



# THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE SOUTH AUSTRALIAN STATE AND REGIONAL ECONOMIES, 2018/19

A Report to PIRSA Fisheries and  
Aquaculture

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## ABBREVIATIONS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ASBTIA	Australian Southern Bluefin Tuna Industry Association
ASC	Aquaculture Stewardship Council
doz	dozen
fte	full-time equivalent
GRP	gross regional product
GSP	gross state product
GVP	gross value of production
JPY	Japanese yen
KI	Kangaroo Island
PIRSA	Primary Industries and Regions South Australia
SA	South Australia
SARDI	South Australian Research and Development Institute
SBT	Southern Bluefin Tuna
US	United States
WA	Western Australia



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## EXECUTIVE SUMMARY

The aim of this study was to estimate the economic contribution of aquaculture activity in South Australia in 2018/19. The results reported here update and expand on those provided in previous studies (BDO EconSearch 2019). This report provides estimates of economic contribution for 2018/19 by aquaculture sector (Tuna, Oysters, Mussels, Abalone, Freshwater Finfish, Marine Finfish, Marron/Yabbies, other aquaculture and aquaculture tourism enterprises) at the state and regional (West Coast, Eyre Peninsula, Yorke Peninsula, Kangaroo Island, Adelaide and Hills and Murraylands and South East) 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.

Reports prior to 2003/04 only included the first level of processing, marketing or handling of aquaculture production in the overall economic contribution. However, for the purpose of this report, all reports since 2003/04 (BDO EconSearch 2019) and future analyses, the following stages in the marketing chain are included in the quantifiable economic contribution:

- the farm gate value of production
- the net value of local (SA) processing
- the net value of local retail and food service trade
- 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.

Value of output and production estimates for South Australian aquaculture for 2018/19, as in previous years, were based on PIRSA Fisheries and Aquaculture's 2018/19 Production Returns as reported by South Australian aquaculture licence holders. The number of licences covered by production returns represented approximately 81 per cent of the total number of aquaculture licences. The consultants coordinated the compilation, analysis and validation of these data. Estimates of SA aquaculture production and value of production for the years 2017/18 and 2018/19 are provided in Table ES-1.

The state's total value of seafood production (landed) in 2018/19 was \$489.3 million, of which aquaculture contributed 43 per cent (\$211.7m) and wild-catch fisheries, making up the balance (\$277.6m). In aggregate, Tuna is the largest single sector in the state's aquaculture industry, accounting for almost 61 per cent of the state's gross value of aquaculture production in 2018/19. The other three main sectors in 2018/19 were Marine Finfish (19 per cent), Oysters (10 per cent) and Abalone (7 per cent).

In addition, data were collected for aquaculture tourism ventures offering the opportunity to interact with marine life, resulting in an estimated 5,500 visitors in 2018/19 with a value of \$0.61m. This was an increase on the estimates for 2017/18 (4,900 visitors with a value of \$0.39m).

A large proportion of the South Australian aquaculture production, particularly Tuna, is considered a premium high value product, and is exported overseas to high-end markets. Accordingly, the value of the Australian dollar can have a significant impact on the economic performance of the industry. Significant changes in the value of the Australian dollar also have the potential to influence the demand for Australian aquaculture exports. The Australian dollar depreciated throughout 2018/19 beginning at US\$0.74 in July 2018 and ending at US\$0.69 in June 2019.

Table ES-1 Aquaculture production and value of production, South Australia, 2017/18 and 2018/19

	Weight ('000kg)			Value (\$m)		
	2017/18	2018/19	Change	2017/18	2018/19	Change
Southern Bluefin Tuna	8,000	8,252	3%	126.00	129.00	2%
Marine Finfish	2,487	2,951	19%	29.87	39.48	32%
Oysters						
adult <sup>a</sup>	2,177	2,099	-4%	20.16	20.45	1%
on-grown <sup>b</sup>	330	86	-74%	0.70	0.27	-61%
spat <sup>c</sup>	-	-	-	2.20	5.09	131%
Mussels	1,833	1,898	4%	3.98	3.80	-5%
Abalone <sup>d</sup>	399	337	-16%	14.24	13.82	-3%
Freshwater Finfish	390	177	-55%	5.27	2.39	-55%
Marron and Yabbies <sup>e</sup>	2	2	9%	0.09	0.07	-22%
Other <sup>f</sup>	697	355	-49%	5.24	2.70	-48%
<b>Total <sup>g</sup></b>	<b>15,986</b>	<b>16,070</b>	<b>1%</b>	<b>204.84</b>	<b>211.70</b>	<b>3%</b>
Tourism (visitors)	4,900	5,500	12%	0.39	0.61	55%

<sup>a</sup> The weight for adult Oysters is an approximation on the basis that a dozen Oysters weighs one kilogram.

<sup>b</sup> The volume and value of juvenile Oysters sold for on-growing are excluded from the total volume and value of aquaculture as it is considered an input to production for the final sales of adult Oysters.

<sup>c</sup> The value of spat is also excluded from the total. All spat grown in SA is now sold in SA (i.e. no spat grown in SA is exported to other states) and is considered an input to production for the final sales of adult Oysters.

<sup>d</sup> Abalone produced from marine and land-based aquaculture sites, i.e. the data represent species not class of licence.

<sup>e</sup> The volume and value of Marron and Yabby production is potentially underestimated as the number of production returns for this sector is low.

<sup>f</sup> Other aquaculture production in 2017/18 and 2018/19 was mostly comprised of Algae production.

<sup>g</sup> Totals may contain rounding errors.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

The results of the contribution analysis, at the state level, are summarised in Table ES-2. The direct contributions measure on-farm and aquaculture related downstream activities (fish processing, transport, retail and food services). The flow-on contributions measure the economic effects in other sectors of the economy (trade, transport, etc.) generated by the aquaculture industry, that is, the multiplier effects.

The direct output contribution was estimated to be \$264.2m (\$211.7m on-farm and \$52.5m in downstream activities) in 2018/19 (Table ES-2). Total output (\$575.7m) needs to be used with care as it includes elements of double counting. Approximately 78 per cent of the output contribution was generated in regional South Australia (Table ES-3).

In 2018/19, aquaculture's total contribution to gross state product (GSP) of \$270.2m (Table ES-2) represented 0.24 per cent of the total GSP for South Australia (\$110.4b in 2018/19). Around 74 per cent of the contribution to GSP was generated in regional South Australia (Table ES-3).

Table ES-2 The economic contribution of aquaculture in South Australia, 2018/19

	Tuna	Marine Finfish	Mussels	Oysters	Abalone <sup>a</sup>	Freshwater Finfish	Marron and Yabbies	Other <sup>b</sup>	Total
<b>Output (\$m)</b>									
Direct									
On-farm	129.0	39.5	3.8	20.5	13.8	2.4	0.1	2.7	211.7
Downstream	15.0	16.9	4.0	15.3	0.5	0.8	0.0	0.0	52.5
Total Direct	144.0	56.4	7.8	35.7	14.3	3.2	0.1	2.7	264.2
Total Flow-on	185.2	49.5	10.8	36.1	18.0	2.9	0.1	2.1	304.7
Total <sup>c</sup>	329.2	105.8	18.6	71.8	32.3	6.1	0.3	4.8	568.9
<b>Contribution to GSP (\$m)</b>									
Direct									
On-farm	25.8	18.2	2.3	15.9	4.2	1.3	0.0	1.2	69.1
Downstream	4.1	8.0	1.8	7.3	0.1	0.4	0.0	0.0	21.9
Total Direct	30.0	26.3	4.2	23.3	4.4	1.7	0.0	1.2	91.0
Total Flow-on	109.2	28.9	6.3	20.8	11.0	1.7	0.1	1.3	179.2
Total	139.2	55.2	10.5	44.1	15.3	3.4	0.1	2.5	270.2
<b>Employment (fte)</b>									
Direct									
On-farm	278	78	32	212	53	14	6	5	676
Downstream	57	123	28	115	2	7	0	0	332
Total Direct	335	201	60	327	54	21	6	5	1,008
Total Flow-on	830	229	49	162	84	13	1	10	1,377
Total	1,165	429	109	489	138	34	7	15	2,385
<b>Household income (\$m)</b>									
Direct									
On-farm	11.1	5.8	2.5	7.4	2.2	0.7	0.0	0.3	30.0
Downstream	2.3	5.9	1.3	5.3	0.1	0.3	0.0	0.0	15.2
Total Direct	13.4	11.7	3.9	12.7	2.3	1.0	0.1	0.3	45.2
Total Flow-on	56.3	15.6	3.3	11.2	5.6	0.9	0.0	0.7	93.7
Total <sup>d</sup>	69.7	27.2	7.2	23.9	7.9	1.9	0.1	0.9	138.9

<sup>a</sup> Abalone produced from marine and land-based aquaculture sites, i.e. the data represent species not class of licence.

<sup>b</sup> Other aquaculture production in 2018/19 was mostly comprised of Algae production.

<sup>c</sup> Note there is double counting in the total output contribution (see Section 2.2 for an explanation).

<sup>d</sup> Totals may contain rounding errors.

Source: BDO EconSearch analysis

Direct employment was estimated to be 1,008 fte (676 on-farm and 332 in downstream activities) in 2018/19 with 1,377 flow-on jobs, giving total employment of 2,385 fte (Table ES-2). Around 71 per cent of these jobs were generated in regional South Australia (Table ES-3). Direct household income was estimated to be approximately \$45.2m in 2018/19 and flow-on income approximately \$93.7m, giving a total household income contribution of around \$138.9m (Table ES-2). Around 68 per cent of the household income contribution was generated in regional South Australia (Table ES-3).

In regional areas, the contribution of the aquaculture industry in 2018/19 was concentrated in the Eyre Peninsula region, reflecting the dominance of Tuna and also the majority of production of Other Aquaculture, Oysters, Marine Finfish and Mussel farming (Table ES-3).

**Table ES-3 The total regional economic contribution (direct and flow-on) of aquaculture in SA, 2018/19**

	Output <sup>a</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
West Coast	11.5	3%	7.8	4%	102	6%	4.4	5%
Eyre Peninsula	415.2	94%	184.8	93%	1,515	90%	86.8	91%
Yorke Peninsula	0.2	0%	0.1	0%	4	0%	0.1	0%
Kangaroo Island	10.6	2%	4.9	2%	46	3%	2.6	3%
Adelaide and Hills <sup>b</sup>	3.4	1%	1.9	1%	18	1%	1.0	1%
Murraylands and SE	0.4	0%	0.2	0%	6	0%	0.2	0%
<b>Total Regional Contribution <sup>c</sup></b>	<b>441.4</b>	<b>100%</b>	<b>199.8</b>	<b>100%</b>	<b>1,689</b>	<b>100%</b>	<b>95.0</b>	<b>100%</b>
<b>Regional Contribution as a Proportion of Total</b>	-	<b>78%</b>	-	<b>74%</b>	-	<b>71%</b>	-	<b>68%</b>

<sup>a</sup> Note there is double counting in the total output contribution.

<sup>b</sup> Includes Adelaide metropolitan area.

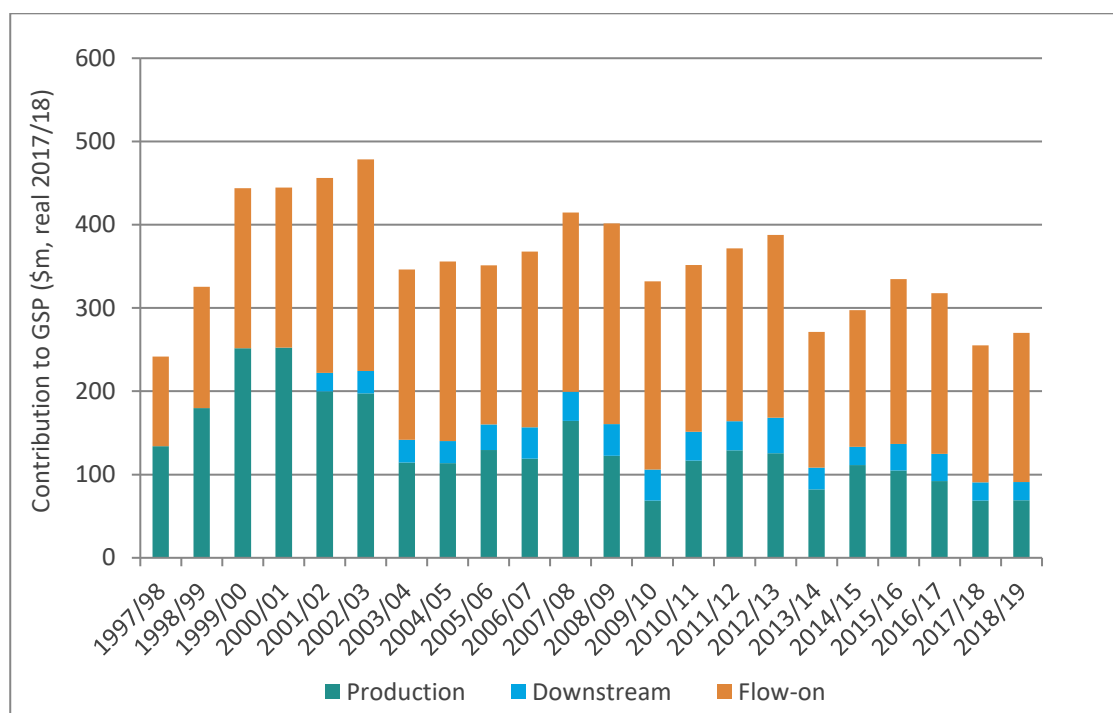
<sup>c</sup> Totals may contain rounding errors.

Source: BDO EconSearch analysis

Total contribution to GSP, in real terms, attributable to aquaculture in SA exhibited a rising trend over the period 1997/98 to 2002/03 and then, despite fluctuations, a declining trend through to 2018/19 (Figure ES-1)<sup>1</sup>. The significant reduction in the GSP contribution 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. Real GSP fell by 30 per cent between 2012/13 and 2013/14 due to a fall in value for a number of sectors including Tuna, Marine Finfish, Oysters, Freshwater Finfish and other aquaculture. Real GSP fell by 24 per cent between 2015/16 and 2017/18 resulting from reduced Oyster production related to difficulties sourcing spat after the POMS outbreak in Tasmania in early 2016, and a lack of microalgae production by a major aquaculture business. Real GSP increased by 6 per cent in 2018/19 as a result of an increase in value in the Tuna and Marine Finfish sectors and a refinement in the modelling process leading to an increase in flow-on contributions.

<sup>1</sup> From 1997/98 to 2000/01 only the first level of processing, marketing and handling of aquaculture production (i.e. production effects) was included in the overall economic contribution. Estimates of the economic contribution of aquaculture presented in this report (i.e. for 2018/19) and all reports since 2003/04 include retail and food service trade and local transport services at all stages of the marketing chain (i.e. downstream contributions).

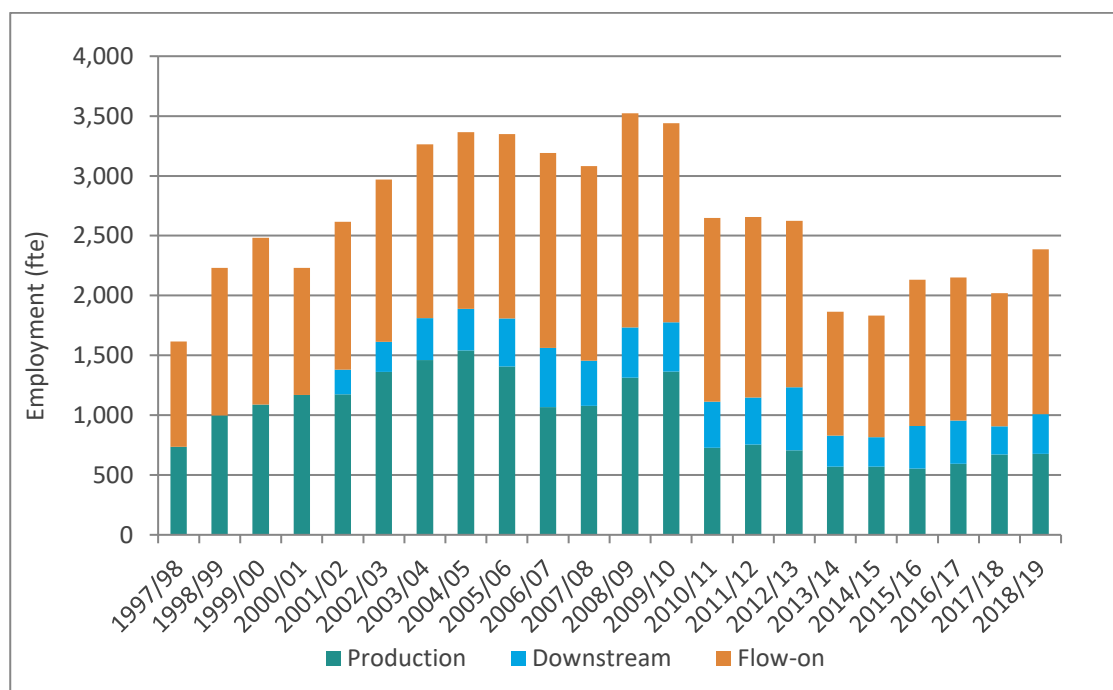
Figure ES-1 Total GSP contribution of aquaculture in SA, 1997/98 to 2018/19 <sup>a</sup>



<sup>a</sup> Total GSP contributions for the period 1997/98 to 2000/01 exclude some downstream activities (including some transport and all retail and food services). Estimates of GSP are expressed in real 2018/19 terms.

Source: Figure 12-1

Figure ES-2 Total employment contribution of aquaculture in SA, 1997/98 to 2018/19 <sup>a</sup>



<sup>a</sup> Total employment contribution for the period 1997/98 to 2000/01 excluding some downstream activities (including some transport and all retail and food services).

Source: Figure 12-1

The total employment contribution attributable to aquaculture in SA exhibited a rising trend over the period 1997/98 to 2008/09, reflecting an expansion in capacity and production growth across most aquaculture sectors over this period (Figure ES-2). The apparent reported fall in employment between 2009/10 and 2010/11 was due to the use of a new refined data collection form which resulted in improvements in the quality and accuracy of the responses from licence holders in the PIRSA Fisheries and Aquaculture Production Returns. The data collected in 2010/11 show that employment was inadvertently overstated in previous years. The fall in employment results in a reduction in household income and, due to the consequences from the modelled economic contributions, there are fewer people being employed in downstream and flow-on activities. This matter has now been resolved through the use of the refined Production Return forms. Total employment was fairly stable between 2010/11 and 2012/13, at around 2,600 fte but fell to around 1,900 in 2013/14 and 2014/15 in line with the fall in total value of production. Total employment rose to 2,385 fte jobs in 2018/19 driven by the increase in production over this period.

Projections for each sector in terms of production and on-farm employment over the three-year period, 2019/20 to 2021/22, are summarised in Table ES-4 by species and in Table ES-5 by region. These projections were based on PIRSA Fisheries and Aquaculture's 2018/19 Production Return responses submitted by the aquaculture industry. Where possible, these data were validated and improved by industry representatives and with other sources of information. Projections and industry confirmation were made prior to the Covid-19 pandemic and therefore likely to impact on these figures in 2019/20 and 2020/21.

**Table ES-4 Projected growth in South Australian aquaculture production and employment, by species, 2019/20 to 2021/22 <sup>a</sup>**

	Estimated cumulative change relative to 2018/19					
	Production			On-farm employment		
	2019/20	2020/21	2021/22	2019/20	2020/21	2021/22
Southern Bluefin Tuna	8%	10%	21%	2%	-1%	1%
Marine Finfish <sup>b</sup>	23%	29%	33%	20%	22%	25%
Oysters	14%	25%	30%	6%	11%	11%
Mussels	9%	27%	36%	19%	19%	19%
Abalone	4%	15%	50%	0%	70%	20%
Freshwater Finfish <sup>c</sup>	14%	21%	21%	-2%	2%	2%
Marron and Yabbies	21%	28%	28%	0%	17%	18%
Other <sup>d</sup>	25%	35%	35%	71%	71%	71%
Tourism	20%	35%	35%	5%	5%	10%

<sup>a</sup> Based on an analysis of PIRSA Fisheries and Aquaculture's 2018/19 Production Return responses submitted by the aquaculture industry. The plausibility of the projections for Tuna, Marine Finfish, Mussels, Oysters and Abalone have been validated or modified by industry representatives and annual reports (pers. comm. and Clean Seas 2019).

<sup>b</sup> Predominantly Yellowtail Kingfish production.

<sup>c</sup> Predominantly Barramundi production.

<sup>d</sup> Other aquaculture production in 2018/19 was comprised predominantly of Algae production.

The projections for each sector through to 2021/22, relative to 2018/19, can be summarised as follows.

- Tuna production - production will increase by 8 per cent in 2019/20, by 10 per cent in 2020/21 and by 21 per cent in 2021/22 (Brian Jeffriess, pers. comm.).
  - The Australian wild catch Southern Bluefin Tuna (SBT) quota for the triennium 2018-2020 is 6,165t of which the Government require the Australian Southern Bluefin Tuna Industry

Association (ASBTIA) to set aside 250t pa to cover the recreational and charter catch and 800t is required for longlining. This means 5,115t of SBT catch will be made available for Tuna farms.

