THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE SOUTH AUSTRALIAN STATE AND REGIONAL ECONOMIES, 2019/20

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	Department of Primary Industries and Regions
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 2019/20. The results reported here update and expand on those provided in previous studies (BDO EconSearch 2020a). This report provides estimates of economic contribution for 2019/20 by aquaculture sector (Tuna, Marine Finfish, Oysters, Mussels, Abalone, Freshwater 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 clearly illustrate 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 2020a) 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 2019/20, as in previous years, were based on PIRSA Fisheries and Aquaculture's 2019/20 Production Returns as reported by South Australian aquaculture licence holders. The number of licences covered by production returns represented approximately 93 per cent of the total number of aquaculture licences. BDO EconSearch coordinated the compilation, analysis and validation of these data. Estimates of SA aquaculture production and value of production for the years 2018/19 and 2019/20 are provided in Table ES-1.

The state's total value of seafood production (landed) in 2019/20 was $461.8m, of which aquaculture contributed almost half ($229.0m) and wild-catch fisheries making up the balance ($232.8m). In aggregate, Tuna is the largest single sector in the state's aquaculture industry, accounting for almost 60 per cent of the state's gross value of aquaculture production in 2019/20. The other three main sectors in 2019/20 were Marine Finfish (17 per cent), Oysters (11 per cent) and Abalone (5 per cent).

In addition, data were collected for aquaculture tourism ventures offering the opportunity to interact with marine life, resulting in an estimated 2,500 visitors in 2019/20 with a value of $0.41m. This was a significant fall on the estimates for 2018/19 (5,500 visitors with a value of $0.61m).

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 marginally overall between 2018/19 and 2019/20, beginning at US$0.70 in July 2019 and ending at US$0.69 in June 2020 but fluctuated between US$0.58 and US$0.73 during 2019/20.

Table ES-1 Aquaculture production and value of production, South Australia, 2018/19 and 2019/20

	Weight ('000kg)			Value ($m)		
	2018/19	2019/20	Change	2018/19	2019/20	Change
Southern Bluefin Tuna	8,252	8,345	1%	129.00	137.00	6%
Marine Finfish	2,951	3,068	4%	39.48	39.61	0%
Oysters						
adult [a]	2,099	2,659	27%	20.45	24.95	22%
on-grown [b]	86	423	394%	0.27	1.37	404%
spat [c]	-	-	-	5.09	6.35	25%
Mussels	1,898	1,737	-8%	3.80	3.47	-9%
Abalone [d]	337	285	-15%	13.82	11.97	-13%
Freshwater Finfish	177	274	54%	2.39	3.60	51%
Marron and Yabbies [e]	2	3	36%	0.07	0.13	69%
Other [f]	355	1,101	210%	2.70	8.26	206%
Total [g]	**16,070**	**17,472**	**9%**	**211.70**	**228.98**	**8%**
Tourism (visitors)	5,500	2,500	-55%	0.61	0.41	-32%

[a] The weight for adult Oysters is an approximation on the basis that a dozen Oysters weighs one kilogram.

[b] 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.

[c] 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.

[d] Abalone produced from marine and land-based aquaculture sites, i.e. the data represent species not class of licence.

[e] The volume and value of Marron and Yabby production is potentially underestimated in 2018/19 as the number of production returns for this sector was low.

[f] Other aquaculture production in 2018/19 and 2019/20 was mostly comprised of land-based Algae production.

[g] Totals may contain rounding errors.

Source: PIRSA Fisheries and Aquaculture 2019/20 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 $285.8m ($229.0m on-farm and $56.8m in downstream activities) in 2019/20 (Table ES-2). Total output ($602.6m) needs to be used with care as it includes elements of double counting. Approximately 77 per cent of the output contribution was generated in regional South Australia (Table ES-3).

In 2019/20, aquaculture's total contribution to gross state product (GSP) of $293.8m (Table ES-2) represented 0.27 per cent of the total GSP for South Australia ($110.4b in 2019/20). 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, 2019/20

	Tuna	Marine Finfish	Mussels	Oysters	Abalone[a]	Freshwater Finfish	Marron and Yabbies	Other[b]	Total
Output ($m)									
Direct									
On-farm	*137.0*	*39.6*	*3.5*	*24.9*	*12.0*	*3.6*	*0.1*	*8.3*	***229.0***
Downstream	*15.2*	*17.2*	*3.6*	*19.4*	*0.4*	*1.0*	*0.1*	*0.0*	***56.8***
Total Direct	152.2	56.8	7.1	44.3	12.4	4.5	0.2	8.3	**285.8**
Total Flow-on	178.8	51.0	8.5	53.5	15.2	4.2	0.2	5.4	**316.9**
Total [c]	**331.0**	**107.8**	**15.6**	**97.8**	**27.6**	**8.8**	**0.4**	**13.7**	**602.6**
Contribution to GSP ($m)									
Direct									
On-farm	*35.6*	*17.3*	*2.1*	*19.0*	*3.8*	*1.9*	*0.1*	*3.9*	***83.7***
Downstream	*4.2*	*8.2*	*1.7*	*9.3*	*0.1*	*0.5*	*0.0*	*0.0*	***24.0***
Total Direct	39.8	25.5	3.8	28.3	3.9	2.3	0.1	3.9	**107.6**
Total Flow-on	105.3	29.8	4.9	31.0	9.3	2.5	0.1	3.3	**186.2**
Total	**145.1**	**55.3**	**8.7**	**59.4**	**13.2**	**4.8**	**0.2**	**7.1**	**293.8**
Employment (fte)									
Direct									
On-farm	*234*	*81*	*29*	*299*	*45*	*26*	*5*	*5*	***724***
Downstream	*57*	*124*	*26*	*144*	*2*	*7*	*0*	*0*	***360***
Total Direct	291	205	55	443	46	33	5	5	**1,084**
Total Flow-on	795	234	38	239	70	20	1	26	**1,423**
Total	**1,087**	**439**	**92**	**682**	**116**	**53**	**6**	**31**	**2,506**
Household income ($m)									
Direct									
On-farm	*8.9*	*5.9*	*1.4*	*14.4*	*1.8*	*1.1*	*0.1*	*0.2*	***33.8***
Downstream	*2.3*	*6.0*	*1.2*	*6.8*	*0.1*	*0.4*	*0.0*	*0.0*	***16.7***
Total Direct	11.2	11.9	2.6	21.2	1.8	1.5	0.1	0.2	**50.5**
Total Flow-on	54.5	16.0	2.6	16.6	4.7	1.4	0.1	1.8	**97.7**
Total [d]	**65.7**	**27.9**	**5.2**	**37.8**	**6.6**	**2.9**	**0.1**	**2.0**	**148.2**

[a] Abalone produced from marine and land-based aquaculture sites, i.e. the data represent species not class of licence.

[b] Other aquaculture production in 2019/20 was mostly comprised of land-based Algae production.

[c] Note there is double counting in the total output contribution (see Section 2.2 for an explanation).

[c] Totals may contain rounding errors.

Source: BDO EconSearch analysis

Direct employment was estimated to be 1,084 fte (724 on-farm and 360 in downstream activities) in 2019/20 with 1,423 flow-on jobs, giving total employment of 2,506 fte (Table ES-2). Around 70 per cent of these jobs were generated in regional South Australia (Table ES-3). Direct household income was estimated to be approximately $50.5m in 2019/20 and flow-on income approximately $97.7m, giving a total household income contribution of around $148.2m (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 2019/20 was concentrated in the Eyre Peninsula region, reflecting the dominance of Tuna, Marine Finfish and Mussel farming, the majority of production of Other Aquaculture and Oyster farming (Table ES-3).

Table ES-3 The total regional economic contribution (direct and flow-on) of aquaculture in SA, 2019/20

	Output [a]		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
West Coast	12.0	3%	8.0	4%	141	8%	5.9	6%
Eyre Peninsula	433.0	93%	199.8	92%	1,509	86%	88.7	88%
Yorke Peninsula	0.7	0%	0.4	0%	21	1%	0.8	1%
Kangaroo Island	12.2	3%	5.7	3%	53	3%	3.2	3%
Adelaide and Hills [b]	1.7	0%	0.9	0%	18	1%	0.9	1%
Murraylands and SE	4.4	1%	2.4	1%	19	1%	1.1	1%
Total Regional Contribution [c]	**464.1**	**100%**	**217.3**	**100%**	**1,762**	**100%**	**100.6**	**100%**
Regional Contribution as a Proportion of Total	-	**77%**	-	**74%**	-	**70%**	-	**68%**

[a] Note there is double counting in the total output contribution.

[b] Includes Adelaide metropolitan area.

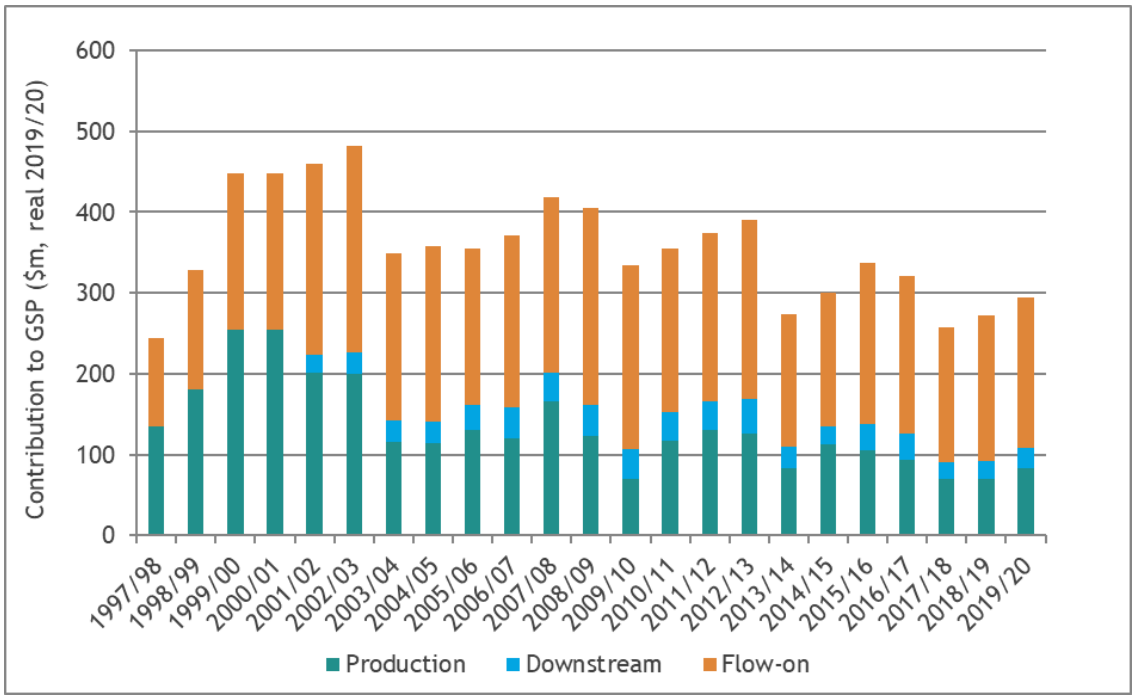
[c] Totals may contain rounding errors.

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 2019/20 (Figure ES-1)[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 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 2016/17 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 8 per cent in 2019/20 as a result of an increase in value in the Tuna, Oyster and Other Aquaculture sectors.

[1] 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 2019/20) 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).

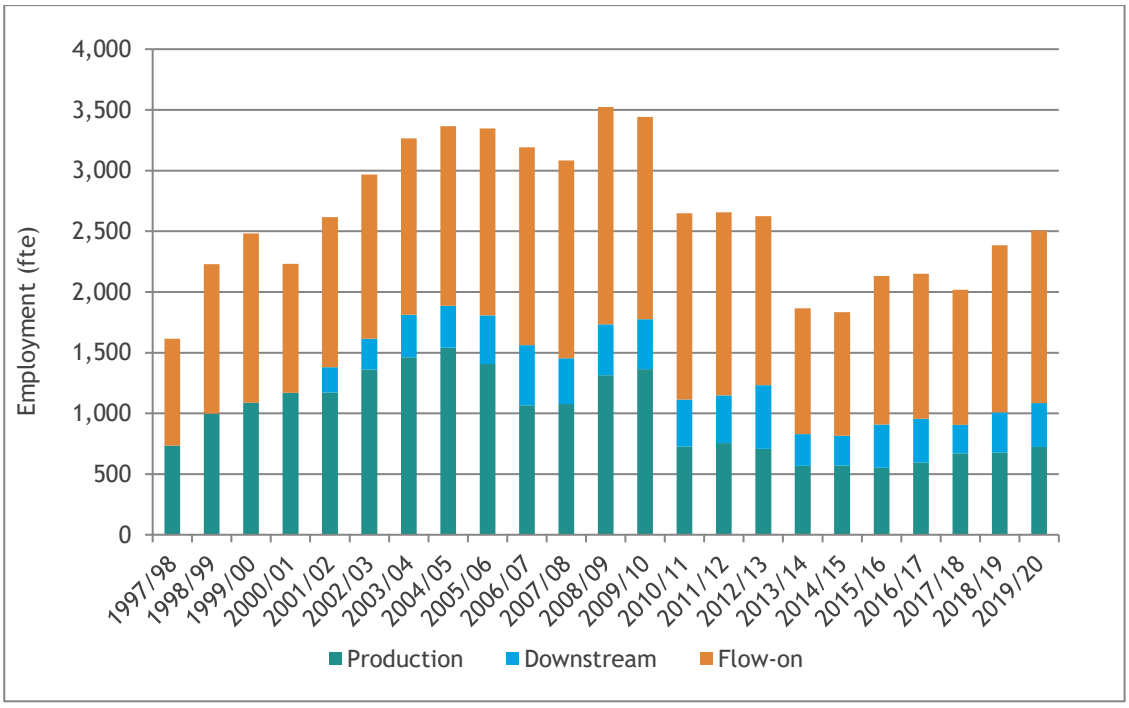
Figure ES-1 Total GSP contribution of aquaculture in SA, 1997/98 to 2019/20 [a]



[a] 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 2019/20 terms.

Source: Figure 12-1

Figure ES-2 Total employment contribution of aquaculture in SA, 1997/98 to 2019/20 [a]



[a] 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 2,506 fte jobs in 2019/20 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, 2020/21 to 2022/23, 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 2019/20 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.

Table ES-4 Projected growth in South Australian aquaculture production and employment, by species, 2020/21 to 2022/23 [a]

	Estimated cumulative change relative to 2019/20					
	Production			On-farm employment		
	2020/21	2021/22	2022/23	2020/21	2021/22	2022/23
Southern Bluefin Tuna	0%	-9%	4%	2%	1%	-1%
Marine Finfish [b]	2%	18%	23%	22%	8%	15%
Oysters	5%	20%	25%	7%	9%	12%
Mussels	-20%	20%	30%	9%	19%	19%
Abalone	10%	5%	2%	10%	12%	14%
Freshwater Finfish [c]	-15%	-12%	1%	-10%	-2%	0%
Marron and Yabbies	5%	-13%	-13%	-15%	-13%	-9%
Other [d]	50%	50%	50%	70%	70%	70%
Tourism	-50%	-100%	80%	0%	-90%	80%

[a] Based on an analysis of PIRSA Fisheries and Aquaculture's 2019/20 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 2020).

