FINAL REPORT

Aquaculture in Queensland

Prioritising regulatory reform

Prepared for
Queensland Office of Best Practice Regulation

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THE CENTRE FOR INTERNATIONAL ECONOMICS
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1 Introduction

In November 2012, the Agriculture, Resources and Environment Committee (AREC) of the Queensland Parliament published a report on its inquiry into Queensland's agriculture and resource industries.

The committee's inquiry sets out three propositions relevant to the aquaculture industry, namely:

1 Queensland's aquaculture has huge potential for growth;

2 regulatory burdens hinder the aquaculture industry preventing Queensland achieving its potential; and

3 Queensland's aquaculture industry would benefit if its regulatory framework more closely matched to that of Tasmania's or South Australia's regulatory framework.

This project

The Queensland Office of Best Practice Regulation has commissioned the CIE to assess these three main propositions.

This requires addressing two main questions:

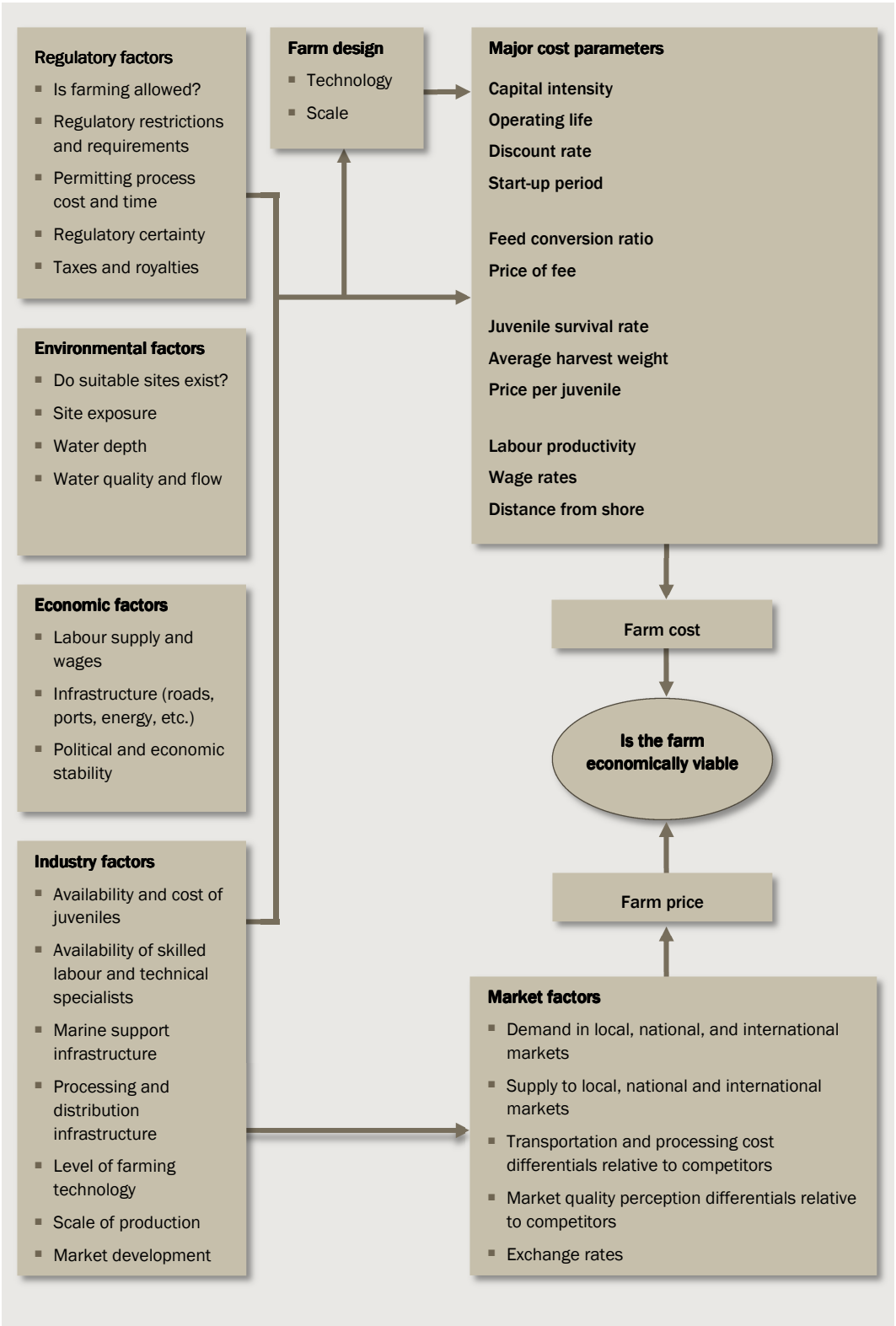
- what constraints, if any, are holding back the current Queensland aquaculture industry and how important are any regulatory constraints relative to the other technical and economic constraints?
- how large could Queensland's aquaculture industry become if such constraints were removed?

To address these questions requires a systematic review of the drivers affecting the economic viability of the aquaculture industry. These are many and varied and are set out in chart 1.1. Regulatory factors are only one of several factors affecting viability. Others include environmental, market, industry, cost, technology and macroeconomic factors. All of these factors need to be assessed to determine the relative importance of regulatory factors and to assess potential.

To start to understand these drivers, in chapter 2 we assess the current status of non-regulatory factors identified in chart 2.1 for Queensland aquaculture, including global factors affecting the market for aquaculture, Australia's and Queensland's current place in that market as well as the current size and economic value of the industry.

In chapter 3, we outline the current regulatory framework for the Queensland aquaculture industry, identifying the key constraints on industry expansion and compare the regulatory regime in Queensland to South Australia and Tasmania.

1.1 Major factors affecting the economic viability of a fish farm



Source: Rubino, Michael (editor), 2008, *Offshore Aquaculture in the United States: Economic Considerations, Implications and Opportunities*. U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA),

In chapter 4, we review the capacity of non-regulatory factors identified in chart 1.1 (economic, industry and market factors) to influence or constrain the future economic viability of aquaculture in Queensland and assess the overall potential for expansion. In chapter 5, we conclude by assessing whether reform is necessary and if so, should it be an immediate priority for the Queensland Government.

2 The current aquaculture industry and recent trends

Before we test the key propositions put forward by the Agriculture, Resources and Environment Committee, it is important to understand the current state of Queensland's aquaculture industry and the environment in which it operates. Since the Queensland aquaculture industry operates in a global environment, it is useful to understand recent trends at the global and national level as well as understanding the current state of the industry in Queensland.

Aquaculture

Aquaculture encompasses the farming of both marine and freshwater aquatic organisms such as fish, shellfish and even plants and can range from land-based to open-ocean production.

Aquaculture typically starts with the production of fingerlings/juveniles from broodstock in a hatchery, which are subsequently 'grown out' in an aquaculture production system. Various production systems can be used including racks, ponds, farm dams, and offshore cages. The production system can be defined as marine or land based, freshwater, brackish or marine water, and as an open or closed system. An open production system operates within a natural water body and relies on water movement to provide inputs, such as dissolved oxygen and nutrients and to flush out waste products. A closed production system recirculates water within a closed system (for example, ponds and tanks) to control the supply and condition of water both entering and being discharged from the production system.

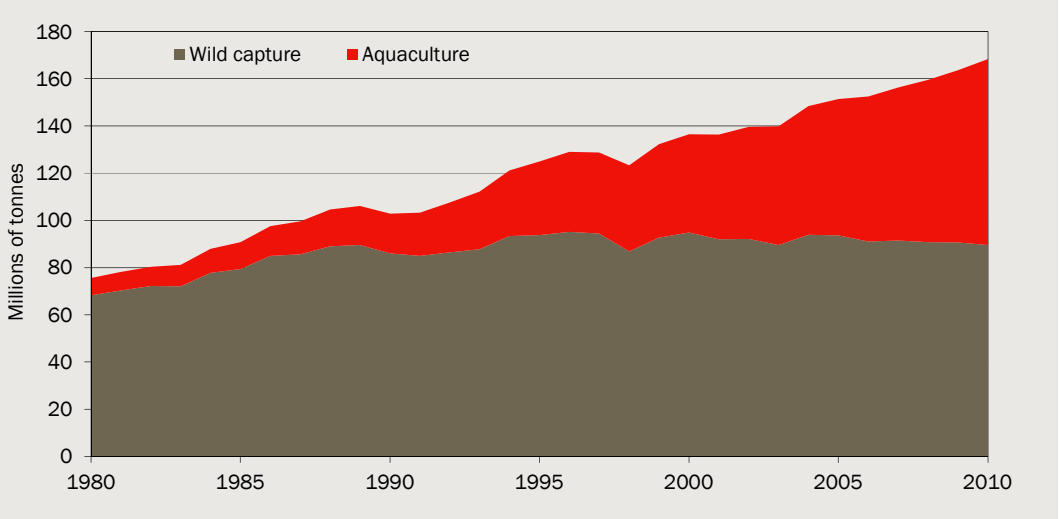
The key determinant of which production system is used is the species to be farmed, which is chosen based on environmental, economic, and market factors in order to maximise the economic viability of the aquaculture operation.

Global trends in aquaculture production

The growth and composition of the global aquaculture industry provides insight into the potential of Queensland to contribute to the global market for aquaculture products.

Over the past three decades, the global aquaculture industry has increased at an average annual rate of 8 per cent in quantity terms. Further the contribution of aquaculture to total global fisheries production, including wild capture, has increased from 10 per cent in 1980 to 47 per cent in 2010 (chart 2.1).

2.1 Global capture and aquaculture fisheries production



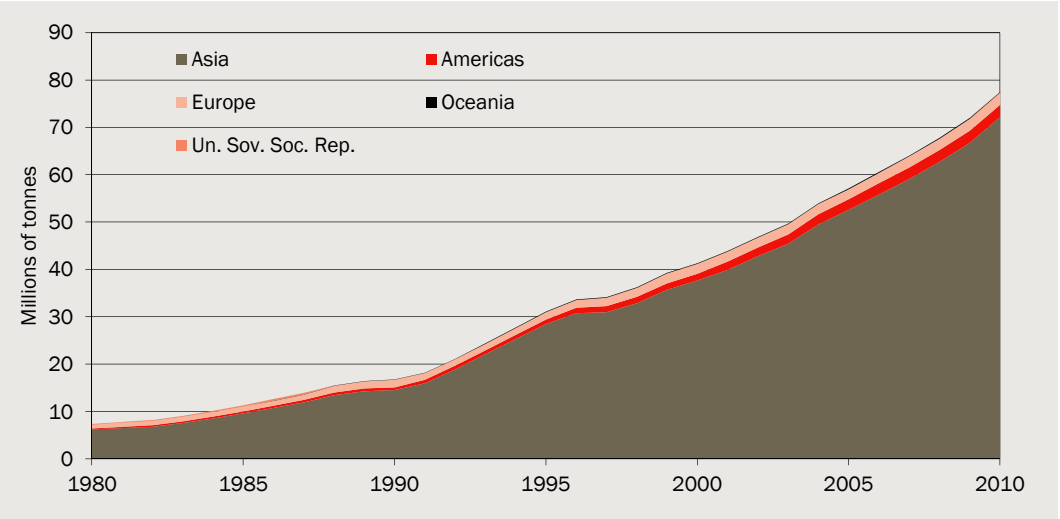
Note: Wild capture excludes the number of whales, seals and other aquatic animals and mammals.

