	5,448
Value:														
Adult oysters (\$'000)	3,535	3,950	5,205	4,908	5,489	9,389	11,011	13,303	15,116	19,959	19,995	23,879	37,841	30,132
Spat (\$'000)	na	na	610	1,168	997	800	579	856	1,002	1,193	1,195	957	1,143	1,469
Total (\$'000)	3,535	3,950	5,815	6,076	6,486	10,189	11,590	14,159	16,118	21,152	21,190	24,836	38,984	31,601

^a All figures have been rounded to the nearest thousand. Individual figures provided in the columns may not sum to the 'Total' for this reason.

Source: SARDI Aquatic Sciences and PIRSA Aquaculture.

Appendix Table 3.3 Other aquaculture production, South Australia, 1995/96 to 2007/08 ^a

	1994/95		1995/96		1996/97		1997/98		1998/99		1999/00		2000/01		2001/02		2002/03		2003/04		2004/05		2005/06		2006/07		2007/08			
	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)	Whole Weight ('000kg)	Value (\$'000)		
Marine Finfish	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	2,074	17,674
Mussels	na	na	na	na	na	na	na	na	84	183	81	173	111	260	171	371	254	466	400	697	377	657	469	950	1,032	1,914	1,369	2,591		
Abalone	na	na	na	na	na	na	na	na	21	856	40	2000	53	2677	34	1901	59	3080	105	3155	177	5318	250	8,222	196	7,155	167	5,151		
Freshwater Finfish	32	188	21	158	163	1833	216	2799	263	3293	287	3379	277	2919	281	2845	489	6322	256	2585	283	2810	453	3,726	423	4,019	421	4,513		
Marron and Yabbies	14	185	23	316	15	227	17	246	34	391	28	460	25	368	19	377	29	626	28	633	42	893	12	318	29	721	22	559		
Other ^b	296	2,629	323	3,158	280	2,012	379	3,041	412	3,259	337	2,828	480	4,322	334	3,375	1,077	8,769	894	7,533	2,019	17,015	2,148	17,591	1,953	18,514	1,727	14,765		
Total	342	3,002	367	3,632	458	4,072	612	6,086	814	7,982	773	8,840	946	10,546	839	8,869	1,908	19,263	1,683	14,603	2,898	26,693	3,332	30,807	3,633	32,323	5,779	45,254		

^a All figures have been rounded to the nearest thousand. Individual figures provided in the columns may not sum to the 'Total' for this reason.

^b Other aquaculture production is comprised predominantly of ornamental fish and algae production.

Source: SARDI Aquatic Sciences and PIRSA Aquaculture.

Appendix 4 The Total Economic Impact of Aquaculture in South Australia, by Aquaculture Sector, 2001/02 to 2006/07²³

Appendix Table 4.1 The total economic impact (direct and flow-on) of aquaculture in South Australia, by aquaculture sector, 2001/02

Sector	Output		Value Added		Employment		Household Income	
	(\$m)		(\$m)		(jobs)		(\$m)	
Tuna farming	490.8	85.0%	260.1	85.6%	1,806	69.0%	69.8	73.9%
Oyster farming	57.6	10.0%	28.9	9.5%	514	19.7%	15.5	16.4%
Abalone farming	5.6	1.0%	3.0	1.0%	64	2.4%	1.7	1.8%
Mussels farming	1.6	0.3%	0.9	0.3%	31	1.2%	0.7	0.8%
Barramundi farming	8.7	1.5%	4.4	1.4%	74	2.8%	2.6	2.8%
Yabby/Marron farming	1.1	0.2%	0.6	0.2%	13	0.5%	0.2	0.2%
Other aquaculture	12.1	2.1%	6.0	2.0%	115	4.4%	3.9	4.1%
Total (SA)	577.5	100.0%	303.8	100.0%	2,617	100.0%	94.4	100.0%

Source: EconSearch (2003).

Appendix Table 4.2 The total economic impact (direct and flow-on) of aquaculture in South Australia, by aquaculture sector, 2002/03

Sector	Output		Value Added		Employment		Household Income	
	(\$m)		(\$m)		(jobs)		(\$m)	
Tuna farming	508.5	79.3%	266.2	80.5%	1,791	60.3%	71.6	66.7%
Oyster farming	64.8	10.1%	32.4	9.8%	582	19.6%	17.4	16.2%
Abalone farming	9.6	1.5%	4.9	1.5%	97	3.3%	2.6	2.4%
Mussels farming	2.3	0.4%	1.2	0.4%	44	1.5%	1.1	1.0%
Barramundi farming	22.7	3.5%	11.1	3.4%	162	5.5%	6.6	6.1%
Yabby/Marron farming	2.0	0.3%	1.0	0.3%	22	0.7%	0.4	0.4%
Other aquaculture	31.6	4.9%	13.9	4.2%	270	9.1%	7.8	7.2%
Total (SA)	641.5	100.0%	330.8	100.0%	2,969	100.0%	107.4	100.0%

Source: EconSearch (2004).