[b] Predominantly Yellowtail Kingfish production.

[c] Predominantly Barramundi production.

[d] Other aquaculture production in 2019/20 was comprised predominantly of land-based Algae production.

The projections for each sector through to 2022/23, relative to 2019/20, can be summarised as follows.

- Tuna production – production will not change in 2020/21, fall by 9 per cent in 2021/22 but increase by 4 per cent in 2022/23 (Brian Jeffriess, pers. comm.).
    - The Australian wild catch Southern Bluefin Tuna (SBT) quota for the triennium 2018 to 2020 is 6,165t. This increased to 6,238t in the 2021 to 2023 triennium (Commission for the Conservation of Southern Bluefin Tuna 2021). Despite the Australian quota increasing, the commercial share remained the same. This is a result of the Australian Government and

ASBTIA agreeing that a permanent 5 per cent of the Australian quota would be used to cover the charter/recreational catch and the other 95 per cent would be the commercial share. Previously 4 per cent of the quota had been voluntarily retained by ASBTIA to be not caught, to cover the increasing charter/recreational catch.

  - By the end of February 2020 the Australian wild catch SBT fishery had caught about 75 per cent of the quota for farming, and stopped fishing because of the weak prices as a result of COVID-19. These price concerns turned out to be real and will be reflected in 2020/21 value of production.
  - The SBT fishery harvest will be higher in 2021/22 and 2022/23 because they will carry over unused quota in both years, to be used the following year.

- Tuna employment – direct employment will increase by 2 per cent in 2020/21 and 1 per cent in 2021/22 but fall by 1 per cent in 2022/23 (Brian Jeffriess, pers. comm.).
  - The economic challenges of lower prices are reflected in the financial bottom line but not in fewer jobs. However, there will be fewer employed in 2020/21 because of lower availability of labour and reduced harvest.
  - As exports recover and interstate borders open up, employment returns to the 2018/19 level.
  - As exports to non-Japan destinations 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 placement direct on the at-sea freezer boat. Even for Japan, an increasing percentage of exports will be shipped by on-shore container, which are more employment-intensive.
  - The industry is investing more in upstream jobs, including marketing.
  - The share of Australia's quota going to farming will remain around 5,100t farm to 800t longline because there is a financial incentive to use quota in farms.
  - It is very difficult to increase East Coast longline tonnage because it is a short catching season, it relies on quota left over from the farm catch, and it is only shipped fresh to a competitive Japanese market heavily supplied by New Zealand fresh SBT in a similar period.
  - Further increases in the sardine quota are expected in 2022. The tuna industry now owns 12 of the 14 sardine licences. This makes planning for tuna farming much easier.

- 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 2019/20, production volumes have increased by an average of 40 per cent annually. Clean Seas Seafood Limited expect production to increase by another 2 per cent in 2020/21 and then increase to 33 per cent by 2022/23. After a period of consolidation, employment is projected to increase by 22 per cent in 2020/21, fall back somewhat in 2021/22 (8 per cent increase on 2019/20) before increasing once again in 2022/23 (15 per cent increase on 2019/20). Clean Seas Seafood hatchery infrastructure and farm leases have the potential to more than triple production from the current level. 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 2020).

- Oysters – Overall, sale of mature Oysters will increase by 5 per cent in 2020/21, by 20 per cent in 2021/22 and by 25 per cent in 2022/23. 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 (South Australian Oyster Growers Association, pers. comm.).
- Mussels – A moderate fall in production is expected in 2020/21 (20 per cent) as a result of Covid-19 pandemic affected sales. Production is expected to return to 2019/20 levels in 2021/22 and increase by a further 10 per cent in 2022/23. Employment is expected to increase, by 9 per cent in 2020/21 and by 19 per cent in 2021/22 and 2022/23 (Andy Dyer, SA Mussel Growers Association, pers. comm.).
- Abalone – low growth in production is expected in 2020/21 (10 per cent) but then production is expected to fall in 2021/22 (5 per cent) and 2022/23 (a further 3 per cent). However, employment is expected to increase by 10 per cent in 2020/21 and then by 12 per cent in 2021/22 and 14 per cent in 2022/23 (David Connell, Yumbah, pers. comm.).
- Freshwater Finfish – a moderate fall in production in 2020/21 (15 per cent) and 2021/22 (12 per cent) but increasing in 2022/23 (1 per cent). A decline in employment is expected in 2020/21 (-10 per cent) and in 2021/22 (-2 per cent). Employment is expected to return to 2019/20 levels in 2022/23
- Marron and Yabbies – low growth in production in 2020/21 (5 per cent) and then a fall in production in 2021/22 and 2022/23 (-13 per cent). Moderate falls in employment are expected (-15 per cent in 2020/21 but recovering to -9 per cent in 2022/23).
- Other aquaculture – significant growth in production (50 per cent in 2020/21 to be maintained through to 2022/23) and high growth in employment (70 per cent increase in 2020/21 to be maintained through to 2022/23).
- Tourism – significant falls in revenue in 2020/21 (50 per cent) and 2021/22 (100 per cent) but then a recovery to increase by 80 per cent on 2019/20 levels in 2022/23. No change in employment is expected for 2020/21 but a significant fall in employment is expected in 2021/22 (90 per cent). Employment is expected to recover in line with revenue in 2022/23 (80 per cent).

Table ES-5 Projected growth in South Australian aquaculture production and employment, by region, 2020/21 to 2022/23 [a]

	Estimated cumulative change relative to 2019/20					
	Production			On-farm employment		
	2020/21	2021/22	2022/23	2020/21	2021/22	2022/23
Adelaide and Hills	-21%	0%	0%	-19%	-3%	-3%
Eyre Peninsula	1%	5%	13%	7%	7%	7%
Kangaroo Island	15%	31%	49%	18%	9%	17%
Murraylands and South East	-12%	-18%	1%	0%	0%	3%
West Coast	20%	33%	46%	7%	9%	12%
Yorke Peninsula	-24%	-6%	5%	20%	2%	9%

[a] 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, 2020/21 to 2022/23 [a]

	Actual GVP ($m)	Low GVP Forecast ($m) [b]			High GVP Forecast ($m) [c]		
	2019/20	2020/21	2021/22	2022/23	2020/21	2021/22	2022/23
Southern Bluefin Tuna	137.0	91.0	118.0	130.0	91.0	118.0	130.0
Marine Finfish	39.6	40.3	45.7	47.3	40.4	46.8	48.7
Oysters	24.9	26.1	29.3	30.2	26.3	30.1	31.1
Mussels	3.5	2.8	4.1	4.3	2.8	4.2	4.5
Abalone	12.0	13.2	12.6	12.2	13.2	12.6	12.2
Freshwater Finfish	3.6	3.1	3.2	3.6	3.1	3.2	3.6
Marron and Yabbies	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	8.3	11.6	11.6	11.6	12.4	12.4	12.4
Total [d]	**229.0**	**188.3**	**224.6**	**239.4**	**189.2**	**227.2**	**242.7**
Tourism	0.41	0.21	0.00	0.74	0.21	0.00	0.74

[a] All estimates of gross value of production (GVP) are in 2020 dollars.

[b] The low estimate of gross value of production (GVP) is based on a small but negative price effect for that proportion of the growth that is likely to be supplied to the SA domestic market. It was assumed that 100 per cent of the growth in Tuna and Abalone production would be exported to interstate and overseas markets (i.e. low and high estimates of GVP identical) and 75 per cent of the growth in other sectors would be exported.

[c] The high estimate of GVP is based on no price response over the projection period (i.e. prices remain at 2019/20 levels).

[d] 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 2019/20. The results reported here update and expand on those provided in previous studies (BDO EconSearch 2020a). Estimates of the economic contribution of aquaculture activity in South Australia in 2019/20 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 laevigata*)
- Freshwater Finfish (predominantly Barramundi, *Lates calcarifer* and Rainbow Trout, *Oncorhynchus mykiss*)
- Marron (*Cherax tenuimanus*) and Yabbies (*Cherax destructor*)
- Other aquaculture (comprised of land-based Algae, *Dunaliella salina*; and Goldfish, *Carassius auratus*)
- 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:

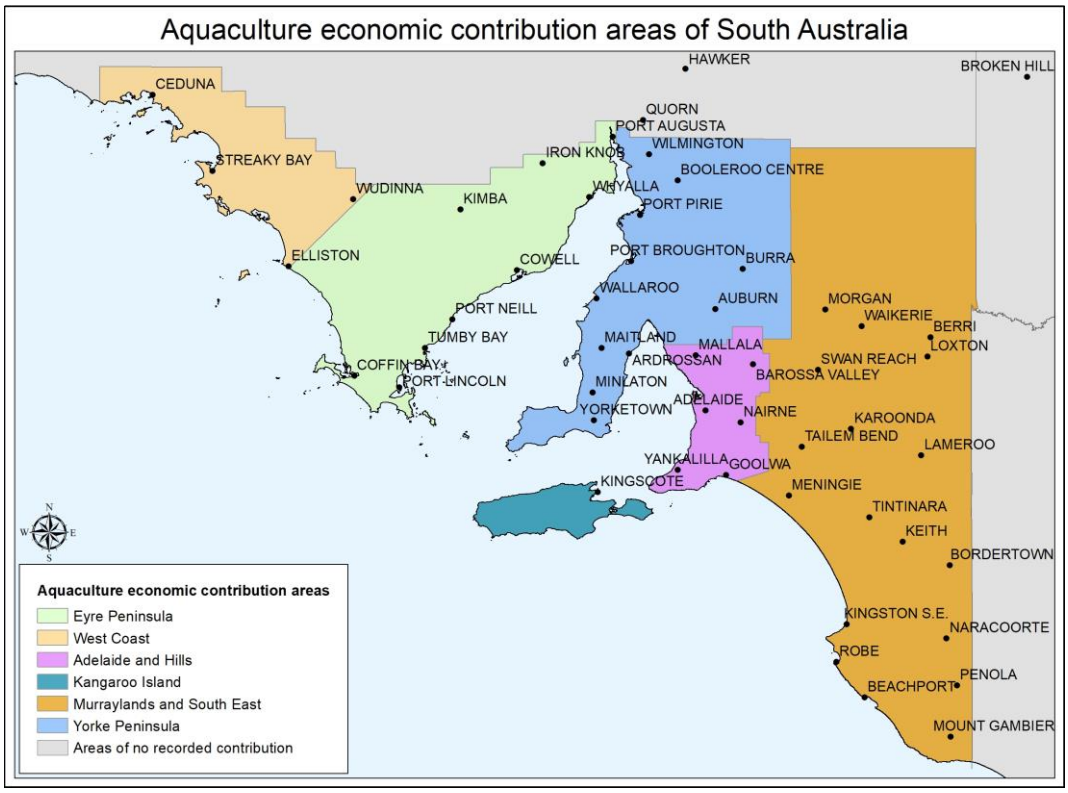
- West Coast (WA border to Elliston including Wudinna)
- Eyre Peninsula (Lower Eyre Peninsula to Port Augusta, including Kimba)
- Yorke Peninsula (covers Yorke Peninsula, Mid North and Barossa)
- Kangaroo Island
- Adelaide and Adelaide Hills (including Fleurieu peninsula)
- Murraylands (Riverland and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

Major aquaculture growing regions are shown in Figure ES-2.

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

Figure 1-2 Major aquaculture growing regions in SA

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 (2020b).

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 2019/20 (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 [a]	Scope of Contribution Analysis in Recent and Future Studies [b]
Farm gate production	Yes	Yes
Processing	Yes	Yes
Retail	No	Yes
Food Service	No	Yes
Transport between stages	Part	Yes
Other aspects of the economic contribution of aquaculture		
Regional investment	Yes (Tuna only)	Yes – qualitative only
Tourism	No	Yes – qualitative only
Education and training	No	Yes – qualitative only

[a] For the years 1996/97 to 2000/01.

[b] For the years 2001/02 to 2019/20 (BDO EconSearch 2020a).

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 2019/20 were based on PIRSA Fisheries and Aquaculture's 2019/20 Production Returns submitted by the aquaculture industry. The number of licences covered by production returns represented approximately 93 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 2019/20 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 2018/19 and 2019/20 are presented in Table 3-1. Some description of these data is provided below. Similar data for the period 1995/96 to 2019/20 are provided in Appendix 1 of the report. Overall, total production increased by 9 per cent between 2018/19 (16,070t) and 2019/20 (17,472t) and total value increased by 8 per cent (from $211.7m to $228.9m) (Table 3-1).

Table 3-1 Aquaculture production and value of production, SA, 2018/19 and 2019/20

	Weight ('000kg)			Value ($m)		
	2018/19	2019/20	Change	2018/19	2019/20	Change
Southern Bluefin Tuna	8,252	8,345	1%	129.00	137.00	6%
Marine Finfish	2,951	3,068	4%	39.48	39.61	0%
Oysters						
adult [a]	2,099	2,659	27%	20.45	24.95	22%
on-grown [b]	86	423	394%	0.27	1.37	404%
spat [c]	-	-	-	5.09	6.35	25%
Mussels	1,898	1,737	-8%	3.80	3.47	-9%
Abalone [d]	337	285	-15%	13.82	11.97	-13%
Freshwater Finfish	177	274	54%	2.39	3.60	51%
Marron and Yabbies [e]	2	3	36%	0.07	0.13	69%
Other [f]	355	1,101	210%	2.70	8.26	206%
Total [g]	**16,070**	**17,472**	**9%**	**211.70**	**228.98**	**8%**
Tourism (visitors)	5,500	2,500	-55%	0.61	0.41	-32%

[a] The weight for adult Oysters is an approximation on the basis that a dozen Oysters weighs one kilogram.

[b] 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.

[c] 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.

[d] Abalone produced from marine and land-based aquaculture sites, i.e. the data represent species not class of licence.

[e] The volume and value of Marron and Yabby production in 2018/19 is potentially underestimated as the number of production returns for this sector is low.

[f] Other aquaculture production in 2018/19 and 2019/20 was mostly comprised of land-based Algae production.

[g] Totals may contain rounding errors.

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns

Between 2018/19 and 2019/20 the following changes in production and value of production are apparent.

- The value of Tuna farm output increased by 6 per cent as a result of a 1 per cent increase volume of farmed Tuna and a 5 per cent rise 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 less than 1 per cent as a result of a 4 per cent rise in production and despite a 4 per cent fall in the price of Marine Finfish (Clean Seas Seafood Limited 2020).
- The value of Oyster production increased by 22 per cent as a result of a 27 per cent rise in volume and despite a 4 per cent decline in price of adult Oysters. The spat supply shortage caused by POMS impacting Tasmanian Oyster hatcheries in 2016/17 was still impacting production in 2019/20 but production is slowly returning to pre-POMS levels (South Australian Oyster Growers Association, pers. comm.).
- The value of Mussel production fell by 9 per cent due to an 8 per cent fall in the volume of Mussel production as a result of the COVID-19 pandemic restricting access to export markets and dampening domestic food service consumption (validated by Andy Dyer, SA Mussel Growers Association, pers. comm.).
- The value of Abalone production declined by 9 per cent as a result of a 8 per cent fall in the volume of Abalone production and despite a 2 per cent increase in the per unit price. The fall in the volume of production was due to poor growth performance due to stress (David Connell, General Manager, Yumbah Aquaculture, pers. comm.).
- The value of Freshwater Finfish production increased by 51 per cent as a result of a 54 per cent increase in the volume of Freshwater Finfish production and despite a 2 per cent fall the per unit price.
- The value of Marron/Yabbies production increased by 69 per cent as a result of a 36 per cent rise in the volume of Marron/Yabbies production and a 24 per cent increase per unit price of Marron/Yabbies. This is most likely a function of the under reporting for this sector in 2018/19.
- The value of Other aquaculture production more than tripled as a result of a significant increase in production and a slight decline in price (1 per cent). Other aquaculture is dominated by land-based algae production. In 2018/19 the major land-based 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 2019/20, there were 2,500 visitors with a value of $0.4m, a fall on 2018/19 (5,500 visitors for a value of $0.6m). This sector was significantly impacted by the COVID-19 pandemic.