Data source: Food and Agriculture Organization of the United Nations (FAO), Global Fishery Statistical Collections.

The historical growth demonstrates that wild capture fisheries production is limited and that there is strong demand for aquaculture production to meet strong global demand in the world market.

The steady increase in aquaculture production over the past three decades has been dominated by an expanding aquaculture industry in Asia, primarily in China. Aquaculture production in Asia has increased from 6.2 million tonnes in 1980 to 72.2 million tonnes in 2010, contributing over 90 per cent of global production (chart 2.2). The contribution of the Oceania region, including Australia, was only 0.3 per cent to global production in 2010.

2.2 Aquaculture production by global region

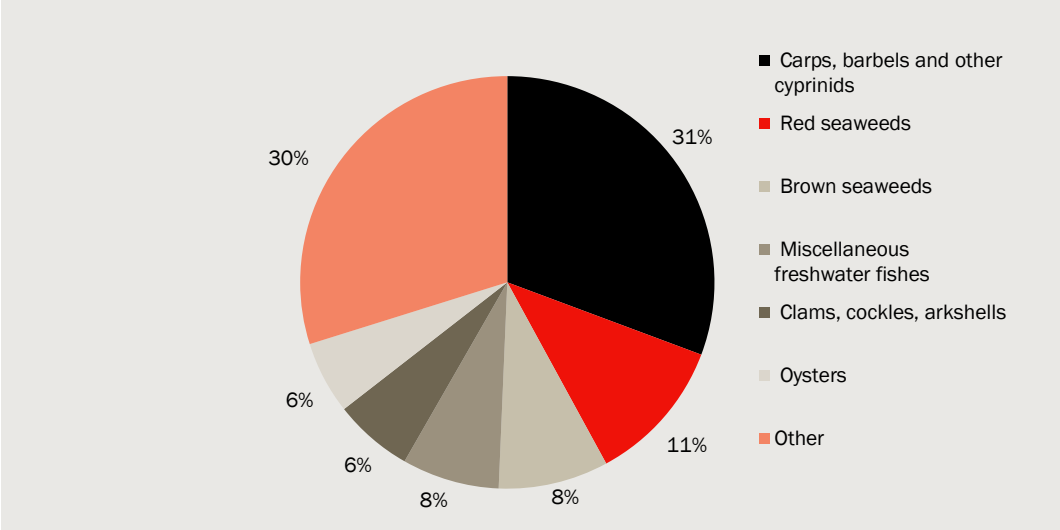


Data source: Food and Agriculture Organization of the United Nations (FAO), Global Fishery Statistical Collections.

The dominance of Asia in aquaculture production is reflected in the world's six largest aquaculture producers in 2010 — China, Indonesia, India, Viet Nam, Philippines and Korea — are all Asian countries.

The key species produced globally in 2010 were carps, barbels and other cyprinids (31 per cent), red seaweeds (11 per cent), brown seaweeds (8 per cent) and miscellaneous freshwater fishes (8 per cent) (chart 2.3). Globally, shrimps and prawns constituted 5 per cent of total aquaculture production.

2.3 Key species from global production



Note: Other includes production of shrimps/prawns; tilapias and other cichlids; miscellaneous aquatic plants; salmons, trouts, smelts; mussels, pearls, and other miscellaneous species.

Data source: Food and Agriculture Organization of the United Nations (FAO), Global Fishery Statistical Collections.

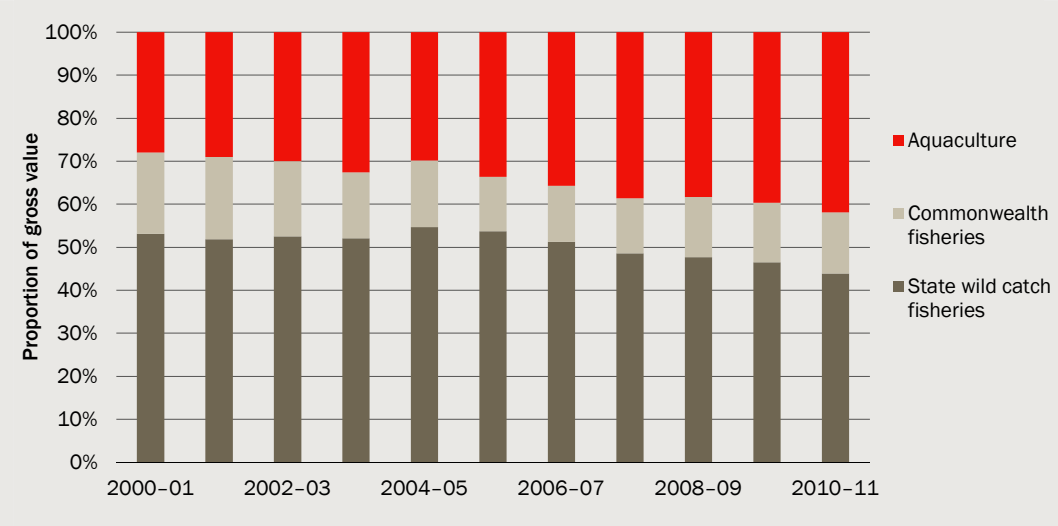
Aquaculture in Australia

In Australia, aquaculture has also increased its share of fisheries production. Aquaculture constituted approximately 43 per cent of the gross value of fisheries production[1] in 2010-11, increasing from approximately 29 per cent in 2000-01 (chart 2.4).

Aquaculture production in Australia has increased at an annual rate of around 8 per cent over the past 20 years. While this this is a relatively rapid rate of growth compared to other industries, it is significantly slower than the growth of aquaculture production in Indonesia and Viet Nam; aquaculture production in these countries increased by around 20 per cent during the 2000s (chart 2.5). Nevertheless, Australia's growth rate during the 2000s was comparable with India and faster than China, the world's largest aquaculture producer.

1 Includes state wild catch fisheries, aquaculture and Commonwealth fisheries.

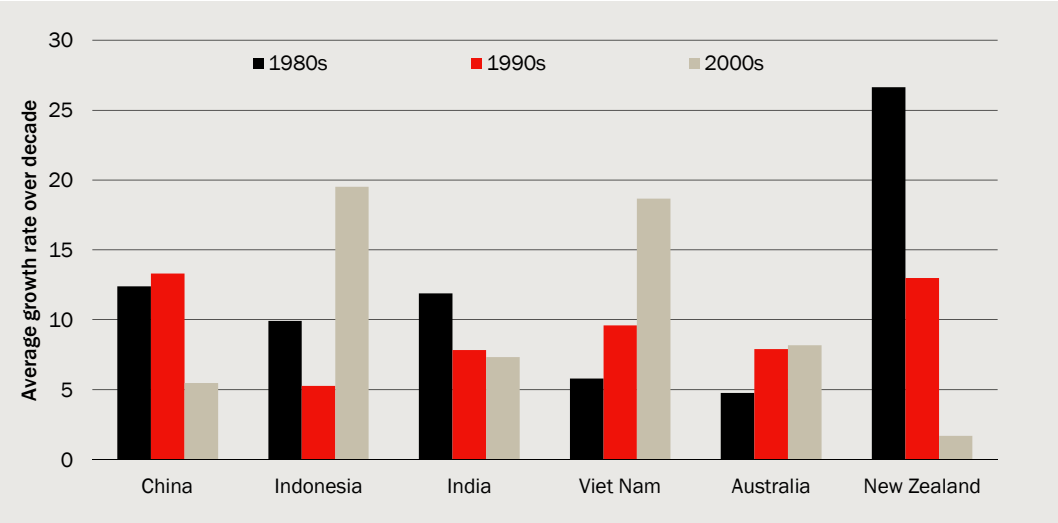
2.4 Gross value of fisheries production in Australia



Note: Gross value of aquaculture excludes the value of hatchery production.

Data source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

2.5 Average growth rates of aquaculture production over past three decades



Note: 2000s includes calendar year 2010.

Data source: Food and Agriculture Organization of the United Nations (FAO), Global Fishery Statistical Collections.

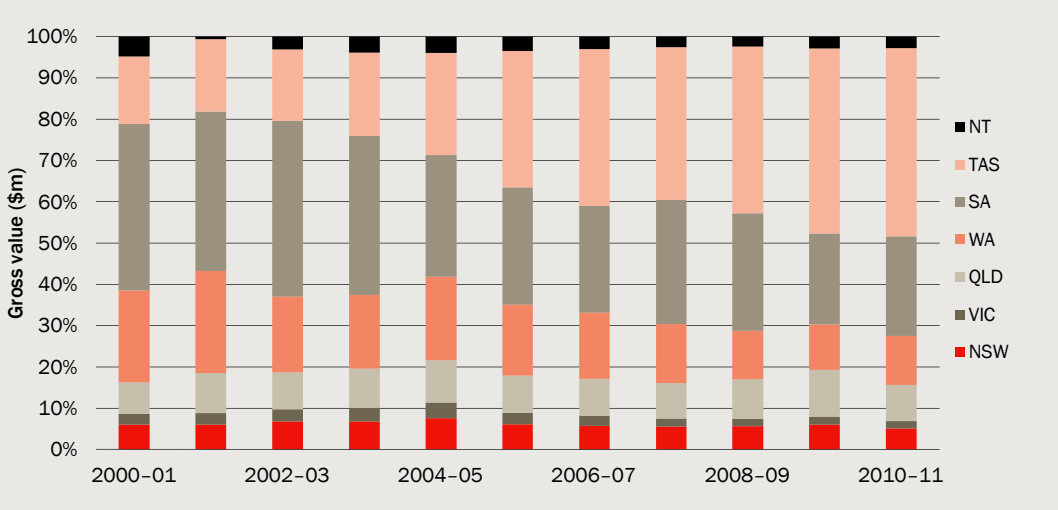
In New Zealand, aquaculture boomed in the 1980s with an average growth rate of 27 per cent. However, this was from a relatively low base and growth has tapered to around 2 per cent as the industry has matured.

In 2010-11, Tasmania produced the largest share of Australia's total aquaculture production (in gross value terms) at approximately 46 per cent, followed by South Australia with approximately 24 per cent (chart 2.6).[2] Over the past decade the

2 Includes southern bluefin tuna caught in Commonwealth waters and fattened in farms near Port Lincoln, South Australia.

Tasmanian aquaculture industry has grown at an average rate of around 14 per cent. This was the highest of all the Australian states and territories (chart 2.7). The Tasmanian Government has actively encouraged the aquaculture industry over the past 10-15 years through the development of 14 separate Marine Farming Development Plans. These Plans cover more than 10 000 leasable hectares. Queensland had the second highest average annual growth rate of 4 per cent. Over the past ten years, Queensland has consistently contributed between 8 and 11 per cent of Australia's total gross value of aquaculture production.