- The Commission for the Conservation of Southern Bluefin Tuna global quota for the triennium 2021-2023 will be set in October 2020. The latest update suggests the global quota will be increased by 2,200t. Australia's share of the global quota is 35.56per cent, which means an approximate increase of 780t for Australia. It is estimated that a further 700t of that will go into Tuna farms.
- Expecting moderate Yen price increases.
- Exports to countries other than Japan (mainly Korea and China) are increasing.
- A higher share of Australia's SBT quota will go to farming because it is very difficult to increase East Coast longline tonnage due to a short catching season.
- Tuna employment - direct employment will increase by 2 per cent in 2019/20, decline by 1 per cent in 2020/21 and increase by 1 per cent in 2021/22 (Brian Jeffriess, pers. comm.).
  - The expected price increases will reduce the cost pressures and lead to more investment and jobs.
  - As exports to destinations other than Japan increase, onshore jobs increase. The reason for this is that these smaller volume shipments go by container after onshore packing, rather than exports to Japan where around 60 per cent go by freezer boat after processing at the farm pontoon and placed directly on the at-sea freezer boat.
  - The industry is gradually moving a greater distance from the shore, meaning more boats and jobs are required. This will particularly be the case from 2021 onwards as the higher SBT quota exceeds the current farming tonnage and area allowed.
  - The industry is investing more in upstream jobs, including marketing.
  - The increase in employment in 2021/22 will result from the increase in SBT quota in 2021.
  - Further increases in the Sardine quota are expected in 2020. The Tuna industry now owns 12 of the 14 Sardine licences. However, a large portion of the increase in feed requirements will be sourced from imports which are labour intensive.
- Marine Finfish - Clean Seas Seafood Limited have seen a significant increase in production since a feed crisis affected production between 2010 and 2013. Between 2013/14 and 2018/19, production volumes have increased by an average of 43 per cent annually. Clean Seas Seafood Limited expect production to increase by another 23 per cent in 2019/20 and then increase to 33 per cent by 2021/22. After a period of consolidation, employment is projected to increase by 20 per cent in 2019/20 and increase to 25 per cent by 2021/22. Clean Seas Seafood hatchery infrastructure and farm leases have the potential to more than triple production from the current level. Clean Seas Seafood Limited now have the necessary leases in the upper Spencer Gulf and expect production to commence in mid-2020. This will allow the company to increase their farming capacity. The Royal Park processing plant is now processing all fish for the Australian and International markets with fresh and liquid nitrogen rapid frozen product. The state of the art facility provides quality control across the supply chain from hatchery to customer. The facility has a significant capacity for future expansion. In July 2019 Clean Seas Seafood Limited received certification from the Aquaculture Stewardship Council (ASC) which will also help to grow sales into Europe and North America (Clean Seas Seafood Limited 2019).



- Oysters - Overall, sale of mature Oysters will increase by 14 per cent in 2019/20, by 25 per cent in 2020/21 and by 30 per cent in 2021/22. Depending on when producers were impacted by the spat shortage will impact the timing of their return to full production (i.e. farms fully stocked). The establishment of two new land-based hatcheries are now in full production and are able to fully supply spat to SA Oyster farms. The industry association anticipates the production projections for 2020/21 onwards are conservative and production may recover more rapidly than that presented (South Australian Oyster Growers Association, pers. comm.).
- Mussels - Moderate growth in production is expected in 2018/19 (9 per cent) increasing to 36 per cent by 2021/22. The two major Mussel farming operations have merged and are now able to achieve growth through economies of scale and the introduction of new product lines. Employment is also expected to increase, by 19 per cent in 2019/20 and be maintained through to 2021/22) (Andy Dyer, SA Mussel Growers Association, pers. comm.).
- Abalone - low growth in production is expected in 2019/20 (4 per cent) increasing to 15 per cent in 2020/21 and 50 per cent in 2021/22 based on the expansion on the KI Abalone farm. Employment is expected to be the same in 2019/20 as in 2018/19 increasing by 70 per cent in 2020/21 to accommodate the expansion and then falling back to 20 per cent of 2018/19 levels in 2021/22 (David Connell, Yumbah, pers. comm.).
- Freshwater Finfish - moderate growth in production in 2019/20 (14 per cent) and 2020/21 and 2021/22 (21 per cent). A decline in employment is expected in 2019/20 (-2 per cent) with low growth expected in 2020/21 and 2021/22 (2 per cent).
- Marron and Yabbies - moderate growth in production (21 per cent in 2019/20 and 28 per cent in 2020/21 and 2021/22) but no growth in employment in 2019/20 and then moderate employment growth expected in 2020/21 (17 per cent) and 2021/22 (18 per cent).
- Other aquaculture - moderate growth in production (25 per cent in 2019/20 increasing to 35 per cent by 2021/22) and high growth in employment (71 per cent increase in 2019/20 to be maintained through to 2021/22).
- Tourism - moderate growth in revenue (20 per cent in 2019/20 increasing to 35 per cent by 2021/22) and low growth in employment (5 per cent increase in 2019/20 increasing to 10 per cent by 2021/22).

**Table ES-5 Projected growth in South Australian aquaculture production and employment, by region, 2019/20 to 2021/22 <sup>a</sup>**

	Estimated cumulative change relative to 2018/19					
	Production			On-farm employment		
	2019/20	2020/21	2021/22	2019/20	2020/21	2021/22
Adelaide and Hills	15%	23%	23%	-1%	1%	1%
Eyre Peninsula	10%	14%	21%	8%	9%	9%
Kangaroo Island	11%	47%	126%	1%	178%	61%
Murraylands and South East	0%	0%	0%	0%	4%	4%
West Coast	7%	14%	21%	1%	12%	12%
Yorke Peninsula	26%	-13%	13%	10%	10%	10%

<sup>a</sup> See notes to Table ES-4. Changes are assumed to occur within the same region as current operations as plans to expand into other regions are not collected in the Production Returns.

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 2019/20 to 2021/22 have been imputed from the production projections. These GVP projections are presented in Table ES-6.

**Table ES-6 Projected growth in South Australian aquaculture value of production, 2019/20 to 2021/22 <sup>a</sup>**

	Actual GVP (\$m)	Low GVP Forecast (\$m) <sup>b</sup>			High GVP Forecast (\$m) <sup>c</sup>		
	2018/19	2019/20	2020/21	2021/22	2019/20	2020/21	2021/22
Southern Bluefin Tuna	129.0	140.0	155.0	175.0	140.0	155.0	175.0
Marine Finfish	39.5	47.2	49.1	50.3	48.6	50.9	52.5
Oysters	20.5	22.9	24.8	25.5	23.3	25.6	26.5
Mussels	3.8	4.1	4.7	4.9	4.1	4.8	5.2
Abalone	13.8	14.4	15.9	20.7	14.4	15.9	20.7
Freshwater Finfish	2.4	2.7	2.8	2.8	2.7	2.9	2.9
Marron and Yabbies	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	2.7	3.3	3.5	3.5	3.4	3.6	3.6
<b>Total <sup>d</sup></b>	<b>211.7</b>	<b>234.6</b>	<b>255.8</b>	<b>282.9</b>	<b>236.6</b>	<b>258.8</b>	<b>286.5</b>
Tourism	0.61	0.73	0.82	0.82	0.73	0.82	0.82

<sup>a</sup> All estimates of gross value of production (GVP) are in 2019 dollars.

<sup>b</sup> 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 75 per cent of the growth in other sectors would be exported.

<sup>c</sup> The high estimate of GVP is based on no price response over the projection period (i.e. prices remain at 2018/19 levels).

<sup>d</sup> Totals may contain rounding errors.

## 1. INTRODUCTION

The aim of this study was to estimate the economic contribution of aquaculture activity in South Australia in 2018/19. The results reported here update and expand on those provided in previous studies (BDO EconSearch 2019). Estimates of the economic contribution of aquaculture activity in South Australia in 2018/19 are provided for the following aquaculture sectors:

- Tuna (Southern Bluefin Tuna, *Thunnus maccoyii*)
- Marine Finfish (predominantly Yellowtail Kingfish, *Seriola lalandi*)
- Oysters (predominantly Pacific Oyster, *Crassostrea gigas*)
- Mussels (Blue Mussel, *Mytilus galloprovincialis*)
- Abalone (predominantly Greenlip Abalone, *Haliotis laevis*)
- Freshwater Finfish (predominantly Barramundi, *Lates calcarifer* and Rainbow Trout, *Oncorhynchus mykiss*)
- Marron (*Cherax tenuimanus*) and Yabbies (*Cherax destructor*)
- Other aquaculture (comprised of Algae, *Dunaliella salina*; Silver Perch, *Bidyanus bidyanus*; and Barcoo Grunter, *Scortum barcoo*)
- Tourism (aquaculture tourism operators offer the opportunity to swim with tuna and interact with other marine organisms).

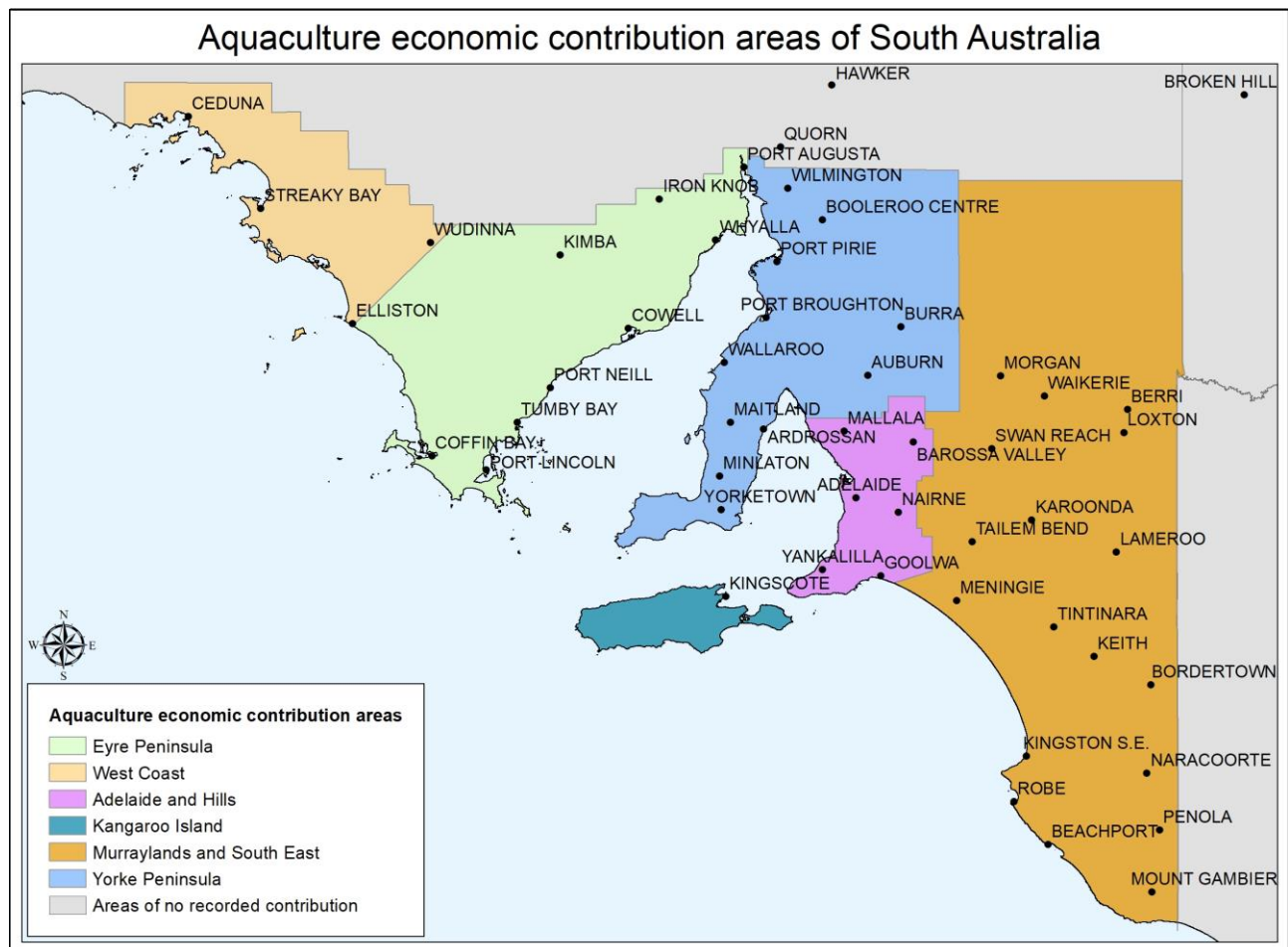
The contributions of these sectors are presented at both the regional and state levels. Regional contributions are based on the following disaggregation and illustrated in Figure 1-1:

- West Coast (WA border to Elliston including Wudinna)
- Eyre Peninsula (Lower Eyre Peninsula to Port Augusta, including Kimba)
- Yorke Peninsula (covers Yorke Peninsula, Mid North and Barossa)
- Kangaroo Island
- Adelaide and Adelaide Hills (including Fleurieu peninsula)
- Murraylands (Riverland and Murraylands) and the South East (Limestone Coast).

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 10:	The economic contributions of each aquaculture sector are presented at the state and regional levels.
Section 11:	Other facets of regional economic development associated with aquaculture activity in SA are presented.
Section 12:	Economic contributions of aquaculture over time.

Figure 1-1 Aquaculture economic contribution regions



Source: PIRSA Fisheries and Aquaculture

## 2. METHOD

### 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 contribution can be measured through input-output modelling. This study applies input-output analytical procedures to measure the contribution of aquaculture development on the South Australian state and regional economies.

Economic contributions at the state and regional levels were based on input-output models prepared for the Department of the Premier and Cabinet. For a technical description of the input-output modelling procedure, see BDO EconSearch (2020).

In terms of scope, some previous studies have only included the first level of processing, marketing or handling of aquaculture production in the overall economic contribution. Estimates of the economic contribution of aquaculture presented in this report and all reports since 2003/04 (BDO EconSearch 2019) are consistent with the 'message' and method in:

- PIRSA's Food for the Future value chain analysis 2018/19 (Seafood Scorecard)
- South Australian Seafood Industry Federation Inc. (2009) South Australian Seafood Industry Food Plan 2010-2015.

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

- the farm gate value of production
- the net value of local (SA) processing
- the net value of local retail and food service trade
- 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 were qualitatively assessed. The table below illustrates the change in scope of the economic contribution assessment.

Table 2-1 Change in scope of the economic contribution assessment

Stage in Market Chain	Scope of Contribution Analysis In Earlier Studies <sup>a</sup>	Scope of Contribution Analysis in Recent and Future Studies <sup>b</sup>
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 contribution of aquaculture		
Regional investment	Yes (Tuna only)	Yes - qualitative only
Tourism	No	Yes - qualitative only
Education and training	No	Yes - qualitative only

<sup>a</sup> For the years 1996/97 to 2000/01.

<sup>b</sup> For the years 2001/02 to 2018/19 (BDO EconSearch 2019).

## 2.2. Indicators of Economic Contribution

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

- output
- contribution to gross state or regional product
- employment
- 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 contribution avoids the problem of double counting that may arise from using value of 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.

**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 contribution are presented in terms of

- direct contributions
- flow-on (or indirect) contributions
- total contributions.

**Direct contributions** are the initial round of output, employment and household income generated by an economic activity. Estimates of the direct economic contribution of aquaculture in the South Australian state and regional economies are consistent with the method employed in PIRSA's Food for the Future value-chain analysis, 2009/10, as outlined above.

**Flow-on (or indirect) contributions** 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 contributions** are the sum of direct and flow-on contributions.

## 2.3. Data

Value of output and production estimates for South Australian aquaculture for 2018/19 were based on PIRSA Fisheries and Aquaculture's 2018/19 Production Returns submitted by the aquaculture industry. The number of licences covered by production returns represented approximately 81 per cent of the total number of aquaculture licences.

Representative cost structures and other relevant information for enterprises operating in individual sectors of the aquaculture and fishing industries were updated from 2002/03 to 2018/19 using a range of indicators, including data derived from the Production Returns. 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
- proportion of feed sourced from local region, other SA or interstate - average per enterprise

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.

### 3. AQUACULTURE PRODUCTION AND EMPLOYMENT IN SA

#### 3.1. Production and Value of Production

Estimates of South Australian aquaculture production and value of production for the years 2017/18 and 2018/19 are presented in Table 3-1. Some description of these data is provided below. Similar data for the period 1995/96 to 2018/19 are provided in Appendix 1 of the report. Overall, total production increased by 1 per cent between 2017/18 (15,986t) and 2018/19 (16,070t) and total value increased by 3 per cent (from \$204.8m to \$211.7m) (Table 3-1).

Table 3-1 Aquaculture production and value of production, SA, 2016/17 and 2018/19

	Weight ('000kg)			Value (\$m)		
	2017/18	2018/19	Change	2017/18	2018/19	Change
Southern Bluefin Tuna	8,000	8,252	3%	126.00	129.00	2%
Marine Finfish	2,487	2,951	19%	29.87	39.48	32%
Oysters						
adult <sup>a</sup>	2,177	2,099	-4%	20.16	20.45	1%
on-grown <sup>b</sup>	330	86	-74%	0.70	0.27	-61%
spat <sup>c</sup>	-	-	-	2.20	5.09	131%
Mussels	1,833	1,898	4%	3.98	3.80	-5%
Abalone <sup>d</sup>	399	337	-16%	14.24	13.82	-3%
Freshwater Finfish	390	177	-55%	5.27	2.39	-55%
Marron and Yabbies <sup>e</sup>	2	2	9%	0.09	0.07	-22%
Other <sup>f</sup>	697	355	-49%	5.24	2.70	-48%
<b>Total <sup>g</sup></b>	<b>15,986</b>	<b>16,070</b>	<b>1%</b>	<b>204.84</b>	<b>211.70</b>	<b>3%</b>
Tourism (visitors)	4,900	5,500	12%	0.39	0.61	55%

<sup>a</sup> The weight for adult Oysters is an approximation on the basis that a dozen Oysters weighs one kilogram.

<sup>b</sup> The volume and value of juvenile Oysters sold for on-growing are excluded from the total volume and value of aquaculture as it is considered an input to production for the final sales of adult Oysters.

<sup>c</sup> The value of spat is also excluded from the total. All spat grown in SA is now sold in SA (i.e. no spat grown in SA is exported to other states) and is considered an input to production for the final sales of adult Oysters.

<sup>d</sup> Abalone produced from marine and land-based aquaculture sites, i.e. the data represent species not class of licence.

<sup>e</sup> The volume and value of Marron and Yabby production is potentially underestimated as the number of production returns for this sector is low.

<sup>f</sup> Other aquaculture production in 2017/18 and 2018/19 was mostly comprised of Algae production.

<sup>g</sup> Totals may contain rounding errors.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

Between 2017/18 and 2018/19 the following changes in production and value of production are apparent.

- The value of Tuna farm output increased by 2 per cent as a result of a 3 per cent increase volume of farmed Tuna and despite a 1 per cent fall in price (ABARES data modified and verified by Brian Jeffriess, Australian Southern Bluefin Tuna Industry Association (ASBTIA), pers. comm.). The ABARES data were modified to reconcile the data from calendar year to financial year and to include domestic sales.



- The value of Marine Finfish production increased by 32 per cent as a result of an 11 per cent rise in price and a 19 per cent increase in the volume of Marine Finfish. As a result of a marketing program targeting chefs and by promoting their “SensoryFresh” product (a frozen product that uses rapid-freezing technology), Clean Seas Seafood Limited have strengthened both existing and growth markets. Volume growth into North America was up by 30 per cent on 2017/18 and growth into Asia was up by 50 per cent. The company also saw an increased improvement in farm gate prices (Clean Seas Seafood Limited 2019).
- The value of Oyster production increased by 1 per cent as a result of a 5 per cent rise in price and despite a 4 per cent decline in volume of adult Oysters. The spat supply shortage caused by POMS impacting Tasmanian Oyster hatcheries in 2016/17 was still impacting production in 2018/19 (South Australian Oyster Growers Association, pers. comm.).
- The value of Mussel production fell by 5 per cent due to an 8 per cent fall in the per unit price of Mussels and despite a 4 per cent increase in the volume of Mussel production (validated by Andy Dyer, SA Mussel Growers Association, pers. comm.).
- The value of Abalone production declined by 3 per cent as a result of a 16 per cent fall in the volume of Abalone production and despite a 15 per cent increase in the per unit price (David Connell, General Manager, Yumbah Aquaculture, pers. comm.).
- The value of Freshwater Finfish production decreased by 55 per cent as a result of a 55 per cent fall in the volume of Freshwater Finfish production and little change in the per unit price.
- The value of Marron/Yabbies production decreased by 22 per cent as a result of a 28 per cent fall in the per unit price of Marron/Yabbies and despite a 9 per cent increase in the volume of Marron/Yabbies production.
- The value of Other aquaculture production decreased by 48 per cent as a result of an 49 per cent decline in production. Other aquaculture is dominated by algae production. In 2018/19 the major algae producer missed harvesting time during the peak growth season due to delays in the upgrade to their processing plant.
- Aquaculture tourism operators offer the opportunity to interact with marine organisms. In 2018/19, there were 5,500 visitors with a value of \$0.61m, an increase on 2017/18 (4,900 visitors for a value of \$0.39m).

A breakdown of aquaculture value of production in 2018/19 by region is detailed in Table 3-2 and Table 3-3. Similar data for aquaculture production in 2018/19 are detailed in Table 3-4 and Table 3-5. Activity in the Tuna, Marine Finfish, Oysters, Mussels, Abalone and Other aquaculture is concentrated in the Eyre Peninsula region. The production of remaining aquaculture species (i.e. Freshwater Finfish and Marron/Yabbies) is more widely distributed across SA.