A breakdown of aquaculture value of production in 2019/20 by region is detailed in Table 3-2 and Table 3-3. Similar data for aquaculture production in 2019/20 are detailed in Table 3-4 and Table 3-5. Activity in the Tuna, Marine Finfish, Oysters, Mussels, and Other aquaculture is concentrated in the Eyre Peninsula region. The production of remaining aquaculture species (i.e. Abalone, Freshwater Finfish and Marron/Yabbies) is more widely distributed across SA.

Table 3-2 Aquaculture value of production by sector and region, South Australia, 2019/20 ($'000)

	West Coast	Eyre Peninsula	Yorke Peninsula	Kangaroo Island	Adelaide and Hills	Murraylands and South East	All regions
Southern Bluefin Tuna	0	137,000	0	0	0	0	137,000
Marine Finfish	0	39,608	0	0	0	0	39,608
Oysters [a]	5,530	19,130	45	242	0	0	24,948
Mussels	0	3,472	0	0	0	0	3,472
Abalone	0	5,924	0	6,048	0	0	11,972
Freshwater Finfish [a]	0	2	1	2	886	2,707	3,597
Marron and Yabbies [a]	0	18	29	78	1	0	126
Other [a]	0	8,256	1	0	0	0	8,257
Total	**5,530**	**213,409**	**76**	**6,371**	**886**	**2,707**	**228,979**
Tourism	0	0	0	0	410	0	410

[a] Includes the value of fingerling sales but excludes local spat and on-grown sales for Oysters.

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns

Table 3-3 Proportion of aquaculture value of production by sector and region, South Australia, 2019/20

	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 [a]	22.2%	76.7%	0.2%	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%	49.5%	0.0%	50.5%	0.0%	0.0%	100.0%
Freshwater Finfish [a]	0.0%	0.0%	0.0%	0.1%	24.6%	75.2%	100.0%
Marron and Yabbies [a]	0.0%	13.9%	23.1%	62.2%	0.7%	0.1%	100.0%
Other	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Total [a]	**2.4%**	**93.2%**	**<0.0%**	**2.8%**	**0.4%**	**1.2%**	**100.0%**
Tourism	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%

[a] Proportion of aquaculture value of production in the Yorke Peninsula was 0.03%.

Source: Table 3-2

Table 3-4 Aquaculture production by sector and region, South Australia, 2019/20 (kg)

	West Coast	Eyre Peninsula	Yorke Peninsula	Kangaroo Island	Adelaide and Hills	Murraylands and South East	All regions
Southern Bluefin Tuna	0	8,345,000	0	0	0	0	8,345,000
Marine Finfish	0	3,067,991	0	0	0	0	3,067,991
Oysters	541,093	2,091,407	3,155	23,600	0	0	2,659,255
Mussels	0	1,736,788	0	0	0	0	1,736,788
Abalone	0	141,050	0	144,000	0	0	285,050
Freshwater Finfish	0	194	48	150	91,634	181,912	273,938
Marron and Yabbies	0	432	1,129	1,417	14	2	2,994
Other	0	1,100,782	2	0	0	0	1,100,784
Total	**541,093**	**16,483,644**	**4,334**	**169,167**	**91,647**	**181,914**	**17,471,799**
Tourism (visitors)	0	0	0	0	2,500	0	2,500

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns

Table 3-5 Proportion of aquaculture production by sector and region, South Australia, 2019/20

	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	20.3%	78.6%	0.1%	0.9%	0.0%	0.0%	100.0%
Mussels	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Abalone	0.0%	49.5%	0.0%	50.5%	0.0%	0.0%	100.0%
Freshwater Finfish	0.0%	0.1%	0.0%	0.1%	33.5%	66.4%	100.0%
Marron and Yabbies	0.0%	14.4%	37.7%	47.3%	0.5%	0.1%	100.0%
Other	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Total	**3.1%**	**94.3%**	**<0.0%**	**1.0%**	**0.5%**	**1.0%**	**100.0%**
Tourism (visitors)	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%

[a] Proportion of aquaculture production in the Yorke Peninsula was 0.0002%.

Source: Table 3-4

3.2. Employment in SA Aquaculture

Estimates of direct employment in South Australian aquaculture for the years 2018/19 and 2019/20 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 2019/20 Production Returns submitted by the aquaculture industry. Overall, direct employment in aquaculture operations

reported by industry, increased by 7 per cent between 2018/19 (676 fte) and 2019/20 (724 fte). In 2019/20 there were 3 jobs associated with aquaculture tourism operations, a fall from 8 jobs in 2018/19.

Table 3-6 Direct employment by aquaculture sector, South Australia, 2018/19 and 2019/20

	Employment (fte)		
	2018/19	2019/20	Change from 2018/19
Southern Bluefin Tuna	278	234	-16%
Marine Finfish	78	81	5%
Oysters	212	299	41%
Mussels	32	29	-9%
Abalone	53	45	-15%
Freshwater Finfish	14	26	84%
Marron and Yabbies	6	5	-17%
Other [a]	5	5	11%
Total	**676**	**724**	**7%**
Tourism [b]	8	3	-63%

[a] 'Other aquaculture' also includes land based and miscellaneous licences which cannot be allocated to specific sectors.

[b] Note employment totals include rounding.

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns

Some notable differences in direct employment between 2018/19 and 2019/20 by species are:

- 41 per cent increase in Oysters in line with the increase in production in 2019/20.
- 84 per cent increase in Freshwater Finfish in line with the increase in production in 2019/20.

A breakdown of direct employment in 2019/20 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 79 per cent of Oysters by volume but was responsible for only 55 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, 2019/20 (fte)

	West Coast	Eyre Peninsula	Yorke Peninsula	Kangaroo Island	Adelaide and Hills	Murraylands and South East	All regions
Southern Bluefin Tuna	0	234	0	0	0	0	234
Marine Finfish	0	81	0	0	0	0	81
Oysters	110	165	18	5	0	0	299
Mussels	0	29	0	0	0	0	29
Abalone	0	28	0	17	0	0	45
Freshwater Finfish	0	2	0	1	14	10	26
Marron and Yabbies	0	1	0	4	0	1	5
Other	0	5	0	0	0	0	5
Total	**110**	**545**	**18**	**26**	**14**	**11**	**724**
Tourism	0	0	0	0	3	0	3

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns

Table 3-8 Proportion of direct employment by region, South Australia, 2019/20

	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	37.0%	55.4%	6.1%	1.5%	0.0%	0.0%	100.0%
Mussels	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Abalone	0.0%	63.2%	0.0%	36.8%	0.0%	0.0%	100.0%
Freshwater Finfish	0.0%	5.8%	0.0%	1.9%	52.3%	39.9%	100.0%
Marron and Yabbies	0.0%	10.0%	0.0%	80.0%	0.0%	10.0%	100.0%
Other	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Total	**15.2%**	**75.3%**	**2.5%**	**3.5%**	**1.9%**	**1.5%**	**100.0%**
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, 2020/21 to 2022/23. The projections from the PIRSA Fisheries and Aquaculture 2019/20 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.

Table 3-9 Projected growth in South Australian aquaculture production and on-farm employment, by species, 2020/21 to 2022/23 (percentage change on 2019/20) [a]

	Estimated cumulative change relative to 2019/20					
	Production			On-farm employment		
	2020/21	2021/22	2022/23	2020/21	2021/22	2022/23
Southern Bluefin Tuna	0%	-9%	4%	2%	1%	-1%
Marine Finfish [b]	2%	18%	23%	22%	8%	15%
Oysters	5%	20%	25%	7%	9%	12%
Mussels	-20%	20%	30%	9%	19%	19%
Abalone	10%	5%	2%	10%	12%	14%
Freshwater Finfish [c]	-15%	-12%	1%	-10%	-2%	0%
Marron and Yabbies	5%	-13%	-13%	-15%	-13%	-9%
Other [d]	50%	50%	50%	70%	70%	70%
Tourism	-50%	-100%	80%	0%	-90%	80%

[a] Based on an analysis of PIRSA Fisheries and Aquaculture's 2019/20 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 2020).

[b] Predominantly Yellowtail Kingfish production.

[c] Predominantly Barramundi production.

[d] Other aquaculture production in 2019/20 was mostly comprised of land-based Algae.

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns, Clean Seas Seafood Limited 2020, 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, 2020/21 to 2022/23 (percentage change on 2019/20)[a]

	Estimated cumulative change relative to 2019/20					
	Production			On-farm employment		
	2020/21	2021/22	2022/23	2020/21	2021/22	2022/23
Adelaide and Hills	-21%	0%	0%	-19%	-3%	-3%
Eyre Peninsula	1%	5%	13%	7%	7%	7%
Kangaroo Island	15%	31%	49%	18%	9%	17%
Murraylands and South East	-12%	-18%	1%	0%	0%	3%
West Coast	20%	33%	46%	7%	9%	12%
Yorke Peninsula	-24%	-6%	5%	20%	2%	9%

[a] 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 2019/20 Production Returns, Clean Seas Seafood Limited 2020, Brian Jeffriess pers. comm., SA Mussel Growers Association, Yumbah Aquaculture and SA Oyster Growers Association.

The projections for each sector through to 2022/23, relative to 2019/20, can be summarised as follows.

- Tuna production – production will not change in 2020/21, fall by 9 per cent in 2021/22 but increase by 4 per cent in 2022/23 (Brian Jeffriess, pers. comm.).
    - The Australian wild catch Southern Bluefin Tuna (SBT) quota for the triennium 2018 to 2020 is 6,165t. This increased to 6,238t in the 2021 to 2023 triennium (Commission for the Conservation of Southern Bluefin Tuna 2021). Despite the Australian quota increasing the commercial share remained the same. This is a result of the Australian Government and

ASBTIA agreeing that a permanent 5 per cent of the Australian quota would be used to cover the charter/recreational catch and the other 95 per cent would be the commercial share. Previously 4 per cent of the quota had been voluntarily retained by ASBTIA to be not caught, to cover the increasing charter/recreational catch.

  - By the end of February 2020 the Australian wild catch SBT fishery had caught about 75 per cent of the quota for farming, and stopped fishing because of the weak prices as a result of COVID-19. These price concerns turned out to be real and will be reflected in 2020/21 value of production.
  - The SBT fishery harvest will be higher in 2021/22 and 2022/23 because they will carry over unused quota in both years, to be used the following year.

- Tuna employment – direct employment will increase by 2 per cent in 2020/21 and 1 per cent in 2021/22 but fall by 1 per cent in 2022/23 (Brian Jeffriess, pers. comm.).
  - The economic challenges of lower prices are reflected in the financial bottom line but not in fewer jobs. However, there will be fewer employed in 2020/21 because of lower availability of labour and reduced harvest.
  - As exports recover and interstate borders open up, employment returns to the 2018/19 level.
  - As exports to non-Japan destinations 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 placement direct on the at-sea freezer boat. Even for Japan, an increasing percentage of exports will be shipped by on-shore container, which are more employment-intensive.
  - The industry is investing more in upstream jobs, including marketing.
  - The share of Australia's quota going to farming is will remain around 5,100t farm to 800t longline because there are a financial incentive to use quota in farms.
  - It is very difficult to increase East Coast longline tonnage because it is a short catching season, it relies on quota left over from the farm catch, and it is only shipped fresh to a competitive Japanese market heavily supplied by New Zealand fresh SBT in a similar period.
  - Further increases in the sardine quota are expected in 2022. The tuna industry now owns 12 of the 14 sardine licences. This makes planning for tuna farming much easier.

- 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 2019/20, production volumes have increased by an average of 40 per cent annually. Clean Seas Seafood Limited expect production to increase by another 2 per cent in 2020/21 and then increase to 33 per cent by 2022/23. After a period of consolidation, employment is projected to increase by 22 per cent in 2020/21, fall back somewhat in 2021/22 (8 per cent increase on 2019/20) before increasing once again in 2022/23 (15 per cent increase on 2019/20). Clean Seas Seafood hatchery infrastructure and farm leases have the potential to more than triple production from the current level. 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 increase sales into Europe and North America (Clean Seas Seafood Limited 2020).

- Oysters – Overall, sale of mature Oysters will increase by an estimated 5 per cent in 2020/21, by 20 per cent in 2021/22 and by 25 per cent in 2022/23. 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 (South Australian Oyster Growers Association, pers. comm.).
- Mussels – A moderate fall in production is expected in 2020/21 (20 per cent) as a result of Covid-19 pandemic affected sales. Production is expected to return to 2019/20 levels in 2021/22 and increase by a further 10 per cent in 2022/23. Employment is expected to increase, by 9 per cent in 2020/21 and by 19 per cent in 2021/22 and 2022/23 (Andy Dyer, SA Mussel Growers Association, pers. comm.).
- Abalone – low growth in production is expected in 2020/21 (10 per cent) but then production is expected to fall in 2021/22 (5 per cent) and 2022/23 (a further 3 per cent). However, employment is expected to increase by 10 per cent in 2020/21 and then by 12 per cent in 2021/22 and 14 per cent in 2022/23 (David Connell, Yumbah, pers. comm.).
- Freshwater Finfish – a moderate fall in production in 2020/21 (15 per cent) with a small recovery in 2021/22 (12 per cent below the 2019/20 level) but recovering more strongly in 2022/23 (1 per cent above the 2019/20 level). A decline in employment is expected in 2020/21 (-10 per cent) and with a strong rebound in 2021/22 (-2 per cent compared to 2019/20). Employment is expected to return to 2019/20 levels in 2022/23
- Marron and Yabbies – low growth in production in 2020/21 (5 per cent) and then a fall in production in 2021/22 and 2022/23 (-13 per cent). Moderate falls in employment are expected (-15 per cent in 2020/21 but recovering to -9 per cent in 2022/23).
- Other aquaculture – significant growth in production (50 per cent in 2020/21 to be maintained through to 2022/23) and high growth in employment (70 per cent increase in 2020/21 to be maintained through to 2022/23).
- Tourism – significant falls in revenue in 2020/21 (-50 per cent) and 2021/22 (-100 per cent) but then a recovery to increase by 80 per cent on 2019/20 levels in 2022/23. No change in employment is expected for 2020/21 but a significant fall in employment is expected in 2021/22 (90 per cent). Employment is expected to recover in line with revenue in 2022/23 (80 per cent).

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, 2020/21 to 2022/23 (t or '000 doz.)