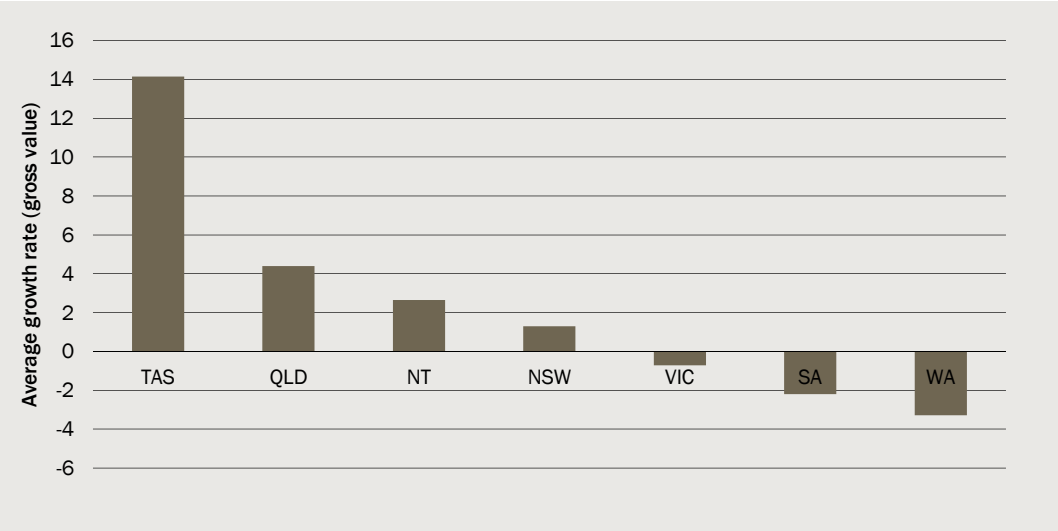
2.6 Aquaculture production by state/territory



Note: Excludes the value of hatchery production.

Data source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

2.7 Average annual growth rate over past decade[a]



[a] Average growth rate for Northern Territory between 2002-03 and 2010-11.

Data source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

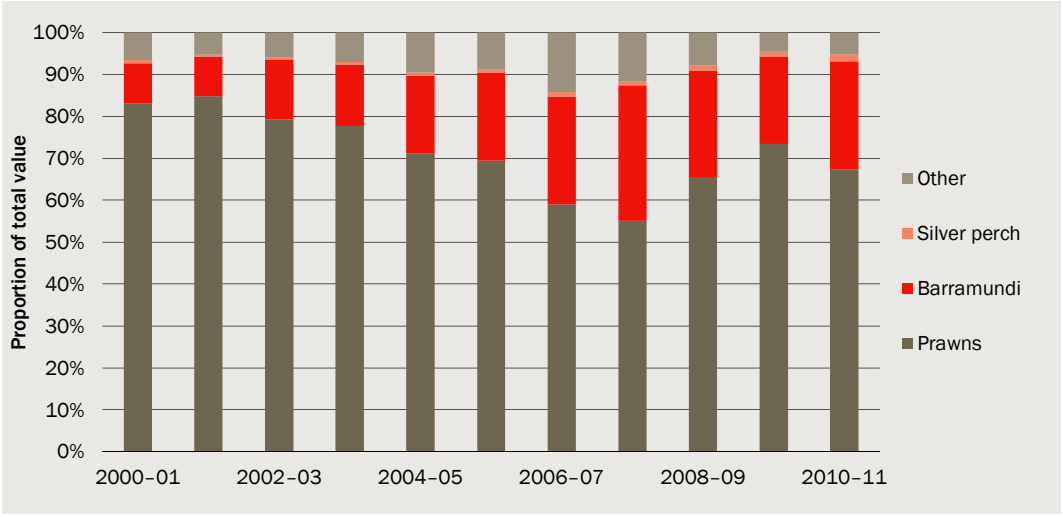
Both Tasmania and South Australia largely farm relatively high valued aquaculture species of salmon and tuna, respectively. The farming of southern bluefin tuna is an exception to typical production systems, using juvenile and young adult tuna caught in the Southern Ocean, which is grown out in aquaculture farms. In Queensland, the primary farmed species are prawns and barramundi.

Composition and size of Queensland current aquaculture

As previously mentioned, aquaculture production can take place in freshwater and marine water environments, depending on the species farmed. Freshwater species farmed in Queensland include barramundi, jade perch, redclaw, silver perch, and eels. Marine species farmed include black tiger prawns, kuruma prawns, barramundi, mud crabs and rock oysters.

The economic viability of production varies across species because of profitability, economies of scale, marketing, exposure to environmental factors and the cost of inputs (for example, feed). The predominant species farmed in Queensland are prawns and barramundi, contributing approximately 67 per cent and 26 per cent, respectively, in gross value terms in 2010-11 (chart 2.8).

2.8 Gross value of Queensland aquaculture production by species

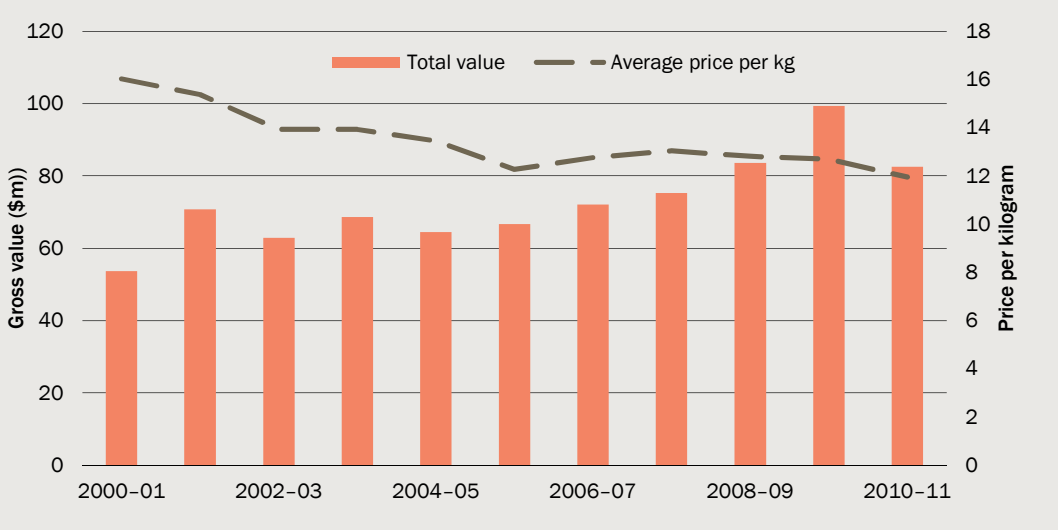


Note: Excludes the value of hatchery production.

Data source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

The average price per kilogram of Queensland's aquaculture production, across all species farmed, has been declining over the past ten years from $16 in 2000-01 to approximately $12 in 2010-11. During the same period the total gross value of the industry in Queensland increased from $53.7 million to $82.5 million (chart 2.9). The gross value of the industry has increased over the past ten years, despite decline in average price, primarily because of increases in the quantity of the two primary aquaculture species farmed in Queensland, prawns and barramundi (chart 2.10).

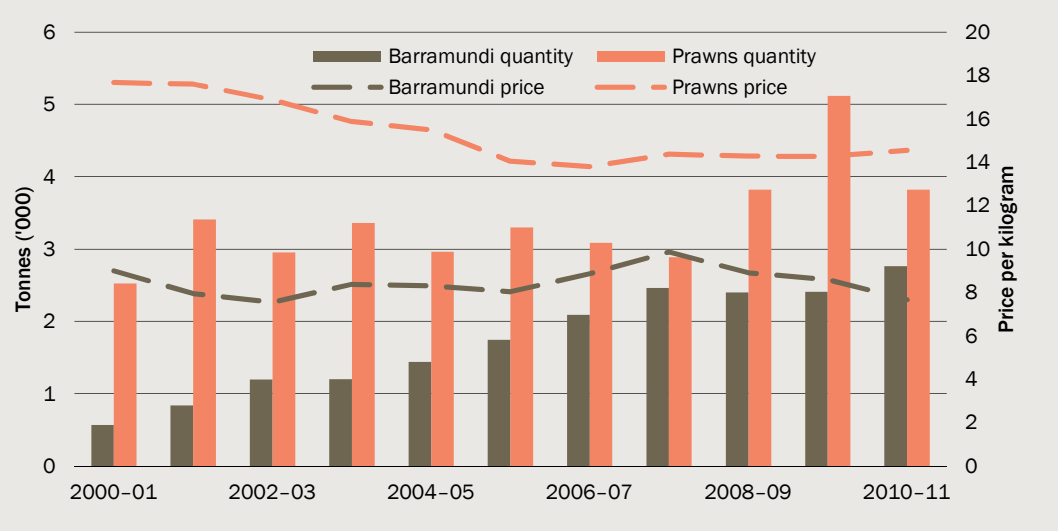
2.9 Average price per kilogram and gross value of Queensland's aquaculture production



Note: Price per kilogram estimated using quantity and value data from ABARES, 2012, *Australian fisheries statistics 2011.*

Data source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

2.10 Price and quantity of Queensland's key aquaculture species



Note: Price per kilogram estimated using quantity and value data from ABARES, 2012, *Australian fisheries statistics 2011.*

Data source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

Trade in fisheries products

Exports of Australia's fisheries products[3]

In 2010-11, Queensland exported approximately 9600 tonnes of fisheries products (including production from both wild capture and aquaculture), consisting predominantly of 4300 tonnes of whole fresh, chilled or frozen fish and 3700 tonnes of prawns. Across Australian states and territories, Queensland exported the highest proportion of Australia's total export of fisheries products (in quantity terms), exporting 23 per cent, closely followed by South Australia and Tasmania each exporting approximately 22 per cent.

The story changes slightly in value terms, with Queensland exporting the fourth largest proportion of Australian exports of fisheries products, 16 per cent in 2010-11. South Australia, Western Australian and Tasmania exported the highest proportion of Australian seafood exports in 2010-11 in value terms with 24 per cent, 24 per cent and 17 per cent respectively.[4]

Australia's key export edible species in 2010-11 in value terms were rock lobster, abalone and tuna, prawns and salmon with the primary non edible species being pearls. The key export destinations for these species were Hong Kong, Japan and China (see table 2.11).

2.11 Australia's key export species and destinations

Key species	Quantity	Value	Key export destinations by value
2010-11	Tonnes	$ million	
Tuna	7 809	131	▪ Japan — $38 million for fresh or chilled (whole) — $89 million for frozen (whole)
Salmon	6 077	51	▪ China — $12 million for fresh or chilled (whole) ▪ Japan — $14 million for fresh or chilled (whole)
Rock lobster	7 017	369	▪ Hong Kong — $223 million for live, fresh or chilled ▪ China — $68 million for live, fresh or chilled
Prawns	6 419	77	▪ Japan — $33 million for whole ▪ Hong Kong — $11 million for whole ▪ China — $8 million for whole
Abalone	3 424	212	▪ Hong Kong — $65 million for fresh, chilled or frozen – $46 million for prepared & preserved) ▪ China — $37 million for fresh, chilled or frozen
Total edible fisheries products	41 542	991	
Pearls	na	241	na

Note: na — data not available.

Source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

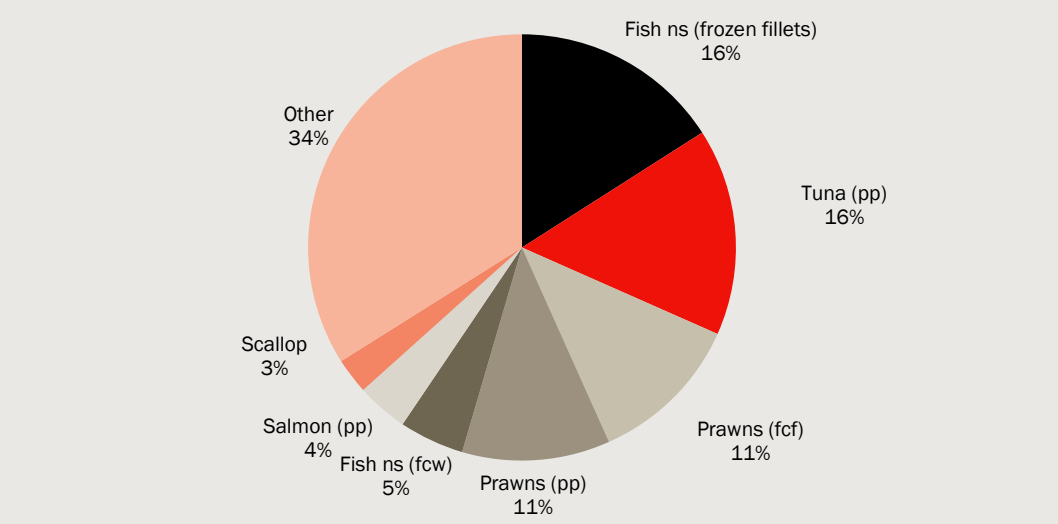
3 Export data is based on total production from aquaculture, state fisheries and Commonwealth fisheries.