Table 3-2 Aquaculture value of production by sector and region, South Australia, 2018/19 (\$'000)

	West Coast	Eyre Peninsula	Yorke Peninsula	Kangaroo Island	Adelaide and Hills	Murraylands and South East	All regions
Southern Bluefin Tuna	0	129,000	0	0	0	0	129,000
Marine Finfish	0	39,479	0	0	0	0	39,479
Oysters <sup>a</sup>	5,966	14,212	69	204	0	0	20,451
Mussels	0	3,796	0	0	0	0	3,796
Abalone	0	8,487	0	5,330	0	0	13,817
Freshwater Finfish <sup>a</sup>	1	3	0	0	2,140	242	2,387
Marron and Yabbies <sup>a</sup>	0	1	20	49	2	2	74
Other <sup>a</sup>	71	2,628	0	0	0	0	2,699
<b>Total</b>	<b>6,038</b>	<b>197,606</b>	<b>89</b>	<b>5,583</b>	<b>2,142</b>	<b>244</b>	<b>211,703</b>
Tourism	0	0	0	0	606	0	606

<sup>a</sup> Includes the value of fingerling sales but excludes local spat and on-grown sales for Oysters.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

Table 3-3 Proportion of aquaculture value of production by sector and region, South Australia, 2018/19

	West Coast	Eyre Peninsula	Yorke Peninsula	Kangaroo Island	Adelaide and Hills	Murraylands and South East	All regions
Southern Bluefin Tuna	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Marine Finfish	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Oysters <sup>a</sup>	29.2%	69.5%	0.3%	1.0%	0.0%	0.0%	100.0%
Mussels	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Abalone	0.0%	61.4%	0.0%	38.6%	0.0%	0.0%	100.0%
Freshwater Finfish <sup>a</sup>	0.1%	0.1%	0.0%	0.0%	89.6%	10.1%	100.0%
Marron and Yabbies <sup>a</sup>	0.0%	2.0%	26.5%	65.8%	2.9%	2.8%	100.0%
Other <sup>a</sup>	2.6%	97.4%	0.0%	0.0%	0.0%	0.0%	100.0%
<b>Total</b>	<b>2.9%</b>	<b>93.3%</b>	<b>0.0%</b>	<b>2.6%</b>	<b>1.0%</b>	<b>0.1%</b>	<b>100.0%</b>
Tourism	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%

Source: Table 3-2

Table 3-4 Aquaculture production by sector and region, South Australia, 2018/19 (kg)

	West Coast	Eyre Peninsula	Yorke Peninsula	Kangaroo Island	Adelaide and Hills	Murraylands and South East	All regions
Southern Bluefin Tuna	0	8,252,000	0	0	0	0	8,252,000
Marine Finfish	0	2,950,633	0	0	0	0	2,950,633
Oysters	573,206	1,504,956	4,014	16,360	0	0	2,098,536
Mussels	0	1,897,918	0	0	0	0	1,897,918
Abalone	0	207,000	0	130,000	0	0	337,000
Freshwater Finfish	38	305	21	0	163,115	13,870	177,349
Marron and Yabbies	0	39	1,046	975	41	93	2,194
Other	4,420	350,352	0	0	0	0	354,772
<b>Total</b>	<b>577,664</b>	<b>15,163,203</b>	<b>5,081</b>	<b>147,335</b>	<b>163,156</b>	<b>13,963</b>	<b>16,070,402</b>
Tourism (visitors)	0	0	0	0	5,500	0	5,500

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

Table 3-5 Proportion of aquaculture production by sector and region, South Australia, 2018/19

	West Coast	Eyre Peninsula	Yorke Peninsula	Kangaroo Island	Adelaide and Hills	Murraylands and South East	All regions
Southern Bluefin Tuna	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Marine Finfish	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Oysters	27.3%	71.7%	0.2%	0.8%	0.0%	0.0%	100.0%
Mussels	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Abalone	0.0%	61.4%	0.0%	38.6%	0.0%	0.0%	100.0%
Freshwater Finfish	0.0%	0.2%	0.0%	0.0%	92.0%	7.8%	100.0%
Marron and Yabbies	0.0%	1.8%	47.7%	44.4%	1.9%	4.3%	100.0%
Other	1.2%	98.8%	0.0%	0.0%	0.0%	0.0%	100.0%
<b>Total</b>	<b>3.6%</b>	<b>94.4%</b>	<b>0.0%</b>	<b>0.9%</b>	<b>1.0%</b>	<b>0.1%</b>	<b>100.0%</b>
Tourism (visitors)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%

Source: Table 3-4

### 3.2. Employment in SA Aquaculture

Estimates of direct employment in South Australian aquaculture for the years 2017/18 and 2018/19 are provided in Table 3-6. Consistent with previous analyses undertaken by BDO EconSearch, these estimates include employment on inactive, undeveloped and underdeveloped leases. As for the production data, these employment estimates have been derived from PIRSA Fisheries and Aquaculture's 2018/19 Production Returns submitted by the aquaculture industry. Overall, direct employment in aquaculture operations reported by industry, increased by 1 per cent between 2017/18 (670 fte) and 2018/19 (676 fte). In 2018/19 there were an additional 8 jobs associated with aquaculture tourism operations, an increase from 6 jobs in 2017/18.

Table 3-6 Direct employment by aquaculture sector, South Australia, 2017/18 and 2018/19

	Employment (fte)		Change from 2017/18
	2017/18	2018/19	
Southern Bluefin Tuna	264	278	5%
Marine Finfish	101	78	-23%
Oysters	199	212	7%
Mussels	26	32	22%
Abalone	42	53	25%
Freshwater Finfish	26	14	-46%
Marron and Yabbies	7	6	-18%
Other <sup>a</sup>	5	5	-2%
<b>Total</b>	<b>670</b>	<b>676</b>	<b>1%</b>
Tourism <sup>b</sup>	6	8	25%

<sup>a</sup> 'Other aquaculture' also includes land-based and miscellaneous licences which cannot be allocated to specific sectors.

<sup>b</sup> Note employment totals include rounding.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

Some notable differences in direct employment between 2017/18 and 2018/19 by species are:

- 46 per cent decrease in Freshwater Finfish in line with the significant fall in production in 2018/19.
- 23 per cent fall in Marine Finfish due to a reduction in employment at the grow out facilities.
- 25 per cent increase for Abalone, a result of an expected increase in production in future years.
- 22 per cent increase for Mussels, a result of an expected increase in production in future years (Andy Dyer, SA Mussel Growers Association, pers. comm.)
- 25 per cent increase for aquaculture tourism enterprises, in line with an increase in visitors to tourism leases in 2018/19 and expected future increases in visitors.
- 18 per cent decline in Marron and Yabbies in line with a fall in the value of production in 2018/19, primarily a result of a fall in average price

A breakdown of direct employment in 2018/19 in SA aquaculture by region is detailed in Table 3-7 and Table 3-8. There are some notable differences in the recorded regional distribution of production and employment. For example, the Eyre Peninsula region was estimated to produce 70 per cent of Oysters by volume but was responsible for only 60 per cent of Oyster employment (Table 3-5 and Table 3-8). These differences may reflect the total number of leases in the Eyre Peninsula region are operated by a smaller number of owners and the workers cover more leases compared to, say the West Coast region, where leases may be spread over more individual owners and therefore more workers.

Table 3-7 Direct employment by aquaculture sector and region, South Australia, 2018/19 (fte)

	West Coast	Eyre Peninsula	Yorke Peninsula	Kangaroo Island	Adelaide and Hills	Murraylands and South East	All regions
Southern Bluefin Tuna	0	278	0	0	0	0	278
Marine Finfish	0	78	0	0	0	0	78
Oysters	75	127	3	2	5	0	212
Mussels	0	32	0	0	0	0	32
Abalone	0	38	0	15	0	0	53
Freshwater Finfish	0	0	0	0	10	4	14
Marron and Yabbies	0	0	0	4	0	1	6
Other	1	4	0	0	0	0	5
<b>Total</b>	<b>75</b>	<b>556</b>	<b>3</b>	<b>22</b>	<b>16</b>	<b>5</b>	<b>676</b>
Tourism	0	0	0	0	8	0	8

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

Table 3-8 Proportion of direct employment by region, South Australia, 2018/19

	West Coast	Eyre Peninsula	Yorke Peninsula	Kangaroo Island	Adelaide and Hills	Murraylands and South East	All regions
Southern Bluefin Tuna	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Marine Finfish	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Oysters	35.2%	59.7%	1.5%	1.1%	2.5%	0.0%	100.0%
Mussels	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Abalone	0.0%	72.0%	0.0%	28.0%	0.0%	0.0%	100.0%
Freshwater Finfish	0.0%	0.0%	0.0%	0.0%	74.3%	25.7%	100.0%
Marron and Yabbies	0.0%	5.0%	0.0%	73.3%	5.0%	16.7%	100.0%
Other	11.6%	88.4%	0.0%	0.0%	0.0%	0.0%	100.0%
<b>Total</b>	<b>11.1%</b>	<b>82.2%</b>	<b>0.5%</b>	<b>3.2%</b>	<b>2.4%</b>	<b>0.7%</b>	<b>100.0%</b>
Tourism	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%

Source: Table 3-8

### 3.3. Projected Growth in Production and Employment

Aquaculture licence holders were required to provide projections of their production and on-farm employment over the three-year period, 2019/20 to 2021/22. The projections from the PIRSA Fisheries and Aquaculture 2018/19 Production Returns are summarised in Table 3-9 by species and in Table 3-10 by region. Where possible, these data were validated and improved by industry representatives and with other sources of information. The implied production (tonnes or '000 doz.) and on-farm employment (full-time equivalents) levels by species are provided in Table 3-11 and Table 3-12, respectively. Note, projections and industry confirmation were made prior to the Covid-19 pandemic and therefore likely to impact on these figures in 2019/20 and 2020/21.

**Table 3-9 Projected growth in South Australian aquaculture production and on-farm employment, by species, 2019/20 to 2021/22 (percentage change on 2018/19) <sup>a</sup>**

	Estimated cumulative change relative to 2018/19					
	Production			On-farm employment		
	2019/20	2020/21	2021/22	2019/20	2020/21	2021/22
Southern Bluefin Tuna	8%	10%	21%	2%	-1%	1%
Marine Finfish <sup>b</sup>	23%	29%	33%	20%	22%	25%
Oysters	14%	25%	30%	6%	11%	11%
Mussels	9%	27%	36%	19%	19%	19%
Abalone	4%	15%	50%	0%	70%	20%
Freshwater Finfish <sup>c</sup>	14%	21%	21%	-2%	2%	2%
Marron and Yabbies	21%	28%	28%	0%	17%	18%
Other <sup>d</sup>	25%	35%	35%	71%	71%	71%
Tourism	20%	35%	35%	5%	5%	10%

<sup>a</sup> Based on an analysis of PIRSA Fisheries and Aquaculture's 2018/19 Production Return responses. The plausibility of the projections for Tuna, Marine Finfish, Mussels, Oysters and Abalone have been validated or modified by industry representatives and annual reports (pers. comm., Clean Seas Seafood Limited 2019).

<sup>b</sup> Predominantly Yellowtail Kingfish production.

<sup>c</sup> Predominantly Barramundi production.

<sup>d</sup> Other aquaculture production in 2018/19 was mostly comprised of Algae.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns, Clean Seas Seafood Limited 2019, Brian Jeffriess pers. comm., SA Mussel Growers Association, Yumbah Aquaculture and SA Oyster Growers Association.

**Table 3-10 Projected growth in South Australian aquaculture production and on-farm employment, by region, 2019/20 to 2021/22 (percentage change on 2018/19)<sup>a</sup>**

	Estimated cumulative change relative to 2018/19					
	Production			Production		
	2019/20	2020/21	2021/22	2019/20	2020/21	2021/22
Adelaide and Hills	15%	23%	23%	-1%	1%	1%
Eyre Peninsula	10%	14%	21%	8%	9%	9%
Kangaroo Island	11%	47%	126%	1%	178%	61%
Murraylands and South East	0%	0%	0%	0%	4%	4%
West Coast	7%	14%	21%	1%	12%	12%
Yorke Peninsula	26%	-13%	13%	10%	10%	10%

<sup>a</sup> See notes to Table 3-9. Changes are assumed to occur within the same region as current operations as plans to expand into other regions are not collected in the Production Returns.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns, Clean Seas Seafood Limited 2019, Brian Jeffriess pers. comm., SA Mussel Growers Association, Yumbah Aquaculture and SA Oyster Growers Association.

The projections for each sector through to 2021/22, relative to 2018/19, can be summarised as follows.

- Tuna production - production will increase by 8 per cent in 2019/20, by 10 per cent in 2020/21 and by 21 per cent in 2021/22 (Brian Jeffriess, pers. comm.).
  - The Australian wild catch Southern Bluefin Tuna (SBT) quota for the triennium 2018-2020 is 6,165t of which the Government require the Australian Southern Bluefin Tuna Industry Association (ASBTIA) to set aside 250t pa to cover the recreational and charter catch and

- 800t is required for longlining. This means 5,115t of SBT catch will be made available for Tuna farms.
- The Commission for the Conservation of Southern Bluefin Tuna global quota for the triennium 2021-2023 will be set in October 2020. The latest update suggests the global quota will be increased by 2,200t. Australia's share of the global quota is 35.56per cent, which means an approximate increase of 780t for Australia. It is estimated that a further 700t of that will go into Tuna farms.
  - Expecting moderate Yen price increases.
  - Exports to countries other than Japan (mainly Korea and China) are increasing.
  - A higher share of Australia's SBT quota will go to farming because it is very difficult to increase East Coast longline tonnage due to a short catching season.
- Tuna employment - direct employment will increase by 2 per cent in 2019/20, decline by 1 per cent in 2020/21 and increase by 1 per cent in 2021/22 (Brian Jeffriess, pers. comm.).
    - The expected price increases will reduce the cost pressures and lead to more investment and jobs.
    - As exports to destinations other than Japan increase, onshore jobs increase. The reason for this is that these smaller volume shipments go by container after onshore packing, rather than exports to Japan where around 60 per cent go by freezer boat after processing at the farm pontoon and placed directly on the at-sea freezer boat.
    - The industry is gradually moving a greater distance from the shore, meaning more boats and jobs are required. This will particularly be the case from 2021 onwards as the higher SBT quota exceeds the current farming tonnage and area allowed.
    - The industry is investing more in upstream jobs, including marketing.
    - The increase in employment in 2021/22 will result from the increase in SBT quota in 2021.
    - Further increases in the Sardine quota are expected in 2020. The Tuna industry now owns 12 of the 14 Sardine licences. However, a large portion of the increase in feed requirements will be sourced from imports which are labour intensive.
  - Marine Finfish - Clean Seas Seafood Limited have seen a significant increase in production since a feed crisis affected production between 2010 and 2013. Between 2013/14 and 2018/19, production volumes have increased by an average of 43 per cent annually. Clean Seas Seafood Limited expect production to increase by another 23 per cent in 2019/20 and then increase to 33 per cent by 2021/22. After a period of consolidation, employment is projected to increase by 20 per cent in 2019/20 and increase to 25 per cent by 2021/22. Clean Seas Seafood hatchery infrastructure and farm leases have the potential to more than triple production from the current level. Clean Seas Seafood Limited now have the necessary leases in the upper Spencer Gulf and expect production to commence in mid-2020. This will allow the company to increase their farming capacity. The Royal Park processing plant is now processing all fish for the Australian and International markets with fresh and liquid nitrogen rapid frozen product. The state of the art facility provides quality control across the supply chain from hatchery to customer. The facility has a significant capacity for future expansion. In July 2019 Clean Seas Seafood Limited received certification from the Aquaculture Stewardship Council (ASC) which will also help to grow sales into Europe and North America (Clean Seas Seafood Limited 2019).

- Oysters - Overall, sale of mature Oysters will increase by 14 per cent in 2019/20, by 25 per cent in 2020/21 and by 30 per cent in 2021/22. Depending on when producers were impacted by the spat shortage will impact the timing of their return to full production (i.e. farms fully stocked). The establishment of two new land-based hatcheries are now in full production and are able to fully supply spat to SA Oyster farms. The industry association anticipates the production projections for 2020/21 onwards are conservative and production may recover more rapidly than that presented (South Australian Oyster Growers Association, pers. comm.).
- Mussels - Moderate growth in production is expected in 2018/19 (9 per cent) increasing to 36 per cent by 2021/22. The two major Mussel farming operations have merged and are now able to achieve growth through economies of scale and the introduction of new product lines. Employment is also expected to increase, by 19 per cent in 2019/20 and be maintained through to 2021/22) (Andy Dyer, SA Mussel Growers Association, pers. comm.).
- Abalone - low growth in production is expected in 2019/20 (4 per cent) increasing to 15 per cent in 2020/21 and 50 per cent in 2021/22 based on the expansion on the KI Abalone farm. Employment is expected to be the same in 2019/20 as in 2018/19 increasing by 70 per cent in 2020/21 to accommodate the expansion and then falling back to 20 per cent of 2018/19 levels in 2021/22 (David Connell, Yumbah, pers. comm.).
- Freshwater Finfish - moderate growth in production in 2019/20 (14 per cent) and 2020/21 and 2021/22 (21 per cent). A decline in employment is expected in 2019/20 (-2 per cent) with low growth expected in 2020/21 and 2021/22 (2 per cent).
- Marron and Yabbies - moderate growth in production (21 per cent in 2019/20 and 28 per cent in 2020/21 and 2021/22) but no growth in employment in 2019/20 and then moderate employment growth expected in 2020/21 (17 per cent) and 2021/22 (18 per cent).
- Other aquaculture - moderate growth in production (25 per cent in 2019/20 increasing to 35 per cent by 2021/22) and high growth in employment (71 per cent increase in 2019/20 to be maintained through to 2021/22).
- Tourism - moderate growth in revenue (20 per cent in 2019/20 increasing to 35 per cent by 2021/22) and low growth in employment (5 per cent increase in 2019/20 increasing to 10 per cent by 2021/22).

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 3-9) 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 3-9 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 per cent change in the quantity supplied. This can, in turn, be approximated using the reciprocal of the price elasticity of demand.



**Table 3-11 Projected growth in South Australian aquaculture production, 2019/20 to 2021/22 (t or '000 doz.)**

	Actual Production <sup>a</sup>	Forecast Production <sup>b</sup>			Av. annual growth rate
	2018/19	2019/20	2020/21	2021/22	
Southern Bluefin Tuna (t)	8,252	8,900	9,100	10,000	6.6%
Marine Finfish (t)	2,951	3,629	3,806	3,924	10.0%
Oysters ('000 doz.)	2,099	2,394	2,623	2,718	9.0%
Mussels (t)	1,898	2,071	2,417	2,589	10.9%
Abalone (t)	337	350	388	506	14.5%
Freshwater Finfish (t)	177	202	215	215	6.6%
Marron and Yabbies (t)	2	3	3	3	8.5%
Other (t)	355	443	479	479	10.5%
<b>Total</b>	<b>16,070</b>	<b>17,992</b>	<b>19,030</b>	<b>20,434</b>	<b>8.3%</b>
Tourism (visitors)	5,500	6,600	7,425	7,425	10.5%

<sup>a</sup> See Table 3-1.

<sup>b</sup> Based on the projections summarised in Table 3-9. Figures rounded to the nearest thousand so small percentage changes are not reflected in the absolute values.

Source: Table 3-1, PIRSA Fisheries and Aquaculture and BDO EconSearch analysis

**Table 3-12 Projected growth in South Australian aquaculture on-farm employment, 2019/20 to 2021/22 (full-time equivalents)**

	Actual Employment (fte) <sup>a</sup>	Forecast Employment (fte) <sup>b</sup>			Av. annual growth rate
	2018/19	2019/20	2020/21	2021/22	
Southern Bluefin Tuna	278	284	275	279	0.2%
Marine Finfish	78	93	94	97	7.7%
Oysters	212	224	235	235	3.5%
Mussels	32	38	38	38	5.9%
Abalone	53	53	89	63	6.3%
Freshwater Finfish	14	14	14	14	0.8%
Marron and Yabbies	6	6	7	7	5.8%
Other	5	8	8	8	19.5%
<b>Total</b>	<b>676</b>	<b>719</b>	<b>760</b>	<b>741</b>	<b>3.1%</b>
Tourism	8	8	8	8	3.2%

<sup>a</sup> Derived from PIRSA Fisheries and Aquaculture's 2018/19 Production Returns responses. Includes employment on inactive, undeveloped and underdeveloped leases.

<sup>b</sup> Based on the projections summarised in Table 3.9.

Source: PIRSA Fisheries and Aquaculture and BDO EconSearch analysis

Short-run elasticities of demand for primary products are generally relatively price inelastic. 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 aquaculture products, it was assumed for the purpose of this analysis that the medium-run price elasticity of demand for aquaculture products is -2.0 and the reciprocal, the price flexibility coefficient, is -0.5.

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 75 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 2019/20 to 2021/22. These projections are presented in Table 3-13.