	Actual Production [a]	Forecast Production [b]			Av. annual growth rate
	2019/20	2020/21	2021/22	2022/23	
Southern Bluefin Tuna (t)	8,345	8,345	7,600	8,700	1.4%
Marine Finfish (t)	3,068	3,131	3,621	3,775	7.2%
Oysters ('000 doz.)	2,659	2,803	3,204	3,319	7.7%
Mussels (t)	1,737	1,389	2,084	2,258	9.1%
Abalone (t)	285	314	299	291	0.7%
Freshwater Finfish (t)	274	233	242	276	0.2%
Marron and Yabbies (t)	3	3	3	3	-4.5%
Other (t)	1,101	1,651	1,651	1,651	14.5%
Total	**17,472**	**17,868**	**18,705**	**20,272**	**5.1%**
Tourism (visitors)	2,500	1,250	0	4,500	21.6%

[a] See Table 3-1.

[b] 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, 2020/21 to 2022/23 (full-time equivalents)

	Actual Employment (fte) [a]	Forecast Employment (fte) [b]			Av. annual growth rate
	2019/20	2020/21	2021/22	2022/23	
Southern Bluefin Tuna	234	240	237	231	-0.4%
Marine Finfish	81	99	87	93	4.8%
Oysters	299	318	326	334	3.8%
Mussels	29	32	34	34	5.9%
Abalone	45	49	50	51	4.4%
Freshwater Finfish	26	23	25	26	-0.2%
Marron and Yabbies	5	4	4	5	-3.1%
Other	5	9	9	9	19.3%
Total	**724**	**774**	**773**	**783**	**2.6%**
Tourism	3	3	0	5	21.6%

[a] Derived from PIRSA Fisheries and Aquaculture's 2019/20 Production Returns responses. Includes employment on inactive, undeveloped and underdeveloped leases.

[b] 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 2020/21 to 2022/23. These projections are presented in Table 3-13.

Table 3-13 Projected growth in South Australian aquaculture value of production, 2020/21 to 2022/23[a]

	Actual GVP ($m)	Low GVP Forecast ($m) [b]			High GVP Forecast ($m) [c]		
	2019/20	2020/21	2021/22	2022/23	2020/21	2021/22	2022/23
Southern Bluefin Tuna	137.0	91.0	118.0	130.0	91.0	118.0	130.0
Marine Finfish	39.6	40.3	45.7	47.3	40.4	46.8	48.7
Oysters	24.9	26.1	29.3	30.2	26.3	30.1	31.1
Mussels	3.5	2.8	4.1	4.3	2.8	4.2	4.5
Abalone	12.0	13.2	12.6	12.2	13.2	12.6	12.2
Freshwater Finfish	3.6	3.1	3.2	3.6	3.1	3.2	3.6
Marron and Yabbies	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	8.3	11.6	11.6	11.6	12.4	12.4	12.4
Total [d]	**229.0**	**188.3**	**224.6**	**239.4**	**189.2**	**227.2**	**242.7**
Tourism	0.41	0.21	0.00	0.74	0.21	0.00	0.74

[a] All estimates of gross value of production (GVP) are in 2020 dollars.

[b] The low estimate of gross value of production (GVP) is based on a small but negative price effect for that proportion of the growth that is likely to be supplied to the SA domestic market. It was assumed that 100 per cent of the growth in Tuna and Abalone production would be exported to interstate and overseas markets (i.e. low and high estimates of GVP identical) and 75 per cent of the growth in other sectors would be exported.

[c] The high estimate of GVP is based on no price response over the projection period (i.e. prices remain at 2019/20 levels).

[d] 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 2019/20 Production Returns. Estimates are provided below for the following indicators for SA for 2019/20.

- 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, 2019/20

	Production	Value of production	Direct employment
Southern Bluefin Tuna	48%	60%	32%
Marine Finfish	18%	17%	11%
Oysters	15%	11%	41%
Mussels	10%	2%	4%
Abalone	2%	5%	6%
Freshwater Finfish	2%	2%	4%
Marron and Yabbies	0.02%	0.05%	1%
Other	6%	4%	1%
Total	**100%**	**100%**	**100%**

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns

Table 3-15 Number of aquaculture licences submitting a production return [a], by sector, South Australia, 2019/20

	Number of licences submitting a Production Return
Southern Bluefin Tuna	21
Marine Finfish	26
Oysters	334
Mussels	26
Abalone	4
Freshwater Finfish	15
Marron and Yabbies	10
Other	2
Shellfish or land based licences with no production reported	31
Tourism	1
Total	**471**

[a] 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 2019/20. It does, however, include miscellaneous licences for the holding of empty sea cages or maintenance sites. The total number of licences by category are detailed in Table 3-18.

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns

Table 3-16 Aquaculture spat and fingerling introductions and sales, South Australia, 2019/20

	All licence holders		Spat/fingerling sales [g]		
	No. spat/fingerlings introduced ('000)	Proportion sourced from SA	No. spat/fingerlings sold ('000)	Value ($'000)	No. of respondents
Southern Bluefin Tuna [a]	329	100%	-	-	0
Marine Finfish [b]	1,165	100%	n.p.	n.p.	1
Oysters [c]	118,044	100%	n.p.	n.p.	4
Mussels [d]	10,000	0%-	-	-	1
Abalone [e]	275	100%	-	-	0
Freshwater Finfish [h]	991	64%	n.p.	n.p.	4
Marron and Yabbies	0	-	n.p.	n.p.	1
Other [f]	0	-	-	-	0
Total	**120,804**		**136,529**	**6,383**	**10**

[a] Wild caught juveniles, on-grown product sourced from Commonwealth waters off SA.

[b] Self-produced, on-grown fingerlings.

[c] Excludes stock sourced from other producers in SA for on-growing.

[d] Wild spat caught on-site or sourced from hatcheries.

[e] Includes self-produced at a land-based hatchery, on-grown spat.

[f] Other aquaculture is dominated by land-based algae production for which juvenile introduction is not relevant.

[g] Where the number of respondents is less than 5 the data has not been published (n.p.) to ensure the confidentiality of respondents.

[h] Non SA sourced Freshwater Finfish fingerlings were from Tasmania, New South Wales and Queensland.

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns

Table 3-17 Reasons provided for nil returns, 2019/20

Reason provided for nil returns	Number of licences	
Normal operation does not involve sales [a]	114	45%
None provided / ambiguous / personal	7	3%
Ownership / regulatory [b]	34	13%
Stock levels too low / unable to purchase spat/fingerlings	38	15%
No infrastructure on site/Still in development	23	9%
Poor market conditions	5	2%
Environmental conditions [c]	10	4%
Not operating	23	9%
Total	**254**	**100%**

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

[b] For example, the licence is for sale, currently being transferred, or under another regulatory process.

[c] E.g. bush fires, drought, etc.

Source: PIRSA Fisheries and Aquaculture 2019/20 Production Returns

Table 3-18 Aquaculture Licence Holders and category, 2019/20

Aquaculture licence category	Number of licences
Southern Bluefin Tuna	13
Marine Finfish	22
Oysters [a]	347
Mussels	32
Abalone [b]	5
Landbased Category A	30
Landbased Category B	30
Landbased Category C	13
Landbased Category D	6
Miscellaneous [c]	6
Tourism	1
Total	**505**

[a] Oysters includes both marine based intertidal and subtidal licences, with land based oyster hatcheries included in the relevant Landbased category.

[b] Abalone includes subtidal marine based abalone farms only, with land based coastal abalone farms and hatcheries included in the relevant Landbased category.

[c] Miscellaneous includes licences for the purposes of holding empty sea-cages, with no production or stock on site.

Source: PIRSA Fisheries and Aquaculture 2019/20

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

The state's total value of seafood production (landed) in 2019/20 was $461.8m, of which aquaculture contributed almost half ($229.0m) and wild-catch fisheries, the balance ($232.8m) (Table 3-19). In aggregate, Tuna is the largest single sector in the state's aquaculture industry, accounting for almost 60 per cent of the state's gross value of aquaculture production in 2019/20. The other three main sectors in 2019/20 were Marine Finfish (17 per cent), Oysters (11 per cent) and Abalone (5 per cent).

Table 3-19 Value of aquaculture production and wild fisheries catch, South Australia, 2019/20

	Production or catch ('000kg)	Value of production or catch ($m)	Contribution to aquaculture value of production	Contribution to total seafood value of production or catch
Aquaculture				
Southern Bluefin Tuna	8,345	137.0	59.8%	29.7%
Marine Finfish	3,068	39.6	17.3%	8.6%
Oysters	2,659	24.9	10.9%	5.4%
Mussels	1,737	3.5	1.5%	0.8%
Abalone	285	12.0	5.2%	2.6%
Freshwater Finfish	274	3.6	1.6%	0.8%
Marron and Yabbies [a]	3	0.1	0.1%	0.0%
Other [b]	1,101	8.3	3.6%	1.8%
Total Aquaculture	**17,472**	**229.0**	**100.0%**	**49.6%**
Wild Catch Fisheries [c]				
Rock Lobster	1,468	122.3	-	26.5%
Abalone	509	21.7	-	4.7%
Prawns	1,968	26.4	-	5.7%
Sardines	39,889	26.7	-	5.8%
Other Marine Fisheries	2,767	26.2	-	5.7%
Inland Water Fisheries	1,978	9.5	-	2.1%
Total Wild Catch	**48,579**	**232.8**	**-**	**50.4%**
Total Seafood	**66,051**	**461.8**	**-**	**100.0%**

[a] 0.05% contribution to aquaculture value of production and 0.03% contribution to total seafood value of production or catch.

[b] Other aquaculture production in 2019/20 was mostly comprised of land-based Algae.

[c] 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 2019/20 Production Returns

3.6. Exchange Rates

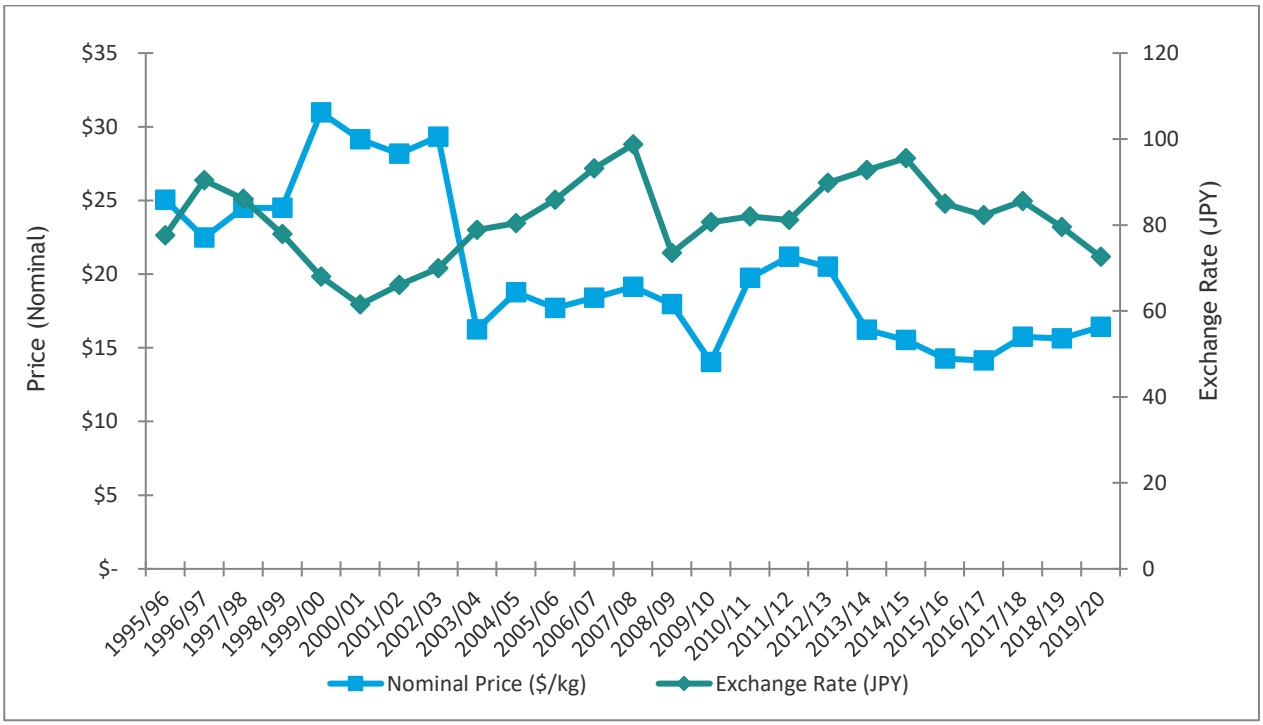
A large proportion of the South Australian aquaculture production, particularly Tuna, is exported overseas. Accordingly, the value of the Australian dollar can have a significant impact on the economic performance of the industry. The value of the Australian dollar influences the price of Australian 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 slightly overall between 2018/19 and 2019/20, beginning at US$0.70 in July 2019 and ending at US$0.69 in June 2020 but fluctuated between US$0.58 and US$0.73 during 2019/20.

The average exchange rate in 2019/20 was US$0.67, a 6 per cent decline compared to the average for the previous year (US$0.72) (RBA 2021). 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 2018/19 and 2019/20.

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 2018/19 was 79.51 JPY decreasing to 72.57 (JPY) in 2019/20 (Figure 3-1).

The relationship between the price of Tuna and the exchange rate (JPY) between 1995/96 and 2019/20 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 2019/20 is -0.58. This indicates that there is a moderate 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 2019/20



Source: RBA (2021)

4. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN SA, 2019/20

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 2019/20 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 2019/20, 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, 2019/20

Estimates of the economic contribution generated by the Tuna farming industry in SA on a sector-by-sector basis for 2019/20 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 $137.0m and in other sectors (processing and transport), $15.2m in 2019/20. Flow-on output in other sectors of the state economy summed to $17.8m (Table 4-1). The sectors most affected were the Tuna fishing (Tuna capture), property and business services, Sardine fishing, manufacturing, finance and transport and trade, 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 2.17 indicates that for each dollar of sales generated by the Tuna industry (farming and downstream) there was a total of $2.17 of output generated by businesses throughout the state, $1.00 in the Tuna industry (farming and downstream) and $1.17 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, 2019/20

Sector	Output		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Tuna farming	137.0	41%	35.6	25%	234	22%	8.9	14%
Processing	12.9	4%	3.1	2%	46	4%	1.4	2%
Transport	2.3	1%	1.0	1%	11	1%	1.0	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%
Total Direct	*152.2*	*46%*	*39.8*	*27%*	*291*	*27%*	*11.2*	*17%*
Flow-on effects								
Tuna fishing	31.8	10%	19.0	13%	189	17%	9.3	14%
Property and business serv.	27.6	8%	18.0	12%	102	9%	8.2	12%
Sardines	26.4	8%	20.1	14%	63	6%	5.9	9%
Manufacturing	12.6	4%	3.7	3%	43	4%	2.5	4%
Finance and insurance	12.6	4%	8.0	6%	29	3%	2.4	4%
Trade	12.1	4%	7.3	5%	85	8%	5.4	8%
Transport	7.3	2%	3.4	2%	32	3%	2.7	4%
Other Sectors [b]	48.4	15%	25.8	18%	252	23%	18.1	28%
Total Flow-on	*178.8*	*54%*	*105.3*	*73%*	*795*	*73%*	*54.5*	*83%*
Total [a]	**331.0**	**100%**	**145.1**	**100%**	**1,087**	**100%**	**65.7**	**100%**
Total/Direct	2.17		3.65		3.73		5.85	

[a] Note there is double counting in the total output contribution.