4 Exports are identified according to source state or territory, not state or territory in which the product was caught or farmed.

Australia's imports of fisheries products

In 2010-11 Australia imported approximately $770 million of edible fish products, $500 million of crustaceans and molluscs products, and $258 million of non-edible fisheries products such as pearls and fish meal. The primary edible fisheries products imported into Australia in 2010-11 were frozen fillets of fish (species not specified), prepared and preserved tuna, and prawns either prepared and preserved or fresh, chilled or frozen (chart 2.12).

2.12 Key imported edible fisheries products



Note: pp is prepared and preserved; fcf is fresh, chilled or frozen; fcw is fresh or chilled whole; ns is not specified.

Data source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

Domestic and international markets for Queensland's key aquaculture species

Queensland's aquaculture production of prawns is approximately 96 per cent of total Australian prawn aquaculture and roughly 14 per cent of Australia's total prawn production (wild and farmed). The Australian domestic market for prawns in 2010-11 was approximately 37 000 tonnes worth $376 million (table 2.13).

The average price per kilogram for Queensland's farmed prawns was $15 in 2010-11 compared to the average price of $9 per kilogram for imported prawns.

By contrast to prawns, Queensland's aquaculture production of fish products is 6 per cent of Australian farmed fish products and 2 per cent of Australia's total production (wild and farmed) of fish products. The domestic market for fish products is approximately 280 500 tonnes worth $1.5 billion (table 2.14). In 2010-11 domestic production supplied approximately 48 per cent of the domestic market, with the remaining 52 per cent of domestic demand supplied by imported product.

2.13 Production and markets for prawns

2010-11	Quantity (tonnes)		Value ($'000)		Average price per kilogram	
	QLD	Aust.	QLD	Aust.	QLD	Aust.
Production						
Total production (wild & farmed)	9 614	26 866	120 634	304 822	13	11
Total wild production		22 896		247 491		11
Wild production state fisheries[a]	5 792	12 799	65 034	149 482	11	12
Wild production C'wealth fisheries		10 097		98 009		10
Aquaculture production	3 822	3 970	55 600	57 332	15	14
Market						
Imports		16 448	na	148 617	na	9
Exports[b]	3 725	6 419	48 675	77 096	13	12
Domestic market[c]		36 895		376 343		

[a] Estimated taking total production minus aquaculture production estimates and minus wild production from Commonwealth fisheries in the case of Australia. [b] Exports are identified according to source state or territory, not state or territory in which the product was caught or farmed. [c] Domestic market is estimated using total production minus exports plus imports.

Source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

2.14 Production and markets for fish products

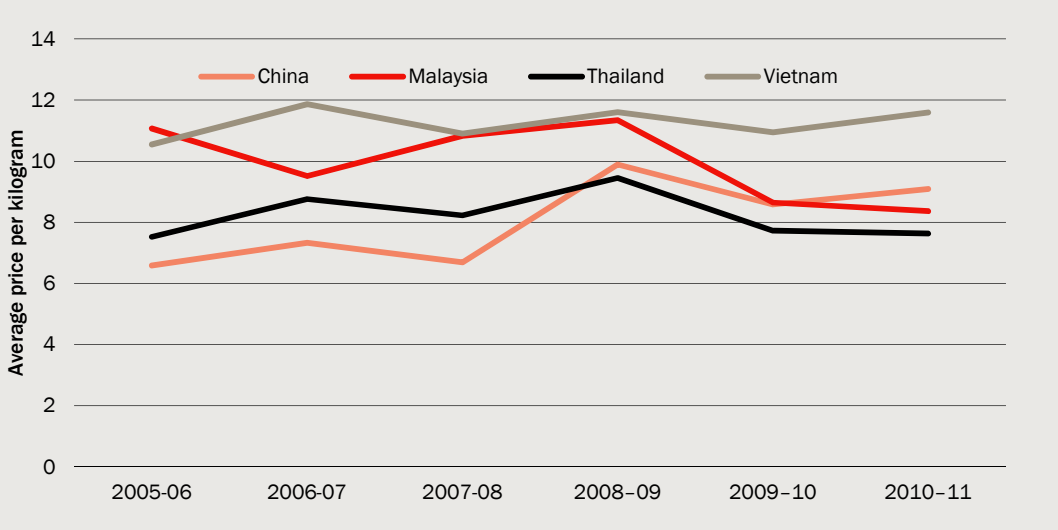
2010-11	Quantity (tonnes)		Value ($'000)		Average price per kilogram	
	QLD	Aust.	QLD	Aust.	QLD	Aust.
Production						
Total production (wild & farmed)	13 208	155 263	98 666	982 854	7	6
Total wild production		109 074		404 966		4
Wild production state fisheries[a]	10 243	76 742	74 493	219 858	7	3
Wild production C'wealth fisheries		32 332		185 108		6
Aquaculture production	2 965	49 975	24 173	607 687	8	12
Market						
Imports		147 191	na	769 089	na	5
Exports[b]	4 273	21 926	70 355	287 351	16	13
Domestic market[c]		280 527		1 464 591		

[a] Estimated taking total production minus aquaculture production estimates and minus wild production from Commonwealth fisheries in the case of Australia. [b] Exports are identified according to source state or territory, not state or territory in which the product was caught or farmed. [c] Domestic market is estimated using total production minus exports plus imports.

Source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

In 2010-11, Australia imported over 90 per cent of fresh, chilled or frozen prawns from four Asian countries, namely, China, Malaysia, Thailand and Vietnam. The average price for prawn imports in 2010-11 was $9 per kilogram which is substantially lower than the average price paid for Queensland's farmed prawns of $15. In 2010-11, the average price for prawn imports varied across Australia's key import sources ranging from $7.60 per kilogram for prawns sourced from Thailand to $11.60 per kilogram for prawns imported from Vietnam. Over the past five years the average import price for prawns ranged between $6 and $12 per kilogram (chart 2.15).

2.15 Average import prawn price per kilogram by key import sources



Data source: Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

Economic character of aquaculture in Queensland

Table 2.16 shows ABS data for total sales value, expenses, profit and value added for all Australian aquaculture. Profit margins are relatively low and value added (return to fixed factors: capital, labour and land) has ranged from 43 per cent in 2007–08 down to 22 per cent of sales value in 2010–11 (average 31 per cent). Returns to labour (wages and salaries) as a proportion of sales make up around 21 per cent of sales (table 2.17) and have made up most of the industry's value added in the latter years. Average earnings per worker are not high at $35 000 a year, although these are higher than for agricultural workers on average. Around 60 per cent of firms are reportedly making profits (table 2.18) which is similar to agriculture overall.

2.16 Key indicators of industry performance across select industries

	Sales and service income	Total expenses	Operating profit before tax	Capital expenditure	Industry value added
	$m	$m	$m	$m	$m
Aquaculture					
2007-08	978	921	214	141	427
2008-09	944	1 031	-48	264	327
2009-10	1 157	1 215	70	282	276
2010-11	1 013	1 141	-63	105	227

Note: na represents not available for publication.

Source: ABS, 2012, *Australian Industry, 2010-11*. 81550D0001_201011 Australian Industry, 2010-11. Released June 2012.

2.17 Labour statistics across select industries

	Employment at end June	Wages and salaries to sales and service income	Wages and salaries per employee
	'000	%	$'000
Aquaculture			
2007-08	8	21	34
2008-09	7	21	34
2009-10	7	18	36
2010-11	7	21	35

Note: na represents not available for publication.

Source: ABS, 2012, *Australian Industry, 2010-11*. 81550D0001_201011 Australian Industry, 2010-11. Released June 2012.

2.18 Profitability indicators: Australian Aquaculture across select industries

	Profit margin	Made a profit	Broke even	Made a loss
	%	%	%	%
Aquaculture				
2007-08	22	56	1	43
2008-09	na	52	1	46
2009-10	6	58	6	37
2010-11	- 6	na	na	na

Note: na represents not available for publication.

Source: ABS, 2012, *Australian Industry, 2010-11*. 81550D0001_201011 Australian Industry, 2010-11. Released June 2012.

There are around 7000 people employed in aquaculture in Australia (table 2.12). Around 500 of these are in Queensland (7 per cent, table 2.19) and Queensland's output represents around 8 per cent of Australia's aquaculture output by value. About 80 per cent of employees are engaged in prawn and barramundi production in as few as 50 farms. Output per workers on these farms is around $210 000 per year which is about 45 per cent higher than the average output per worker in aquaculture for Australia. This might suggest that the productivity of Queensland farms is above the Australian average although the statistical evidence is thin.

Estimates of input use by value suggest the following rough indicative cost structure for prawns:

- feed 26 per cent;
- labour 21 per cent;
- processing, packaging and freight 15 per cent;
- capital 11 per cent;
- larvae 9 per cent;
- electricity and water 9 per cent; and
- other 9 per cent.

2.19 Snapshot of labour employed in Queensland aquaculture production

Aquaculture species	Number of farms (2010-11)	Labour indicator	2009-10	2010-11
Prawns (growout labour)	71 aquaculture approvals authorising prawn production 20 farms produced prawns in 2010-11	FTE labour units	330	334
		Value of output per FTE ($)	221 410	166 370
Barramundi	305 aquaculture approvals authorising barramundi production 30 farms produced market ready fish in 2010-11	FTE labour units	94	92
		Value of output per FTE ($)	219 000	229 000
Redclaw	199 aquaculture approvals authorising redclaw culture 28 farms reported production of redclaw	FTE labour units	22	22
		Value of output per FTE ($)	43 500	41 800
Freshwater fish	273 aquaculture authority holders authorised to grow freshwater fish 15 growout farms and 14 hatcheries reported production of at least one species in 2010-11.	FTE labour units	21	18.5
		Value of output per FTE ($)	116 600	120 650
Eel culture	44 aquaculture approvals authorised 7 farms produced eels	FTE labour units		9
		Value of output per FTE ($)		93 100
Hatchery and aquarium	na	FTE labour units	58	55
		Value of output per FTE ($)	66 250	53 600
Pearl oyster culture	3 farms reported production	FTE labour units	na	na
		Value of output per FTE ($)	na	na
Edible oyster	98 authorised oyster areas, 26 oyster areas sold product	FTE labour units	21	22.6
		Value of output per FTE ($)	24 200	20 900

Source: Wingfield, M., 2012, *Ross Lobegeiger Report to Farmers: aquaculture production survey Queensland 2010-11*. Queensland Department of Agriculture, Fisheries and Forestry.