**Table 3-13** Projected growth in South Australian aquaculture value of production, 2019/20 to 2021/22<sup>a</sup>

	Actual GVP (\$m)	Low GVP Forecast (\$m) <sup>b</sup>			High GVP Forecast (\$m) <sup>c</sup>		
	2018/19	2019/20	2020/21	2021/22	2019/20	2020/21	2021/22
Southern Bluefin Tuna	129.0	140.0	155.0	175.0	140.0	155.0	175.0
Marine Finfish	39.5	47.2	49.1	50.3	48.6	50.9	52.5
Oysters	20.5	22.9	24.8	25.5	23.3	25.6	26.5
Mussels	3.8	4.1	4.7	4.9	4.1	4.8	5.2
Abalone	13.8	14.4	15.9	20.7	14.4	15.9	20.7
Freshwater Finfish	2.4	2.7	2.8	2.8	2.7	2.9	2.9
Marron and Yabbies	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	2.7	3.3	3.5	3.5	3.4	3.6	3.6
<b>Total <sup>d</sup></b>	<b>211.7</b>	<b>234.6</b>	<b>255.8</b>	<b>282.9</b>	<b>236.6</b>	<b>258.8</b>	<b>286.5</b>
Tourism	0.61	0.73	0.82	0.82	0.73	0.82	0.82

<sup>a</sup> All estimates of gross value of production (GVP) are in 2019 dollars.

<sup>b</sup> 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 75 per cent of the growth in other sectors would be exported.

<sup>c</sup> The high estimate of GVP is based on no price response over the projection period (i.e. prices remain at 2018/19 levels).

<sup>d</sup> Totals may contain rounding errors.

Source: PIRSA Fisheries and Aquaculture and BDO EconSearch analysis

### 3.4. Other Indicators from the Production Returns

It was possible to derive a range of other data from the 2018/19 Production Returns. Estimates are provided below for the following indicators for SA for 2018/19.

- Proportion of aquaculture production, value of production and employment by sector (Table 3-14).
- The number of aquaculture licences reporting activity by sector (Table 3-15).
- Aquaculture spat and fingerling introductions and sales (Table 3-16).
- Reasons provided for nil returns (Table 3-17)
- Total number of aquaculture licences by category (Table 3-18).

**Table 3-14 Proportion of aquaculture production, value of production and employment by sector, South Australia, 2018/19**

	Production	Value	Direct employment
Southern Bluefin Tuna	51%	61%	41%
Marine Finfish	18%	19%	11%
Oysters	13%	10%	31%
Mussels	12%	2%	5%
Abalone	2%	7%	8%
Freshwater Finfish	1%	1%	2%
Marron and Yabbies <sup>a</sup>	0%	0%	1%
Other	2%	1%	1%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

<sup>a</sup> 0.01% of total aquaculture production and 0.04% of the total value of aquaculture production.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

**Table 3-15 Number of aquaculture licences reporting activity <sup>a</sup>, by sector, South Australia, 2018/19**

	Number of licences submitting a Production Return
Southern Bluefin Tuna	17
Marine Finfish	27
Oysters	255
Mussels	26
Abalone	7
Freshwater Finfish	13
Marron and Yabbies	12
Other	1
Tourism	1
Shellfish or Land based Licences with no production reported	53
<b>Total</b>	<b>412</b>

<sup>a</sup> This is not the total number of licences in each sector as not every licence holder submitted a production return. Licences are counted twice if they produced in two sectors in 2018/19. Total number of licences by sector are detailed in Table 3-18.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

Table 3-16 Aquaculture spat and fingerling introductions and sales, South Australia, 2018/19

	All licence holders		Spat/fingerling sales <sup>g</sup>		
	No. spat/fingerlings introduced ('000)	Proportion sourced from SA	No. spat/fingerlings sold ('000)	Value (\$'000)	No. of respondents
Southern Bluefin Tuna <sup>a</sup>	347	100%	-	-	0
Marine Finfish <sup>b</sup>	1,108	100%	n.p.	n.p.	1
Oysters <sup>c</sup>	181,566	100%	9,668	5,089	6
Mussels <sup>d</sup>	0	-	-	-	0
Abalone <sup>e</sup>	0	100%	-	-	0
Freshwater Finfish	1,641	64%	n.p.	n.p.	4
Marron and Yabbies	0	-	n.p.	n.p.	2
Other <sup>f</sup>	0	-	-	-	0
<b>Total</b>	<b>184,662</b>		<b>10,790</b>	<b>5,131</b>	<b>13</b>

<sup>a</sup> Wild caught juveniles, on-grown product sourced from Commonwealth waters off SA.

<sup>b</sup> Self-produced, on-grown fingerlings.

<sup>c</sup> Excludes stock sourced from other producers in SA for on-growing.

<sup>d</sup> Wild spat caught on-site or sourced from hatcheries.

<sup>e</sup> Includes self-produced at a land-based hatchery, on-grown spat.

<sup>f</sup> Other aquaculture is dominated by algae production for which juvenile introduction is not relevant.

<sup>g</sup> Where the number of respondents is less than 5 the data has not been published (n.p.) to ensure the confidentiality of respondents.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

Table 3-17 Reasons provided for nil returns, 2018/19

Reason provided for nil returns	Number of licences	
Normal operation does not involve sales <sup>a</sup>	60	29%
None provided / ambiguous / personal	15	7%
Ownership / regulatory <sup>b</sup>	18	9%
Stock levels too low / unable to purchase spat/fingerlings	34	17%
No infrastructure on site	33	16%
Not operating	42	21%
Other	2	1%
<b>Total</b>	<b>204</b>	<b>100%</b>

<sup>a</sup> For example, the licence may be used for research, holding stock, catching spat, or growing juveniles which are transferred to another licence before selling.

<sup>b</sup> For example, the licence is for sale, currently being transferred, or under another regulatory process.

Source: PIRSA Fisheries and Aquaculture 2018/19 Production Returns

Table 3-18 Aquaculture Licence Holders and category, 2018/19

Aquaculture licence and category	Number of licences
Southern Bluefin Tuna	14
Marine Finfish	23
Oysters <sup>a</sup>	340
Mussels	32
Abalone <sup>b</sup>	5
Landbased Category A	32
Landbased Category B	31
Landbased Category C	12
Landbased Category D	7
Miscellaneous	10
<b>Total</b>	<b>506</b>

<sup>a</sup> Oysters includes both marine based intertidal and subtidal licences.

<sup>b</sup> Abalone includes subtidal marine based abalone farms only, with Landbased coastal abalone farms and hatcheries included in the relevant Landbased category.

Source: PIRSA Fisheries and Aquaculture 2018/19

### 3.5. The Value of Aquaculture and Wild Catch Fisheries in South Australia

The state's total value of seafood production (landed) in 2018/19 was around \$489.3 million, of which aquaculture contributed 43 per cent (\$211.7m) and wild-catch fisheries, the balance (\$277.6m) (Table 3-19). In aggregate, Tuna is the largest single sector in the state's aquaculture industry, accounting for almost 61 per cent of the state's gross value of aquaculture production in 2018/19. The other three main sectors in 2018/19 were Marine Finfish (19 per cent), Oysters (10 per cent) and Abalone (7 per cent).

Table 3-19 Value of aquaculture production and wild fisheries catch, South Australia, 2018/19

	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
<b>Aquaculture</b>				
Southern Bluefin Tuna	8,252	129.0	60.9%	26.4%
Marine Finfish	2,951	39.5	18.6%	8.1%
Oysters	2,099	20.5	9.7%	4.2%
Mussels	1,898	3.8	1.8%	0.8%
Abalone	337	13.8	6.5%	2.8%
Freshwater Finfish	177	2.4	1.1%	0.5%
Marron and Yabbies <sup>a</sup>	2	0.1	0.0%	0.0%
Other <sup>b</sup>	355	2.7	1.3%	0.6%
<b>Total Aquaculture</b>	<b>16,070</b>	<b>211.7</b>	<b>100.0%</b>	<b>43.3%</b>
<b>Wild Catch Fisheries <sup>cc</sup></b>				
Rock Lobster	1,565	136.5	-	27.9%
Abalone	658	28.5	-	5.8%
Prawns	2,449	47.6	-	9.7%
Sardines	40,041	26.4	-	5.4%
Other Marine Fisheries	2,737	27.3	-	5.6%
Inland Water Fisheries	1,861	11.3	-	2.3%
<b>Total Wild Catch</b>	<b>49,311</b>	<b>277.6</b>	<b>-</b>	<b>56.7%</b>
<b>Total Seafood</b>	<b>65,381</b>	<b>489.3</b>	<b>-</b>	<b>100.0%</b>

<sup>a</sup> 0.04% contribution to aquaculture value of production and 0.02% contribution to total seafood value of production or catch.

<sup>b</sup> Other aquaculture production in 2018/19 was mostly comprised of Algae.

<sup>c</sup> Excludes catch from the Commonwealth managed fisheries and the SA Charter Boat Fishery. SARDI Aquatic Sciences estimates.

Source: SARDI Aquatic Sciences and PIRSA Fisheries and Aquaculture 2018/19 Production Returns

### 3.6. Exchange Rates

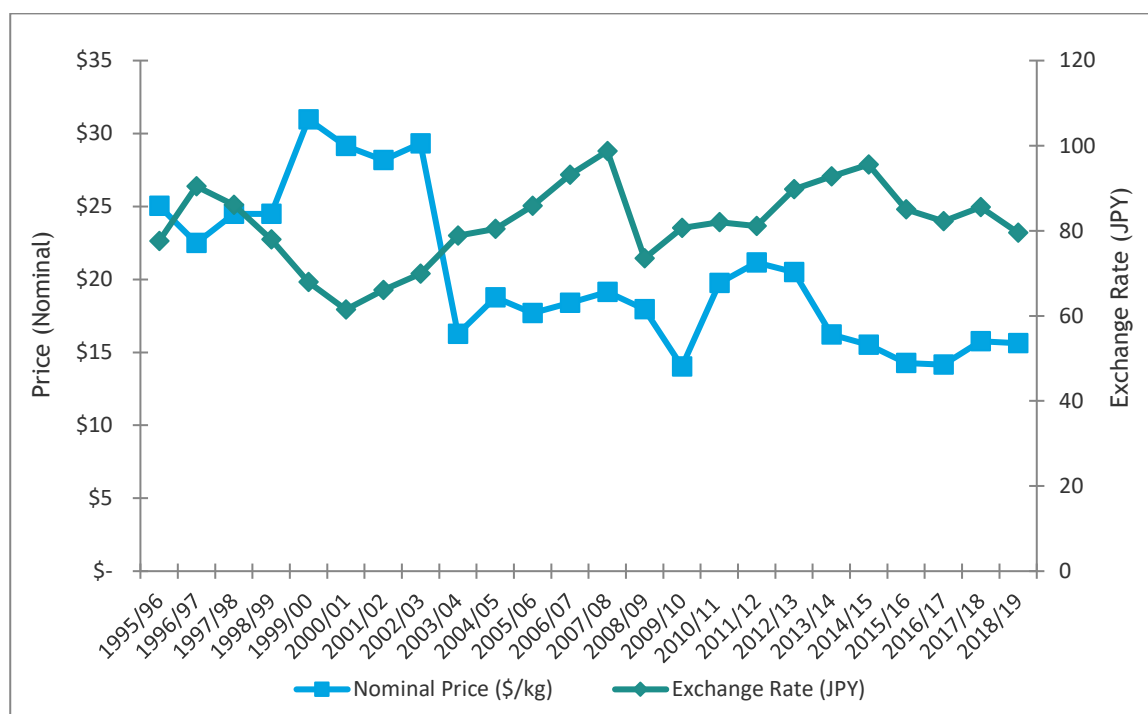
A large proportion of the South Australian aquaculture production, particularly Tuna, is exported overseas. Accordingly, the value of the Australian dollar can have a significant impact on the economic performance of the industry. The value of the Australian dollar influences the price of Australian exports overseas. Significant changes in the value of the Australian dollar have the potential to influence the demand for Australian aquaculture exports. The Australian dollar depreciated throughout 2018/19 beginning at US\$0.74 in July 2018 and ending at US\$0.69 in June 2019.

The average exchange rate in 2018/19 was US\$0.72, an 8 per cent decline compared to the average for the previous year (US\$0.78) (RBA 2020). Other things held equal, a fall in the value of the currency would have the effect of increasing the price of aquaculture product received by Australian exporters between 2017/18 and 2018/19.

A significant export destination for South Australian Tuna is Japan. Thus it may be useful to compare the value of the Australian dollar with the Japanese yen (JPY). The average rate of exchange in 2017/18 was 85.55 JPY decreasing to 79.51 (JPY) in 2018/19 (Figure 3-1).

The relationship between the price of Tuna and the exchange rate (JPY) between 1995/96 and 2018/19 can be readily observed in Figure 3-1. A widely used measure of the relationship between two variables, such as price and exchange rate, is the coefficient of correlation. The coefficient of correlation can range in value from +1.0 for a perfect positive correlation to -1.0 for a perfect inverse correlation. The coefficient of correlation between the exchange rate (JPY) and the price for SA farmed Tuna for the period 1995/96 to 2018/19 is -0.62. This indicates that there is a strong inverse relationship between the two variables. Thus, when the Australian dollar depreciates against the JPY there is, generally, a corresponding rise in the average price of SA farmed Tuna. While this relationship is not expected to hold in each individual year, it does hold over the longer periods as evidenced by the relative trends in Figure 3-1.

Figure 3-1 Exchange rate (JPY) and price for Tuna, 1995/96 to 2018/19



Source: RBA (2020)

## 4. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN SA, 2018/19

Estimates of the direct economic contribution 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 2018/19 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. These flow-on effects have been estimated using input-output analysis. Input-output analysis is widely used in economic contribution analysis and is a practicable method for measuring economic contributions at regional and state levels. In order to compile a representative cost structure for each sector, costs were derived from data provided by operators in 2002/03 and updated to 2018/19, as described earlier. On an item-by-item basis, the expenditures were allocated between those occurring in South Australia and those goods and services imported from outside the state. These data were then incorporated into the state input-output model to estimate the flow-on or indirect economic contributions.

### 4.1. The Economic Contribution of Tuna Farming in South Australia, 2018/19

Estimates of the economic contribution generated by the Tuna farming industry in SA on a sector-by-sector basis for 2018/19 are provided in Table 4-1 and Figure 4-1 to Figure 4-4. Contributions are measured in terms of value of output, contribution to gross state product (GSP), employment and household income.

#### *Output contributions...*

There are substantial economic contributions from the Tuna farming industry in South Australia. Direct output (business turnover) generated in South Australia by Tuna farms summed to \$129.0 million and in other sectors (processing and transport), \$15.0 million in 2018/19. Flow-on output in other sectors of the state economy summed to \$185.2 million (Table 4-1). The sectors most affected were the Tuna fishing (Tuna capture), property and business services, Sardine fishing, manufacturing, trade, finance and transport sectors (Figure 4-1).

The bottom row of Table 4-1 gives the total contribution/direct contribution ratio for each economic indicator. For output, the ratio of 2.29 indicates that for each dollar of sales generated by the Tuna industry (farming and downstream) there was a total of \$2.29 of output generated by businesses throughout the state, \$1.00 in the Tuna industry (farming and downstream) and \$1.29 in other sectors of the economy (e.g. tuna fishing, property and business services, manufacturing, Sardine fishing, trade, finance and transport sectors).



**Table 4-1 The economic contribution of Tuna farming in South Australia, 2018/19**

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Tuna farming	129.0	39%	25.8	19%	278	24%	11.1	16%
Processing	12.8	4%	3.1	2%	46	4%	1.4	2%
Transport	2.3	1%	1.0	1%	11	1%	0.9	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%
<b>Total Direct</b>	<b>144.0</b>	<b>44%</b>	<b>30.0</b>	<b>22%</b>	<b>335</b>	<b>29%</b>	<b>13.4</b>	<b>19%</b>
Flow-on effects								
Tuna fishing	34.6	11%	20.7	15%	202	17%	10.0	14%
Property and business serv.	28.5	9%	18.6	13%	104	9%	8.3	12%
Sardines	26.4	8%	20.1	14%	63	5%	5.9	9%
Manufacturing	12.9	4%	3.8	3%	44	4%	2.6	4%
Finance and insurance	13.1	4%	8.3	6%	30	3%	2.5	4%
Trade	12.7	4%	7.6	5%	90	8%	5.6	8%
Transport	7.4	2%	3.4	2%	33	3%	2.7	4%
Other Sectors <sup>b</sup>	49.5	15%	26.7	19%	264	23%	18.7	27%
<b>Total Flow-on</b>	<b>185.2</b>	<b>56%</b>	<b>109.2</b>	<b>78%</b>	<b>830</b>	<b>71%</b>	<b>56.3</b>	<b>81%</b>
<b>Total <sup>a</sup></b>	<b>329.2</b>	<b>100%</b>	<b>139.2</b>	<b>100%</b>	<b>1,165</b>	<b>100%</b>	<b>69.7</b>	<b>100%</b>
Total/Direct	2.29		4.64		3.48		5.20	

<sup>a</sup> Note there is double counting in the total output contribution.

<sup>b</sup> E.g. accommodation, restaurants and cafes, utilities, communications, agriculture, forestry and fishing sectors.

Source: BDO EconSearch analysis

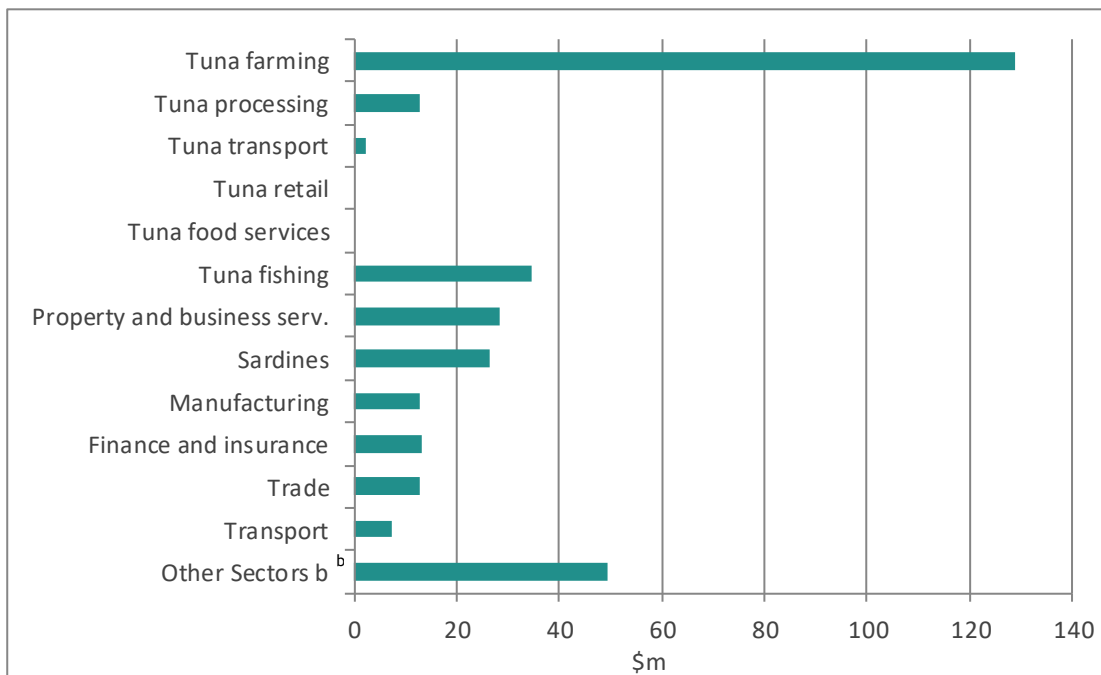
### ***Contribution to gross state product...***

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 activity.

The direct contribution to GSP by the Tuna industry (i.e. farming, processing and transport) was \$30.0 million in 2018/19 (\$25.8m from tuna farming and \$4.1m from downstream activities). Associated with this was flow-on GSP in the other sectors of the state economy of \$109.2m (Table 4-1). The flow-ons were greatest in the Tuna fishing (\$20.7m), Sardine fishing (\$20.1m), property and business services (\$18.6m), finance and insurance (\$8.3m), trade (\$7.6m), manufacturing (\$3.8m) and transport (\$3.4m) sectors (Figure 4-2). The total contribution to GSP was approximately \$139.2m in 2018/19.

The bottom row in Table 4-1 shows that for each one dollar contribution to GSP by the Tuna industry there was an additional \$3.64 (\$4.64 in total) contribution to GSP in other sectors of the state economy (e.g. tuna fishing, property and business services, Sardine fishing, trade, manufacturing and finance sectors).

Figure 4-1 Tuna farming in South Australia, output contributions by sector, 2018/19 <sup>a</sup>

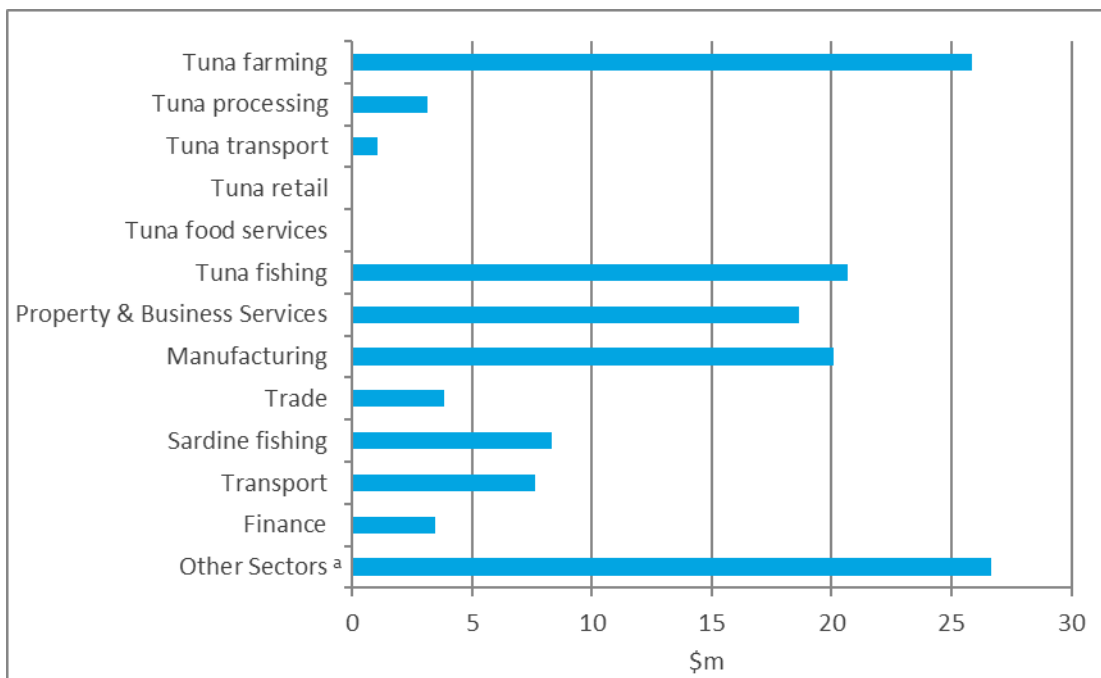


<sup>a</sup> Note there is double counting in the total output contribution.