[b] E.g. accommodation, restaurants and cafes, utilities, communications, agriculture, forestry and fishing sectors.

Source: BDO EconSearch analysis

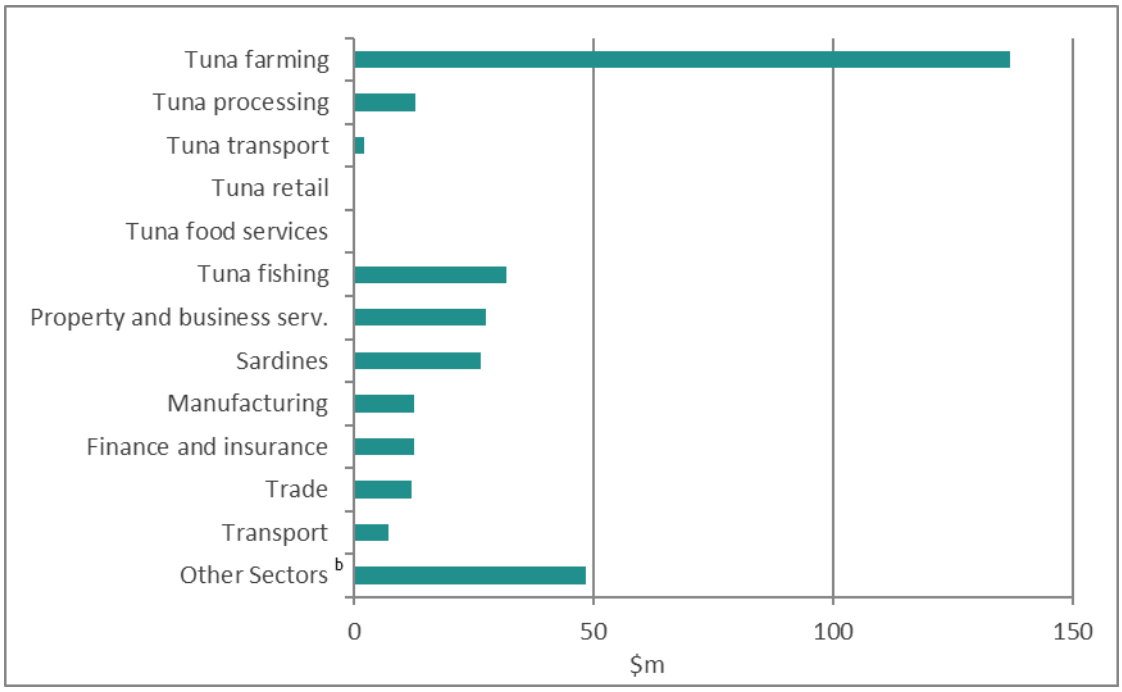
Contribution to gross state product...

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 $39.8m in 2019/20 ($35.6m from tuna farming and $4.2m from downstream activities). Associated with this was flow-on GSP in the other sectors of the state economy of $105.3m (Table 4-1). The flow-ons were greatest in the Sardine fishing ($20.1m), Tuna fishing ($19.0m), property and business services ($18.0m), finance and insurance ($8.0m), trade ($7.3m), manufacturing ($3.7m) and transport ($3.4m) sectors (Figure 4-2). The total contribution to GSP was approximately $145.1m in 2019/20.

The bottom row in Table 4-1 shows that for each one dollar contribution to GSP by the Tuna industry there was an additional $2.65 ($3.65 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, 2019/20 [a]

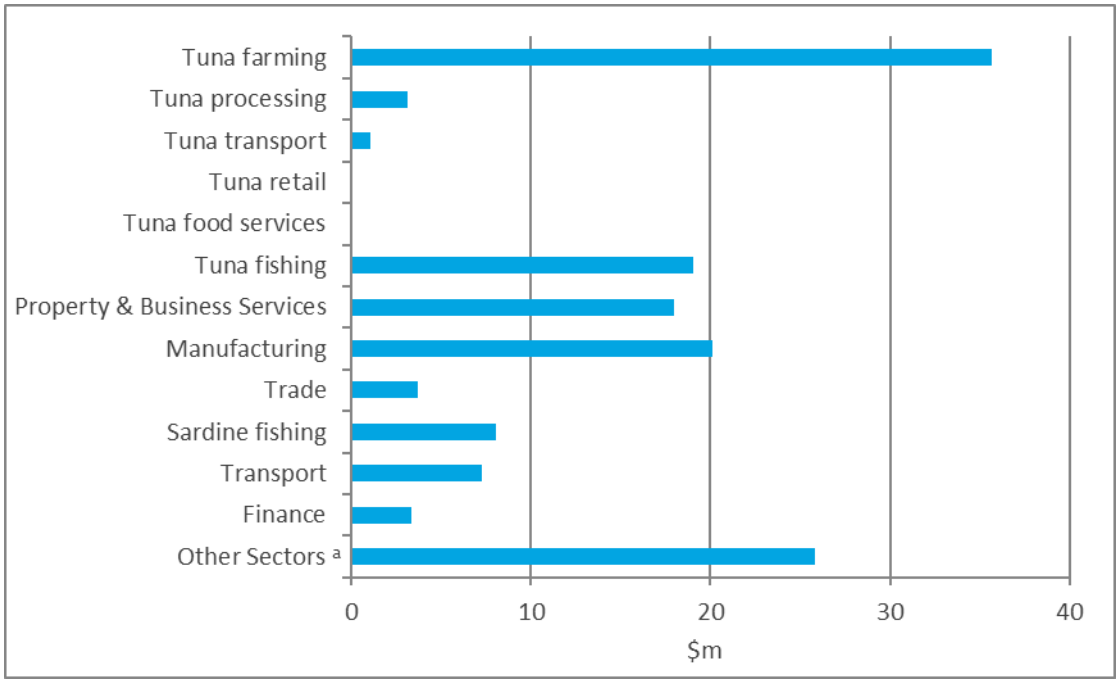


[a] Note there is double counting in the total output contribution.

[b] 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, 2019/20



[a] E.g. accommodation, restaurants and cafes, utilities, communications, agriculture, forestry and fishing sectors.

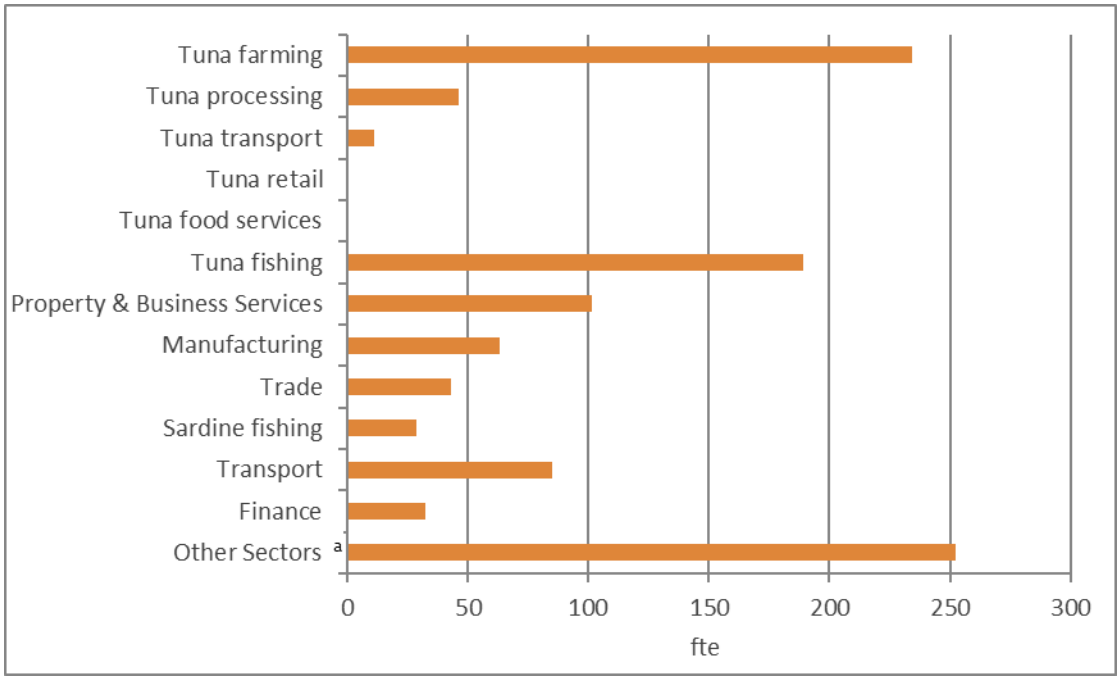
Source: BDO EconSearch analysis

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 234 full-time equivalents (fte) and, through associated processing and transport activities, another 57 fte in 2019/20 (Table 4-1). Flow-on business activity was estimated to generate a further 795 fte to give total employment of 1,087 fte in the state. The sectors of the economy with employment flow-ons from Tuna farming, processing and transport include the Tuna fishing (189 fte), property and business services (102), trade (85), Sardine fishing (63), and manufacturing (43) (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 2.73 jobs (3.73 jobs in total) in the rest of the state.

Figure 4-3 Tuna farming in South Australia, employment contributions by sector, 2019/20



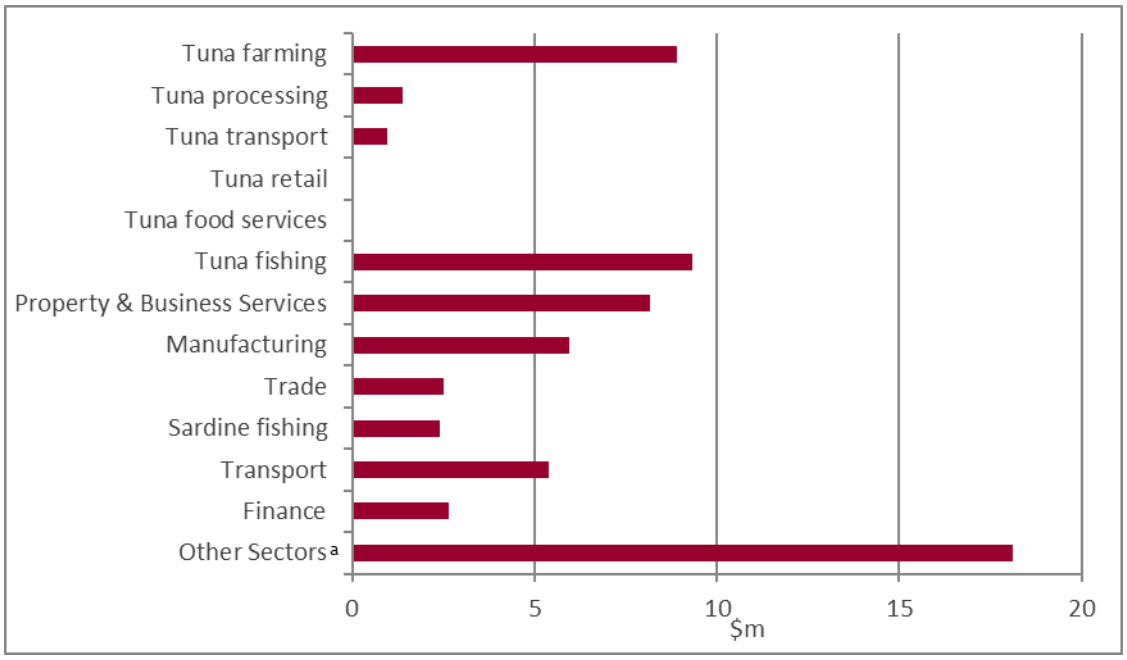
[a] E.g. accommodation, restaurants and cafes, utilities, communications, agriculture, forestry and fishing sectors.

Source: BDO EconSearch analysis

Personal income of $8.9m was earned in the Tuna farming sector and another $2.3m in downstream activities. This comprised both wages by employees and estimated drawings by owner/operators. An additional $54.5m 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 $65.7m (Figure 4-4).

For each $1.00 of household income generated directly by Tuna farming, processing and transport in 2019/20 there was an additional $4.85 ($5.85 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, 2019/20



[a] 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, 2019/20

Table 4-2 provides estimates of the economic contribution generated by Oyster farming in South Australia on a sector-by-sector basis in 2019/20. 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 $6.35m of spat sales and $1.37m 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 $24.9m in 2019/20 while output generated in SA by associated downstream activities (processing, transport, retail and food service) summed to $19.4m. Flow-ons to other sectors of the state economy added another $53.5m in output in 2019/20. 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, 2019/20 [a]

Sector	Output		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Oyster farming [b]	24.9	26%	19.0	32%	299	44%	14.4	38%
Processing	3.3	3%	0.8	1%	12	2%	0.4	1%
Transport	3.1	3%	1.4	2%	15	2%	1.3	3%
Retail	0.2	0%	0.1	0%	2	0%	0.1	0%
Food services	12.7	13%	6.9	12%	115	17%	5.0	13%
Total Direct	*44.3*	*45%*	*28.3*	*48%*	*443*	*65%*	*21.2*	*56%*
Flow-on effects								
Property and business serv	11.7	12%	8.0	14%	34	5%	2.6	7%
Manufacturing	5.6	6%	1.6	3%	18	3%	1.0	3%
Trade	6.5	7%	3.9	7%	46	7%	2.9	8%
Transport	2.6	3%	1.2	2%	11	2%	0.9	2%
Finance	5.5	6%	3.3	6%	13	2%	1.1	3%
Other Sectors	21.6	22%	13.0	22%	117	17%	8.1	21%
Total Flow-on	*53.5*	*55%*	*31.0*	*52%*	*239*	*35%*	*16.6*	*44%*
Total [c]	**97.8**	**100%**	**59.4**	**100%**	**682**	**100%**	**37.8**	**100%**
Total/Direct	2.21		2.10		1.54		1.78	

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

[b] Includes sales of adults but excludes sales of spat and on-grown oysters.

[c] 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 2019/20, total Oyster farming-related contribution to GSP in South Australia was approximately $59.4m, $19.0m generated by Oyster farming directly, $9.3m generated directly by downstream activities and $31.0m generated in other sectors of the state economy.

Employment and household income...

In 2019/20, SA Oyster farming was responsible for the direct employment of around 299 fte and downstream activities created employment for around 144 fte. Flow-on business activity was estimated to generate a further 239 fte to give total employment of 682 fte in the state. The flow-on jobs were concentrated in the trade (46 fte), property and business services (34 fte) and manufacturing (18 fte).

Personal income of around $14.4m was earned in the Oyster farming sector and another $6.8m in downstream activities. This comprised both wages by employees and estimated drawings by owner/operators. An additional $16.6m 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 $37.8m.

4.3. The Economic Contribution of Marine Finfish Farming in South Australia, 2019/20

Table 4-2 provides estimates of the economic contribution generated by Marine Finfish farming in South Australia on a sector-by-sector basis in 2019/20. As for Tuna and Oysters in the previous sections, contributions are measured in terms of output (business turnover), contribution to GSP, employment and household income.

