Seafood Industry Report

This report analyses the seafood industry in Australia and Asian markets.

Companies’ Data

<table>
<thead>
<tr>
<th>Company</th>
<th>Ticker</th>
<th>Market Cap (M)</th>
<th>12-month change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angel Seafood Holdings Ltd.</td>
<td>AS1</td>
<td>28.6</td>
<td>N/A</td>
</tr>
<tr>
<td>Clean Seas Seafood Ltd.</td>
<td>CSS</td>
<td>100.0</td>
<td>71.4</td>
</tr>
<tr>
<td>Huon Aquaculture Group Ltd.</td>
<td>HUG</td>
<td>413.1</td>
<td>6.3</td>
</tr>
<tr>
<td>Murray Cod Australia Ltd.</td>
<td>MCA</td>
<td>24.3</td>
<td>14.8</td>
</tr>
<tr>
<td>New Zealand King Salmon Co. Ltd.</td>
<td>NZK</td>
<td>281.1</td>
<td>56.2</td>
</tr>
<tr>
<td>Ocean Grown Abalone Ltd.</td>
<td>OGA</td>
<td>39.4</td>
<td>-5.0</td>
</tr>
<tr>
<td>Seafarms Group Ltd.</td>
<td>SFG</td>
<td>91.4</td>
<td>-31.6</td>
</tr>
<tr>
<td>Tassal Group Ltd.</td>
<td>TGR</td>
<td>613.4</td>
<td>-19.5</td>
</tr>
</tbody>
</table>

Source: FactSet

<table>
<thead>
<tr>
<th>Company</th>
<th>Ticker</th>
<th>Target Sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angel Seafood Holdings Limited</td>
<td>AS1</td>
<td>Pacific Oysters</td>
</tr>
<tr>
<td>Clean Seas Seafood Limited</td>
<td>CSS</td>
<td>Yellowtail Kingfish</td>
</tr>
<tr>
<td>Huon Aquaculture Group Limited</td>
<td>HUG</td>
<td>Atlantic Salmon</td>
</tr>
<tr>
<td>Murray Cod Australia Limited</td>
<td>MCA</td>
<td>Murray Cod</td>
</tr>
<tr>
<td>New Zealand King Salmon Co. Ltd.</td>
<td>NZK</td>
<td>King Salmon</td>
</tr>
<tr>
<td>Ocean Grown Abalone Ltd.</td>
<td>OGA</td>
<td>Abalone</td>
</tr>
<tr>
<td>Seafarms Group Ltd.</td>
<td>SFG</td>
<td>Black Tiger Prawn, Banana Prawn</td>
</tr>
<tr>
<td>Tassal Group Limited</td>
<td>TGR</td>
<td>Atlantic Salmon</td>
</tr>
</tbody>
</table>

Source: FAO

Australian seafood is set to grow due to premium quality and growing domestic and global demand

Background on Seafood Industry

Australia’s seafood industry is still regarded to be in its infancy stage with production predominately made up of privately-owned, family-run farms. The 2.4% global growth in demand for seafood is likely to continue driven by population growth of 8.5 billion by 2030, and by the rising spending power of the global middle class, which is forecast to increase from 1.8 billion in 2009 to 4.9 billion by 2030. Wild catch is at risk of declining due to overfishing and aquaculture will have to make up the gap in demand and supply.

Australia has a global reputation for sustained high quality product, which allows for producers to sell at a premium in international markets. That quality is supported by strong State/Federal legislation and government funded research. Entry into the aquaculture industry has high regulatory barriers, placing a premium on incumbent operators.

The major risk involved within the seafood industry are biosecurity risk, price risk and the sustainability of operations.

Australian Seafood Markets

The top five aquaculture species groups in Australia, in order of production value, are: salmonids, tuna, edible oysters, pearl oysters and prawns. Other species produced in Australia include Abalone and Murray Cod.

ASX-listed Seafood Companies

The first listed seafood company in Australia was SFG in July 1999. As at the date of this report there are 8 seafood companies listed on the ASX.

SFG is Australia’s largest producer of Black Tiger Prawns. It is currently undergoing construction of a new production facility titled Project Sea Dragon which will allow them to increase their current production of 1,700 tonnes to 150,000 tonnes at full capacity.

CSS currently produces King Fish. MCA produces Murray cod which is only harvestable in Australia, making it the largest producer of the fish in the world.

HUGO is Australia’s second largest producer of Atlantic Salmon behind TGR. NZK is a New Zealand producer of King Salmon which supplies product to Australia and internationally.

AS1 is listing on the 19th of February 2018. It produces Pacific Rock oysters in the Eyre Peninsula region.