<sup>b</sup> E.g. accommodation, restaurants and cafes, utilities, communications, agriculture, forestry and fishing sectors.

Source: BDO EconSearch analysis

Figure 4-2 Tuna farming in South Australia, contribution to GSP by sector, 2018/19



<sup>a</sup> E.g. accommodation, restaurants and cafes, utilities, communications, agriculture, forestry and fishing sectors.

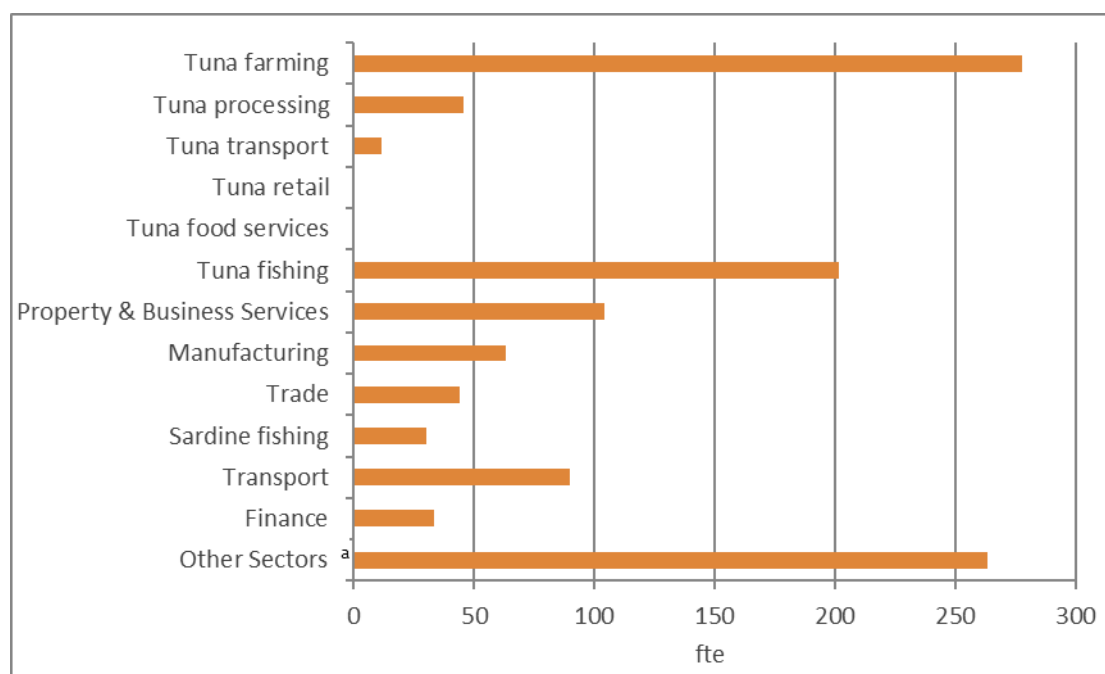
Source: BDO EconSearch analysis

### 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 278 full-time equivalents (fte) and, through associated processing and transport activities, another 57 fte in 2018/19 (Table 4-1). Flow-on business activity was estimated to generate a further 830 fte to give total employment of 1,165 fte in the state. The sectors of the economy with employment flow-ons from Tuna farming, processing and transport include the Tuna fishing (202 fte), property and business services (104), trade (90), Sardine fishing (63), and manufacturing (44) (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 2.48 jobs (3.48 jobs in total) in the rest of the state.

Figure 4-3 Tuna farming in South Australia, employment contributions by sector, 2018/19



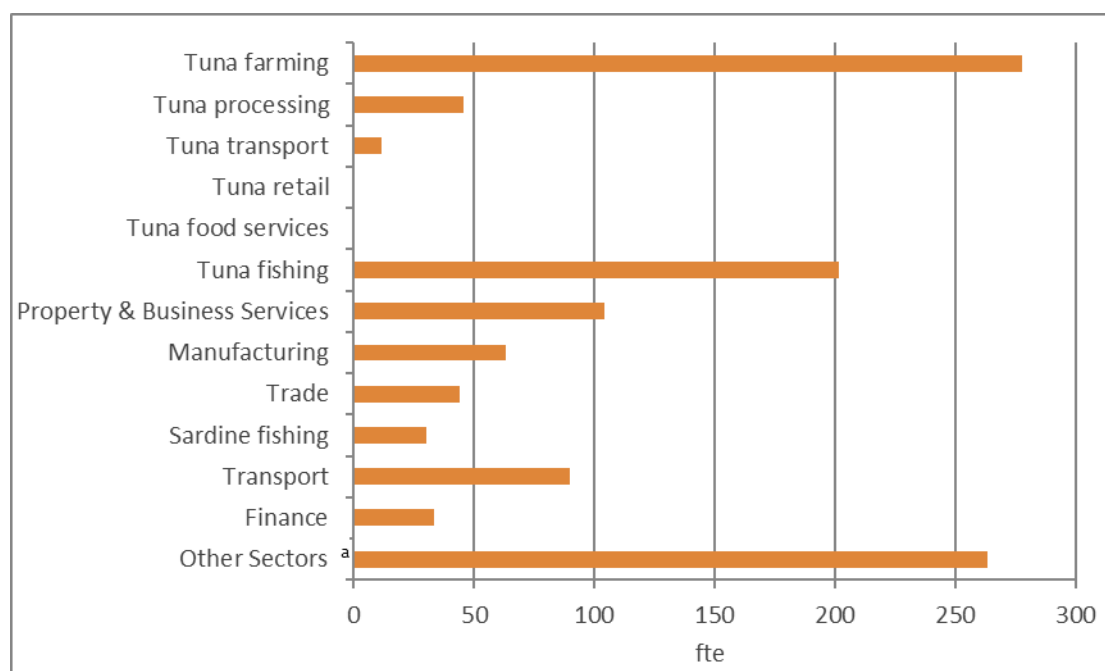
<sup>a</sup> E.g. accommodation, restaurants and cafes, utilities, communications, agriculture, forestry and fishing sectors.

Source: BDO EconSearch analysis

Personal income of \$11.1 million was earned in the Tuna farming sector and another \$2.3 million in downstream activities. This comprised both wages by employees and estimated drawings by owner/operators. An additional \$56.3 million of household income was earned in other businesses in the state as a result of Tuna farming and downstream activities. The total household income contribution was around \$69.7 million (Figure 4-4).

For each \$1.00 of household income generated directly by Tuna farming, processing and transport in 2018/19 there was an additional \$4.20 (\$5.20 in total) generated in other sectors of the state economy (Table 4-1).

Figure 4-4 Tuna farming in South Australia, household income contributions by sector, 2018/19



<sup>a</sup> E.g. accommodation, restaurants and cafes, utilities, communications, agriculture, forestry and fishing sectors.

Source: BDO EconSearch analysis

## 4.2. The Economic Contribution of Oyster Farming in South Australia, 2018/19

Table 4-2 provides estimates of the economic contribution generated by Oyster farming in South Australia on a sector-by-sector basis in 2018/19. As for Tuna in the previous section, contributions are measured in terms of output (business turnover), contribution to GSP, employment and household income.

It should be noted that the gross value of production includes the value of adult Oyster sales only. Approximately \$5.09 million of spat sales and \$270,000 of sales from on-grown Oysters have been excluded as they are considered an input to production for the final sales of adult Oysters. In previous reports (EconSearch 2018) the value of spat sales was included as some spat was exported interstate. However, all spat grown in SA are now supplied to SA Oyster farms and are, as stated above, now considered an input to production for the final sales of adult Oysters.

### **Output contributions...**

Direct output (business turnover) generated in SA by Oyster farming enterprises summed to \$20.5 million in 2018/19 while output generated in SA by associated downstream activities (processing, transport, retail and food service) summed to \$15.3 million. Flow-ons to other sectors of the state economy added another \$36.1 million in output in 2018/19. The sectors most affected were the property and business services, manufacturing, trade and finance sectors.

Table 4-2 The economic contribution of Oyster farming in South Australia, 2018/19 <sup>a</sup>

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Oyster farming <sup>b</sup>	20.5	28%	15.9	36%	212	43%	7.4	31%
Processing	2.6	4%	0.6	1%	9	2%	0.3	1%
Transport	2.5	3%	1.1	3%	12	3%	1.0	4%
Retail	0.2	0%	0.1	0%	2	0%	0.1	0%
Food services	10.0	14%	5.5	12%	92	19%	3.9	17%
<b>Total Direct</b>	<b>35.7</b>	<b>50%</b>	<b>23.3</b>	<b>53%</b>	<b>327</b>	<b>67%</b>	<b>12.7</b>	<b>53%</b>
Flow-on effects								
Property and business serv	7.8	11%	5.3	12%	24	5%	1.8	7%
Manufacturing	3.8	5%	1.1	2%	12	3%	0.7	3%
Trade	4.2	6%	2.5	6%	30	6%	1.9	8%
Transport	1.8	2%	0.8	2%	8	2%	0.6	3%
Finance	3.6	5%	2.2	5%	9	2%	0.7	3%
Other Sectors	14.9	21%	8.9	20%	79	16%	5.5	23%
<b>Total Flow-on</b>	<b>36.1</b>	<b>50%</b>	<b>20.8</b>	<b>47%</b>	<b>162</b>	<b>33%</b>	<b>11.2</b>	<b>47%</b>
<b>Total <sup>c</sup></b>	<b>71.8</b>	<b>100%</b>	<b>44.1</b>	<b>100%</b>	<b>489</b>	<b>100%</b>	<b>23.9</b>	<b>100%</b>
Total/Direct	2.01		1.89		1.50		1.88	

<sup>a</sup> 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.

<sup>b</sup> Includes sales of adults but excludes sales of spat and on-grown oysters.

<sup>c</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

### ***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 2018/19, total Oyster farming-related contribution to GSP in South Australia was approximately \$44.1 million, \$15.9 million generated by Oyster farming directly, \$7.3 million generated directly by downstream activities and \$20.8 million generated in other sectors of the state economy.

### ***Employment and household income...***

In 2018/19, SA Oyster farming was responsible for the direct employment of around 212 fte and downstream activities created employment for around 115 fte. Flow-on business activity was estimated to generate a further 162 fte to give total employment of 489 fte in the state. The flow-on jobs were concentrated in the trade (30 fte), property and business services (24 fte) and manufacturing (12 fte).

Personal income of around \$7.4 million was earned in the Oyster farming sector and another \$5.3 million in downstream activities. This comprised both wages by employees and estimated drawings by owner/operators. An additional \$11.2 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 contribution was \$23.9 million.

### 4.3. The Economic Contribution of the Remaining Aquaculture Sectors in South Australia, 2018/19

The economic contributions of the remaining individual aquaculture sectors in South Australia in 2018/19 are reported in Table 4-3 to Table 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 following aquaculture sectors, the contributions 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 contributions 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 contribution of Marine Finfish farming in South Australia, 2018/19 <sup>a</sup>**

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Marine finfish farming	39.5	37%	18.2	33%	78	18%	5.8	21%
Processing	3.2	3%	0.8	1%	12	3%	0.3	1%
Transport	3.2	3%	1.5	3%	16	4%	1.3	5%
Retail	1.3	1%	0.8	1%	12	3%	0.6	2%
Food services	9.1	9%	5.0	9%	83	19%	3.6	13%
<b>Total Direct</b>	<b>56.4</b>	<b>53%</b>	<b>26.3</b>	<b>48%</b>	<b>201</b>	<b>47%</b>	<b>11.7</b>	<b>43%</b>
Flow-on effects								
Property and business serv	9.3	9%	6.3	11%	30	7%	2.2	8%
Manufacturing	4.2	4%	1.2	2%	14	3%	0.8	3%
Trade	6.1	6%	3.7	7%	45	10%	2.7	10%
Transport	2.7	3%	1.2	2%	12	3%	1.0	4%
Finance	4.4	4%	2.7	5%	10	2%	0.9	3%
Other Sectors	22.8	22%	13.8	25%	118	27%	8.0	29%
<b>Total Flow-on</b>	<b>49.5</b>	<b>47%</b>	<b>28.9</b>	<b>52%</b>	<b>229</b>	<b>53%</b>	<b>15.6</b>	<b>57%</b>
<b>Total <sup>a</sup></b>	<b>105.8</b>	<b>100%</b>	<b>55.2</b>	<b>100%</b>	<b>429</b>	<b>100%</b>	<b>27.2</b>	<b>100%</b>
Total/Direct	1.88		2.10		2.14		2.33	

<sup>a</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

Table 4-4 The economic contribution of Mussel farming in South Australia, 2018/19 <sup>a</sup>

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Mussel farming	3.8	20%	2.3	22%	32	29%	2.5	35%
Processing	1.0	5%	0.2	2%	4	3%	0.1	1%
Transport	0.6	3%	0.3	3%	3	3%	0.3	4%
Retail	0.5	3%	0.3	3%	5	4%	0.2	3%
Food services	1.9	10%	1.0	10%	17	16%	0.7	10%
<b>Total Direct</b>	<b>7.8</b>	<b>42%</b>	<b>4.2</b>	<b>40%</b>	<b>60</b>	<b>55%</b>	<b>3.9</b>	<b>54%</b>
Flow-on effects								
Property and business serv	2.3	12%	1.6	15%	7	6%	0.5	7%
Manufacturing	1.1	6%	0.3	3%	4	3%	0.2	3%
Trade	1.3	7%	0.8	7%	9	8%	0.6	8%
Transport	0.5	3%	0.2	2%	2	2%	0.2	2%
Finance	1.1	6%	0.7	6%	3	2%	0.2	3%
Other Sectors	4.6	25%	2.7	26%	24	22%	1.7	23%
<b>Total Flow-on</b>	<b>10.8</b>	<b>58%</b>	<b>6.3</b>	<b>60%</b>	<b>49</b>	<b>45%</b>	<b>3.3</b>	<b>46%</b>
<b>Total <sup>a</sup></b>	<b>18.6</b>	<b>100%</b>	<b>10.5</b>	<b>100%</b>	<b>109</b>	<b>100%</b>	<b>7.2</b>	<b>100%</b>
Total/Direct	2.39		2.50		1.81		1.87	

<sup>a</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

Table 4-5 The economic contribution of Abalone<sup>a</sup> farming in South Australia, 2018/19 <sup>a</sup>

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Abalone farming	13.8	43%	4.2	28%	53	38%	2.2	28%
Processing	0.4	1%	0.1	1%	2	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%
<b>Total Direct</b>	<b>14.3</b>	<b>44%</b>	<b>4.4</b>	<b>28%</b>	<b>54</b>	<b>39%</b>	<b>2.3</b>	<b>29%</b>
Flow-on effects								
Property and business serv	2.5	8%	1.7	11%	7	5%	0.5	7%
Manufacturing	0.9	3%	0.3	2%	3	2%	0.2	2%
Trade	1.5	5%	0.9	6%	11	8%	0.7	9%
Transport	0.6	2%	0.3	2%	3	2%	0.2	3%
Finance	1.2	4%	0.7	5%	3	2%	0.2	3%
Other Sectors	11.3	35%	7.1	46%	56	41%	3.8	48%
<b>Total Flow-on</b>	<b>18.0</b>	<b>56%</b>	<b>11.0</b>	<b>72%</b>	<b>84</b>	<b>61%</b>	<b>5.6</b>	<b>71%</b>
<b>Total <sup>a</sup></b>	<b>32.3</b>	<b>100%</b>	<b>15.3</b>	<b>100%</b>	<b>138</b>	<b>100%</b>	<b>7.9</b>	<b>100%</b>
Total/Direct	2.26		3.51		2.54		3.48	

<sup>a</sup> Abalone produced from marine and land-based aquaculture sites, i.e. the data represent species not class of licence.

<sup>b</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

**Table 4-6 The economic contribution of Freshwater Finfish farming in South Australia, 2018/19 <sup>a</sup>**

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Freshwater finfish farming	2.4	39%	1.3	38%	14	41%	0.7	34%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.2	4%	0.1	3%	1	3%	0.1	5%
Retail	0.1	1%	0.0	1%	1	2%	0.0	2%
Food services	0.5	8%	0.3	8%	5	14%	0.2	10%
<b>Total Direct</b>	<b>3.2</b>	<b>53%</b>	<b>1.7</b>	<b>50%</b>	<b>21</b>	<b>61%</b>	<b>1.0</b>	<b>52%</b>
Flow-on effects								
Property and business serv	0.6	10%	0.4	13%	2	6%	0.1	8%
Manufacturing	0.3	4%	0.1	2%	1	3%	0.1	3%
Trade	0.4	7%	0.2	7%	3	9%	0.2	9%
Transport	0.2	3%	0.1	2%	1	2%	0.1	3%
Finance	0.3	5%	0.2	6%	1	2%	0.1	3%
Other Sectors	1.1	18%	0.7	19%	6	18%	0.4	22%
<b>Total Flow-on</b>	<b>2.9</b>	<b>47%</b>	<b>1.7</b>	<b>50%</b>	<b>13</b>	<b>39%</b>	<b>0.9</b>	<b>48%</b>
<b>Total <sup>a</sup></b>	<b>6.1</b>	<b>100%</b>	<b>3.4</b>	<b>100%</b>	<b>34</b>	<b>100%</b>	<b>1.9</b>	<b>100%</b>
Total/Direct	1.89		1.98		1.65		1.93	

<sup>a</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

**Table 4-7 The economic contribution of Marron/Yabby farming in South Australia, 2018/19 <sup>a</sup>**

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Marron/yabbies farming	0.1	29%	0.0	19%	6	86%	0.0	38%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.0	1%	0.0	1%	0	0%	0.0	1%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	12%	0.0	13%	0	4%	0.0	12%
<b>Total Direct</b>	<b>0.1</b>	<b>42%</b>	<b>0.0</b>	<b>32%</b>	<b>6</b>	<b>90%</b>	<b>0.1</b>	<b>51%</b>
Flow-on effects								
Property and business serv	0.0	13%	0.0	18%	0	2%	0.0	9%
Manufacturing	0.0	6%	0.0	3%	0	1%	0.0	3%
Trade	0.0	8%	0.0	9%	0	2%	0.0	9%
Transport	0.0	3%	0.0	3%	0	0%	0.0	3%
Finance	0.0	6%	0.0	7%	0	1%	0.0	3%
Other Sectors	0.1	23%	0.0	28%	0	4%	0.0	23%
<b>Total Flow-on</b>	<b>0.1</b>	<b>58%</b>	<b>0.1</b>	<b>68%</b>	<b>1</b>	<b>10%</b>	<b>0.0</b>	<b>49%</b>
<b>Total <sup>a</sup></b>	<b>0.3</b>	<b>100%</b>	<b>0.1</b>	<b>100%</b>	<b>7</b>	<b>100%</b>	<b>0.1</b>	<b>100%</b>
Total/Direct	2.37		3.10		1.11		1.97	

<sup>a</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis



Table 4-8 The economic contribution of other aquaculture farming in South Australia, 2018/19 <sup>a</sup>

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Other aquaculture	2.7	56%	1.2	49%	5	31%	0.3	27%
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%
<b>Total Direct</b>	<b>2.7</b>	<b>56%</b>	<b>1.2</b>	<b>49%</b>	<b>5</b>	<b>31%</b>	<b>0.3</b>	<b>27%</b>
Flow-on effects								
Property and business serv	0.4	7%	0.2	10%	1	9%	0.1	10%
Manufacturing	0.1	3%	0.0	2%	0	3%	0.0	3%
Trade	0.2	5%	0.1	6%	2	13%	0.1	11%
Transport	0.1	2%	0.0	2%	0	3%	0.0	4%
Finance	0.2	4%	0.1	4%	0	3%	0.0	3%
Other Sectors	1.1	23%	0.7	28%	6	39%	0.4	42%
<b>Total Flow-on</b>	<b>2.1</b>	<b>44%</b>	<b>1.3</b>	<b>51%</b>	<b>10</b>	<b>69%</b>	<b>0.7</b>	<b>73%</b>
<b>Total <sup>b</sup></b>	<b>4.8</b>	<b>100%</b>	<b>2.5</b>	<b>100%</b>	<b>15</b>	<b>100%</b>	<b>0.9</b>	<b>100%</b>
<b>Total/Direct</b>	<b>1.78</b>		<b>2.04</b>		<b>3.22</b>		<b>3.68</b>	

<sup>a</sup> Other aquaculture production in 2018/19 was comprised of Algae and Silver Perch (including fingerlings and spat) production. The downstream contributions of other aquaculture production are unknown and have been excluded from the analysis.