Like other intensive livestock meat enterprises such as poultry and pork production, feed is the largest cost for an aquaculture enterprise, although it is only about half what it is for poultry and pork in percentage terms. Conversion rates from feed to meat are higher for aquaculture (1.5:1) compared with other intensive livestock (over 2:1). That said, aquaculture feeds are highly proteinaceous and expensive compared with poultry feed ($1500 per tonne compared with $350). Similarities with intensive livestock suggest that aquaculture has a high dependence on purchased inputs and therefore could be highly elastic in supply. However, one distinguishing feature is aquaculture's reliance on abundant clean coastal water, which is potentially a scarce factor and may make supply less elastic than for other forms of intensive livestock.

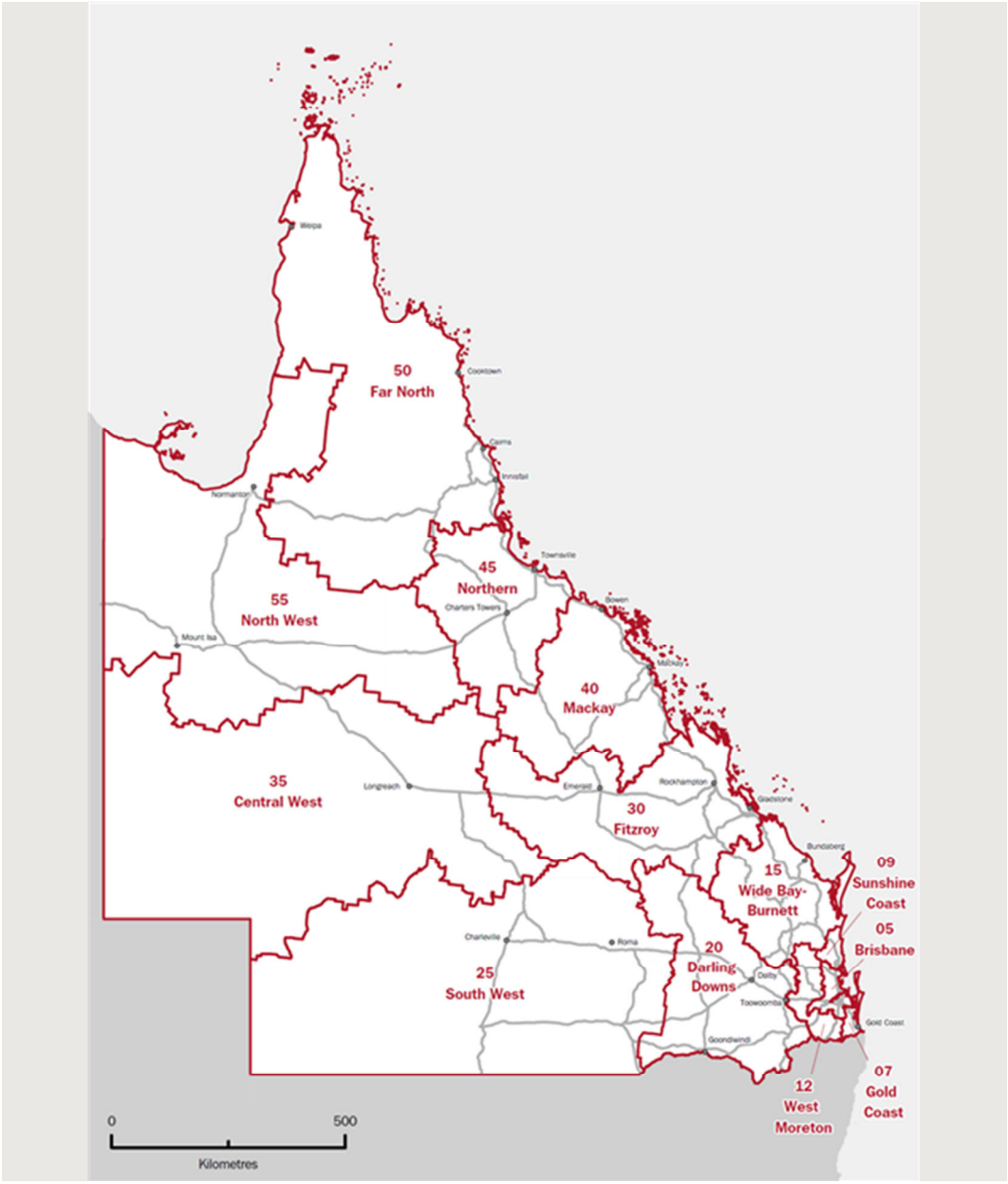
The scarcity of sites is also influenced by regulation and control over where aquaculture can take place. In the past 13 years there have been no new approvals granted for prawn farms and no new ones have been built (QAIF 2012). Although (as seen in table 2.13) there are more licences (approvals) than farms, these redundancies do not necessarily imply there is no scarcity of large economically viable *approved* sites. Some of these apparently redundant approvals are for very small unviable sites. Moreover, approvals do not closely correlate to sites and approved areas. Some sites may have approvals for

several species, but produce only one at a time. For instance, a site may have approval to farm both prawns and barramundi.

Queensland aquaculture by region

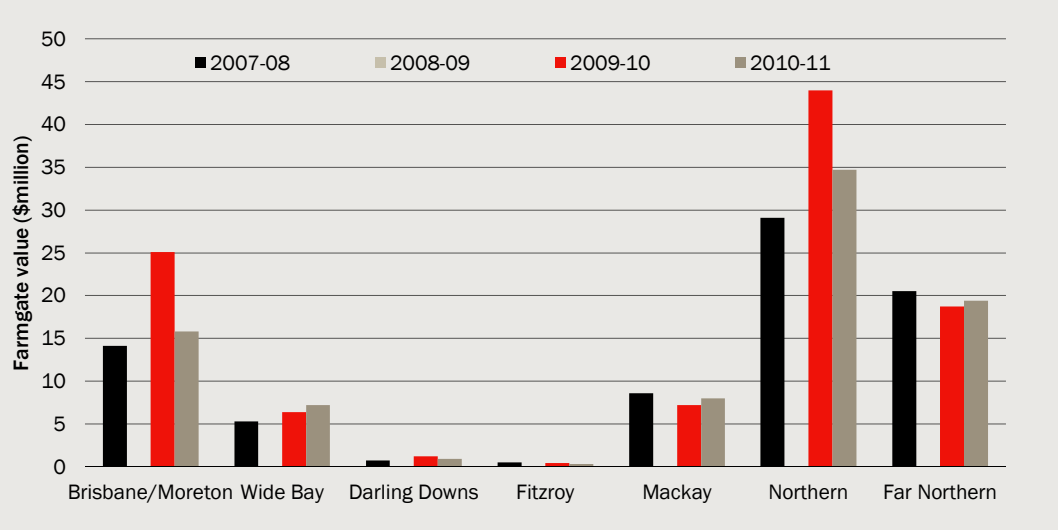
Aquaculture production in Queensland predominantly occurs in the Northern and Far Northern statistical divisions (chart 2.20). In 2010-11, 81 per cent of Queensland's aquaculture farmgate value was produced in three statistical divisions — Northern, Far Northern and Brisbane/Moreton (chart 2.21). These three statistical divisions also had the highest production rates per hectare of ponded area (chart 2.22).

2.20 Queensland ABS Statistical Divisions



Data source: ABS, 2006, Catalogue 1216.0 Australian Standard Geographical Classification (ASGC) – 2006, Jul 2006.

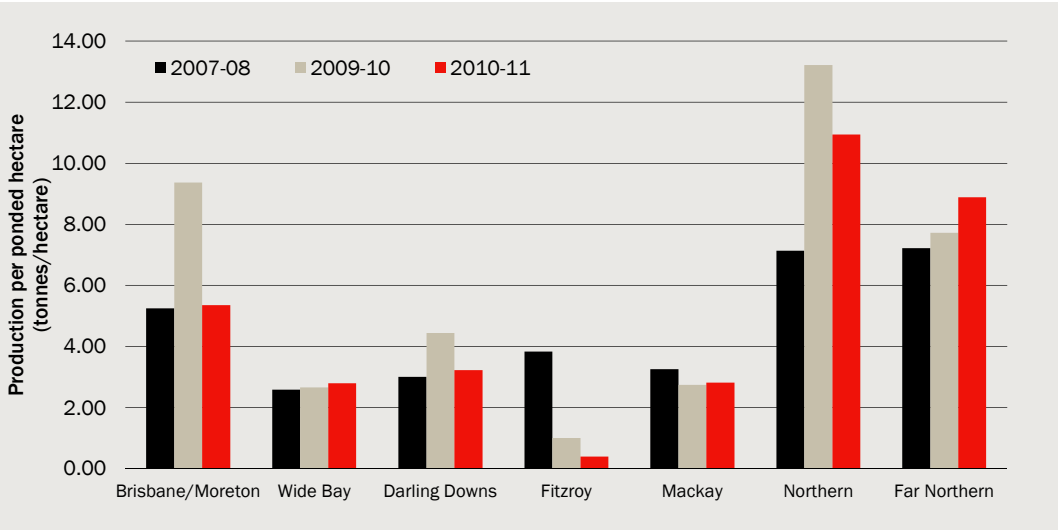
2.21 Aquaculture farmgate value across statistical divisions



Note: Data for 2008-09 not available for publication.

Data source: Wingfield, M., 2012, *Ross Lobegeiger Report to farmers: Aquaculture production survey Queensland 2010-11*. Queensland Department of Agriculture, Fisheries and Forestry.

2.22 Production per hectare of ponded area by statistical division



Note: Data for 2008-09 not available for publication.

Data source: Wingfield, M., 2012, Ross Lobegeiger Report to farmers: Aquaculture production survey Queensland 2010-11. Queensland Department of Agriculture, Fisheries and Forestry.

3 The regulatory framework for aquaculture

The Parliamentary Inquiry into Queensland's Agriculture and Resource Industries contended that the current regulatory framework for aquaculture in Queensland is a major deterrent to new investment in the industry.[5] In this chapter, we test this proposition by reviewing the regulatory framework for aquaculture in Queensland and the extent to which it is restricting industry expansion. We also compare Queensland with other states that are seen to have a more favourable regulatory environment and examine the scope for reform.

The need for regulation of aquaculture

Given the need for property rights and the potential for environmental and amenity impacts from some aquaculture operations, regulation interventions in aquaculture are common around the world. More specifically, aquaculture developments require regulation for the following broad reasons: [6]

- to set out arrangements for access to public resources and a need to define property rights; and
- the potential for aquaculture facilities to have detrimental impacts on the environment — specific environmental issues include:
  - nutrient enrichment of the water — this can be caused through discharge from on-shore facilities or through off-shore cages. Nutrients can be sourced from uneaten food, dissolved nutrients and fish faeces. This can lead to local algal blooms.
  - impact on the wild fish populations through:
    - disease — fish diseases may be transmitted from aquaculture stock to the wild population;
    - introduction of exotic species — exotic species could potentially escape from an aquaculture facility and become established to the detriment of native species; and
    - genetic pollution of wild stocks by escapees — selectively bred or genetically modified aquaculture stock may escape and breed with the wild population. This could potentially alter the gene pool in natural populations.

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5 Queensland Parliament Agriculture, Resources and Environment Committee, Inquiry into Queensland's Agriculture and Resource Industries, Report No. 13, November 2012, p. 38.

6 Productivity Commission, 2004, *Assessing Environmental Regulatory Arrangements for Aquaculture*, pp. 5-6.

– structures — structures used for aquaculture can have environmental potential for entrapment or entanglement, modifying habitats or have amenity impacts.