Conclusion

The demand for quality seafood products is set to increase and certain Australian producers are well positioned to capture this demand.
Contents

Background on Seafood Industry ................................................................. 1
Australian Seafood Markets ......................................................................... 1
ASX-listed Seafood Companies .................................................................... 1
Conclusion .................................................................................................... 3

GLOBAL OVERVIEW ON THE SEAFOOD INDUSTRY .................................................... 3

INDUSTRY OVERVIEW ........................................................................................... 5

Australian Seafood Industry ......................................................................... 5
Overview ......................................................................................................... 5
The Australian Fishing Zone ........................................................................... 7
Regulation ....................................................................................................... 7
Legalities ........................................................................................................... 8
Seafood Demand .............................................................................................. 8
Australia’s Export Market ............................................................................. 9
Seafood Supply ............................................................................................... 11
Supply chain .................................................................................................... 12
Sustainability ................................................................................................. 12
Bio-security .................................................................................................... 13

OVERVIEW OF PRODUCT MARKETS .................................................................. 17

Salmon ............................................................................................................ 17
Murray Cod ..................................................................................................... 25
Abalone .......................................................................................................... 28
Prawns ............................................................................................................ 31
Oysters .......................................................................................................... 34
Yellow Tail Kingfish ...................................................................................... 42
Southern Bluefin Tuna .................................................................................. 45

APPENDICES .................................................................................................... 49

Appendix 1: Seafarms Project Sea Dragon ..................................................... 49
GLOBAL OVERVIEW ON THE SEAFOOD INDUSTRY

Growing population and increasing wealth are underpinning the demand for protein: Global population is expected to increase from 7 billion today to 9 billion by 2050 according to the United Nations projections. Over that time the world’s total food requirement is expected to increase by 70% in value due to increased aggregate food consumption and an increased share of animal protein due to the expansion of the middle class, particularly in Asia.

The middle class is forecast to increase from 3.2 billion at the end of 2016 to 4.9 billion people by 2030, an increase of 53.1% in accordance to the (OECD). The bulk of this growth will come from Asia: by 2030 Asia will represent 66% of the global middle-class population and 59% of middle-class consumption, compared to 28% and 23%, respectively in 2009.

Fish and other seafood are the largest source of animal protein (160 million tonnes) consumed globally, exceeding that of pork (114 million tonnes), poultry (106 million tonnes) or beef (68 million tonnes).

Average per capita fish consumption today is around 17.5 kg/year, forecast to rise modestly to 18.2 kg/year by 2030. The latest Rabobank report released in November 2017 notes that seafood is the world’s most consumed animal protein, with consumption up 26% over the last 15 years, driven by population and dietary preferences for seafood.

From the forecasts above the main growth in demand for seafood is in China and South East Asia, with flat or declining trends in Europe, Latin America and the Caribbean.

Aquaculture, which represents nearly half of the total global fisheries production (70 million tonnes), has been the fastest-growing protein sector over the last 30 years. Aquaculture is defined by the Food and Agriculture Organization (FAO) as the “production of fish, crustaceans, mollusks, and marine plants, with these being in turn processed into products for human consumption, especially as seafood.” The process involves the stocking, feeding and protection of these aquatic flora and fauna.

Wild catch fishing represents the majority of the other half of the total global fisheries production, which has been declining over recent years due to unsustainable fishing. As seen in Figure 2, the aquaculture industry has made up for the loss of production from wild catch and in 2010 overtook wild catch fishing as the world’s leading source of seafood.

Globally, the wild fish catch peaked in the 1990s, which has since modestly declined, and will need to decline further for at least some temporary period if fisheries are to recover enough to produce present catch levels sustainably.

The United National Environmental Program suggests that this temporary effort decline needs to be in the order of 50% of today’s levels for the wild resource recovery process to be achievable long term.
Seafood per capita consumption in developing countries in particular has risen strongly in recent years, increasing 39% in the period 2000 to 2014 (to 19.2kg per head), while consumption in the developed world remained steady during that period. The FAO has identified the following as key components of projected global seafood consumption:

- Developing countries will drive expansion in fisheries and aquaculture production, trade and consumption due to growing population and the perceived health benefits of fish and other seafood;
- Fish prices by 2023 are forecast (in nominal terms) to be well above historical averages; and
- World fish and seafood consumption is projected to reach over 20.9kgs per capita in 2023.

Seafood production is expected to be 17% higher by 2023 from further gains in aquaculture output which is forecast to reach 49% of total fishery production in 2023. Hence, there is significant future demand for seafood.
INDUSTRY OVERVIEW
Australian Seafood Industry

Overview
Seafood demand in Australia has increased over the last three decades. Currently, Australia’s consumer demand for seafood exceeds the supply from domestic production and continues to grow.

Australian aquaculture has the potential to significantly expand to help meet domestic and international demand.

Figure 4 Comparison of Australian seafood consumption and Australian seafood production in tonnes

Source: Food and Agriculture Organization of the United Nations

Aquaculture production occurs throughout Australia, from the tropical north to the temperate south. The aquaculture industry is largely based in regional Australia and makes a significant and positive contribution to regional development.

Since 2002–03 the real gross value of aquaculture production has increased by 12 per cent ($108 million) to over $1 billion.

The largest increase over this decade came from the value of production of salmonids (salmon and trout) and edible oysters.

In 2012–13 farmed salmonids, almost entirely from Tasmania, were Australia’s most valuable fisheries product, worth $497 million.
In 2014–15, increased aquaculture production volume resulted in the total volume of fisheries and aquaculture production rising, for the first time since 2009–10, by 6 per cent (up 12 624 tonnes), to 235 710 tonnes (comprising 89 217 tonnes of aquaculture products and 151 439 tonnes of wild-caught products).