<sup>b</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

## 5. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE EYRE PENINSULA REGION, 2018/19

This region covers the Eyre Peninsula from Lower Eyre Peninsula to Port Augusta, including Kimba (see Figure 1-1).

Production and value by aquaculture sector for the Eyre Peninsula is summarised in Table 5-1.

**Table 5-1 Production and value of production in the Eyre Peninsula Region, 2018/19**

	Production (t)	Value of Production (\$'000)
Southern Bluefin Tuna	8,252	129,000
Marine Finfish	2,951	39,479
Oysters	1,505	14,212
Mussels	1,898	3,796
Abalone	207	8,487
Freshwater Finfish	0	3
Marron and Yabbies	0	1
Other	350	2,628
<b>Total</b>	<b>15,163</b>	<b>197,606</b>

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of all aquaculture in the Eyre Peninsula region of South Australia in 2018/19 are reported in Table 5-2. The interpretation of these results is identical to the state-level contributions described in Section 4 of the report.

**Table 5-2 The economic contribution of all aquaculture in the Eyre Peninsula Region, 2018/19**

Sector	Output <sup>b</sup>		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Aquaculture production	197.6	48%	61.3	33%	556	37%	24.7	28%
Aquaculture downstream <sup>a</sup>	26.6	6%	8.5	5%	107	7%	5.4	6%
<b>Total Direct</b>	<b>224.2</b>	<b>54%</b>	<b>69.7</b>	<b>38%</b>	<b>663</b>	<b>44%</b>	<b>30.1</b>	<b>35%</b>
Flow-on effects								
Tuna Fishing	34.6	8%	22.1	12%	201	13%	11.1	13%
Other Sectors	156.4	38%	93.0	50%	651	43%	45.6	53%
<b>Total Flow-on</b>	<b>191.0</b>	<b>46%</b>	<b>115.1</b>	<b>62%</b>	<b>852</b>	<b>56%</b>	<b>56.7</b>	<b>65%</b>
<b>Total</b>	<b>415.2</b>	<b>100%</b>	<b>184.8</b>	<b>100%</b>	<b>1,515</b>	<b>100%</b>	<b>86.8</b>	<b>100%</b>

<sup>a</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

## 5.1. The Economic Contribution of Tuna Farming in the Eyre Peninsula Region, 2018/19

Estimates of the economic contribution of Tuna farming in the Eyre Peninsula region of South Australia in 2018/19 are reported in Table 5-3.

**Table 5-3 The economic contribution of Tuna farming in the Eyre Peninsula Region, 2018/19**

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Tuna farming	129.0	45%	25.8	22%	278	29%	11.1	20%
Processing	12.8	4%	3.1	3%	44	5%	1.3	2%
Transport	2.3	1%	1.0	1%	11	1%	0.9	2%
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%
<b>Total Direct</b>	<b>144.0</b>	<b>50%</b>	<b>30.0</b>	<b>26%</b>	<b>332</b>	<b>35%</b>	<b>13.3</b>	<b>24%</b>
Flow-on effects								
Tuna fishing	34.6	12%	22.1	19%	201	21%	11.1	20%
Property and business serv.	18.0	6%	12.1	11%	54	6%	4.4	8%
Sardines	26.4	9%	26.4	23%	63	7%	5.9	11%
Manufacturing	8.9	3%	2.6	2%	34	4%	2.0	4%
Finance and insurance	5.4	2%	4.0	3%	11	1%	0.8	2%
Trade	9.4	3%	5.7	5%	69	7%	4.3	8%
Transport	8.9	3%	4.3	4%	33	4%	2.8	5%
Other Sectors <sup>b</sup>	29.6	10%	7.7	7%	151	16%	10.2	19%
<b>Total Flow-on</b>	<b>141.3</b>	<b>50%</b>	<b>85.0</b>	<b>74%</b>	<b>617</b>	<b>65%</b>	<b>41.4</b>	<b>76%</b>
<b>Total <sup>a</sup></b>	<b>285.3</b>	<b>100%</b>	<b>114.9</b>	<b>100%</b>	<b>949</b>	<b>100%</b>	<b>54.7</b>	<b>100%</b>
Total/Direct	1.98		3.83		2.86		4.11	

<sup>a</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

### **Output contributions...**

Direct output (business turnover) generated locally by Tuna farms summed to \$129.0 million and in other sectors (processing and transport), \$15.0 million in 2018/19. Flow-on output in other sectors summed to \$141.3 million. The sectors most affected were the Tuna fishing (Tuna capture), Sardine fishing, property and business services, trade and manufacturing sectors (Table 5-3).

The bottom row of Table 5-3 gives the total contribution/direct contribution ratio for each economic indicator. For output, the ratio of 1.98 indicates that for each dollar of sales generated directly by Tuna farming, processing and transport there was a total of \$1.98 of output generated by businesses throughout the Eyre Peninsula region, \$1.00 in Tuna farming, processing and transport and \$0.98 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 \$30.0 million in 2018/19 (\$25.8m directly by Tuna farming and \$4.1m by downstream businesses). Flow-on GRP generated in the other sectors of the regional economy was \$85.0 million in 2018/19. The flow-ons were greatest in the Sardine fishing (\$26.4m), Tuna fishing (\$22.1m), and

property and business services (\$12.1m) sectors. The total contribution to GSP was approximately \$114.9m in 2018/19.

The bottom row in Table 5-3 shows that for each dollar of GRP generated directly in Tuna farming, processing and transport there was an additional \$2.83 (\$3.83 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 278 fte and associated processing and transport, approximately 55 fte in the Eyre Peninsula region in 2018/19. Flow-on business activity was estimated to have generated a further 617 fte jobs locally to give total employment of approximately 949 fte in the region. The sectors of the local economy with employment flow-ons from Tuna farming, processing and transport included the Tuna fishing (201 fte), trade (69), Sardine fishing (63) and property and business services (54) sectors.

The bottom row in Table 5-3 shows that for each job generated directly in Tuna farming, processing and transport there was an additional 1.86 jobs (2.86 jobs in total) in the rest of the region.

Personal income of \$11.1 million was earned in the Tuna farming sector and another \$2.2 million in downstream activities. This comprised both wages by employees and estimated drawings by owner/operators. An additional \$41.4 million of household income was earned in other businesses in the region as a result of Tuna farming and downstream activities. The total household income contribution was \$54.7 million. For each \$1.00 of household income generated directly by Tuna farming, processing and transport in 2018/19 there was an additional \$3.11 (\$4.11 in total) generated in other sectors of the Eyre Peninsula regional economy.

## **5.2. The Economic Contribution of Oyster Farming in the Eyre Peninsula Region, 2018/19**

Estimates of the economic contribution of Oyster farming in the Eyre Peninsula region in 2018/19 are reported in Table 5-4. The interpretation of these results is identical to the state-level contributions described in Section 4 of the report.

#### ***Output contributions...***

Direct output (business turnover) generated by Oyster enterprises in the Eyre Peninsula region summed to approximately \$14.2 million in 2018/19 while output generated in the Eyre Peninsula region by associated downstream activities (processing, transport, retail and food service) summed to \$2.5 million. Flow-ons to other sectors of the regional economy added another \$8.8 million in output in 2018/19. The sectors most affected were the property and business services and trade sectors (Table 5-4).

#### ***Contribution to gross regional product...***

Total Oyster farming-related contribution to GRP in the Eyre Peninsula region was \$17.5 million in 2018/19, \$11.1 million generated by Oyster farming directly, \$1.1 million generated by downstream activities and \$5.3 million generated in other sectors of the regional economy.

#### ***Employment and household income...***

In 2018/19 in the Eyre Peninsula region, Oyster farming was responsible for the direct employment of approximately 127 fte and associated downstream activities created employment for an additional 13 fte.

Flow-on business activity was estimated to generate a further 42 fte. The total employment contribution was 182 fte.

In 2018/19, personal income of \$5.3 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 \$2.7 million of household income was earned in other local businesses as a result of Oyster industry operations. The total household income contribution was around \$8.0 million.

**Table 5-4 The economic contribution of Oyster farming in the Eyre Peninsula region, 2018/19 <sup>a</sup>**

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
<b>Direct effects</b>								
Oyster farming <sup>b</sup>	14.2	56%	11.1	63%	127	70%	4.4	55%
Processing	0.5	2%	0.1	1%	2	1%	0.0	1%
Transport	1.7	7%	0.8	4%	8	5%	0.7	9%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.3	1%	0.2	1%	3	2%	0.1	2%
<b>Total Direct</b>	<b>16.7</b>	<b>65%</b>	<b>12.2</b>	<b>70%</b>	<b>139</b>	<b>77%</b>	<b>5.3</b>	<b>66%</b>
<b>Flow-on effects</b>								
Property and business serv.	2.0	8%	1.4	8%	4	2%	0.3	4%
Manufacturing	0.5	2%	0.2	1%	2	1%	0.1	1%
Trade	1.2	5%	0.7	4%	10	5%	0.6	7%
Transport	0.8	3%	0.4	2%	3	2%	0.2	3%
Finance	0.5	2%	0.3	2%	1	0%	0.1	1%
Other Sectors	3.8	15%	2.3	13%	22	12%	1.4	18%
<b>Total Flow-on</b>	<b>8.8</b>	<b>35%</b>	<b>5.3</b>	<b>30%</b>	<b>42</b>	<b>23%</b>	<b>2.7</b>	<b>34%</b>
<b>Total <sup>c</sup></b>	<b>25.6</b>	<b>100%</b>	<b>17.5</b>	<b>100%</b>	<b>182</b>	<b>100%</b>	<b>8.0</b>	<b>100%</b>
Total/Direct	1.6		1.5		1		1.6	

<sup>a</sup> 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.

<sup>b</sup> Includes sales of adults but excludes sales of spat and on-grown oysters.

<sup>c</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

### 5.3. The Economic Contribution of the Remaining Aquaculture Sectors in the Eyre Peninsula Region, 2018/19

The economic contributions of other aquaculture sectors in the Eyre Peninsula region in 2018/19 (i.e. Marine Finfish, Mussels, Abalone, Freshwater Finfish, Marron and Yabbies and other aquaculture enterprises) are reported in aggregate in Table 5-5. 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 some of these other aquaculture sectors, the contributions 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 contributions 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 5-5 The economic contribution of the remaining aquaculture sectors <sup>a</sup> in the Eyre Peninsula region, 2018/19 <sup>b</sup>**

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
<b>Direct effects</b>								
Remaining aquaculture	54.4	52%	24.3	46%	152	39%	9.2	38%
Processing	4.5	4%	1.1	2%	15	4%	0.5	2%
Transport	3.9	4%	1.8	3%	19	5%	1.6	7%
Retail	0.1	0%	0.1	0%	1	0%	0.0	0%
Food services	0.5	1%	0.3	1%	5	1%	0.2	1%
<b>Total Direct</b>	<b>63.4</b>	<b>61%</b>	<b>27.6</b>	<b>53%</b>	<b>191</b>	<b>50%</b>	<b>11.5</b>	<b>48%</b>
<b>Flow-on effects</b>								
Property and business serv.	6.1	6%	4.3	8%	14	4%	1.0	4%
Manufacturing	1.7	2%	0.5	1%	7	2%	0.4	2%
Trade	5.2	5%	3.2	6%	42	11%	2.4	10%
Transport	3.4	3%	1.6	3%	13	3%	1.1	4%
Finance	1.7	2%	1.3	2%	3	1%	0.3	1%
Other Sectors	22.8	22%	13.9	27%	114	30%	7.4	31%
<b>Total Flow-on</b>	<b>40.9</b>	<b>39%</b>	<b>24.8</b>	<b>47%</b>	<b>193</b>	<b>50%</b>	<b>12.5</b>	<b>52%</b>
<b>Total <sup>c</sup></b>	<b>104.4</b>	<b>100%</b>	<b>52.4</b>	<b>100%</b>	<b>384</b>	<b>100%</b>	<b>24.0</b>	<b>100%</b>
<b>Total/Direct</b>	<b>1.7</b>		<b>1.9</b>		<b>2</b>		<b>2.1</b>	

<sup>a</sup> Includes Marine Finfish, Mussels, Abalone, Freshwater Finfish, Marron and Yabby farming and Other aquaculture enterprises.

<sup>b</sup> 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.

<sup>c</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

## 6. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE WEST COAST REGION, 2018/19

This region covers the West Coast of SA from the WA border to Elliston including Wudinna (see Figure 1-1). Production and value by aquaculture sector for the West Coast region is summarised in Table 6-1.

Table 6-1 Production and value of production in the West Coast Region, 2018/19

	Production (t)	Value of Production (\$'000)
Southern Bluefin Tuna	0	0
Marine Finfish	0	0
Oysters	573	5,966
Mussels	0	0
Abalone	0	0
Freshwater Finfish	0	1
Marron and Yabbies	0	0
Other	4	71
<b>Total</b>	<b>578</b>	<b>6,038</b>

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of aquaculture in the West Coast region of SA in 2018/19 (Oysters, Freshwater Finfish and Other Aquaculture) are reported in aggregate in Table 6-2. Note that for some of the aquaculture sectors in the West Coast region, the contributions 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 contributions 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.

### **Output contributions...**

Direct output (business turnover) generated by aquaculture summed to \$6.0 million and associated downstream activities, \$1.1 million in the West Coast region in 2018/19. Flow-on output in other sectors of the regional economy summed to \$4.4 million in 2018/19. The sectors most affected were the property and business services and trade sectors (Table 6-2).

### **Contribution to gross regional product...**

Total aquaculture-related contribution to gross regional product in the West Coast region was approximately \$7.8 million in 2018/19, \$4.7 million generated by aquaculture directly, \$0.5 million generated in associated downstream activities and \$2.7 million generated in other sectors of the regional economy.

### **Employment and household income...**

Aquaculture and downstream activities were responsible for the direct employment of 81 fte in 2018/19 in the West Coast region. Flow-on business activity was estimated to generate a further 21 fte. The total employment contribution was 102 fte.

In 2018/19, personal income of \$3.0 million was earned in aquaculture and downstream activities in the West Coast region comprising both wages by employees and estimated drawings by owner/operators. An

additional \$1.4 million of household income was earned in other local businesses as a result of aquaculture industry operations. Total household income contribution was \$4.4 million in 2018/19.

**Table 6-2 The economic contribution of aquaculture <sup>a</sup> in the West Coast region, 2018/19 <sup>b</sup>**

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Aquaculture	6.0	52%	4.7	60%	75	74%	2.6	60%
Processing	0.2	2%	0.0	1%	1	1%	0.0	0%
Transport	0.7	6%	0.3	4%	3	3%	0.3	7%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.1	1%	0.1	1%	1	1%	0.1	1%
<b>Total Direct</b>	<b>7.1</b>	<b>62%</b>	<b>5.1</b>	<b>66%</b>	<b>81</b>	<b>79%</b>	<b>3.0</b>	<b>69%</b>
Flow-on effects								
Property and business serv.	1.0	9%	0.8	10%	2	2%	0.1	3%
Manufacturing	0.3	2%	0.1	1%	1	1%	0.1	1%
Trade	0.6	6%	0.4	5%	5	5%	0.3	7%
Transport	0.4	3%	0.2	2%	1	1%	0.1	3%
Finance	0.2	2%	0.2	2%	0	0%	0.0	1%
Other Sectors	1.9	16%	1.1	14%	11	11%	0.7	16%
<b>Total Flow-on</b>	<b>4.4</b>	<b>38%</b>	<b>2.7</b>	<b>34%</b>	<b>21</b>	<b>21%</b>	<b>1.4</b>	<b>31%</b>
<b>Total <sup>c</sup></b>	<b>11.5</b>	<b>100%</b>	<b>7.8</b>	<b>100%</b>	<b>102</b>	<b>100%</b>	<b>4.4</b>	<b>100%</b>
Total/Direct	1.7		1.5		1		1.5	

<sup>a</sup> Predominantly Oysters but also includes Freshwater Finfish and Other Aquaculture.

<sup>b</sup> 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.

<sup>c</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis



## 7. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE YORKE PENINSULA REGION, 2018/19

This region covers the Yorke Peninsula, Mid North and Barossa (see Figure 1-1).

Production and value by aquaculture sector for the Yorke Peninsula region is summarised in Table 7-1.

Table 7-1 Production and value of production in the Yorke Peninsula Region, 2018/19

	Production (t)	Value of Production (\$'000)
Southern Bluefin Tuna	0.00	0.00
Marine Finfish	0.00	0.00
Oysters	4.01	69.35
Mussels	0.00	0.00
Abalone	0.00	0.00
Freshwater Finfish	0.02	0.34
Marron and Yabbies	1.05	19.73
Other	0.00	0.00
<b>Total</b>	<b>5.08</b>	<b>89.42</b>

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of aquaculture in the Yorke Peninsula region of SA in 2018/19 (i.e. Oysters, Freshwater Finfish and Marron/Yabby enterprises) are reported in aggregate in Table 7-2.

Note that for some of the aquaculture sectors in the Yorke Peninsula region, the contributions 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 contributions 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.

### ***Output contributions...***

Total aquaculture-related contribution to output in the Yorke Peninsula region was approximately \$0.2 million in 2018/19, \$0.1 million generated by aquaculture directly and \$0.1 million generated in associated downstream activities and in other sectors of the regional economy (Table 7-2).

### ***Contribution to gross regional product...***

Total aquaculture-related contribution to gross regional product in the Yorke Peninsula region was approximately \$0.1 million in 2018/19, \$0.1 million generated by aquaculture directly and less than \$0.1 million generated in associated downstream activities and in other sectors of the regional economy.

### ***Employment and household income...***

Aquaculture and downstream activities were responsible for the direct employment of 3 fte in 2018/19 in the Yorke Peninsula region. Flow-on business activity was estimated to generate 1 fte. The total employment contribution was 4 fte.

In 2018/19, personal income of less than \$0.1 million was earned in aquaculture and downstream activities in the Yorke Peninsula region comprising both wages by employees and estimated drawings by

owner/operators. Less than \$0.1m of household income was earned in other local businesses as a result of aquaculture industry operations.

**Table 7-2 The economic contribution of aquaculture <sup>a</sup> in the Yorke Peninsula region, 2018/19 <sup>b</sup>**

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Aquaculture	0.1	49%	0.1	53%	3	87%	0.0	62%
Processing	0.0	1%	0.0	0%	0	0%	0.0	0%
Transport	0.0	5%	0.0	4%	0	1%	0.0	5%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	1%	0.0	1%	0	1%	0.0	1%
<b>Total Direct</b>	<b>0.1</b>	<b>56%</b>	<b>0.1</b>	<b>58%</b>	<b>3</b>	<b>89%</b>	<b>0.1</b>	<b>69%</b>
Flow-on effects								
Property and business serv.	0.0	9%	0.0	11%	0	1%	0.0	4%
Manufacturing	0.0	4%	0.0	2%	0	1%	0.0	2%
Trade	0.0	5%	0.0	5%	0	2%	0.0	5%
Transport	0.0	4%	0.0	3%	0	1%	0.0	3%
Finance	0.0	4%	0.0	4%	0	1%	0.0	2%
Other Sectors	0.0	18%	0.0	18%	0	5%	0.0	16%
<b>Total Flow-on</b>	<b>0.1</b>	<b>44%</b>	<b>0.0</b>	<b>42%</b>	<b>0</b>	<b>11%</b>	<b>0.0</b>	<b>31%</b>
<b>Total <sup>c</sup></b>	<b>0.2</b>	<b>100%</b>	<b>0.1</b>	<b>100%</b>	<b>4</b>	<b>100%</b>	<b>0.1</b>	<b>100%</b>
Total/Direct	1.8		1.7		1		1.5	

<sup>a</sup> Includes Oysters, Freshwater Finfish and Marron/Yabby farming enterprises.

<sup>b</sup> 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.

<sup>c</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

## 8. THE ECONOMIC CONTRIBUTION OF AQUACULTURE ON KANGAROO ISLAND, 2018/19

This region covers the Island of Kangaroo Island (see Figure 1-1).

Production and value by aquaculture sector for Kangaroo Island is summarised in Table 8-1.

Table 8-1 Production and value of production on Kangaroo Island, 2018/19

	Production (t)	Value of Production (\$'000)
Southern Bluefin Tuna	0	0
Marine Finfish	0	0
Oysters	16	204
Mussels	0	0
Abalone	130	5,330
Freshwater Finfish	0	0
Marron and Yabbies	1	49
Other	0	0
<b>Total</b>	<b>147</b>	<b>5,583</b>

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of aquaculture on Kangaroo Island (KI) in 2018/19 (i.e. Abalone, Oysters and Marron/Yabby farming enterprises) are reported in aggregate in Table 8-2.

Note that for some of the aquaculture sectors in the KI region, the contributions 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 contributions 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.

### ***Output contributions...***

Direct output (business turnover) generated by aquaculture summed to \$5.6 million and associated downstream activities, \$0.2 million on KI in 2018/19. Flow-on output in other sectors of the regional economy summed to \$4.8 million in 2018/19. The sectors most affected were the property and business services and trade sectors (Table 8-2).

### ***Contribution to gross regional product...***

Total aquaculture-related contribution to gross regional product on KI was approximately \$4.9 million in 2018/19, \$1.8 million generated by aquaculture directly, \$0.1 million generated in associated downstream activities and \$3.0 million generated in other sectors of the regional economy.