The regulatory framework in Queensland

The regulatory framework for aquaculture in Queensland is relatively complex, involving multiple agencies across all three levels of government — local, state and commonwealth.

Development-related regulations

Under the *Sustainable Planning Act 2009*, making a material change in use of premises for the purpose of conducting aquaculture activities is regarded as a development.[7]

If the development complies with the *Code for self-assessable development*, government approval is not required, although the aquaculturist (this could be either an individual or a company) must be registered. The activities covered by the Code are considered to have limited potential for impact on the environment and/or the community. In general, the Code covers activities that relate to indigenous species in above-ground tanks that are not to be sold as bait or for stocking public waters, farms dams or other aquaculture operations and do not cause the discharge of waste into Queensland waters.[8]

Aquaculture developments that do not comply with the Code require approval from Fisheries Queensland, the Department of Environment and Heritage Protection as well as local government.[9] This covers most existing aquaculture in Queensland. Approvals may be subject to a range of conditions, including environmental conditions.

In addition, aquaculturalists may also require approval from Fisheries Queensland and the Department of Environment and Heritage Protection for the removal of marine plants for farm maintainance, where it does not comply with the Code (MP03).

Environmental regulation

The Queensland Government regulates the environmental impacts of aquaculture primarily through imposing licensing conditions. Fisheries Queensland is primarily interested in biosecurity and disease management. Proponents are required to prepare an Environmental Impact Statement. A one-off fee of $2800 also applies. Fisheries

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7 Queensland Government, *Code for self-assessable development: Low impact aquaculture*, Code No. AQUA01, April 2011, p. 1.

8 For details refer to Queensland Government, *Code for self-assessable development: Low impact aquaculture*, Code No. AQUA01, April 2011, pp. 1-3.

9 Queensland Department of Agriculture, Forestry and Fisheries website, http://www.daff.qld.gov.au/28_13267.htm, accessed 5 February 2013.

Queensland has identified several activities as potentially high-risk, which require specific management arrangements. These high risk activities are:[10]

- aquaculture on potentially flood-prone land;
- aquaculture of any species that are non-indigenous to the area, such as:
- exotic ornamental fish species, and
- barramundi in inland catchments (Murray-Darling, Lake Eyre and Bulloo-Bancannia); and
- use of aquacultured product for bait.

An approval from the Department of Environment and Heritage Protection for the discharge from aquaculture facilities is also required. The discharge requirements for existing prawn farms are set out in DEHP's operational policy for marine prawn aquaculture, *Licensing wastewater releases from existing marine prawn farms in Queensland*.[11]

Commonwealth Government environmental regulations

In addition to State Government environmental regulation, the Commonwealth Government also has a role in regulating the aquaculture industry in Queensland, particularly in the Great Barrier Reef Marine Park (GBRMP).

Aquaculture in the Great Barrier Reef Marine Park

The GBRMP covers around 30-40 per cent of Queensland's total mainland coastline. It is managed by the Great Barrier Reef Marine Park Authority (GBRMPA), which is a Commonwealth Government agency. This means that different rules apply to aquaculture development in the GBRMP compared to the rest of Queensland.

Any aquaculture development in the GBRMP would require a permit from GBRMPA. For land-based aquaculture adjacent to the GBRMP that discharge waste into creeks and rivers in the GBRMP catchment, the Australian Government has accredited Queensland laws. This means that a separate assessment by GBRMPA is not required. However, an approval from GBRMPA is required for wastewater discharged directly into the GBRMP.

This means that the scope for the Queensland Government to unilaterally relax the environmental restrictions in the GBRMP is limited, since GBRMPA may revoke its accreditation for Queensland laws and require a separate approval from proponents.

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10 Queensland Department of Primary Industries and Fisheries, Aquaculture policy, *Management arrangements for potentially high-risk activities in the context of ecologically sustainable development for aquaculture facilities*, FAMOP001, Version 1, December 2004, p. 10.

11 Department of Environment and Heritage Protection, Operational policy: marine prawn aquaculture, *Licensing wastewater releases from existing marine prawn farms in Queensland*, 24 August 2012.

In assessing an application, the GBRMPA must consider criteria outlined in the *Great Barrier Reef Marine Park Regulations 1983*.[12] The regulations specify a number of mandatory and discretionary criteria, which primarily focus on the impact on the environment, as well as the social, cultural and heritage values of the Marine Park.

With all applications for Marine Park permits, the onus is on the applicant to establish that the environmental impacts of the proposed operation are acceptable.[13] This is likely to involve the proponent submitting an Environmental Impact Statement. There are also Permit Application Assessment Fees payable upon submission of the application. The fee payable for activities that require an Environmental Impact Statement to be prepared is currently $107 320 and is not refundable if the application is unsuccessful.[14]

Furthermore, if it is considered the proposal may restrict reasonable use by the public of a part of the Marine Park, the GBRMPA can require a public notification of the proposal and invite public comments. These comments are then considered in assessing the application.

The GBRMPA *Position Statement on Aquaculture within the Great Barrier Reef Marine Park* distinguishes between:

- Extensive aquaculture — in general, extensive aquaculture in the GBRMP involves filter-feeding organisms. The GBRMPA considers that the existing regulatory requirements for this type of aquaculture are adequate for the assessment of extensive aquaculture operations.
- Intensive aquaculture — unlike extensive aquaculture, intensive aquaculture requires feed. The ecological risks associated with this type of aquaculture are unlikely to be acceptable in the GBRMP using currently available technologies.

Other Commonwealth Government regulation

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) could also potentially apply to aquaculture developments. Under the Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities. The minister decides whether assessment and approval is required under the EPBC Act.

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12 For further details see Great Barrier Reef Marine Park Authority website, http://www.gbrmpa.gov.au/zoning-permits-and-plans/permits/steps-in-the-permitting-process, accessed 6 February 2013.

13 Great Barrier Reef Marine Park Authority website, http://www.gbrmpa.gov.au/zoning-permits-and-plans/permits/steps-in-the-permitting-process, accessed 8 February 2013.

14 Great Barrier Reef Marine Park Authority website, http://www.gbrmpa.gov.au/zoning-permits-and-plans/permits/permit-application-assessment-fee, accessed 8 February 2013.

The eight matters of national environmental significance protected under the EPBC Act are:

- world heritage properties;
- national heritage places;
- wetlands of international importance (listed under the Ramsar Convention);
- listed threatened species and ecological communities;
- migratory species protected under international agreements;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park; and
- nuclear actions (including uranium mines).[15]

Since the Great Barrier Reef Marine Park is listed as a matter of national environmental significance and is also a world heritage area, there is some overlap between the EPBC Act and the Great Barrier Reef Marine Park legislation. Where permission is required under both pieces of legislation, approvals are streamlined and done at the same time where possible.[16]

Other regulated activities

Table 3.1 summarises some additional approvals that may be required for specific activities that may be undertaken as part of an aquaculture business.

Access to and use of resources

Aquaculturalists may also require a range of other permits to give them access to or use of land and water space. These include access to or use of:

- terrestrial land — as with any use of public or private land, aquaculturalists would require some form of tenure over the land on which an aquaculture facility was based;
- tidal land for aquaculture activities (other than inlet/outlet structures) — aquaculturalists would require a Resource Allocation Authority from Fisheries Queensland; or
- tidal land for inlet and outlet structures — a permit to occupy would be required from the Department of Natural Resources and Mines.

15 Department of Sustainability, Environment, Water, Population and Communities website, http://www.environment.gov.au/epbc/protect/index.html, accessed 8 February 2013.

16 Department of Sustainability, Environment, Water, Population and Communities website, http://www.environment.gov.au/epbc/publications/safeguarding-gbrmp.html, accessed 8 February 2013.

3.1 Other regulatory requirements

Activity	Approval	Legislation	Assessing agency
Collection of regulated species from the wild			
▪ Non-protected species	General Fisheries Permit	Fisheries Act 1994	Fisheries Queensland
▪ Protected species	Permit for take of protected species	Environmental Protection and Biodiversity Conservation Act 1999	SEWPaC
▪ Protected species in the GBRMP	Permit for take of protected species	Great Barrier Reef Marine Park Act 1975	GBRMPA
Purchase of broodstock from licensed commercial fishers	Docket of sale	Fisheries Act 1994	Fisheries Queensland
Translocation of aquatic animals into Queensland from other states	Translocation approval	Fisheries Act 1994	Fisheries Queensland
Importation of aquatic animals from outside Australia	Import permit	Quarantine Act 1908	AQIS
Food safety	Compliance with Food Safety Program	Food Act 2006 Food Production (Safety) Act 2000	Safe Food Queensland Queensland Health
Stocking of public dams and impoundments	General Fisheries Permit	Fisheries Act 1994	Fisheries Queensland

Source: Queensland Department of Agriculture, Fisheries and Forestry website, http://www.daff.qld.gov.au/28_13267.htm, accessed 7 February 2012.

Regulatory barriers to expansion

Based on discussions with stakeholders, there appear to be three main regulatory barriers to expansion:

- costly, uncertain, inefficient and prohibitive environmental regulation;
- no structured approach to the allocation of aquaculture space; and
- the fragmented regulatory framework.

Impacts: environmental regulation

As identified by the Productivity Commission, there are some legitimate environmental concerns with aquaculture and some regulation is therefore necessary. The issue is whether the environmental requirements applied in Queensland are too onerous and therefore do not find the right balance between aquaculture development and environmental protection.

There is some evidence to suggest that the environmental regulation of aquaculture in Queensland may be too restrictive and costly with uncertain outcomes, which is hindering the industry's expansion. Despite significant growth in the Queensland

aquaculture industry in the past ten years there have been no new farms approved during that period.

A number of stakeholders referred to the experience of the proposed Guthalunga prawn and fish farm. The application process took 13 years and cost around $3 million.[17] The proposal was finally approved by the Federal Environment Minister in 2011; however, the approval was subject to a 'zero net discharge' condition. Consultation suggested that while achieving zero net discharge may be technically possible with current technology, it would be economically unviable.

Perhaps unsurprisingly there were different interpretations among stakeholders about the scientific basis for this decision. Some stakeholders pointed to CSIRO research to show that prawn farming has minimal environmental impacts. In particular, research by CSIRO showed that all Australian prawn farms meet world best practice discharge water quality.[18] Indeed in some cases the discharge is reportedly cleaner than the inflow water. However, other stakeholders argued that the receiving waters are already not meeting various water quality standards and the CSIRO research did not consider the impact on ecosystems close to the point of discharge.

Nevertheless, the approval process for new aquaculture facilities in the GBRMP is lengthy, costly and produces uncertain outcomes. This is a major deterrent for investors, either to start a new farm or to expand an existing one. In addition, existing farmers are worried that zero net discharge requirements may be applied to their own operations in the future.

A key problem is that the GBRMP covers a significant proportion of Queensland's coastline. This is also the area that is most attractive as a location for prawn farms. The GBRMP is a World Heritage Area with high preservation value. As stated in the GBRMPA's Environmental Impact Management Policy, management decisions relating to the Marine Park will be based primarily on environmental values. That is, GBRMPA is not required to balance the economic benefits of the proposal against any environmental costs.

Although the contribution of aquaculture to the overall sediment and nutrient load in the GBR lagoon may be minimal relative to other industries, the marginal contribution of any new aquaculture facility may increase the nutrient and sediment load in the receiving waters above prescribed water quality standards (that is, a new aquaculture facility may be 'the straw that breaks the camel's back').