This growth was mainly due to increases in aquaculture production and increases in salmon farming.

Australia’s strength in the seafood industry is in producing high-quality seafood products such as southern bluefin tuna, salmon and edible oysters.

Australia has an international reputation as a producer of safe, sustainable and high quality seafood products. Most of the value of Australian aquaculture production comes from high value species such as pearls, salmonids, tuna and oysters but there are over forty species commercially produced in Australia.

The top five aquaculture species groups in Australia, in order of production value, are: salmonids, tuna, edible oysters, pearl oysters and prawns.

Other species groups grown in Australia include: abalone, freshwater finfish (such as barramundi, Murray cod, silver perch), brackish water or marine finfish (such as barramundi, snapper, yellowtail kingfish, mulloway, groupers), mussels, ornamental fish, marine sponges, mud crab and sea cucumber.
The Australian Fishing Zone
Australia's territorial sea extends from the coast out to 12 nautical miles. Within the territorial sea, Australia has full sovereignty—including with respect to fisheries—subject only to the rights of foreign ships to 'innocent passage' through the territorial sea.

Consistent with international law, Australia has also claimed sovereign rights to explore and exploit the natural resources of the continental shelf (including sedentary species) where the shelf extends beyond 200 nautical miles.

As a matter of Australian domestic law, the Offshore Constitutional Settlement provides for the Australian states and the Northern Territory to manage fisheries out to 3 nautical miles from the coast, and for the Australian Government to manage fisheries from three to 200 nautical miles. However, these default arrangements are frequently varied through instruments known as offshore constitutional settlement arrangements.

Figure 7 The Australian fishing zone showing the location of Commonwealth fisheries

Source: Australian Government Department of Agriculture and Water Resources

This marine territory covers 8,148,250 square kilometres— but, because of a lack of nutrient-rich currents (and so relatively low productivity due to the dominance of the two southern polar flowing currents of warm tropical waters), Australia ranks only 52nd in the world in terms of volume of fish landed.

Regulation
Aquaculture in Australia is managed under strict environmental guidelines. While the Australian Government has a number of important functions in relation to aquaculture, including national programs for research, management of biosecurity, aquatic animal health, food safety, environmental management, and market access and trade, most elements of the regulation of domestic aquaculture production rest with the states and territories.

Aquaculture operations, particularly those that operate in, or discharge into, public waters, are required to comply with stringent environmental controls monitored on an ongoing basis by state agencies. Strict food health standards also apply to both aquaculture and wild capture products.

These environmental and food safety standards ensure fish grown in Australian waters are safe to eat and that seafood production does not unduly affect aquatic environments.
Strict food health standards also apply to both aquaculture and wild capture products. These environmental and food safety standards ensure fish grown in Australian waters are safe to eat and seafood production does not unduly affect aquatic environments.

The Australian Government also applies strict food safety requirements for imported seafood:

- The Australian Government Department of Agriculture inspects imported food, including seafood, to check that it meets Australian requirements for public health and safety and complies with Australian food standards as detailed in the Australia New Zealand Food Standards Code;
- Imported Food Control Act 1992 means importers are responsible for ensuring that all food imported into Australia complies with relevant standards in the code;
- Food Standards Australia New Zealand provides advice to the department on the foods that pose a medium to high risk to public health;
- The Australian Customs and Border Protection Service refers foods to the department for inspection;
- If any consignment fails inspection, the department will go back to testing 100 per cent of that product until a history of compliance is re-established for the producer of the food.

**Legalities**

Australia is party to a range of conventions that establish global, regional and subregional management organisations that manage highly migratory, straddling, pelagic and demersal fish stocks. These instruments include:

- The Convention on the Conservation of Southern Bluefin Tuna, which establishes the Commission for the Conservation of Southern Bluefin Tuna;
- The Agreement for the Establishment of the Indian Ocean Tuna Commission, which establishes the Indian Ocean Tuna Commission, and;
- the Convention for the Conservation of Antarctic Marine Living Resources, which establishes the Commission for the Conservation of Antarctic Marine Living Resources; and
- Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific.

Beyond these instruments, jurisdictions variously maintain supporting and enabling fishery/seafood legislation as necessary (e.g. for food safety and human health, or environmental protection).

State and Territory fishery legislation is subservient to national legislation, including the Commonwealth’s EPBC Act. The EPBC Act bears directly on Commonwealth, State and the Northern Territory fisheries management in three ways:

- Assessing matters of national environmental significance;
- Avoiding impact on listed threatened species, listed migratory species, cetaceans and members of listed marine species;
- Monitoring and precluding international movement of wildlife specimens; as it relates to fisheries, the commercial export of Australian native species or species listed under the Convention on the International Trade in Endangered Species (CITES).

Many of these organisations are now focusing on the problem of Illegal, Unreported and Unregulated (IUU) fishing as a major threat to the effective management and conservation of regional fish stocks and are consequently seeking to identify vessels engaged in IUU fishing within respective areas of competence in order to effectively combat and eliminate these operations.