### ***Employment and household income...***

Aquaculture and downstream activities were responsible for the direct employment of 23 fte in 2018/19 on KI region. Flow-on business activity was estimated to generate a further 23 fte. The total employment contribution was 46 fte.

In 2018/19, personal income of \$1.0 million was earned in aquaculture and downstream activities on KI comprising both wages by employees and estimated drawings by owner/operators. An additional \$1.5 million

of household income was earned in other local businesses as a result of aquaculture industry operations. The total household income contribution was approximately \$2.6 million in 2018/19.

**Table 8-2 The economic contribution of aquaculture <sup>a</sup> on KI, 2018/19 <sup>b</sup>**

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Aquaculture	5.6	53%	1.8	37%	22	47%	1.0	37%
Processing	0.2	2%	0.0	1%	1	2%	0.0	1%
Transport	0.0	0%	0.0	0%	0	0%	0.0	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%
<i>Total Direct</i>	<i>5.8</i>	<i>55%</i>	<i>1.9</i>	<i>38%</i>	<i>23</i>	<i>50%</i>	<i>1.0</i>	<i>40%</i>
Flow-on effects								
Property and business serv.	0.5	5%	0.3	7%	1	3%	0.1	3%
Manufacturing	0.2	2%	0.1	1%	1	2%	0.0	2%
Trade	0.4	4%	0.2	5%	3	7%	0.2	7%
Transport	0.2	1%	0.1	1%	1	2%	0.1	2%
Finance	0.2	2%	0.1	3%	1	1%	0.0	2%
Other Sectors	3.4	32%	2.2	44%	16	35%	1.1	44%
<i>Total Flow-on</i>	<i>4.8</i>	<i>45%</i>	<i>3.0</i>	<i>62%</i>	<i>23</i>	<i>50%</i>	<i>1.5</i>	<i>60%</i>
<b>Total <sup>c</sup></b>	<b>10.6</b>	<b>100%</b>	<b>4.9</b>	<b>100%</b>	<b>46</b>	<b>100%</b>	<b>2.6</b>	<b>100%</b>
Total/Direct	1.8		2.6		2		2.5	

<sup>a</sup> Includes Abalone, Oysters, Freshwater Finfish and Marron/Yabby farming enterprises.

<sup>b</sup> 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.

<sup>c</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

## 9. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE ADELAIDE AND HILLS REGION, 2018/19

This region covers Adelaide, the Adelaide Hills and Fleurieu Peninsula.

Production and value by aquaculture sector for the Adelaide and Hills region is summarised in Table 9-1.

Table 9-1 Production and value of production in the Adelaide and Hills Region, 2018/19

	Production (t)	Value of Production (\$'000)
Southern Bluefin Tuna	0.00	0.00
Marine Finfish	0.00	0.00
Oysters	0.00	0.00
Mussels	0.00	0.00
Abalone	0.00	0.00
Freshwater Finfish	163.12	2,139.61
Marron and Yabbies	0.04	2.14
Other	0.00	0.00
<b>Total</b>	<b>163.16</b>	<b>2,141.74</b>

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of aquaculture in the Adelaide and Hills region of SA in 2018/19 (i.e. Freshwater Finfish and Marron/Yabby farming enterprises) are reported in aggregate in Table 9-2.

Note that for some of the aquaculture sectors in the Adelaide and Hills region, the contributions 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 contributions 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.

### ***Output contributions...***

Direct output (business turnover) generated by aquaculture summed to \$2.1 million and associated downstream activities, \$0.2 million in the Adelaide and Hills region in 2018/19. Flow-on output in other sectors of the regional economy summed to \$1.1 million in 2018/19. The sectors most affected were the property and business services and trade sectors (Table 9-2).

### ***Contribution to gross regional product...***

Total aquaculture-related contribution to gross regional product in the Adelaide and Hills region was approximately \$1.9 million in 2018/19, \$1.01 million generated by aquaculture directly, \$0.1 million generated in associated downstream activities and \$0.6 million generated in other sectors of the regional economy.

### ***Employment and household income...***

Aquaculture and downstream activities were responsible for the direct employment of 12 fte in 2018/19 in the Adelaide and Hills region. Flow-on business activity was estimated to generate a further 6 fte. The total employment contribution was 18 fte.

In 2018/19, personal income of \$0.7 million was earned in aquaculture and downstream activities in the Adelaide and Hills region comprising both wages by employees and estimated drawings by owner/operators. An additional \$0.3 million of household income was earned in other local businesses as a result of aquaculture industry operations. The total household income contribution was \$1.0 million in 2018/19.

**Table 9-2 The economic contribution of aquaculture <sup>a</sup> in the Adelaide and Hills region, 2018/19 <sup>b</sup>**

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Aquaculture	2.1	62%	1.1	60%	11	60%	0.6	57%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.2	6%	0.1	5%	1	6%	0.1	9%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	1%	0.0	1%	0	1%	0.0	1%
<b>Total Direct</b>	<b>2.4</b>	<b>69%</b>	<b>1.2</b>	<b>66%</b>	<b>12</b>	<b>68%</b>	<b>0.7</b>	<b>67%</b>
Flow-on effects								
Property and business serv.	0.3	7%	0.2	9%	1	5%	0.1	5%
Manufacturing	0.1	2%	0.0	1%	0	1%	0.0	1%
Trade	0.2	6%	0.1	7%	2	10%	0.1	9%
Transport	0.1	2%	0.0	2%	0	2%	0.0	3%
Finance	0.1	2%	0.0	2%	0	1%	0.0	1%
Other Sectors	0.4	12%	0.2	13%	2	14%	0.1	14%
<b>Total Flow-on</b>	<b>1.1</b>	<b>31%</b>	<b>0.6</b>	<b>34%</b>	<b>6</b>	<b>32%</b>	<b>0.3</b>	<b>33%</b>
<b>Total <sup>c</sup></b>	<b>3.4</b>	<b>100%</b>	<b>1.9</b>	<b>100%</b>	<b>18</b>	<b>100%</b>	<b>1.0</b>	<b>100%</b>
Total/Direct	1.5		1.5		1.5		1.5	

<sup>a</sup> Includes Freshwater Finfish and Marron/Yabby farming enterprises.

<sup>b</sup> 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.

<sup>c</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

## 10. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE MURRAYLANDS AND SOUTH EAST REGION, 2018/19

This region covers the Murraylands (Riverland and Murraylands) and the South East (Limestone Coast).

Production and value by aquaculture sector for the Murraylands and South East region is summarised in Table 10-1.

Table 10-1 Production and value of production in the Murraylands and South East Region, 2018/19

	Production (t)	Value of Production (\$'000)
Southern Bluefin Tuna	0	0
Marine Finfish	0	0
Oysters	0	0
Mussels	0	0
Abalone	0	0
Freshwater Finfish	14	242
Marron and Yabbies	0	2
Other	0	0
<b>Total</b>	<b>14</b>	<b>244</b>

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of aquaculture in the Murraylands and South East region of SA in 2018/19 (Freshwater Finfish and Marron and Yabbies) are reported in aggregate in Table 10-2.

Note that for some of the aquaculture sectors in the Murraylands and South East region, the contributions 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 contributions 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.

### ***Output contributions...***

Direct output (business turnover) generated by aquaculture summed to \$0.2 million and associated downstream activities, less than \$0.1 million in the Murraylands and South East region in 2018/19. Flow-on output in other sectors of the regional economy summed to \$0.2 million in 2018/19 (Table 10-2).

### ***Contribution to gross regional product...***

Total aquaculture-related contribution to gross regional product in the Murraylands and South East region was \$0.2 million in 2018/19, \$0.1 million generated by aquaculture directly and in associated downstream activities and \$0.1 million generated in other sectors of the regional economy.

### ***Employment and household income...***

Aquaculture and downstream activities were responsible for the direct employment of 5 fte in 2018/19 in the Murraylands and South East region. Flow-on business activity was estimated to generate a further 1 fte. The total employment contribution was 6 fte.

In 2018/19, personal income of \$0.1 million was earned in aquaculture and downstream activities in the Murraylands and South East region comprising both wages by employees and estimated drawings by

owner/operators. An additional less than \$0.1 million of household income was earned in other local businesses as a result of aquaculture industry operations. The total household income contribution was \$0.2 million in 2018/19.

**Table 10-2 The economic contribution of aquaculture <sup>a</sup> in the Murraylands and South East region, 2018/19**  
<sup>b</sup>

Sector	Output		Contribution to GRP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Direct effects								
Aquaculture	0.2	56%	0.1	54%	5	83%	0.1	60%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.0	5%	0.0	5%	0	2%	0.0	7%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	1%	0.0	1%	0	0%	0.0	1%
<b>Total Direct</b>	<b>0.3</b>	<b>62%</b>	<b>0.1</b>	<b>59%</b>	<b>5</b>	<b>85%</b>	<b>0.1</b>	<b>67%</b>
Flow-on effects								
Property and business serv.	0.0	9%	0.0	11%	0	2%	0.0	4%
Manufacturing	0.0	3%	0.0	1%	0	1%	0.0	1%
Trade	0.0	7%	0.0	8%	0	5%	0.0	9%
Transport	0.0	3%	0.0	2%	0	1%	0.0	3%
Finance	0.0	4%	0.0	4%	0	1%	0.0	2%
Other Sectors	0.1	14%	0.0	15%	0	6%	0.0	12%
<b>Total Flow-on</b>	<b>0.2</b>	<b>38%</b>	<b>0.1</b>	<b>41%</b>	<b>1</b>	<b>15%</b>	<b>0.0</b>	<b>33%</b>
<b>Total <sup>c</sup></b>	<b>0.4</b>	<b>100%</b>	<b>0.2</b>	<b>100%</b>	<b>6</b>	<b>100%</b>	<b>0.2</b>	<b>100%</b>
Total/Direct	1.6		1.7		1		1.5	

<sup>a</sup> Freshwater Finfish and Marron and Yabby production.

<sup>b</sup> 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.

<sup>c</sup> Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis



## 11. OTHER FACETS OF REGIONAL ECONOMIC DEVELOPMENT ASSOCIATED WITH AQUACULTURE ACTIVITY IN SA

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

For example, the Tuna farming sector underpins the very substantial local investment by Tuna farmers in the local processors, shipyard, marinas, property (e.g. hotels), tourism and other industries (e.g. Yellowtail Kingfish aquaculture and viticulture) (Brian Jeffriess, pers. comm.).

### ***Tourism***

Tourism activities associated with the aquaculture sector can provide a further source of income and employment for regional economies. Aquaculture tourism operators offer the opportunity to interact with marine organisms. There was no reported activity by tourism operators in 2016/17. However, in 2017/18 there were 4,900 visitors for a value of \$0.39 million and in 2018/19 there were 5,500 visitors for a value of \$0.61m. Aquaculture tourism activity is projected to grow further over the next three years.

### ***Education and Research***

The aquaculture sector is characterised by a high level of innovation. These innovative ideas have been directed towards value adding opportunities in the Tuna industry (e.g. fresh fish direct marketed to Japan), finfish industry (e.g. creating a new market segment for rapid frozen Yellowtail Kingfish), Oyster industry (e.g. marketing 'King' oysters that are larger in size), the mussel industry (e.g. exploring innovative packaging for product) among other new research and development opportunities.

The success of the Tuna industry, in particular, has been a catalyst for the development of significant research (e.g. Australian Seafood Cooperative Research Centre) and education resources (e.g. the Marine Science Centre at Port Lincoln and the South Australian Research and Development Institute) within South Australia.

There are a number of schools involved in the aquaculture industry which hold land-based or marine based licences for educational purposes of the students. The Eyre Peninsula's Cowell Area School, for example, offers a structured course in aquaculture which is conducted over two years by senior secondary students

on their land-based facility, in addition to a fully operational marine Oyster licence. Education and research opportunities also exist at a higher level where South Australian based universities and vocational education providers offer marine biology and aquaculture related certificates and tertiary awards.

## 12. ECONOMIC CONTRIBUTION OF AQUACULTURE IN SA, TIME SERIES, 1997/98 TO 2018/19

Estimates of the economic contribution of aquaculture on the South Australian economy for the period 1997/98 to 2018/19, in terms of contribution to GSP and employment, are provided in Figure 12-1 and Figure 12-2, respectively. Further detail is provided by aquaculture sector in Appendix 2.

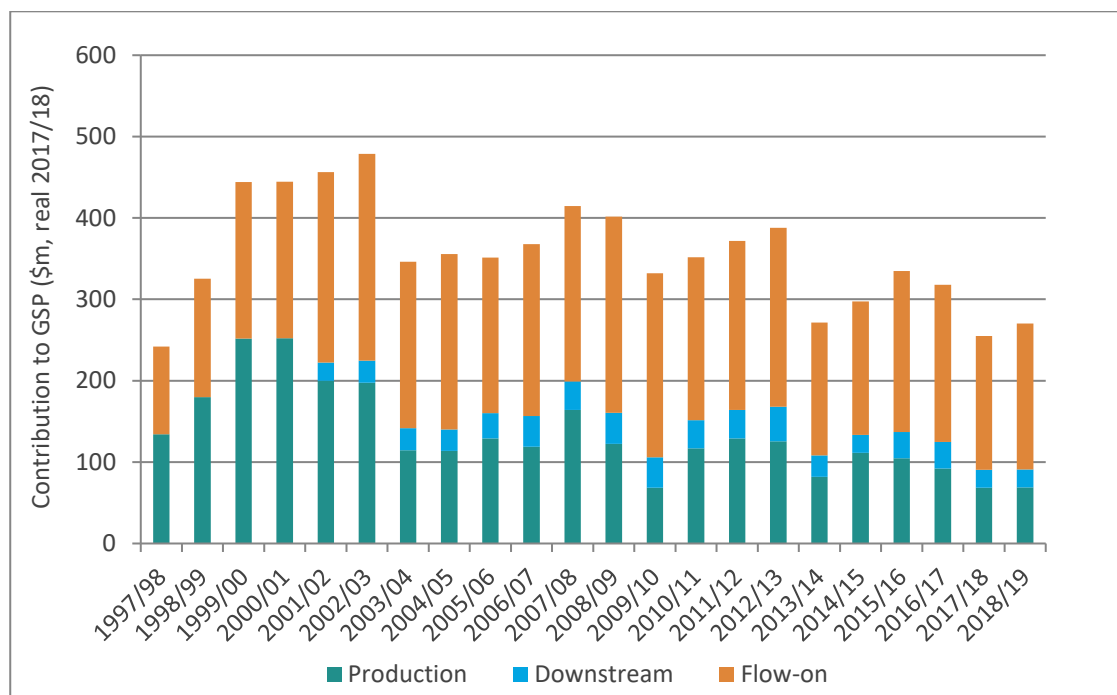
It is important to note that some of the variability in the GSP and employment contributions of SA aquaculture over the period 1997/98 to 2018/19 is a function of changes in methodology. Most significantly, as discussed in Section 2.1 of the report, estimates for the period 1997/98 to 2000/01 exclude some of the downstream contributions associated with aquaculture activity in SA (see Table 2-1 for further details). 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
- improvements in the quality of the responses and response rate to the PIRSA Fisheries and Aquaculture Production Returns.

Total contribution to GSP, in real terms, attributable to aquaculture in SA exhibited a rising trend over the period 1997/98 to 2002/03 and then, despite fluctuations, a declining trend through to 2018/19 (Figure 12-1). The significant reduction in the GSP contribution 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. Real GSP fell by 30 per cent between 2012/13 and 2013/14 as a result of a fall in value for a number of sectors including Tuna, Marine Finfish, Oysters, Freshwater Finfish and other aquaculture. Real GSP fell by 24 per cent between 2015/16 and 2017/18 resulting from falls in Oyster production related to difficulties sourcing spat after the POMS outbreak in Tasmania in early 2016, and a reduction of microalgae production by a major aquaculture business. Real GSP increased by 6 per cent in 2018/19 as a result of an increase in value in the Tuna and Marine Finfish sectors and a refinement in the modelling process leading to an increase in flow-on contributions.

The total employment contribution attributable to aquaculture in SA exhibited a rising trend over the period 1997/98 to 2008/09, reflecting an expansion in capacity and production growth across most aquaculture sectors over this period (Figure 12-2). The apparent reported fall in employment between 2009/10 and 2010/11 was due to the use of a new refined data collection form which resulted in improvements in the quality and accuracy of the responses from licence holders in the PIRSA Fisheries and Aquaculture Production Returns. The data collected in 2010/11 show that employment was inadvertently overstated in previous years. The fall in employment results in a reduction in household income and, due to the consequences from the modelled economic contributions, there are fewer people being employed in downstream and flow-on activities. This matter has now been resolved through the use of the refined Production Return forms. Total employment was fairly stable between 2010/11 and 2012/13, at around 2,600 fte but fell to around 1,900 in 2013/14 and 2014/15 in line with the fall in total value of production. Total employment rose to 2,385 fte jobs in 2018/19 driven by the increase in production over this period.

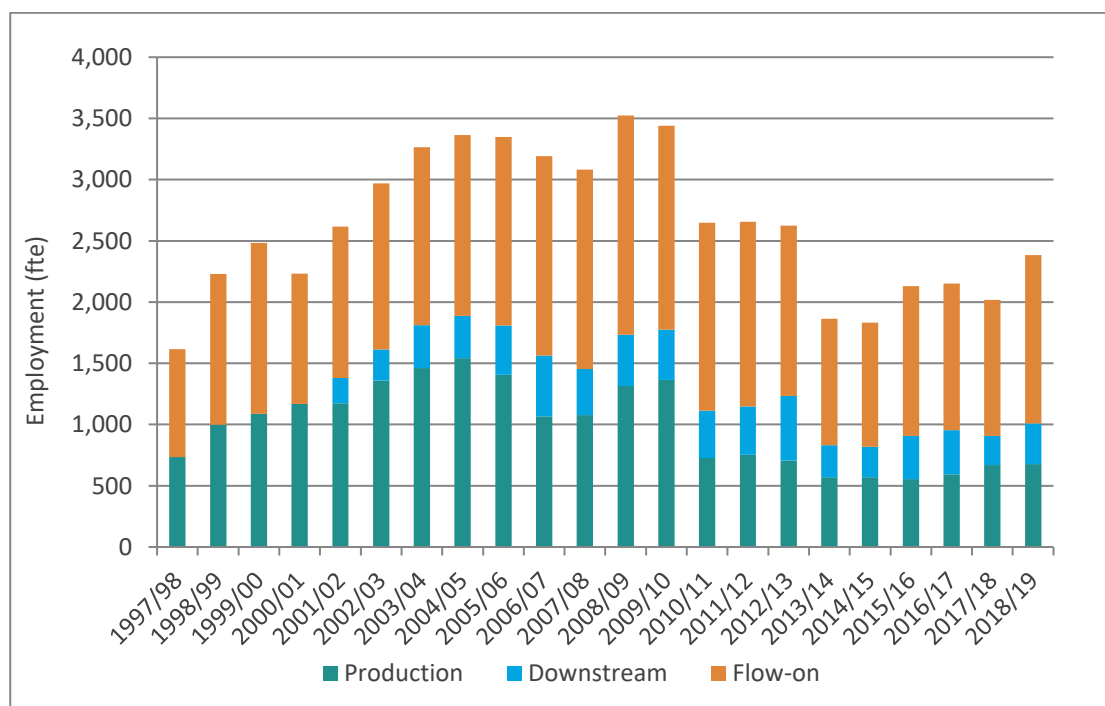
Figure 12-1 Total GSP contribution of aquaculture in SA, 1997/98 to 2018/19 <sup>a</sup>



<sup>a</sup> Total GSP contributions for the period 1997/98 to 2000/01 exclude some downstream activities (including some transport and all retail and food services). Estimates of GSP are expressed in real 2018/19 terms.

Source: BDO EconSearch (2019), Table ES-2 and ABS (2019)

Figure 12-2 Total employment contribution of aquaculture in SA, 1997/98 to 2018/19 <sup>a</sup>



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

Source: BDO EconSearch (2019) and Table ES-2

## REFERENCES

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- Reserve Bank of Australia (RBA) 2020 (and previous issues), *Exchange Rates - Daily Statistics*.
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## DISCLAIMER

The assignment is a consulting engagement as outlined in the 'Framework for Assurance Engagements', issued by the Auditing and Assurances Standards Board, Section 17. Consulting engagements employ an assurance practitioner's technical skills, education, observations, experiences and knowledge of the consulting process. The consulting process is an analytical process that typically involves some combination of activities relating to: objective-setting, fact-finding, definition of problems or opportunities, evaluation of alternatives, development of recommendations including actions, communication of results, and sometimes implementation and follow-up.

The nature and scope of work has been determined by agreement between BDO and the Client. This consulting engagement does not meet the definition of an assurance engagement as defined in the 'Framework for Assurance Engagements', issued by the Auditing and Assurances Standards Board, Section 10.

Except as otherwise noted in this report, we have not performed any testing on the information provided to confirm its completeness and accuracy. Accordingly, we do not express such an audit opinion and readers of the report should draw their own conclusions from the results of the review, based on the scope, agreed-upon procedures carried out and findings.