This situation is unlikely to produce efficient outcomes since the economic benefits of aquaculture per unit of pollution is likely to be higher for aquaculture, compared to other industries. Furthermore, it is unfair on aquaculture producers, since the environmental constraints on aquaculture are much more strict than for other industries.

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17 Queensland Parliament Agriculture, Resources and Environment Committee, *Inquiry into Queensland's Agriculture and Resource Industries*, Report No. 13, November 2012, p. 38.

18 See CSIRO, *The environmental management of prawn farming in Queensland — worlds best practice*, Research summary, p. 3.

Allocation of aquaculture space

Some aquaculture activities require access and use of tidal land or water space. Unlike for terrestrial land, which has long established processes for allocating land for particular purposes and allocating property rights over that land, the system for allocating aquaculture space is not fully developed.

More recently, Queensland has moved towards a zoning system for aquaculture, notably in the Great Sandy Marine Park, where the Great Sandy Regional Marine Aquaculture Plan has been developed. The Plan establishes guidelines and identifies suitable sites for certain types of aquaculture development. However, only non-intensive aquaculture is allowed in this area.[19]

For access to aquaculture space outside of limited allocated space — such as for offshore sea cages — the proponent would need to apply to Fisheries Queensland. Fisheries Queensland would consider a range of factors, such as other uses of that space. However, without an established process, there may be some reluctance to apply.

Fragmented regulatory framework

The aquaculture industry is regulated by multiple agencies across commonwealth, state and local governments. The fragmented nature of the regulatory framework increases complexity and can lead to delays in obtaining approvals. Requiring approval from multiple agencies across different levels of government also increases the risk of an unfavourable response for investors.

Comparison with other States

A proposition put forward to the Parliamentary Inquiry was that the regulatory framework in other states — notably South Australia and Tasmania — is more conducive to aquaculture development compared to Queensland.

South Australia

The regulatory framework for aquaculture in South Australia appears to have a number of advantages over Queensland. The aquaculture industry is regulated by a dedicated Act — the *Aquaculture Act 2001* — which has as its objects:

- to promote ecologically sustainable development of marine and inland aquaculture;
- to maximise benefits to the community from the State's aquaculture resources; and
- otherwise to ensure the efficient and effective regulation of the aquaculture industry.

This effectively means that in assessing applications, government agencies must balance environmental protection against the economic benefits associated with development. A

19 Queensland Department of Agriculture, Fisheries and Forestry website, http://www.daff.qld.gov.au/28_21070.htm, accessed 8 February 2013.

single dedicated Act also means that the regulatory framework is less fragmented and the processes are more streamlined than is the case in Queensland.

Nevertheless, the industry remains heavily regulated. New applications are subjected to an extensive assessment process. They are assessed against strict guidelines based around a nationally accredited Ecological Sustainable Development framework to determine the sustainability and outcome of each application. Applications are referred to a number of other SA government agencies, including the Environment Protection Authority (EPA). There is also an extensive public consultation process, which includes public notices and notification of relevant industry bodies such as fishery associations and nearby aquaculture licence holders. [20]

There appears to be greater transparency in the decision-making processes, compared with Queensland. The Environment Protection Authority may be asked to provide reasons for any licence refusal and must respond within six weeks (although this may be extended if there is insufficient information). The legislation also sets up an appeal process.

Another key advantage of the South Australian regulatory framework is that it establishes aquaculture zones for marine-based aquaculture, as well as aquaculture exclusion zones where aquaculture is not permitted. It also establishes transparent processes for allocating leases.

Tasmania

In Tasmania, aquaculture licences are issued under Fisheries Acts — specifically, the *Living Marine Resources Management Act 1995* or the *Inland Fisheries Act 1995*.

However, there is a separate Act — the *Marine Farming Planning Act 1995* — that establishes aquaculture zones and the processes for allocating leases. The Act aims to achieve well-planned sustainable development of marine farming activities having regard to the need to:

- integrate marine farming activities with other marine uses;
- minimise any adverse impact of marine farming activities;
- set aside areas for activities other than for marine farming activities;
- take account of land uses; and
- take account of the community's right to have an interest in those activities.

Aquaculture is therefore regulated through a combination of:

- the statutory provisions under the Marine Farming Planning Act;
- marine farming lease conditions;

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20 Primary Industries and Regions South Australia (PIRSA) website, http://www.pir.sa.gov.au/aquaculture/leasing_and_licensing, accessed 7 February 2013.

- marine farming management controls contained with plans; and
- marine farming licence conditions.[21]

Importantly, Environmental Impact Statements are undertaken during the development of Marine Farm Development Plan (i.e. at the zone level), rather than by individual lease applicants.[22] This significantly reduces the burden on applicants.

Summary

We find that the regulatory regimes in South Australia and Tasmania have significant advantages over that which applies in Queensland. In particular, processes appear to be more streamlined in South Australia with a single dedicated piece of legislation that requires government agencies to balance environmental protection with the economic benefits associated with industry development.

In both South Australia and Tasmania there appears to be much more extensive zoning for aquaculture than in Queensland. This is likely to encourage industry expansion.

Nevertheless, it is important to note that aquaculture remains heavily regulated in those states.

21 Ford, W. *Marine Farming Planning in Tasmania*, March 2012.

22 Tasmanian Department of Primary Industries, Parks, Water and the Environment website, http://www.dpipwe.tas.gov.au/inter.nsf/WebPages/ALIR-4YS3VE?open, accessed 7 February 2013.

4 Potential for future growth

The Agriculture, Resources and Environment Committee contends that the Queensland aquaculture industry has huge potential for growth in a more favourable regulatory environment. The potential for future growth depends on industry profitability. Profitability is influenced by a wide range of non-regulatory factors. We test the Committee's proposition by examining Queensland's comparative advantage in aquaculture across these factors.

Factors affecting profitability

As shown in chart 1.1, there are likely to be a range of non-regulatory factors affecting the viability of aquaculture in Queensland.

Environmental factors

Queensland has favourable environmental factors for aquaculture including suitable land, clean water (relative to Asia) and climate for a variety of species. The coastline extends for 13 347 kilometres from the border of NSW to the Northern Territory border and includes areas suitable for land-based marine aquaculture. Extending along the coastline is a range of climates suitable for farming a wide variety of temperate and tropical species.

CSIRO analysis identified approximately 594 000 hectares of potentially optimal pond aquaculture land along the Queensland coast that would not compromise the environmental standards for the region.[23] In addition, there are opportunities for inland freshwater aquaculture within the state.

The Queensland coastline includes areas of relatively shallow waters and reasonably sheltered coastal areas. In addition the water is unpolluted and clean water that is suitable to a range of marine aquaculture systems using existing engineering and management techniques. However, the relatively shallow waters close to the coastline may make Queensland a less attractive location for sea cage aquaculture.

Prawn farming is currently the main game in Queensland and benefits from the warm temperature of the waters and the wet seasons, which provide natural filtration services to the farms.

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23 In *The environmental management of prawn farming in Queensland — world's best practice*. Research summary, sourced from McLeod, I., Pantus, F. & Preston, N.P. 2002, the use of a geographical information system for land-based aquaculture planning. Aquaculture Research 33:1-10.

A further comparative advantage is that primary species are native to Australia and currently Australia is free from many of the serious diseases that are affecting aquaculture farms in other countries.

Economic factors

Queensland has relatively well developed infrastructure to link existing aquaculture producers to markets. However, a lack of infrastructure may be holding back production in the Gulf of Carpentaria. While environmental factors make it a favourable location for aquaculture, the lack of reliable road and other infrastructure means significant development in the area is unlikely.

There is clearly sufficient skilled labour available to support the existing industry. However, whether there is sufficient skilled labour available to support a rapid expansion in production is less clear.

High production costs — including high wages and electricity prices — in Queensland relative to Asian competitors may be a significant disadvantage as a location for aquaculture production.

Industry factors

The Queensland aquaculture industry currently benefits from substantial research and development expertise in the fields of aquaculture, marine science, marine engineering and biotechnology. This includes scientific knowledge to improve feed conversion rates, increase average weight, reduce risk of mortality and disease and expand into additional species. This also includes high-quality veterinary support with the capability for disease incident management.

Areas of potential growth in Queensland aquaculture industry extend beyond the production of market ready fisheries products and could include:

- production of fingerlings for grow-out overseas;
- research and development (for example, feed conversion rates); and
- production systems.

Farm design

The economic viability of an aquaculture farm is influenced by the production system and technology used and the scale of the operation. Improvements in areas such as feed conversion rates and production per hectare increase the economic viability of a farm.

Reflecting investment in research and development, Queensland prawn farmers have achieved significant improvements in production per hectare in recent years. For one particular enterprise, average prawn production per hectare in 2010 was 17.5 tonnes per hectare, substantially larger than averages of 4-6 tonnes/hectare achieved in other farms. This particular enterprise also achieved a feed conversion rate of 1.44 and an average

weight of 37 grams, which apparently challenges both domestic and global production records.[24]

The farm design, comprising of the production system and technology, can also lead to an increased number of harvests. Historically, prawn farms produced one harvest per year. In 2002, ACIL Consulting reported the average number of prawn crops per pond per year in Queensland was about 1.2 crops.[25]

Queensland prawn farmers are currently moving towards supplying the domestic market with two harvests, including the Christmas market.

Market factors

Queensland producers achieve some advantages in domestic markets from a perceived quality differential relative to imported products. This may partly reflect food safety concerns about some imported products among some Australian consumers. This has allowed domestic producers to receive a price premium in the domestic market.

Over the past decade, the price received by Queensland prawn and barramundi farmers has been broadly steady or has declined. This is likely to reflect increasing competition from imports in the domestic market. A common perception is that the price of aquaculture products will be on a long run rising trend due to rising global demand and declining output from wild fisheries. While this may be true in the very long run, the evidence over the past ten years has not supported this proposition.

Australia currently imports approximately 16 500 tonnes of prawns worth $150 million. There is scope for Queensland aquaculture to displace some of the imported prawns on the domestic market. The extent to which this will occur will depend on domestic demand for various grades of prawns (high, medium and low) and the price difference between imported and Queensland farmed prawns. In 2010-11 the average price for imported prawns was $9 per kilogram which is substantially lower than the average price received for Queensland's farmed prawns of $15 per kilogram.[26]

As with all trade-exposed industries, the exchange rate is also a major factor determining the profitability of aquaculture in Queensland. The exchange rate remains close to record highs and significantly above the post-float average. This will be reducing the competitiveness and profitability of aquaculture producers in Queensland.

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24 Letter from Nick Moore, General Manager, Gold Coast Marine Aquaculture to CSIRO Nigel Preston, dated Wednesday, 26 May 2010.

25 ACIL Consulting, 2002, *Submission to the Productivity Commission on Industries in the Great Barrier Reef Catchment and measure to address declining water quality.* A report to Australian Prawn Farmers Association (Inc).

26 Skirtun, M, Sahlqvist, P, Curtotti, R and Hobsbawn, P, 2012, *Australian fisheries statistics 2011*, ABARES, Canberra, December.