**Seafood Demand**

Seafood demand in Australia has steadily increased over the last decade. In 2012–13 Australians each consumed an average of 15 kilograms (process weight) of seafood, compared with 13 kilograms in 2000-01.

IBISWorld is forecasting overall seafood consumption to rise by 3.7%, from 19.0 kilograms per capita in 2015-16 to 19.7 kilograms per capita by 2021. However, subdued growth is anticipated for the nation’s fishing and aquaculture industries, with revenue forecast to grow at an annualised 0.9% and 2.7%, respectively, between 2015-16 and 2020-21.
Ongoing increases in disposable income and health consciousness, coupled with rising awareness about the health benefits of certain types of fish and seafood, particularly salmon, is continuing to drive overall fish and seafood consumption. However, industry challenges are expected to challenge revenue growth.

Aquaculture is one of Australia’s most lucrative primary industries, largely due to its emergence as the most viable way to maintain seafood production in the face of ongoing declines in national and global fishing stocks. Industry revenue is forecast by IBIS World to grow at an annualised 2.7% over the coming five years, from $1.2 billion in 2015-16 to $1.3 billion by 2020-21.

The capacity for growth in Australia’s wild fisheries production is limited by the relatively low natural productivity of our marine waters. Domestic aquaculture may be able to expand to reduce the deficit in the long term. To do this the industry would need to build considerable capability to produce high-tonnage species that meet Australian consumers’ requirements for inexpensive, boneless, skinless white-flesh fillets. As in many advanced economies, seafood imports will continue to be necessary to meet domestic demand in Australia in the foreseeable future.

**Australia’s Export Market**

Australia has established a reputation as a supplier of safe, high quality seafood which is produced using environmentally sustainable practices. Australian aquaculture producers target high value overseas markets.

The increasing demand for Australian native species and the proximity to Asian markets, together with world recognised seafood quality and standards, means Australian aquaculture is competitively positioned to take on high value aquaculture products.

**Japan**

Japan is well known for its fish-eating culture. Japanese seafood such as sushi and sashimi has become popular in global markets due to its healthy, low fat and low calorie content.

In 2001, the annual consumption of seafood per capita reached a peak of 40 kilograms, but has since decreased to 27 kilograms in 2014. Total consumption of seafood in 2014 was 6.2 million tons. Much of this decline is due to the westernisation of diets, with people eating more meat, the increasing price of seafood and the increasing availability of ready-to-eat meals.

Consumption of salmon, tuna, bonito and saury has increased nearly 40 per cent, while the consumption of mackerel, horse mackerel and squid has slowly declined by 50 per cent over the past 40 years.

China, the US, Chile and Thailand are the largest exporters of seafood to Japan. Top products by value imported into Japan include prawns, tuna, marlin, salmon and trout Australia exports to Japan include prawns, southern Bluefin tuna, Tasmanian salmon, abalone, pacific oyster and school whiting.

Examples of successful Australian seafood exports include southern Bluefin tuna, which has established a strong brand recognition in sushi restaurants. Tasmanian salmon continues to attract a higher price at markets than its main competitor, Norway (one of the largest producers).

Japanese manufacturers, processors, wholesalers, restaurants chains and supermarkets are all interested in clean, safe, price-competitive and value-add products from overseas, which creates an opportunity for Australia.

Japanese importers are responsible for ensuring that imported products comply with strict regulations. Products may require a certificate of origin, product process information, laboratory test results and other certificates in compliance with Japan Agricultural Standards and local Food Sanitation Law.

**Hong Kong**

Hong Kong relies heavily on seafood imports, with 90 per cent of fish and seafood products imported substantial demand exists for all kinds of seafood, ranging from the low-price fin fish (e.g. croaker and carp) to more expensive gourmet delicacies (e.g. abalone and lobster).

Sustainable seafood is becoming more popular in the market.

Australia is a major supplier of gourmet shellfish sold in Hong Kong. The main items exported from Australia include: live, frozen and canned abalone, frozen scallops, live lobsters, frozen prawns, coral trout, oysters, mussels, king crabs, as well as selected fin fish for western catering.
In 2015, Hong Kong fish and seafood imports were valued at US$3.1 billion, down 1.7 per cent. Australia was the sixth largest supplier, up 9 per cent with 3.6 per cent market share. In 2015 Australian seafood exports to Hong Kong were valued at more than A$112 million.

Because of Australia’s global reputation for high quality seafood there is opportunity to provide seafood to Hong Kong consumers who are becoming increasingly concerned about food safety. However, Hong Kong consumers look for authoritative signs a product is safe, hence certified and award winning products have an advantage in this market.

Hong Kong is a free trade port with no tariffs on importing fish and seafood. Marine products are considered as high-risk food items. Health certificates issued by Australia’s Department of Agriculture and Water Resources are highly recommended for expediting customs clearance and re-export purposes.

China
With a population of over 1.3 billion, China has emerged as the world’s largest consumer market for food and beverage. They are also one of the fastest growing markets in Asia with an average annual growth rate of 35.4 per cent from 2011 to 2014.