²³ Other aquaculture production is comprised of yellowtail kingfish, Atlantic salmon, other marine finfish (e.g. mullocky), rainbow trout and other aquaculture enterprises (e.g. algae production).

Appendix Table 4.3 The total economic impact (direct and flow-on) of aquaculture in South Australia, by aquaculture sector, 2003/04

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	347.9	69.2%	171.9	69.8%	1,759	53.9%	76.9	62.1%
Oyster farming	117.1	23.3%	56.4	22.9%	1,028	31.5%	34.2	27.6%
Abalone farming	9.0	1.8%	4.0	1.6%	149	4.6%	3.7	3.0%
Mussels farming	4.2	0.8%	2.1	0.9%	76	2.3%	2.0	1.6%
Barramundi farming	5.4	1.1%	3.0	1.2%	52	1.6%	1.7	1.4%
Yabby/Marron farming	1.5	0.3%	0.8	0.3%	19	0.6%	0.3	0.3%
Other aquaculture	17.8	3.5%	8.0	3.2%	182	5.6%	5.1	4.1%
Total (SA)	502.9	100.0%	246.2	100.0%	3,264	100.0%	123.9	100.0%

Source: EconSearch (2006a).

Appendix Table 4.4 The total economic impact (direct and flow-on) of aquaculture in South Australia, by aquaculture sector, 2004/05

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	333.3	64.3%	171.9	66.4%	1,535	45.6%	69.5	54.9%
Oyster farming	118.5	22.9%	56.6	21.9%	1,023	30.4%	35.0	27.7%
Abalone farming	15.5	3.0%	6.6	2.5%	255	7.6%	6.3	5.0%
Mussels farming	4.0	0.8%	2.0	0.8%	72	2.1%	1.9	1.5%
Barramundi farming	6.0	1.2%	3.1	1.2%	55	1.6%	2.2	1.8%
Yabby/Marron farming	2.1	0.4%	1.2	0.5%	28	0.8%	0.4	0.4%
Other aquaculture	38.8	7.5%	17.4	6.7%	397	11.8%	11.1	8.8%
Total (SA)	518.2	100.0%	258.7	100.0%	3,366	100.0%	126.5	100.0%

Source: EconSearch (2006b).

Appendix Table 4.5 The total economic impact (direct and flow-on) of aquaculture in South Australia, by aquaculture sector, 2005/06

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	331.6	60.3%	163.0	61.5%	1,425	42.6%	60.8	49.7%
Oyster farming	133.7	24.3%	64.4	24.3%	1,180	35.3%	38.6	31.5%
Abalone farming	18.8	3.4%	7.8	2.9%	151	4.5%	4.1	3.4%
Mussels farming	4.9	0.9%	2.5	1.0%	81	2.4%	2.2	1.8%
Barramundi farming	9.8	1.8%	4.6	1.7%	65	1.9%	4.0	3.3%
Yabby/Marron farming	0.7	0.1%	0.4	0.2%	41	1.2%	0.1	0.1%
Other aquaculture ^a	50.5	9.2%	22.4	8.5%	406	12.1%	12.5	10.2%
Total (SA)	550.1	100.0%	265.1	100.0%	3,348	100.0%	122.4	100.0%

Source: EconSearch (2007).

Appendix Table 4.6 The total economic impact (direct and flow-on) of aquaculture in South Australia, by aquaculture sector, 2006/07

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	306.3	51.6%	145.0	51.4%	1,149	36.0%	53.8	38.7%
Oyster farming	193.9	32.7%	94.6	33.5%	1,295	40.6%	56.4	40.6%
Abalone farming	18.0	3.0%	7.9	2.8%	136	4.3%	5.7	4.1%
Mussels farming	9.2	1.6%	4.6	1.6%	109	3.4%	3.3	2.3%
Barramundi farming	8.9	1.5%	4.2	1.5%	56	1.8%	2.5	1.8%
Yabby/Marron farming	1.6	0.3%	0.9	0.3%	47	1.5%	0.3	0.2%
Other aquaculture ^a	55.9	9.4%	25.1	8.9%	400	12.5%	16.9	12.2%
Total (SA)	593.8	100.0%	282.4	100.0%	3,192	100.0%	138.9	100.0%

Source: EconSearch (2008).