Profitability of aquaculture in Queensland

In chapter 2, broad indicators of profit margins and value added put aquaculture on par with agriculture in terms of economic value per unit of output. It could be argued that regulatory constraints are increasing costs of production through high compliance costs and reduced economies of scale. The current average size of prawn farms is around 35 hectares in Queensland, however, there exists a well-known proposal to establish a prawn farm north of Bowen (the famous Guthalungra case study referred to earlier) for a single farm of 259 hectares. Its output might be expected to expand Queensland prawn production by 50 per cent.[27]

Anecdotal evidence suggests there may be significant economies of scale from such a large operation. The fact the developers of Guthalungra have been pursuing approval for 13 years so far seems to support the fact that the underlying profitability is strong. However, as previously stated, the process of seeking approval has so far cost $3 million and the condition of nil discharge required for the development, although technically feasible, is currently making the project economically unviable.

Similarly, industry sources suggest that cage aquaculture of coral trout could be significantly more profitable than many existing aquaculture operations.

Another positive indicator of underlying profitability is that the industry has achieved a 4.5 per cent growth rate over the past decade. Even more illuminating, is that it has achieved this despite there being a highly restrictive regulatory environment and no new farm approvals.

Furthermore, there is considerable interest within Queensland to expand aquaculture to high value species such as rock lobster and groper. Technologies to support this are currently being developed or have been developed, for example, research and development has advanced significantly over the past decade enabling the successful breeding of tropical rock lobster to the juvenile stage.[28] Such developments increase the potential growth of Queensland's aquaculture industry, however it is less clear whether Queensland would have a comparative advantage in farming these species compared to Asian countries such as Taiwan which has lower costs.

Major non-regulatory barriers to expansion

Queensland appears to have several advantages as a location for aquaculture. There is also some evidence to suggest that aquaculture can be highly profitable in Queensland. Nevertheless, it is important to be cautious about assuming that high returns for existing businesses are necessarily replicable for new entrants. As outlined above, there are a

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27 QFF (2013) Case Study: Aquaculture development — Guthalungra, north of Bowen, in Planning Case Studies Queensland.

28 QLD Department of Agriculture, Fisheries and Forestry, 2012, *Taiwan eyes Queensland's rock lobster expertise.* http://www.daff.qld.gov.au/30_21565.htm

range of non-regulatory factors that could limit growth in the near to medium term even if the regulatory restrictions are relaxed significantly.

An important constraint on growth in existing aquaculture industries (such as prawn and barramundi farming) may be the ability of Queensland producers to find a market for their product at a price that continues to be economically viable. Currently, most aquaculture products produced in Queensland are consumed domestically. Domestic aquaculture products currently sell at a premium to imports, suggesting a preference for products produced in Australia. This may be partly due to higher quality, but could also reflect food safety concerns around imported seafood.

A large increase in domestic production of the magnitude suggested by the QAIF is likely to bid down the price towards (or below) the price of imported products. Consultations suggested that domestic producers may not be able to compete on price against imported products, due to high production costs in Australia (for example, high labour and electricity costs). Lower output prices would clearly reduce the profitability of aquaculture production and therefore reduce its attractiveness to investors.

Producers could export some of the additional production. However, finding export markets would take significant marketing effort and it is not clear whether Australian produced products would receive a premium in export markets.

Another factor that could limit growth is the availability of skilled labour. Successful aquaculture businesses are sophisticated operations, requiring significant knowledge and expertise. Even with established technologies it can take some time for operators to achieve a consistent level of production due to variations in location and other factors. It is not clear there would be sufficient expertise within Queensland (or Australia) to support expansion of the magnitude suggested by the QAIF, at least in the near term. It may be possible to import expertise from overseas, but this has its own regulatory barriers.

According to the Queensland Department of Agriculture, Forestry and Fisheries oyster production in Queensland is only one-tenth of what it was during 1880-1910. The seasonal occurrence of the disease QX in South East Queensland waters restricts the tidal areas where oysters can be viably produced and limits the growing season.[29]

Significant growth in aquaculture production could potentially come from new high-value species. However, it typically takes some time for new technologies to be adopted to any significant extent.

Overall assessment of Queensland's aquaculture potential

There appears to be significant potential for Queensland to expand its aquaculture production with a more favourable regulatory environment. However, an increase of the magnitude suggested by the QAIF seems unlikely in the near to medium term.

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29 Queensland Department of Agriculture, Forestry and Fisheries website, http://www.daff.qld.gov.au/28_13365.htm, accessed 22 February 2013.

The fastest growing of the world's major aquaculture producers — Indonesia and Vietnam — increased production at an average annual growth rate of around 20 per cent during the 2000s. However, developing economies tend to be able to achieve higher growth rates compared to developed economies. The Queensland aquaculture industry may not be able to achieve that sort of growth on a sustainable basis.

New Zealand was able to achieve an exceptionally rapid annual growth rate of aquaculture production during the 1980s of approximately 27 per cent . However, this was from a low base and the growth rate subsequently slowed significantly as the industry matured.

The best indicator of the potential for Queensland's aquaculture industry to expand is likely to be the growth rates achieved by other Australian states with more favourable regulatory environments. Over the ten years to 2010–11, aquaculture production in Tasmania increased at an annual average rate of around 14 per cent. This perhaps represents an upper bound on the medium term growth rate achievable in Queensland after regulatory reform. Were this to occur in Queensland's aquaculture industry it would increase its value of output by around 270 per cent over the next decade.

Such an increase would be spectacular. For prawns alone, it would require a market expansion equivalent to the current import market for prawns, an expansion from around 4000 tonnes a year to 15 000 tonnes. As imported prawns tend to be low priced prawns it would most likely require considerable amounts of marketing to maintain existing prices for domestic aquaculture prawns or displace wild caught prawns. Alternatively, it would require development of export markets. That said, Australian prawn exports have declined markedly (84 per cent by value) over the past decade[30]. Were domestic prices for Australian aquaculture prawns to decline as they displaced imports, to achieve a 270 per cent increase in value would require an even larger increase in output.

Although the current average size of prawn farms is around 35 hectares in Queensland, were much larger farms such as the famous 259-hectare Guthalungra proposal successful, it would take only another five such sized farms in the next 10 years to achieve the volume potential of 270 per cent. Moreover, even existing farms have expansion potential. CSIRO (2012)[31] claims that were the entire Australian Black Tiger prawn industry to adopt new breeding stock, it could increase the industry's production from 5000 tonnes to 12 500 tonnes assuming no further expansion of production area. Currently the average output for farmed prawns is five tonnes per hectare. The new prawns can produce an average of 17.5 tonnes per hectare. CSIRO also argue that the technology means Australian prawn producers could out-compete international producers, despite the lower labour costs in most of the competing countries. Nonetheless, this does imply receiving lower prices.

It is also interesting to note the performance of South Australia's aquaculture industry over the decade since the introduction of the Aquaculture Act. While the regulatory

30 ABARES Outlook conference paper 11.09

31 CSIRO (2012), Improving Tiger Prawn Farming, http://www.csiro.au/Outcomes/Food-and-Agriculture/tiger-prawn-farming.aspx

regime in South Australia has been singled out as best practice in Australia, aquaculture production in South Australia has declined at an average annual rate of around 1 per cent. This was the second worst performance of any Australian jurisdiction. A significant proportion of South Australia's aquaculture production is southern bluefin tuna caught in the Great Australian Bight and fattened in aquaculture farms of Port Lincoln. The decline in South Australia's aquaculture production reflects a reduction in Australia's southern Bluefin tuna catch allocation.[32] Nevertheless, this demonstrates that regulatory reform does not necessarily lead to a rapid expansion in output.

32 Australian Bureau of Agricultural and Resource Economics and Sciences, *Australian Fisheries Statistics 2010*, August 2011, p. 13.

5 Reforming the regulatory framework

The evidence reviewed as part of this study suggests there is a clear case for reform to the regulation of the aquaculture industry in Queensland. The benefits of reform to the Queensland community over time could be substantial.

A clear case for reform

There appears to be significant scope for reform in Queensland. A Productivity Commission report on water quality in the Great Barrier Reef catchment argued that prescriptive end-of-pipe controls is not the answer to improving water quality in the Great Barrier Reef lagoon.[33] A regulatory approach that balances environmental protection against the benefits of industry development is likely to deliver better outcomes for the Queensland community.

Furthermore, there are likely to be benefits from zoning additional space for aquaculture and streamlining regulation and regulatory processes. A system where the government carefully chose aquaculture zones based on both commercial viability and environmental suitability and then leased sites within that zone may encourage industry expansion. However, many of the costs associated with the environmental impact assessments etc. would be borne by the government.

Since the current regulatory regime does not appear to be delivering outcomes that are in the best interests of the community, there is a clear case for reform.

Potential benefits from reform

It is difficult to estimate the potential benefits of reform with any precision, particularly without knowing exactly what the reforms would be. In the previous chapter we suggested that as an upper bound estimate, the Queensland aquaculture industry could potentially increase at an annual rate of around 14 per cent (in value terms) over the decade in a more favourable regulatory environment. Based on average value of production over the past three years of around $90 million, this suggests the value of aquaculture production in Queensland could almost quadruple to around $334 million per year after 10 years. This would be an increase of around $244 million from the current level. This would represent a very large 270 per cent increase in value of output.To assess the economic net benefits of such an increase we need to consider two

33 Productivity Commission, *Industries, Land Use and Water Quality in the Great Barrier Reef Catchment*, Research Report, February 2003, p. XXII.

other factors. Firstly, the benefits of reform need to be assessed against a counterfactual scenario in which there is no reform rather than current levels of production. This is an important point because the Queensland aquaculture industry may expand over the next 10 years, even without reform, albeit at a slower rate. Over the past decade, the Queensland aquaculture industry has been able to achieve an increase in the value of production of around 5 per cent annually, despite a restrictive regulatory environment. Moreover, as previously indicated, CSIRO (2012) indicate there is still significant potential for yield increases in prawns for instance (see footnote 34) and there are new species of finfish that offer higher growth rates than barramundi. If the 4.5 per cent growth rate continued for the next 10 years, the industry would increase to around $140 million even without reform. This suggests that the increase in production attributable to reform could be around $194 million.

Secondly, a significant increase in production would require additional resources (that is, labour, capital and intermediate inputs). To a large extent these resources will be diverted away from alternative uses. So any increase in aquaculture production will be partly offset by lower production in other industries (compared to what would have been the case without reform to the aquaculture industry). The net benefit to the community is therefore the value of the additional aquaculture production less the opportunity cost of the additional resources used in production. So unless aquaculture provides better returns to capital and labour than the industries from which these resources have been diverted, there is no benefit to the community from greater aquaculture production.

The returns to capital and labour in the aquaculture industry are likely to be somewhat higher than other industries (otherwise the industry would be unable to attract the resources away from their current use), although it is not clear by how much. There is some evidence that returns to capital and/or labour are (and could be) significantly higher than other industries, but this may be overstated, particularly for new entrants.

ABS estimates suggest that the value-added by the labour and capital used for aquaculture has averaged around 31 per cent of the value of gross output. If the returns to capital and labour in aquaculture were double other industries, the net benefit to the community would be around $30 million a year after 10 years, about $17 million a year in present value terms using a 7 per cent discount rate and have an average annual present value benefit each year of nearly $8 million.

These estimates are not forecasts. They are projections showing the considerable potential of the industry assuming a number of optimistic factors occur:

- that growth matches the highest growth achieved by any other state in aquaculture historically, namely Tasmania;
- that the value added of new aquaculture ventures is 50 per cent higher than existing aquaculture and the next best activity that resources could be engaged in — based on favourable profit possibilities from studies and accounting for economies of scale and taking up best practice technologies;
- there is either no decrease in domestic prices as a result of expansion, or if there is, production growth will be higher than value growth;
- current regulation is made dramatically less restrictive.

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