Food consumption patterns in China have changed significantly as living standards have risen and more consumers are exposed to a greater diversity of choice, both locally and through travel abroad.

Chinese consumers are increasingly demanding their products to be of high quality, better nutritional value, variety, freshness and convenience. This demand is advantageous for Australia’s export market to China. Market feedback has shown that there is interest in Australian suppliers of seafood, particularly oysters, lobster and abalone.

All imported foodstuffs and beverages are subject to inspections by the China Entry-Exit Inspection and Quarantine Bureau (CIQ).

Manufacturers of seafood are subject to even stricter accreditation for the registration process. On the spot accreditation by Chinese government officials may be also required. Certification and Accreditation Administration of the People’s Republic of China (CNCA) publishes latest lists of approved foreign manufacturers or facilities of seafood.

Chinese certification systems and foreign organic certification systems are not mutually recognised. Organic products that have not been certified by China or products that have only been certified by an overseas organic certifying body cannot be labelled as ‘organic’ or ‘in-conversion to organic’ or other labelling terms claiming to be organic.

It typically takes three to six months and over A$10,000 to apply for and obtain a Chinese organic food certificate. Australia’s largest internationally recognised certification body, Australian Certified Organic (ACO), and National Association for Sustainable Agriculture Australia Limited (NASSA), have both signed agreements with a Chinese certifier to provide Australian certified operators with a more time and cost-effective package for the certified organic food certificate application.

Malaysia
Between 2015 and 2020, Malaysia’s food sales are expected to grow more than 7 per cent year on year. There has been a significant shift in recent years from buying commodities such as fish and rice, towards higher value imported items including meat, dairy, wine, confectionery and organic foods.

Malaysia has a very high per capita consumption of seafood, more than 52 kg per person each year. Fish is considered a cheap source of protein compared to mutton or beef. Substantial demand exists for all kinds of seafood, ranging from local fish (e.g. carp and tilapia) to more expensive gourmet delicacies (e.g. abalone, oyster and lobster).

Korean Market
The origin of fish and seafood products is greatly emphasized by fish and seafood importers, distributors and manufacturers, due to the continued news coverage of the Fukushima nuclear disaster and the impact nuclear water runoff is having on ocean wildlife off the coast of Japan, and the fishing grounds around South Korea. Fishmongers and hypermarkets prominently display the origin of fish and seafood that are imported from countries not affected by the nuclear disaster, such as Norway or Russia.
South Koreans like to purchase their fish and seafood at traditional markets, which are mostly located near the production grounds such as landing ports or fish farms. The location of the markets is associated to freshness and value-for-money. According to the Korea Maritime Institute’s 2012 survey of consumption of fishery products, 41% of consumers usually purchase seafood at traditional markets. However, this is changing. In the same survey, 39.1% indicated that purchase their fish and seafood at discount stores or supermarkets.

Singapore Market
Singapore imports over 90 per cent of food consumed throughout the country due to limited land available for agriculture. Australia, China, Indonesia, Malaysia and United States are Singapore’s main suppliers of food.

Singapore allows free import of food supplies and products but as a country reputed for food safety and hygiene, it has strict regulatory regimes to ensure the safety of food and food supplies that are being imported into the country. The Agri – Food and Veterinary Authority of Singapore (AVA) and Food Control Department are the major governing bodies of Food trade. The exports to Singapore are primarily controlled through regulations imposed on the importers.

Seafood of all varieties in chilled, frozen, processed or canned forms can be exported from any country to Singapore; no qualifying restrictions have been laid as in the case of meat. However chilled shucked raw oyster, chilled cockle meat, chilled cooked prawn/shrimp and chilled crab meat is prohibited for food safety reasons. Live oysters may only be imported from countries which meet AVA’s requirements for a shellfish sanitation programme and that maintain a National Shellfish Sanitation Programme (NSSP). Australia, Canada, France, Ireland, the Netherlands, New Zealand, United Kingdom and USA are the countries that are currently approved for exporting this category of seafood.

A Health Certificate issued by the relevant authority of the exporting country, certifying that Singapore’s animal health and food safety requirements have been complied with, must accompany every consignment of live/frozen oysters.

The main supermarket chains may obtain products via direct import or through local importers/distributors. When product lines are sufficiently large in volume and have fast turnovers, supermarket chains are increasingly opting to import directly. Retailers may also have appointed consolidators in specific countries, including Australia. Exporters supplying to consolidators can deliver orders that are in smaller volumes, as compared to the direct export model.

Distribution to wet markets, hawkers, small grocery and mom-and-pop stores is usually handled by distributors and intermediary wholesalers. The larger distributors usually have their own facilities to handle perishable goods and capabilities for re-packing and distribution to their customers.

Seafood Supply
The combined volume of Australian fisheries and aquaculture production has been relatively stable over the past two decades, as lower production volumes from Australia’s wild capture sector have been offset by strong growth in the volume of aquaculture production.

Figure 8 Australian Seafood Production in tonnes

Source: Australian Bureau of Agricultural and Resource Economics
The capacity for growth in Australia’s wild fisheries production is limited by the relatively low natural productivity of Australian marine waters.