Table 4-3 The economic contribution of Marine Finfish farming in South Australia, 2019/20

Sector	Output		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Marine finfish farming	39.6	37%	17.3	31%	81	18%	5.9	21%
Processing	3.4	3%	0.8	1%	12	3%	0.4	1%
Transport	3.4	3%	1.5	3%	17	4%	1.4	5%
Retail	1.3	1%	0.8	1%	12	3%	0.6	2%
Food services	9.1	8%	5.0	9%	83	19%	3.6	13%
Total Direct	*56.8*	*53%*	*25.5*	*46%*	*205*	*47%*	*11.9*	*42%*
Flow-on effects								
Property and business serv	9.6	9%	6.4	12%	31	7%	2.3	8%
Manufacturing	4.2	4%	1.2	2%	14	3%	0.8	3%
Trade	6.2	6%	3.8	7%	46	10%	2.8	10%
Transport	2.8	3%	1.3	2%	12	3%	1.0	4%
Finance	4.5	4%	2.8	5%	11	2%	0.9	3%
Other Sectors	23.6	22%	14.3	26%	120	27%	8.3	30%
Total Flow-on	*51.0*	*47%*	*29.8*	*54%*	*234*	*53%*	*16.0*	*58%*
Total [a]	**107.8**	**100%**	**55.3**	**100%**	**439**	**100%**	**27.9**	**100%**
Total/Direct	1.90		2.17		2.14		2.35	

[a] Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

Output contributions...

Direct output (business turnover) generated in SA by Marine Finfish farming enterprises summed to $39.6m in 2019/20 while output generated in SA by associated downstream activities (processing, transport, retail and food service) summed to $17.2m. Flow-ons to other sectors of the state economy added another $51.0m in output in 2019/20. The sectors most affected were the property and business services, finance, trade and manufacturing sectors.

Contribution to gross state product...

As noted above, contribution to GSP is calculated as the value of output less the cost of goods and services used in producing the output. In 2019/20, total Marine Finfish farming-related contribution to GSP in South Australia was approximately $55.3m, $17.3m generated by Marine Finfish farming directly, $8.2m generated directly by downstream activities and $29.8m generated in other sectors of the state economy.

Employment and household income...

In 2019/20, SA Marine Finfish farming was responsible for the direct employment of around 81 fte and downstream activities created employment for around 124 fte. Flow-on business activity was estimated to generate a further 234 fte to give total employment of 439 fte in the state. The flow-on jobs were concentrated in the trade (46 fte), property and business services (31 fte) and manufacturing (14 fte).

Personal income of around $5.9m was earned in the Marine Finfish farming sector and another $6.0m in downstream activities. This comprised both wages by employees and estimated drawings by owner/operators. An additional $16.0m 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 $27.9m.

4.4. The Economic Contribution of the Remaining Aquaculture Sectors in South Australia, 2019/20

The economic contributions of the remaining individual aquaculture sectors in South Australia in 2019/20 are reported in Table 4-4 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 4-4 The economic contribution of Mussel farming in South Australia, 2019/20

Sector	Output		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Mussel farming	3.5	22%	2.1	24%	29	31%	1.4	26%
Processing	0.9	6%	0.2	3%	3	4%	0.1	2%
Transport	0.6	4%	0.3	3%	3	3%	0.2	5%
Retail	0.5	3%	0.3	3%	4	4%	0.2	4%
Food services	1.7	11%	0.9	11%	15	17%	0.7	13%
Total Direct	*7.1*	*46%*	*3.8*	*44%*	*55*	*59%*	*2.6*	*50%*
Flow-on effects								
Property and business serv	1.7	11%	1.2	14%	6	6%	0.4	8%
Manufacturing	0.8	5%	0.2	3%	3	3%	0.2	3%
Trade	1.0	6%	0.6	7%	7	7%	0.4	8%
Transport	0.4	3%	0.2	2%	2	2%	0.1	3%
Finance	0.8	5%	0.5	6%	2	2%	0.2	3%
Other Sectors	3.7	24%	2.2	25%	19	21%	1.3	25%
Total Flow-on	*8.5*	*54%*	*4.9*	*56%*	*38*	*41%*	*2.6*	*50%*
Total [a]	**15.6**	**100%**	**8.7**	**100%**	**92**	**100%**	**5.2**	**100%**
Total/Direct	2.19		2.28		1.69		2.02	

[a] Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

Table 4-5 The economic contribution of Abalone[a] farming in South Australia, 2019/20 [a]

Sector	Output		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Abalone farming [a]	12.0	43%	3.8	29%	45	38%	1.8	27%
Processing	0.4	1%	0.1	1%	1	1%	0.0	1%
Transport	0.0	0%	0.0	0%	0	0%	0.0	0%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	0%	0.0	0%	0	0%	0.0	0%
Total Direct	*12.4*	*45%*	*3.9*	*30%*	*46*	*40%*	*1.8*	*28%*
Flow-on effects								
Property and business serv	2.1	7%	1.4	11%	6	5%	0.5	7%
Manufacturing	0.8	3%	0.2	2%	3	2%	0.2	2%
Trade	1.3	5%	0.8	6%	10	8%	0.6	9%
Transport	0.5	2%	0.2	2%	2	2%	0.2	3%
Finance	1.0	4%	0.6	5%	2	2%	0.2	3%
Other Sectors	9.6	35%	6.0	46%	47	41%	3.2	48%
Total Flow-on	*15.2*	*55%*	*9.3*	*70%*	*70*	*60%*	*4.7*	*72%*
Total [b]	**27.6**	**100%**	**13.2**	**100%**	**116**	**100%**	**6.6**	**100%**
Total/Direct	2.23		3.37		2.51		3.57	

[a] Abalone produced from marine and land-based aquaculture sites, i.e. the data represent species not class of licence.

[b] 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, 2019/20

Sector	Output		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Freshwater finfish farming	3.6	41%	1.9	38%	26	49%	1.1	39%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.4	4%	0.2	4%	2	4%	0.2	5%
Retail	0.1	1%	0.0	1%	1	1%	0.0	1%
Food services	0.5	6%	0.3	6%	4	8%	0.2	7%
Total Direct	*4.5*	*52%*	*2.3*	*48%*	*33*	*62%*	*1.5*	*53%*
Flow-on effects								
Property and business serv	0.9	11%	0.6	13%	3	5%	0.2	7%
Manufacturing	0.4	4%	0.1	2%	1	2%	0.1	3%
Trade	0.6	7%	0.4	8%	5	9%	0.3	9%
Transport	0.3	3%	0.1	2%	1	2%	0.1	3%
Finance	0.5	5%	0.3	6%	1	2%	0.1	3%
Other Sectors	1.6	18%	1.0	20%	9	17%	0.6	22%
Total Flow-on	*4.2*	*48%*	*2.5*	*52%*	*20*	*38%*	*1.4*	*47%*
Total [a]	**8.8**	**100%**	**4.8**	**100%**	**53**	**100%**	**2.9**	**100%**
Total/Direct	1.93		2.07		1.60		1.90	

[a] 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, 2019/20

Sector	Output		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Marron/yabbies farming	0.1	32%	0.1	27%	5	77%	0.1	36%
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	0.1	13%	0.0	13%	0	7%	0.0	14%
Total Direct	*0.2*	*46%*	*0.1*	*41%*	*5*	*85%*	*0.1*	*51%*
Flow-on effects								
Property and business serv	0.0	12%	0.0	16%	0	3%	0.0	9%
Manufacturing	0.0	5%	0.0	3%	0	1%	0.0	3%
Trade	0.0	7%	0.0	8%	0	3%	0.0	9%
Transport	0.0	3%	0.0	2%	0	1%	0.0	3%
Finance	0.0	5%	0.0	6%	0	1%	0.0	3%
Other Sectors	0.1	21%	0.1	24%	0	7%	0.0	23%
Total Flow-on	*0.2*	*54%*	*0.1*	*59%*	*1*	*15%*	*0.1*	*49%*
Total [a]	**0.4**	**100%**	**0.2**	**100%**	**6**	**100%**	**0.1**	**100%**
Total/Direct	2.18		2.47		1.18		1.97	

[a] 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, 2019/20 [a]

Sector	Output		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Other aquaculture	8.3	60%	3.9	54%	5	16%	0.2	12%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.0	0%	0.0	0%	0	0%	0.0	0%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	0%	0.0	0%	0	0%	0.0	0%
Total Direct	*8.3*	*60%*	*3.9*	*54%*	*5*	*16%*	*0.2*	*12%*
Flow-on effects								
Property and business serv	0.8	6%	0.5	8%	3	10%	0.2	12%
Manufacturing	0.3	2%	0.1	1%	1	3%	0.1	3%
Trade	0.6	4%	0.4	5%	5	15%	0.3	13%
Transport	0.2	2%	0.1	2%	1	4%	0.1	4%
Finance	0.4	3%	0.3	4%	1	3%	0.1	4%
Other Sectors	3.0	22%	1.9	27%	15	49%	1.0	52%
Total Flow-on	*5.4*	*40%*	*3.3*	*46%*	*26*	*84%*	*1.8*	*88%*
Total [b]	**13.7**	**100%**	**7.1**	**100%**	**31**	**100%**	**2.0**	**100%**
Total/Direct	1.66		1.85		6.17		8.36	

[a] Other aquaculture production in 2019/20 was mostly comprised of land-based Algae production. The downstream contributions of other aquaculture production are unknown and have been excluded from the analysis.

[b] 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, 2019/20

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, 2019/20

	Production (kg)	Value of Production ($'000)
Southern Bluefin Tuna	8,345,000	137,000
Marine Finfish	3,067,991	39,608
Oysters	2,091,407	19,130
Mussels	1,736,788	3,472
Abalone	141,050	5,924
Freshwater Finfish	194	2
Marron and Yabbies	432	18
Other	1,100,782	8,256
Total	**16,483,644**	**213,409**

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 2019/20 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, 2019/20

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Aquaculture production	213.4	49%	75.4	38%	545	36%	25.8	29%
Aquaculture downstream	27.8	6%	8.9	4%	112	7%	5.7	6%
Total Direct	241.2	56%	84.4	42%	658	44%	31.5	36%
Flow-on effects								
Tuna Fishing	31.8	7%	20.3	10%	188	12%	10.4	12%
Other Sectors	160.1	37%	95.1	48%	663	44%	46.7	53%
Total Flow-on	191.9	44%	115.4	58%	851	56%	57.1	64%
Total [a]	433.0	100%	199.8	100%	1,509	100%	88.7	100%

[a] 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, 2019/20

Estimates of the economic contribution of Tuna farming in the Eyre Peninsula region of South Australia in 2019/20 are reported in Table 5-3.

Table 5-3 The economic contribution of Tuna farming in the Eyre Peninsula Region, 2019/20

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Tuna farming	137.0	47%	35.6	29%	234	27%	8.9	17%
Processing	12.9	4%	3.1	3%	44	5%	1.3	3%
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%
Total Direct	*152.2*	*53%*	*39.8*	*33%*	*289*	*33%*	*11.1*	*22%*
Flow-on effects								
Tuna fishing	31.8	11%	20.3	17%	188	21%	10.4	20%
Property and business serv.	17.3	6%	11.6	10%	53	6%	4.3	8%
Sardines	26.4	9%	26.4	22%	63	7%	5.9	12%
Manufacturing	8.7	3%	2.6	2%	34	4%	1.9	4%
Finance and insurance	5.2	2%	3.9	3%	10	1%	0.8	2%
Trade	9.0	3%	5.4	4%	65	7%	4.1	8%
Transport	8.7	3%	4.2	3%	33	4%	2.7	5%
Other Sectors [b]	29.1	10%	7.4	6%	144	16%	9.8	19%
Total Flow-on	*136.3*	*47%*	*81.8*	*67%*	*590*	*67%*	*40.0*	*78%*
Total [a]	**288.5**	**100%**	**121.6**	**100%**	**879**	**100%**	**51.2**	**100%**
Total/Direct	1.90		3.05		3.04		4.60	

[a] 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 $137.0m and in other sectors (processing and transport), $15.2m in 2019/20. Flow-on output in other sectors summed to $136.3m. 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 1.90 indicates that for each dollar of sales generated directly by Tuna farming, processing and transport there was a total of $1.90 of output generated by businesses throughout the Eyre Peninsula region, $1.00 in Tuna farming, processing and transport and $0.90 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 $39.8m in 2019/20 ($35.6m directly by Tuna farming and $4.2m by downstream businesses). Flow-on GRP generated in the other sectors of the regional economy was $81.8m in 2019/20.

The flow-ons were greatest in the Sardine fishing ($26.4m), Tuna fishing ($20.3m), and property and business services ($11.6m) sectors. The total contribution to GSP was approximately $121.6m in 2019/20.

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 $2.05 ($3.05 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 234 fte and associated processing and transport, approximately 55 fte in the Eyre Peninsula region in 2019/20. Flow-on business activity was estimated to have generated a further 590 fte jobs locally to give total employment of approximately 879 fte in the region. The sectors of the local economy with employment flow-ons from Tuna farming, processing and transport included the Tuna fishing (188 fte), trade (65), Sardine fishing (63) and property and business services (53) 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 2.04 jobs (3.04 jobs in total) in the rest of the region.

Personal income of $8.9m was earned in the Tuna farming sector and another $2.2m in downstream activities. This comprised both wages by employees and estimated drawings by owner/operators. An additional $40.0m 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 $51.2m. For each $1.00 of household income generated directly by Tuna farming, processing and transport in 2019/20 there was an additional $3.60 ($4.60 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, 2019/20

Estimates of the economic contribution of Oyster farming in the Eyre Peninsula region in 2019/20 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 $19.1m in 2019/20 while output generated in the Eyre Peninsula region by associated downstream activities (processing, transport, retail and food service) summed to $3.5m. Flow-ons to other sectors of the regional economy added another $14.1m in output in 2019/20. 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 $24.6m in 2019/20, $14.6m generated by Oyster farming directly, $1.5m generated by downstream activities and $8.5m generated in other sectors of the regional economy.

Employment and household income...

In 2019/20 in the Eyre Peninsula region, Oyster farming was responsible for the direct employment of approximately 165 fte and associated downstream activities created employment for an additional 18 fte.

Flow-on business activity was estimated to generate a further 67 fte. The total employment contribution was 250 fte.

In 2019/20, personal income of $9.2m 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 $4.4m of household income was earned in other local businesses as a result of Oyster industry operations. The total household income contribution was around $13.6m.

Table 5-4 The economic contribution of Oyster farming in the Eyre Peninsula region, 2019/20 [a]

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Oyster farming [b]	19.1	52%	14.6	59%	165	66%	8.0	59%
Processing	0.6	2%	0.2	1%	2	1%	0.1	0%
Transport	2.4	7%	1.1	4%	11	5%	1.0	7%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.5	1%	0.3	1%	4	2%	0.2	1%
Total Direct	*22.7*	*62%*	*16.1*	*65%*	*183*	*73%*	*9.2*	*68%*
Flow-on effects								
Property and business serv.	3.3	9%	2.4	10%	6	3%	0.5	4%
Manufacturing	0.8	2%	0.2	1%	3	1%	0.2	1%
Trade	2.0	6%	1.2	5%	16	6%	0.9	7%
Transport	1.2	3%	0.6	2%	4	2%	0.4	3%
Finance	0.7	2%	0.5	2%	1	1%	0.1	1%
Other Sectors	6.0	16%	3.5	14%	35	14%	2.3	17%
Total Flow-on	*14.1*	*38%*	*8.5*	*35%*	*67*	*27%*	*4.4*	*32%*
Total [c]	**36.7**	**100%**	**24.6**	**100%**	**250**	**100%**	**13.6**	**100%**
Total/Direct	1.7		1.6		1		1.5	

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

[b] Includes sales of adults but excludes sales of spat and on-grown oysters.