## APPENDIX 1 Aquaculture Production and Value, 1995/96 to 2018/19

Appendix Table 1-1 Farmed Tuna production, SA, 1995/96 to 2018/19

	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	4,992	6,805	166.7
1999/00	5,131	7,750	240.0
2000/01	5,162	9,051	263.8
2001/02	5,234	9,245	260.5
2002/03	5,375	9,102	266.9
2003/04	5,002	9,290	151.0
2004/05	5,215	7,458	140.0
2005/06	5,189	8,806	155.8
2006/07	5,342	7,486	137.7
2007/08	5,221	9,757	186.7
2008/09	5,017	8,786	157.8
2009/10	4,124	7,284	102.2
2010/11	3,786	5,800	114.5
2011/12	4,570	7,087	150.0
2012/13	4,198	7,486	153.5
2013/14	5,050	7,544	122.4
2014/15	5,447	8,418	130.7
2015/16	4,899	8,895	126.9
2016/17	4,686	8,200	116.0
2017/18	5,130	8,000	126.0
2018/19	5,307	8,252	129.0

Source: ABARES and Brian Jeffriess (pers. comm. 6/03/2020)

Appendix Table 1-2 Oyster production, SA, 1994/95 to 2018/19 <sup>a</sup>

	Production <sup>b</sup>	Value (\$'000)		
	Number ('000 doz.)	Adult	Spat	Total <sup>c</sup>
1994/95	855	3,535	na	3,535
1995/96	976	3,950	na	3,950
1996/97	1,336	5,205	610	5,815
1997/98	1,298	4,908	1,168	6,076
1998/99	1,441	5,489	997	6,486
1999/00	2,516	9,389	800	10,189
2000/01	2,936	11,011	579	11,590
2001/02	3,464	13,303	856	14,159
2002/03	3,865	15,116	1,002	16,118
2003/04	4,644	19,959	1,193	21,152
2004/05	4,650	19,995	1,195	21,190
2005/06	5,397	23,879	957	24,836
2006/07	7,720	37,841	1,143	38,984
2007/08	5,448	30,132	1,469	31,601
2008/09	5,848	32,231	320	32,551
2009/10	6,123	35,027	444	35,471
2010/11	6,154	35,205	1,267	36,472
2011/12	5,241	30,972	271	31,243
2012/13	5,710	35,002	298	35,300
2013/14	4,900	32,077	227	32,303
2014/15	3,891	28,385	333	28,718
2015/16	4,589	30,945	611	30,945
2016/17	5,158	40,066	1,084	40,066
2017/18	2,177	20,161	2,200	20,161
2018/19	2,099	20,451	5,089	20,451

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

<sup>b</sup> Adult Oysters only. Excludes the volume of spat and juvenile Oysters sold for on-growing.

<sup>c</sup> Excludes the value of juvenile oysters sold for on-growing because they are considered an input to production for the final sales of adult Oysters. The value of spat is also excluded from the total from 2015/16 onwards. Since 2015/16, all spat grown in SA is sold in SA (i.e. no spat grown in SA is exported to other states) and is considered an input to production for the final sales of adult Oysters.

Source: SARDI Aquatic Sciences and PIRSA Fisheries and Aquaculture.

Appendix Table 1-3 Remaining aquaculture sector production, SA, 1994/94 to 2018/19 <sup>a</sup>

	Marine Finfish		Mussels		Abalone		Freshwater Finfish		Marron and Yabbies		Other <sup>b</sup>		Total		Tourism	
	Weight (t)	Value (\$'000)	Weight (t)	Value (\$'000)	Weight (t)	Value (\$'000)	Weight (t)	Value (\$'000)	Weight (t)	Value (\$'000)	Weight (t)	Value (\$'000)	Weight (t)	Value (\$'000)	Visitors (no.)	Value (\$'000)
1994/95	na	na	na	na	na	na	32	188	14	185	296	2,629	342	3,002	na	na
1995/96	na	na	na	na	na	na	21	158	23	316	323	3,158	367	3,632	na	na
1996/97	na	na	na	na	na	na	163	1,833	15	227	280	2,012	458	4,072	na	na
1997/98	na	na	na	na	na	na	216	2,799	17	246	379	3,041	612	6,086	na	na
1998/99	na	na	84	183	21	856	263	3,293	34	391	412	3,259	814	7,982	na	na
1999/00	na	na	81	173	40	2,000	287	3,379	28	460	337	2,828	773	8,840	na	na
2000/01	na	na	111	260	53	2,677	277	2,919	25	368	480	4,322	946	10,546	na	na
2001/02	na	na	171	371	34	1,901	281	2,845	19	377	334	3,375	839	8,869	na	na
2002/03	na	na	254	466	59	3,080	489	6,322	29	626	1,077	8,769	1,908	19,263	na	na
2003/04	na	na	400	697	105	3,155	256	2,585	28	633	894	7,533	1,683	14,603	na	na
2004/05	na	na	377	657	177	5,318	283	2,810	42	893	2,019	17,015	2,898	26,693	na	na
2005/06	na	na	469	950	250	8,222	453	3,726	12	318	2,148	17,591	3,332	30,807	na	na
2006/07	na	na	1,032	1,914	196	7,155	423	4,019	29	721	1,953	18,514	3,633	32,323	na	na
2007/08	2,074	17,674	1,369	2,591	167	5,151	421	4,513	22	559	1,707	13,533	5,759	44,022	na	na
2008/09	3,382	29,209	1,340	2,519	227	8,121	424	4,501	23	606	1,402	10,892	6,798	55,847	na	na
2009/10	3,757	27,133	1,343	2,530	286	10,341	415	4,897	23	645	1,319	10,260	7,143	55,807	na	na
2010/11	3,620	27,909	1,174	2,425	317	10,842	168	2,323	37	1,032	2,977	22,471	8,293	67,003	na	na
2011/12	1,504	16,121	1,277	2,677	178	6,410	234	2,676	12	343	2,647	19,321	5,852	47,549	11,959	623
2012/13	889	11,262	1,480	2,935	236	8,600	311	5,386	11	383	3,407	25,673	6,335	54,240	9,284	511
2013/14	579	8,013	1,619	3,446	330	10,890	233	2,368	12	434	230	1,740	3,004	26,892	8,303	511
2014/15	1,076	18,185	1,577	3,069	334	11,401	272	4,108	8	455	4,160	31,212	7,426	68,430	9,732	na
2015/16	2,018	30,001	2,088	4,400	350	14,733	441	6,851	5	204	4,412	37,518	9,314	93,707	460	40
2016/17	2,294	27,088	1,777	3,877	324	13,608	382	4,927	4	132	3,441	25,825	8,222	75,457	0	0
2017/18	2,487	29,865	1,833	3,977	399	14,241	390	5,269	2	95	697	5,237	5,809	58,684	4,900	390
2018/19	2,951	39,479	1,898	3,796	337	13,817	177	2,387	2	74	355	2,699	5,720	62,252	5,500	606

<sup>a</sup> All weights are in whole weight. All figures have been rounded to the nearest thousand. Individual figures provided in the columns may not sum to the 'Total' for this reason.

<sup>b</sup> Other aquaculture production is comprised predominantly of Algae production but varies year to year.

Source: SARDI Aquatic Sciences and PIRSA Fisheries and Aquaculture



## APPENDIX 2 Total Economic Contribution of Aquaculture in SA, by Sector, 2001/02 to 2017/18

Appendix Table 2-1 The total economic contribution (direct and flow-on) of aquaculture in SA, 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%
<b>Total (SA)</b>	<b>577.5</b>	<b>100.0%</b>	<b>303.8</b>	<b>100.0%</b>	<b>2,617</b>	<b>100.0%</b>	<b>94.4</b>	<b>100.0%</b>

Appendix Table 2-2 The total economic contribution (direct and flow-on) of aquaculture in SA, 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%
<b>Total (SA)</b>	<b>641.5</b>	<b>100.0%</b>	<b>330.8</b>	<b>100.0%</b>	<b>2,969</b>	<b>100.0%</b>	<b>107.4</b>	<b>100.0%</b>

Appendix Table 2-3 The total economic contribution (direct and flow-on) of aquaculture in SA, 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%
<b>Total (SA)</b>	<b>502.9</b>	<b>100.0%</b>	<b>246.2</b>	<b>100.0%</b>	<b>3,264</b>	<b>100.0%</b>	<b>123.9</b>	<b>100.0%</b>

**Appendix Table 2-4** The total economic contribution (direct and flow-on) of aquaculture in SA, 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%
<b>Total (SA)</b>	<b>518.2</b>	<b>100.0%</b>	<b>258.7</b>	<b>100.0%</b>	<b>3,366</b>	<b>100.0%</b>	<b>126.5</b>	<b>100.0%</b>

**Appendix Table 2-5** The total economic contribution (direct and flow-on) of aquaculture in SA, 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	50.5	9.2%	22.4	8.5%	406	12.1%	12.5	10.2%
<b>Total (SA)</b>	<b>550.1</b>	<b>100.0%</b>	<b>265.1</b>	<b>100.0%</b>	<b>3,348</b>	<b>100.0%</b>	<b>122.4</b>	<b>100.0%</b>

**Appendix Table 2-6** The total economic contribution (direct and flow-on) of aquaculture in SA, 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	55.9	9.4%	25.1	8.9%	400	12.5%	16.9	12.2%
<b>Total (SA)</b>	<b>593.8</b>	<b>100.0%</b>	<b>282.4</b>	<b>100.0%</b>	<b>3,192</b>	<b>100.0%</b>	<b>138.9</b>	<b>100.0%</b>

Appendix Table 2-7 The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2007/08

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	383.2	58.3%	198.8	59.7%	1,229	39.9%	70.2	48.9%
Marine finfish farming	57.6	8.8%	24.0	7.2%	287	9.3%	13.8	9.6%
Oyster farming	152.8	23.3%	79.8	23.9%	1,105	35.8%	43.9	30.5%
Mussels farming	13.7	2.1%	7.2	2.2%	148	4.8%	4.9	3.4%
Abalone farming	16.4	2.5%	6.0	1.8%	112	3.6%	4.3	3.0%
Freshwater finfish farming	10.9	1.7%	5.5	1.7%	86	2.8%	3.1	2.2%
Marron and yabbies farming	1.3	0.2%	0.8	0.2%	46	1.5%	0.2	0.2%
Other aquaculture	21.1	3.2%	10.9	3.3%	70	2.3%	3.3	2.3%
<b>Total (SA)</b>	<b>656.9</b>	<b>100.0%</b>	<b>333.0</b>	<b>100.0%</b>	<b>3,083</b>	<b>100.0%</b>	<b>143.7</b>	<b>100.0%</b>

Appendix Table 2-8 The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2008/09

Sector	Output		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	360.4	52.3%	168.6	51.5%	1,291	36.7%	70.5	43.0%
Marine finfish farming	95.6	13.9%	39.8	12.2%	438	12.4%	23.4	14.3%
Oyster farming	162.5	23.6%	84.4	25.8%	1,211	34.4%	47.2	28.8%
Mussels farming	13.4	1.9%	7.0	2.1%	185	5.3%	4.8	2.9%
Abalone farming	24.8	3.6%	10.5	3.2%	161	4.6%	7.7	4.7%
Freshwater finfish farming	12.3	1.8%	6.2	1.9%	114	3.2%	4.4	2.7%
Marron and yabbies farming	1.4	0.2%	0.9	0.3%	38	1.1%	0.3	0.2%
Other aquaculture	18.9	2.7%	10.0	3.1%	84	2.4%	5.6	3.4%
<b>Total (SA)</b>	<b>689.2</b>	<b>100.0%</b>	<b>327.6</b>	<b>100.0%</b>	<b>3,523</b>	<b>100.0%</b>	<b>163.8</b>	<b>100.0%</b>

Appendix Table 2-9 The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2009/10

Sector	Output <sup>b</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	288.1	45.8%	119.3	42.9%	1,179	34.3%	62.2	40.2%
Marine finfish farming	94.8	15.1%	33.8	12.1%	422	12.3%	21.2	13.7%
Oyster farming	172.4	27.4%	89.9	32.3%	1,259	36.6%	50.1	32.4%
Mussels farming	13.5	2.1%	7.0	2.5%	185	5.4%	4.8	3.1%
Abalone farming	30.7	4.9%	12.8	4.6%	189	5.5%	8.8	5.7%
Freshwater finfish farming	12.4	2.0%	6.5	2.3%	112	3.3%	4.1	2.7%
Marron and yabbies farming	1.5	0.2%	0.9	0.3%	26	0.7%	0.3	0.2%
Other aquaculture	15.7	2.5%	8.0	2.9%	69	2.0%	3.2	2.1%
<b>Total (SA)</b>	<b>629.2</b>	<b>100.0%</b>	<b>278.3</b>	<b>100.0%</b>	<b>3,441</b>	<b>100.0%</b>	<b>154.8</b>	<b>100.0%</b>

Appendix Table 2-10 The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2010/11

Sector	Output <sup>b</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	283.2	44.2%	140.2	45.8%	868	32.8%	49.7	34.9%
Marine finfish farming	95.9	15.0%	35.0	11.4%	425	16.0%	21.8	15.3%
Oyster farming	176.1	27.5%	91.5	29.9%	966	36.5%	51.8	36.4%
Mussels farming	12.1	1.9%	6.4	2.1%	73	2.8%	4.3	3.0%
Abalone farming	33.7	5.3%	12.6	4.1%	185	7.0%	8.8	6.2%
Freshwater finfish farming	7.2	1.1%	3.8	1.3%	53	2.0%	2.7	1.9%
Marron and yabbies farming	2.4	0.4%	1.5	0.5%	27	1.0%	0.4	0.3%
Other aquaculture	29.7	4.6%	15.1	4.9%	52	2.0%	2.8	1.9%
<b>Total (SA)</b>	<b>640.3</b>	<b>100.0%</b>	<b>306.1</b>	<b>100.0%</b>	<b>2,649</b>	<b>100.0%</b>	<b>142.4</b>	<b>100.0%</b>

Appendix Table 2-11 The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2011/12

Sector	Output <sup>b</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	328.4	50.0%	162.5	49.6%	964	36.3%	56.4	37.9%
Marine finfish farming	49.9	7.6%	22.5	6.9%	257	9.7%	12.8	8.6%
Oyster farming	210.9	32.1%	109.2	33.3%	1,077	40.5%	63.0	42.3%
Mussels farming	13.3	2.0%	7.0	2.1%	85	3.2%	4.7	3.1%
Abalone farming	20.8	3.2%	8.4	2.6%	139	5.2%	6.6	4.4%
Freshwater finfish farming	8.2	1.2%	4.1	1.3%	74	2.8%	3.1	2.1%
Marron and yabbies farming	0.8	0.1%	0.5	0.2%	19	0.7%	0.1	0.1%
Other aquaculture	25.2	3.8%	13.4	4.1%	42	1.6%	2.2	1.5%
<b>Total (SA)</b>	<b>657.4</b>	<b>100.0%</b>	<b>327.6</b>	<b>100.0%</b>	<b>2,656</b>	<b>100.0%</b>	<b>149.0</b>	<b>100.0%</b>

Appendix Table 2-12 The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2012/13

Sector	Output <sup>b</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	339.3	48.0%	166.7	47.8%	954	36.3%	56.9	36.4%
Marine finfish farming	30.6	4.3%	14.9	4.3%	112	4.3%	6.0	3.8%
Oyster farming	249.5	35.3%	122.8	35.2%	1,240	47.2%	76.1	48.6%
Mussels farming	15.8	2.2%	8.3	2.4%	77	2.9%	5.5	3.5%
Abalone farming	25.5	3.6%	9.6	2.8%	112	4.3%	5.6	3.6%
Freshwater finfish farming	13.0	1.8%	7.5	2.2%	73	2.8%	4.0	2.6%
Marron and yabbies farming	0.9	0.1%	0.6	0.2%	22	0.8%	0.2	0.1%
Other aquaculture <sup>a</sup>	32.1	4.5%	18.5	5.3%	35	1.3%	2.1	1.3%
<b>Total (SA)</b>	<b>706.7</b>	<b>100.0%</b>	<b>348.9</b>	<b>100.0%</b>	<b>2,625</b>	<b>100.0%</b>	<b>156.4</b>	<b>100.0%</b>

**Appendix Table 2-13** The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2013/14

Sector	Output <sup>b</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	288.4	55.8%	136.0	54.0%	776	41.6%	50.0	42.7%
Marine finfish farming	21.4	4.1%	10.9	4.3%	94	5.1%	4.9	4.2%
Oyster farming	144.5	28.0%	78.7	31.2%	699	37.5%	44.9	38.3%
Mussels farming	17.1	3.3%	9.3	3.7%	99	5.3%	6.3	5.4%
Abalone farming	34.1	6.6%	11.1	4.4%	120	6.4%	7.2	6.2%
Freshwater finfish farming	7.3	1.4%	3.6	1.4%	49	2.6%	2.7	2.3%
Marron and yabbies farming	1.0	0.2%	0.6	0.3%	15	0.8%	0.2	0.2%
Other aquaculture <sup>a</sup>	3.0	0.6%	1.6	0.6%	12	0.6%	0.9	0.8%
<b>Total (SA)</b>	<b>516.7</b>	<b>100.0%</b>	<b>251.9</b>	<b>100.0%</b>	<b>1,865</b>	<b>100.0%</b>	<b>117.1</b>	<b>100.0%</b>

**Appendix Table 2-14** The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2014/15

Sector	Output <sup>b</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	272.6	49.6%	135.8	48.6%	665	36.3%	44.2	35.3%
Marine finfish farming	46.6	8.5%	24.2	8.6%	156	8.5%	10.7	8.5%
Oyster farming	113.9	20.7%	64.3	23.0%	620	33.8%	36.3	29.0%
Mussels farming	15.5	2.8%	8.5	3.1%	100	5.4%	5.8	4.6%
Abalone farming	35.0	6.4%	11.6	4.1%	133	7.2%	7.6	6.0%
Freshwater finfish farming	11.6	2.1%	5.8	2.1%	56	3.0%	4.5	3.6%
Marron and yabbies farming	0.8	0.1%	0.6	0.2%	10	0.5%	0.1	0.1%
Other aquaculture <sup>a</sup>	53.3	9.7%	28.8	10.3%	94	5.1%	16.1	12.9%
<b>Total (SA)</b>	<b>549.4</b>	<b>100.0%</b>	<b>279.5</b>	<b>100.0%</b>	<b>1,833</b>	<b>100.0%</b>	<b>125.2</b>	<b>100.0%</b>

**Appendix Table 2-15** The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2015/16

Sector	Output <sup>b</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	306.1	46.6%	132.0	41.7%	817	38.3%	56.9	36.9%
Marine finfish farming	76.7	11.7%	40.5	12.8%	228	10.7%	17.3	11.2%
Oyster farming	132.3	20.1%	74.1	23.4%	668	31.4%	41.3	26.8%
Mussels farming	21.6	3.3%	11.9	3.8%	110	5.2%	8.2	5.3%
Abalone farming	43.7	6.6%	14.5	4.6%	132	6.2%	8.7	5.7%
Freshwater finfish farming	15.2	2.3%	8.7	2.8%	74	3.5%	4.8	3.1%
Marron and yabbies farming	0.4	0.1%	0.3	0.1%	7	0.3%	0.1	0.1%
Other aquaculture <sup>a</sup>	60.8	9.3%	34.5	10.9%	94	4.4%	16.8	10.9%
<b>Total (SA)</b>	<b>656.9</b>	<b>100.0%</b>	<b>316.6</b>	<b>100.0%</b>	<b>2,131</b>	<b>100.0%</b>	<b>154.1</b>	<b>100.0%</b>

**Appendix Table 2-16** The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2016/17

Sector	Output <sup>b</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	289.1	45.9%	124.1	40.7%	856	39.8%	58.2	37.9%
Marine finfish farming	77.3	12.3%	36.7	12.0%	270	12.6%	19.0	12.4%
Oyster farming	156.5	24.9%	90.5	29.6%	712	33.1%	47.5	30.9%
Mussels farming	18.6	3.0%	10.3	3.4%	81	3.8%	7.0	4.6%
Abalone farming	33.5	5.3%	13.8	4.5%	104	4.9%	6.3	4.1%
Freshwater finfish farming	11.7	1.9%	6.2	2.0%	53	2.5%	3.6	2.4%
Marron and yabbies farming	0.3	0.0%	0.2	0.1%	6	0.3%	0.1	0.0%
Other aquaculture <sup>a</sup>	42.4	6.7%	23.5	7.7%	69	3.2%	11.9	7.7%
<b>Total (SA)</b>	<b>629.4</b>	<b>100.0%</b>	<b>305.3</b>	<b>100.0%</b>	<b>2,151</b>	<b>100.0%</b>	<b>153.6</b>	<b>100.0%</b>

**Appendix Table 2-17** The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2017/18

Sector	Output <sup>b</sup>		Contribution to GSP		Employment		Household Income	
	(\$m)		(\$m)		(fte)		(\$m)	
Tuna farming	307.2	56.4%	133.5	53.1%	981	48.6%	63.4	50.0%
Marine finfish farming	85.3	15.7%	40.2	16.0%	322	16.0%	21.0	16.6%
Oyster farming	69.5	12.8%	41.5	16.5%	413	20.5%	20.2	15.9%
Mussels farming	19.4	3.6%	10.7	4.2%	89	4.4%	7.4	5.9%
Abalone farming	42.3	7.8%	14.2	5.6%	136	6.7%	8.5	6.7%
Freshwater finfish farming	12.2	2.2%	6.6	2.6%	53	2.6%	3.8	3.0%
Marron and yabbies farming	0.2	0.0%	0.1	0.1%	8	0.4%	0.0	0.0%
Other aquaculture <sup>a</sup>	8.6	1.6%	4.7	1.9%	17	0.9%	2.4	1.9%
<b>Total (SA)</b>	<b>544.7</b>	<b>100.0%</b>	<b>251.5</b>	<b>100.0%</b>	<b>2,019</b>	<b>100.0%</b>	<b>126.8</b>	<b>100.0%</b>