Supply chain

Robust supply chains are central to the success of agricultural industries in an increasingly competitive global market. The key is to create, or re-create, contestable supply chain organisations aligned with the producer in three possible ways:

- For chains dominated by large corporate players it is critical to raise alignment and trust along the supply chain, particularly with respect to encouraging investment.
- Chains that are concentrated, characteristically cooperative structures with large players, need to keep working to reduce capital constraints.
- Smaller industries (such as seafood) with relatively fragmented structures often lack an industry leader that drives innovation. Besides further consolidation, this calls for greater cooperation among players. Deep and sustained involvement by industry bodies could help drive this.

The Port Jackson Partners’ report also highlighted the critical need for additional investment infrastructure to support the growing Australian seafood industry. This includes road infrastructure, rail infrastructure and port infrastructure.

The seafood wholesaling industry in Australia (SFWI) is a sub-segment of the broader food wholesaling industry (FWI) relating to the supply and distribution of fresh and frozen seafood products.

Due to limited seafood resources and processing constraints within the domestic Australian market, the SFWI is reliant on imported fresh and frozen seafood products.

The SFWI is currently undergoing structural change driven by large supermarket chains stocking high quality, fresh pre-packed seafood products in response to consumer demand for healthier seafood products and convenience. The major supermarkets (Woolworths, Coles, IGA) source their domestic seafood products directly from larger fishing and aquaculture producers. Major retailers and wholesalers have shown an increasing interest in issues such a sustainable sourcing, traceability and certification, with the retailers establishing proprietary thru-chain accreditation systems.

The distribution channel structures for fresh and frozen seafood are complex and multi-layered due to diversity of species, catch and geographic source. Seafood catch either flows direct to wholesalers or may pass through an early stage cleaning process, the fragmented supply is from diverse sources across a large number of species.

Airfreight dominates our seafood exports. An important advantage of airfreight is that food can be transported directly to inland destinations in overseas markets. This direct and prompt accessibility is very important in a scenario where inland 2nd tier cities and supermarkets in China.

Sustainability

Sustainability is defined as “the industry having the necessary practices and policies in place that ensure the future of fish species and the marine environment while at the same time providing sufficient supply of fish for commercial and recreational fishing needs.”

While Western consumers increasingly value the lifestyle and nutritional attributes of seafood (taste, ease of preparation, health giving omega 3s), they are concerned for the “sustainability” aspects of seafood and fishery products, and lack confidence in their ability to choose seafood based on their own judgments.

The impact across the board has been to raise both the standard of seafood offered, and the compliance procedures in fishery management production and processing to deliver that offer.

The status of Australian fish stock in 2016 are presented in the table below. Ultimately, the status of species could influence the level of wild catch competition present in Australia. As wild stock are depleting this allows aquaculture to make up the loss as seen in previous global aquaculture trends.
### Figure 9 Status of Key Australian Fish Stock in 2016

<table>
<thead>
<tr>
<th>Stock Status</th>
<th>Number of stocks</th>
<th>Biological stock</th>
<th>Management Unit</th>
<th>Jurisdiction</th>
<th>Total Stocks</th>
<th>Catch (‘000 t)</th>
<th>% of total catch of species</th>
<th>Species Considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable</td>
<td>85</td>
<td>56</td>
<td>34</td>
<td>174</td>
<td>114.84</td>
<td>85.41</td>
<td></td>
<td>Snapper (WA), Blue Swimmer Crab (WA)</td>
</tr>
<tr>
<td>Transitional / Recovering</td>
<td>7</td>
<td>15</td>
<td>4</td>
<td>26</td>
<td>3.91</td>
<td>2.90</td>
<td></td>
<td>Blacklip Abalone (SA, Tas, VIC), Greenlip Abalone (WA, Tas, SA), Yellowfin Tuna, Western King Prawn (SA), Snapper (SA)</td>
</tr>
<tr>
<td>Transitional / Depleting</td>
<td>5</td>
<td>4</td>
<td>9</td>
<td>1.29</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overfished</td>
<td>7</td>
<td>7</td>
<td>3</td>
<td>17</td>
<td>8.51</td>
<td>6.33</td>
<td></td>
<td>Greenlip Abalone (Vic), Mulloway (NSW), Southern Bluefin Tuna, School Shark, Golden Snapper (NT)</td>
</tr>
<tr>
<td>Environmentally Limited</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>0.03</td>
<td>0.02</td>
<td></td>
<td></td>
<td>Venus Clam (Tas), Southern Sand Flathead (Vic)</td>
</tr>
<tr>
<td>Undefined</td>
<td>12</td>
<td>17</td>
<td>20</td>
<td>49</td>
<td>5.87</td>
<td>4.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negligible</td>
<td>2</td>
<td>2</td>
<td>9</td>
<td>13</td>
<td>0.01</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118</td>
<td>105</td>
<td>71</td>
<td>294</td>
<td>134.45</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Fisheries Research and Development Corporation

Unsustainable aquaculture practices can degrade marine and freshwater environments. In many countries where aquaculture production has rapidly expanded, the environmental impacts of aquaculture have not always been managed to a standard equivalent to that required in Australia.