[c] Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

5.3. The Economic Contribution of Marine Finfish Farming in the Eyre Peninsula Region, 2019/20

Estimates of the economic contribution of Marine Finfish farming in the Eyre Peninsula region in 2019/20 are reported in Table 5-5. 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 Marine Finfish farming enterprises in the Eyre Peninsula region summed to approximately $39.6m in 2019/20 while output generated in the Eyre Peninsula region by associated downstream activities (processing, transport, retail and food service) summed to $7.3m. Flow-ons to other sectors of the regional economy added another $27.7m in output in 2019/20. The sectors most affected were the property and business services and trade sectors (Table 5-5).

Table 5-5 The economic contribution of Marine Finfish farming in the Eyre Peninsula region, 2019/20

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)	%	($m)	%	(fte)	%	($m)	%
Direct effects								
Marine finfish farming	39.6	53%	17.3	47%	81	33%	5.9	36%
Processing	3.4	5%	0.8	2%	11	5%	0.3	2%
Transport	3.4	5%	1.5	4%	16	7%	1.4	8%
Retail	0.1	0%	0.0	0%	1	0%	0.0	0%
Food services	0.5	1%	0.2	1%	4	2%	0.2	1%
Total Direct	*46.9*	*63%*	*20.0*	*54%*	*113*	*46%*	*7.8*	*48%*
Flow-on effects								
Property and business serv.	4.2	6%	3.0	8%	10	4%	0.7	4%
Manufacturing	1.1	1%	0.3	1%	4	2%	0.2	1%
Trade	3.8	5%	2.3	6%	31	13%	1.8	11%
Transport	2.6	3%	1.2	3%	10	4%	0.8	5%
Finance	1.2	2%	0.9	2%	2	1%	0.2	1%
Other Sectors	14.8	20%	9.0	24%	74	30%	4.8	30%
Total Flow-on	*27.7*	*37%*	*16.8*	*46%*	*131*	*54%*	*8.5*	*52%*
Total [a]	**74.6**	**100%**	**36.7**	**100%**	**244**	**100%**	**16.4**	**100%**
Total/Direct	1.6		1.8		2		2.1	

[a] Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

Contribution to gross regional product...

Total Marine Finfish farming-related contribution to GRP in the Eyre Peninsula region was $36.7m in 2019/20, $17.3m generated by Marine Finfish farming directly, $2.7m generated by downstream activities and $16.8m generated in other sectors of the regional economy.

Employment and household income...

In 2019/20 in the Eyre Peninsula region, Marine Finfish farming was responsible for the direct employment of approximately 81 fte and associated downstream activities created employment for an additional 32 fte. Flow-on business activity was estimated to generate a further 74 fte. The total employment contribution was 244 fte.

In 2019/20, personal income of $7.8m was earned in Marine Finfish farming and downstream activities in the Eyre Peninsula region comprising both wages by employees and estimated drawings by owner/operators. An additional $8.5m of household income was earned in other local businesses as a result of Oyster industry operations. The total household income contribution was around $16.4m.

5.4. The Economic Contribution of the Remaining Aquaculture Sectors in the Eyre Peninsula Region, 2019/20

The economic contributions of other aquaculture sectors in the Eyre Peninsula region in 2019/20 (i.e. Marine Finfish, Mussels, Abalone, Freshwater Finfish, Marron and Yabbies and other aquaculture enterprises) are reported in aggregate in Table 5-6. 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 5-6 The economic contribution of the remaining aquaculture sectors [a] in the Eyre Peninsula region, 2019/20 [b]

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Remaining aquaculture	17.7	53%	7.9	47%	64	47%	3.0	39%
Processing	1.1	3%	0.3	2%	4	3%	0.1	1%
Transport	0.6	2%	0.3	2%	3	2%	0.2	3%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.1	0%	0.0	0%	1	1%	0.0	0%
Total Direct	*19.5*	*59%*	*8.5*	*50%*	*72*	*53%*	*3.4*	*45%*
Flow-on effects								
Property and business serv.	1.9	6%	1.4	8%	4	3%	0.3	4%
Manufacturing	0.6	2%	0.2	1%	2	2%	0.1	2%
Trade	1.5	5%	0.9	5%	12	9%	0.7	9%
Transport	0.9	3%	0.4	3%	3	3%	0.3	4%
Finance	0.6	2%	0.4	3%	1	1%	0.1	1%
Other Sectors	8.2	25%	5.0	30%	40	30%	2.7	35%
Total Flow-on	*13.8*	*41%*	*8.4*	*50%*	*64*	*47%*	*4.2*	*55%*
Total [c]	**33.2**	**100%**	**16.9**	**100%**	**135**	**100%**	**7.6**	**100%**
Total/Direct	1.7		2.0		2		2.3	

[a] Includes Mussels, Abalone, Freshwater Finfish, Marron and Yabby farming and Other aquaculture enterprises.

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

[c] Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

6. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE WEST COAST REGION, 2019/20

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, 2019/20

	Production (kg)	Value of Production ($'000)
Southern Bluefin Tuna	0	0
Marine Finfish	0	0
Oysters	541,093	5,530
Mussels	0	0
Abalone	0	0
Freshwater Finfish	0	0
Marron and Yabbies	0	0
Other	0	0
Total	**541,093**	**5,530**

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of aquaculture in the West Coast region of SA in 2019/20 (Oysters only) are reported 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 $5.5m and associated downstream activities, $1.0m in the West Coast region in 2019/20. Flow-on output in other sectors of the regional economy summed to $5.4m in 2019/20. 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 $8.0m in 2019/20, $4.2m generated by aquaculture directly, $0.4m generated in associated downstream activities and $3.3m generated in other sectors of the regional economy.

Employment and household income...

Aquaculture and downstream activities were responsible for the direct employment of 115 fte in 2019/20 in the West Coast region. Flow-on business activity was estimated to generate a further 26 fte. The total employment contribution was 141 fte.

In 2019/20, personal income of $4.2m 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 $1.7m of household income was earned in other local businesses as a result of aquaculture industry operations. Total household income contribution was $5.9m in 2019/20.

Table 6-2 The economic contribution of aquaculture [a] in the West Coast region, 2019/20 [b]

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Aquaculture	5.5	46%	4.2	53%	110	78%	3.9	66%
Processing	0.2	2%	0.0	1%	1	0%	0.0	0%
Transport	0.7	6%	0.3	4%	3	2%	0.3	5%
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%
Total Direct	*6.5*	*55%*	*4.7*	*58%*	*115*	*82%*	*4.2*	*72%*
Flow-on effects								
Property and business serv.	1.3	11%	1.0	12%	2	2%	0.2	3%
Manufacturing	0.3	3%	0.1	1%	1	1%	0.1	1%
Trade	0.8	7%	0.5	6%	7	5%	0.4	7%
Transport	0.5	4%	0.2	3%	2	1%	0.1	2%
Finance	0.3	2%	0.2	3%	1	0%	0.0	1%
Other Sectors	2.2	19%	1.3	16%	13	10%	0.9	15%
Total Flow-on	*5.4*	*45%*	*3.3*	*42%*	*26*	*18%*	*1.7*	*28%*
Total [c]	**12.0**	**100%**	**8.0**	**100%**	**141**	**100%**	**5.9**	**100%**
Total/Direct	1.9		1.7		1		1.4	

[a] Predominantly Oysters.

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

[c] Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

7. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE YORKE PENINSULA REGION, 2019/20

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, 2019/20

	Production (kg)	Value of Production ($'000)
Southern Bluefin Tuna	0	0
Marine Finfish	0	0
Oysters	3,155	45
Mussels	0	0
Abalone	0	0
Freshwater Finfish	48	1
Marron and Yabbies	1,129	29
Other	2	1
Total	**4,334**	**76**

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of aquaculture in the Yorke Peninsula region of SA in 2019/20 (i.e. Oysters, Freshwater Finfish and Marron/Yabby enterprises and other aquaculture) 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 $0.7m in 2019/20, $0.1m generated by aquaculture directly and $0.7m 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 $0.4m in 2019/20, $0.1m generated by aquaculture directly and just under $0.4m 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 18 fte in 2019/20 in the Yorke Peninsula region. Flow-on business activity was estimated to generate 3 fte. The total employment contribution was 21 fte.

In 2019/20, personal income of less than $0.6m was earned in aquaculture and downstream activities in the Yorke Peninsula region comprising both wages by employees and estimated drawings by owner/operators.

Approximately $0.2m of household income was earned in other local businesses as a result of aquaculture industry operations. Total household income contribution was $0.8m in 2019/20.

Table 7-2 The economic contribution of aquaculture [a] in the Yorke Peninsula region, 2019/20 [b]

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Aquaculture	0.1	10%	0.0	11%	18	85%	0.6	76%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.0	1%	0.0	1%	0	0%	0.0	0%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	0%	0.0	0%	0	0%	0.0	0%
Total Direct	*0.1*	*12%*	*0.1*	*12%*	*18*	*86%*	*0.6*	*76%*
Flow-on effects								
Property and business serv.	0.2	21%	0.1	26%	0	1%	0.0	2%
Manufacturing	0.1	8%	0.0	4%	0	1%	0.0	1%
Trade	0.1	10%	0.0	11%	1	3%	0.0	4%
Transport	0.0	6%	0.0	5%	0	1%	0.0	2%
Finance	0.1	10%	0.0	10%	0	1%	0.0	2%
Other Sectors	0.2	33%	0.1	33%	1	7%	0.1	12%
Total Flow-on	*0.7*	*88%*	*0.4*	*88%*	*3*	*14%*	*0.2*	*24%*
Total [c]	**0.7**	**100%**	**0.4**	**100%**	**21**	**100%**	**0.8**	**100%**
Total/Direct	8.9		8.6		1		1.3	

[a] Includes Oysters, Freshwater Finfish, Marron/Yabby and other aquaculture farming enterprises.

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

[c] Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

8. THE ECONOMIC CONTRIBUTION OF AQUACULTURE ON KANGAROO ISLAND, 2019/20

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, 2019/20

	Production (kg)	Value of Production ($'000)
Southern Bluefin Tuna	0	0
Marine Finfish	0	0
Oysters	23,600	242
Mussels	0	0
Abalone	144,000	6,048
Freshwater Finfish	150	2
Marron and Yabbies	1,417	78
Other	0	0
Total	**169,167**	**6,371**

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of aquaculture on Kangaroo Island (KI) in 2019/20 (i.e. Abalone, Oysters, Marron/Yabby farming and Freshwater Finfish 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 $6.4m and associated downstream activities, $0.3m on KI in 2019/20. Flow-on output in other sectors of the regional economy summed to $5.6m in 2019/20. 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 $5.7m in 2019/20, $2.1m generated by aquaculture directly, $0.1m generated in associated downstream activities and $3.5m generated in other sectors of the regional economy.

Employment and household income...

Aquaculture and downstream activities were responsible for the direct employment of 27 fte in 2019/20 on KI region. Flow-on business activity was estimated to generate a further 26 fte. The total employment contribution was 53 fte.

In 2019/20, personal income of $1.4m was earned in aquaculture and downstream activities on KI comprising both wages by employees and estimated drawings by owner/operators. An additional $1.8m of household

income was earned in other local businesses as a result of aquaculture industry operations. The total household income contribution was approximately $3.2m in 2019/20.

Table 8-2 The economic contribution of aquaculture [a] on KI, 2019/20 [b]

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Aquaculture	6.4	52%	2.1	37%	26	48%	1.3	42%
Processing	0.2	2%	0.0	1%	1	2%	0.0	1%
Transport	0.1	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%
Total Direct	*6.6*	*54%*	*2.2*	*39%*	*27*	*51%*	*1.4*	*44%*
Flow-on effects								
Property and business serv.	0.6	5%	0.4	7%	2	3%	0.1	3%
Manufacturing	0.2	2%	0.1	1%	1	2%	0.0	2%
Trade	0.5	4%	0.3	5%	4	8%	0.2	7%
Transport	0.2	2%	0.1	1%	1	1%	0.1	2%
Finance	0.3	2%	0.2	3%	1	1%	0.1	2%
Other Sectors	3.8	31%	2.5	43%	18	34%	1.3	41%
Total Flow-on	*5.6*	*46%*	*3.5*	*61%*	*26*	*49%*	*1.8*	*56%*
Total [c]	**12.2**	**100%**	**5.7**	**100%**	**53**	**100%**	**3.2**	**100%**
Total/Direct	1.8		2.6		2		2.3	

[a] Includes Abalone, Oysters, Freshwater Finfish and Marron/Yabby farming enterprises.

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

[c] Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

9. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE ADELAIDE AND HILLS REGION, 2019/20

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, 2019/20

	Production (kg)	Value of Production ($'000)
Southern Bluefin Tuna	0	0
Marine Finfish	0	0
Oysters	0	0
Mussels	0	0
Abalone	0	0
Freshwater Finfish	91,634	886
Marron and Yabbies	14	1
Other	0	0
Total	**91,647**	**886**

Source: Table 3-2 and Table 3-4

Estimates of the economic contribution of aquaculture in the Adelaide and Hills region of SA in 2019/20 (i.e. Freshwater Finfish and Marron and Yabby 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 $0.9m and associated downstream activities, $0.1m in the Adelaide and Hills region in 2019/20. Flow-on output in other sectors of the regional economy summed to $0.7m in 2019/20. 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 $0.9m in 2019/20, $0.5m generated by aquaculture directly and $0.4m generated in other sectors of the regional economy.

Employment and household income...

Aquaculture and downstream activities were responsible for the direct employment of 14 fte in 2019/20 in the Adelaide and Hills region. Flow-on business activity was estimated to generate a further 4 fte. The total employment contribution was 18 fte.

In 2019/20, personal income of $0.7m 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 $0.2m of household income was earned in other local businesses as a result of aquaculture industry operations. The total household income contribution was $0.9m in 2019/20.

Table 9-2 The economic contribution of aquaculture [a] in the Adelaide and Hills region, 2019/20 [b]

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Aquaculture	0.9	51%	0.5	48%	14	76%	0.7	71%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.1	5%	0.0	5%	0	3%	0.0	4%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	0%	0.0	0%	0	0%	0.0	0%
Total Direct	*1.0*	*57%*	*0.5*	*53%*	*14*	*79%*	*0.7*	*75%*
Flow-on effects								
Property and business serv.	0.2	11%	0.1	15%	1	3%	0.0	4%
Manufacturing	0.1	3%	0.0	2%	0	1%	0.0	1%
Trade	0.1	8%	0.1	9%	1	7%	0.1	7%
Transport	0.0	2%	0.0	2%	0	1%	0.0	2%
Finance	0.0	3%	0.0	3%	0	1%	0.0	1%
Other Sectors	0.3	15%	0.2	16%	2	9%	0.1	10%
Total Flow-on	*0.7*	*43%*	*0.4*	*47%*	*4*	*21%*	*0.2*	*25%*
Total [c]	**1.7**	**100%**	**0.9**	**100%**	**18**	**100%**	**0.9**	**100%**
Total/Direct	1.8		1.9		1.3		1.3	

[a] Includes Freshwater Finfish and Marron/Yabby farming enterprises.

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

[c] Note there is double counting in the total output contribution.

Source: BDO EconSearch analysis

10. THE ECONOMIC CONTRIBUTION OF AQUACULTURE IN THE MURRAYLANDS AND SOUTH EAST REGION, 2019/20

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, 2019/20

	Production (kg)	Value of Production ($)
Southern Bluefin Tuna	0	0
Marine Finfish	0	0
Oysters	0	0
Mussels	0	0
Abalone	0	0
Freshwater Finfish	181,912	2,706,504
Marron and Yabbies	2	97
Other	0	0
Total	**181,914**	**2,706,601**

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 2019/20 (Freshwater Finfish enterprises only) 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 $2.7m and associated downstream activities, less than $0.3m in the Murraylands and South East region in 2019/20. Flow-on output in other sectors of the regional economy summed to $1.4m in 2019/20 (Table 10-2).

Contribution to gross regional product...

Total aquaculture-related contribution to gross regional product in the Murraylands and South East region was $2.4m in 2019/20, $1.5m generated by aquaculture directly and in associated downstream activities and $0.8m 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 2019/20 in the Murraylands and South East region. Flow-on business activity was estimated to generate a further 7 fte. The total employment contribution was 19 fte.

In 2019/20, personal income of $0.6m 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 $0.4m of household income was earned in other local businesses as a result of aquaculture industry operations. The total household income contribution was $1.1m in 2019/20.

Table 10-2 The economic contribution of aquaculture [a] in the Murraylands and South East region, 2019/20 [b]

Sector	Output		Contribution to GRP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Direct effects								
Aquaculture	2.7	61%	1.4	59%	11	56%	0.5	47%
Processing	0.0	0%	0.0	0%	0	0%	0.0	0%
Transport	0.3	6%	0.1	6%	1	7%	0.1	12%
Retail	0.0	0%	0.0	0%	0	0%	0.0	0%
Food services	0.0	0%	0.0	0%	0	1%	0.0	1%
Total Direct	*3.0*	*68%*	*1.5*	*65%*	*12*	*64%*	*0.6*	*60%*
Flow-on effects								
Property and business serv.	0.3	7%	0.2	9%	1	4%	0.1	5%
Manufacturing	0.1	2%	0.0	1%	0	2%	0.0	2%
Trade	0.3	6%	0.2	7%	2	11%	0.1	11%
Transport	0.1	3%	0.1	2%	1	3%	0.0	4%
Finance	0.1	3%	0.1	3%	0	2%	0.0	3%
Other Sectors	0.5	12%	0.3	13%	3	15%	0.2	15%
Total Flow-on	*1.4*	*32%*	*0.8*	*35%*	*7*	*36%*	*0.4*	*40%*
Total [c]	**4.4**	**100%**	**2.4**	**100%**	**19**	**100%**	**1.1**	**100%**
Total/Direct	1.5		1.6		2		1.7	

[a] Freshwater Finfish and Marron and Yabby production.

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

[c] Note there is double counting in the total output 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 $0.39m and in 2018/19 there were 5,500 visitors for a value of $0.61m. Aquaculture tourism activity fell in 2019/20 to 2,500 visitors principally in response to the Covid-19 pandemic.

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 the South Australian Research and Development Institute) and education resources (e.g. the Marine Science Centre at Port Lincoln) 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. Other schools that are licensed for aquaculture and offer aquaculture courses are Ceduna Area School, Port Lincoln High School, Kingston Community School, Lucindale Area School and the Kangaroo Island Community Education. 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 2019/20

Estimates of the economic contribution of aquaculture on the South Australian economy for the period 1997/98 to 2019/20, 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.

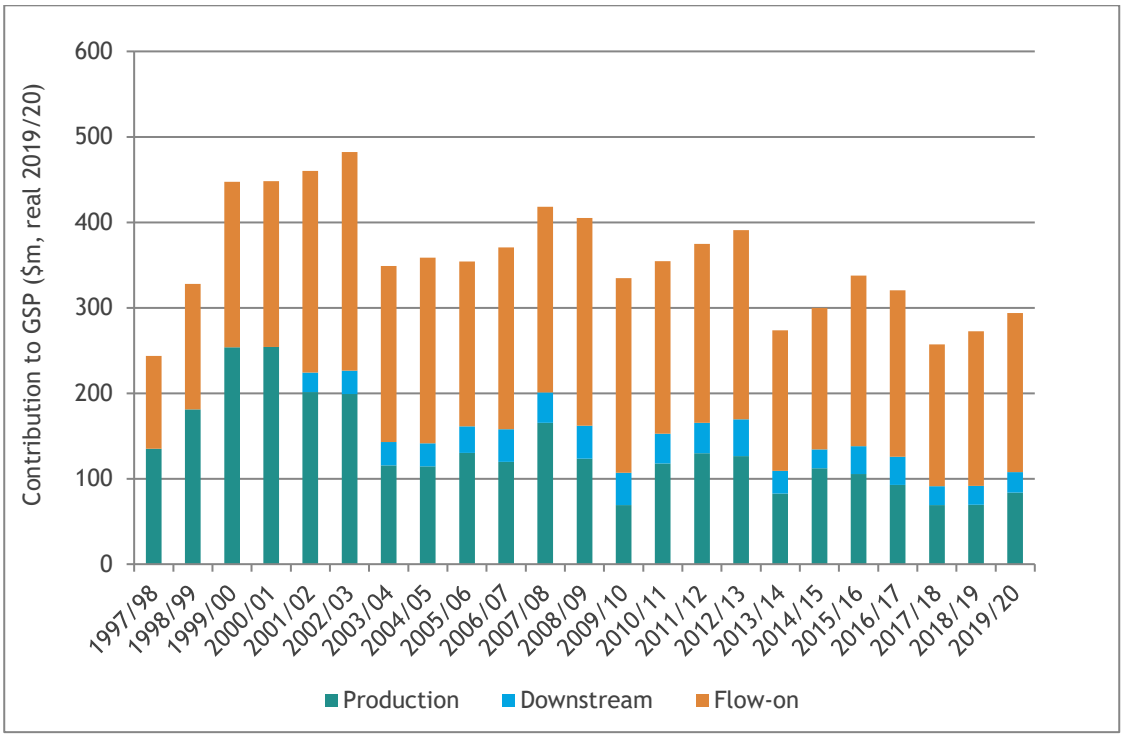
It is important to note that some of the variability in the GSP and employment contributions of SA aquaculture over the period 1997/98 to 2019/20 is a function of changes in methodology. Most significantly, as discussed in Section 2.1 of the report, estimates for the period 1997/98 to 2000/01 exclude 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 2019/20 (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 2016/17 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 8 per cent in 2019/20 as a result of an increase in value in the Tuna, Oyster and Other Aquaculture sectors.

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 2,506 fte jobs in 2019/20 driven by the increase in production over this period.

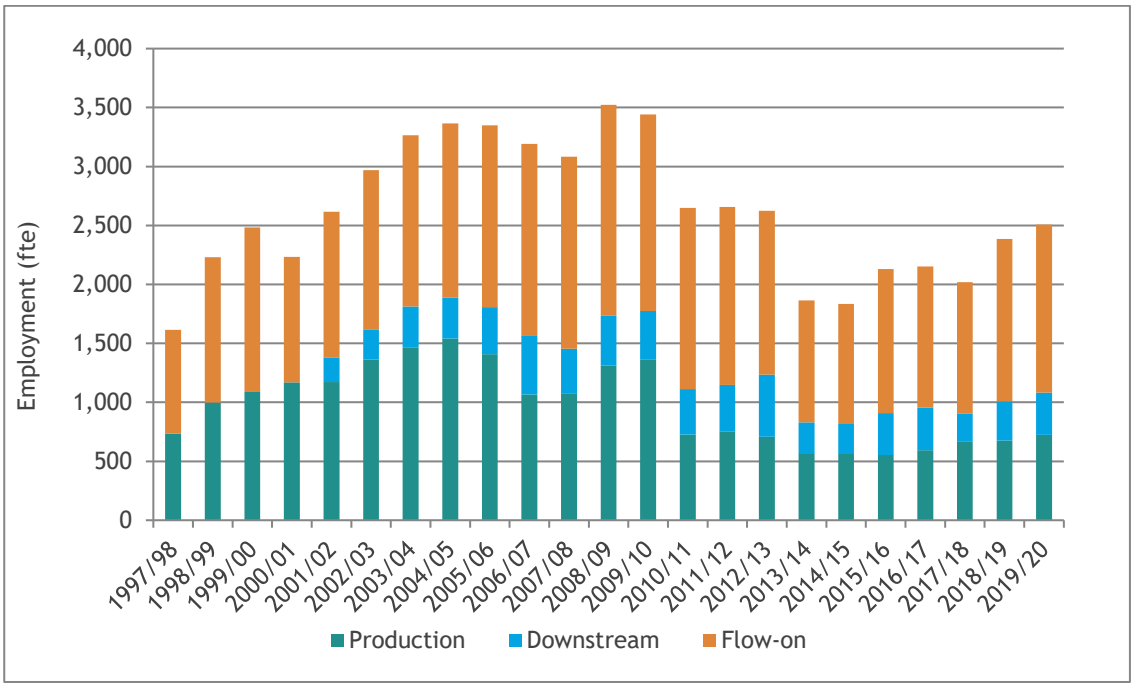
Figure 12-1 Total GSP contribution of aquaculture in SA, 1997/98 to 2019/20 [a]



[a] 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 2019/20 terms.

Source: BDO EconSearch (2020a), Table ES-2 and ABS (2020)

Figure 12-2 Total employment contribution of aquaculture in SA, 1997/98 to 2019/20 [a]



[a] 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 (2020a) and Table ES-2

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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 2019/20

Appendix Table 1-1 Farmed Tuna production, SA, 1995/96 to 2019/20

	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	5,294	8,252	129.0
2019/20	4,570	8,345	137.0

Source: ABARES and Brian Jeffriess (pers. comm. 18/01/2021)

Appendix Table 1-2 Oyster production, SA, 1994/95 to 2019/20 [a]

	Production [b]	Value ($'000)		
	Number ('000 doz.)	Adult	Spat	Total [c]
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
2019/20	2,659	24,948	6,346	24,948

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

[b] Adult Oysters only. Excludes the volume of spat and juvenile Oysters sold for on-growing.

[c] 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, 1994/95 to 2019/20 [a]

	Marine Finfish		Mussels		Abalone		Freshwater Finfish		Marron and Yabbies		Other [b]		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
2019/20	3,068	39,608	1,737	3,472	285	9,128	274	3,597	3	126	1,101	8,257	6,468	64,187	2,500	410

[a] 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.

[b] Other aquaculture production is comprised predominantly of land-based 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 2018/19

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%
Total (SA)	**577.5**	**100.0%**	**303.8**	**100.0%**	**2,617**	**100.0%**	**94.4**	**100.0%**

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%
Total (SA)	**641.5**	**100.0%**	**330.8**	**100.0%**	**2,969**	**100.0%**	**107.4**	**100.0%**

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%
Total (SA)	**502.9**	**100.0%**	**246.2**	**100.0%**	**3,264**	**100.0%**	**123.9**	**100.0%**

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%
Total (SA)	**518.2**	**100.0%**	**258.7**	**100.0%**	**3,366**	**100.0%**	**126.5**	**100.0%**

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%
Total (SA)	**550.1**	**100.0%**	**265.1**	**100.0%**	**3,348**	**100.0%**	**122.4**	**100.0%**

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%
Total (SA)	**593.8**	**100.0%**	**282.4**	**100.0%**	**3,192**	**100.0%**	**138.9**	**100.0%**

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%	1105	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%
Total (SA)	**656.9**	**100.0%**	**333.0**	**100.0%**	**3,083**	**100.0%**	**143.7**	**100.0%**

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%	1211	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%
Total (SA)	**689.2**	**100.0%**	**327.6**	**100.0%**	**3,523**	**100.0%**	**163.8**	**100.0%**

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

Sector	Output		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%	1259	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%
Total (SA)	**629.2**	**100.0%**	**278.3**	**100.0%**	**3,441**	**100.0%**	**154.8**	**100.0%**

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

Sector	Output		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%
Total (SA)	**640.3**	**100.0%**	**306.1**	**100.0%**	**2,649**	**100.0%**	**142.4**	**100.0%**

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

Sector	Output		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%	1077	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%
Total (SA)	**657.4**	**100.0%**	**327.6**	**100.0%**	**2,656**	**100.0%**	**149.0**	**100.0%**

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

Sector	Output		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%	1240	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	32.1	4.5%	18.5	5.3%	35	1.3%	2.1	1.3%
Total (SA)	**706.7**	**100.0%**	**348.9**	**100.0%**	**2,625**	**100.0%**	**156.4**	**100.0%**

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

Sector	Output		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	3.0	0.6%	1.6	0.6%	12	0.6%	0.9	0.8%
Total (SA)	**516.7**	**100.0%**	**251.9**	**100.0%**	**1,865**	**100.0%**	**117.1**	**100.0%**

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

Sector	Output		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	53.3	9.7%	28.8	10.3%	94	5.1%	16.1	12.9%
Total (SA)	**549.4**	**100.0%**	**279.5**	**100.0%**	**1,833**	**100.0%**	**125.2**	**100.0%**

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

Sector	Output		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	60.8	9.3%	34.5	10.9%	94	4.4%	16.8	10.9%
Total (SA)	**656.9**	**100.0%**	**316.6**	**100.0%**	**2,131**	**100.0%**	**154.1**	**100.0%**

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

Sector	Output		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	42.4	6.7%	23.5	7.7%	69	3.2%	11.9	7.7%
Total (SA)	**629.4**	**100.0%**	**305.3**	**100.0%**	**2,151**	**100.0%**	**153.6**	**100.0%**

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

Sector	Output		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	8.6	1.6%	4.7	1.9%	17	0.9%	2.4	1.9%
Total (SA)	**544.7**	**100.0%**	**251.5**	**100.0%**	**2,019**	**100.0%**	**126.8**	**100.0%**

Appendix Table 2-18 The total economic contribution (direct and flow-on) of aquaculture in SA, by aquaculture sector, 2018/19

Sector	Output		Contribution to GSP		Employment		Household Income	
	($m)		($m)		(fte)		($m)	
Tuna farming	329.2	57.9%	139.2	51.5%	1,165	48.8%	69.7	50.2%
Marine finfish farming	105.8	18.6%	55.2	20.4%	429	18.0%	27.2	19.6%
Oyster farming	71.8	12.6%	44.1	16.3%	489	20.5%	23.9	17.2%
Mussels farming	18.6	3.3%	10.5	3.9%	109	4.6%	7.2	5.2%
Abalone farming	32.3	5.7%	15.3	5.7%	138	5.8%	7.9	5.7%
Freshwater finfish farming	6.1	1.1%	3.4	1.2%	34	1.4%	1.9	1.4%
Marron and yabbies farming	0.3	0.0%	0.1	0.0%	7	0.3%	0.1	0.1%
Other aquaculture	4.8	0.8%	2.5	0.9%	15	0.6%	0.9	0.7%
Total (SA)	**568.9**	**100.0%**	**270.2**	**100.0%**	**2,385**	**100.0%**	**138.9**	**100.0%**