Aquaculture is typically a more sustainable production method in comparison to wild catch fishing and hence is likely to grow in order to fulfil the world’s growing demand for seafood in a more sustainable manner. Many aquaculture production methods are not constrained by environmental concerns.

**Bio-security**

Biosecurity refers to measures that are taken to stop the spread or introduction of harmful organisms to human, animal and plant life. The introduction of new species have the potential to dominate marine and freshwater communities, significantly impacting recreational and commercial seafood production activities.

It is estimated that there are around 250 introduced marine species in Australian waters.

In 2005, the Australian Government and most states and territories signed an intergovernmental agreement to develop a national system for preventing and managing marine pest incursions. Given the growth in marine shipping in recent years, which is predicted to grow even more rapidly over the next 2 decades, the biosecurity risk from ballast water is expected to be on the increase not decrease.

Known pests that have hitched a ride into Australia include Carp, Tilapia, the Striped Mussel, toxic algae’s such as those that cause biotoxin producing bloom events and exotic crabs such as the European Shore Crab. Diseases
that have impacted the commercial aquatic sector over the last decade include the Pacific Oyster Mortality Syndrome (POMS) and the Abalone Viral Ganglioneuritis (AVG). The farmed prawn sector has had to deal with exotic acute hepatopancreatic necrosis disease (AHPND) and more recently White Spot Syndrome Virus (WSSV), which is currently impacting Queensland’s Gold Coast region. There have also been issues where it has been difficult to determine the causal factor, such as unexplained mortalities in both wild Groupers and in farmed Pearl Oysters.

**Market Access**

To date biosecurity has not been a significant factor in access to overseas markets for seafood. It may be in the future. The Government through FRDC and its Industry and research organisation partners have spent considerable RD&E investment on biosecurity in recent years and plans to continue to do so into the future.

Over the previous 8 years the data shown on the table below outlines that FRDC has contributed $13 million to biosecurity projects and its industry / research partners have contributed $22 million dollars. A total investment in biosecurity of over $35m. With the 2017/2019 contribution predicted to grow beyond that already budgeted for.

**Figure 10 FRDC and Partner investment in biosecurity projects**

<table>
<thead>
<tr>
<th>Financial years</th>
<th>FRDC Investment</th>
<th>Industry and Researcher Investment</th>
<th>Total biosecurity investment $</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011/2012</td>
<td>874,119</td>
<td>968,154</td>
<td>1,842,272</td>
</tr>
<tr>
<td>2012/2013</td>
<td>960,211</td>
<td>3,081,929</td>
<td>4,042,140</td>
</tr>
<tr>
<td>2013/2014</td>
<td>1,905,849</td>
<td>3,425,808</td>
<td>5,331,657</td>
</tr>
<tr>
<td>2014/2015</td>
<td>1,327,278</td>
<td>3,719,302</td>
<td>5,046,580</td>
</tr>
<tr>
<td>2015/2016</td>
<td>3,072,316</td>
<td>3,659,205</td>
<td>6,731,521</td>
</tr>
<tr>
<td>2016/2017</td>
<td>2,848,976</td>
<td>3,483,284</td>
<td>6,332,260</td>
</tr>
<tr>
<td>2017/2018</td>
<td>1,255,786</td>
<td>2,605,857</td>
<td>3,861,643</td>
</tr>
<tr>
<td>2018/2019</td>
<td>807,019</td>
<td>1,243,996</td>
<td>2,051,015</td>
</tr>
<tr>
<td>Total</td>
<td>13,151,353</td>
<td>22,207,535</td>
<td>35,358,887</td>
</tr>
</tbody>
</table>

Source: Fisheries Research and Development Corporation

As the figure below indicates FRDC and its government, industry and research partner’s investment in biosecurity over recent years has been considerable, with an annual expenditure of between $2m - $6m per annum.

**Figure 11 Total Biosecurity Investment**

The annualised spend for projects initiated between 2010/11 and 2016/17 has been $5.3million per annum on biosecurity related projects.

The key industries that have required RD&E investment have been in the aquaculture sector. Between 2010/11 and 2016/17 the aquaculture sector investment on biosecurity projects has totalled $28,084,304. The bulk of these funds have been to address issues in 3 key aquaculture sectors; Pacific Oysters, Prawns and Atlantic Salmon. These three sectors have invested over $21m into biosecurity projects during this period. This is evident from how frequently they appear in the list of projects conducted since 2010.
The Pacific Oyster sector has been addressing issues regarding Pacific Oyster Mortality Syndrome (POMS) since 2011 with a number of projects looking to help the industry deal with the effects of this incoming disease. This work has been ongoing from 2011 – to date. Initially in NSW where it first appeared in Australia and more recently in Tasmania when it emerged in their environment.

The Black Tiger Prawn farming sector has had projects looking at generic biosecurity risks over the review period as well as having to deal with specific issues arising from: Infectious myonecrosis, harmful algal blooms, yellow head virus (YHV), exotic acute hepatopancreatic necrosis disease (AHPND) and more recently White Spot Syndrome Virus (WSSV).

The Atlantic Salmon sector has from 2010 – 2014 been investing in projects related to Amoebic Gill Disease (AGD) and Salmon Orthomyxo-like virus (SOMV).

The other sector most affected has been the wild Abalone sector that has been addressing the issue of Abalone Viral Ganglioneuritis (AVG) since 2011. This wild sector has invested $1.6 million into biosecurity projects since 2010.

For these 3 key aquaculture sectors and for the wild Abalone sector it has been possible to assess the considerable investment in RD&E on biosecurity against product volumes using the ABARE 2010 – 2014 production data available, as outlined on table 2 below.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific Oysters</td>
<td>$1,595,412</td>
<td>13,084</td>
<td>$121.93</td>
</tr>
<tr>
<td>Farmed Prawns</td>
<td>$377,134</td>
<td>4,157</td>
<td>$81.08</td>
</tr>
<tr>
<td>Wild Abalone</td>
<td>$234,230</td>
<td>4,936</td>
<td>$47.64</td>
</tr>
<tr>
<td>Atlantic Salmon</td>
<td>$1,111,798</td>
<td>42,678</td>
<td>$26.05</td>
</tr>
</tbody>
</table>

Source: Fisheries Research and Development Corporation

As can be seen from the data in the above table these four sectors (and their R&D partners including FRDC) are having to invest considerable amounts into their biosecurity research and development programs.

On the market access front, due to a biosecurity incident, namely the occurrence of POMS in Tasmania, businesses that had overseas customers for their spat oysters have had to cease this trade. But as previously stated market access is not the main driver for biosecurity in the Aquatic sector.

Environmental Biosecurity

In the environmental biosecurity area, other groups have traditionally taken the lead such as Ocean Watch - the National Marine NRM body, and State Government agencies. However, the Federal Government has recently announced a very large project looking to control Carp, as they one of the destructive introduced species in Australia. The FRDC is leading the National Carp Control Plan on behalf of DAWR, which was announced in May 2016.

The program is now underway and the NCCP is now looking at progressing legislative approval to release the carp virus at the end of 2018.

Climate Change Biosecurity

It has been recognised that there will be changes in marine pest and diseases associated with climate change. It has been demonstrated that elevated water temperatures can act as a stressor impacting the immune responses of all cool water aquatic animals such as Abalone, Atlantic Salmon and Pacific Oysters, potentially increasing their susceptibility to bacterial, viral, fungal and parasitic infections.

Stressors can lead to major impacts on wild harvest fisheries and aquaculture – e.g. major floodplain wetland drainage and the accompanying increase of acidic runoff led to the contraction in the range of Sydney Rock Oyster (Saccostrea glomerata) aquaculture in south-east Queensland and NSW estuaries, with debilitating diseases such as QX accompanying these acidic runoff events.

Disentangling causal relationships for disease outbreaks is challenging and will always require ongoing work.
Harmful algal bloom (HAB) outbreaks such as those resulting from the dinoflagellate Alexandrium tamarense on the East Coast of Tasmania are becoming more commonplace. These blooms increase the risk of Paralytic Shellfish Poisoning (PST) and have resulted in lengthy fisheries closures with devastating consequences to shellfish and other sectors. There are increasing questions world-wide on the interactions between HABs and changing climate.

Other effects of Climate Change

In Australia, climate change is predicted to increase the mean temperature of air and water, cause sea-levels to rise, increase the acidity of the oceans, alter rainfall regimes, drive changes in the timing, intensity, and location of oceanic currents, and increase the frequency and intensity of extreme weather events, including extreme rainfall events, floods and bushfires.

Each of these changes is likely to have some effect on important fishery species, however the magnitude of effects remains unclear.

**Figure 13 Climate Conditions for Aquaculture**

<table>
<thead>
<tr>
<th>Species</th>
<th>Temperature</th>
<th>Salinity</th>
<th>Upwelling</th>
<th>Winds &amp; Currents</th>
<th>pH</th>
<th>Biological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abalone</td>
<td>High</td>
<td></td>
<td></td>
<td>High</td>
<td>High</td>
<td>High (sea urchins &amp; pathogens)</td>
</tr>
<tr>
<td>Australian Salmon</td>
<td>Low</td>
<td></td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue Swimmer Crab</td>
<td>high</td>
<td>High</td>
<td></td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern King Prawn</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td></td>
<td>Low (seagrass)</td>
</tr>
<tr>
<td>Flatheads</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low (seagrass)</td>
</tr>
<tr>
<td>Snapper</td>
<td>Medium</td>
<td></td>
<td></td>
<td>Medium</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Southern Bluefin Tuna</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Medium (small pelagics)</td>
</tr>
<tr>
<td>Western King Prawns</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Yellowtail Kingfish</td>
<td>Medium</td>
<td></td>
<td></td>
<td>Medium</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Tuna</td>
<td>medium</td>
<td></td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Coast Adapt
OVERVIEW OF PRODUCT MARKETS

Salmon

Atlantic salmon accounts for roughly half of all farmed salmon. King Salmon (also known as Chinook salmon) is the fourth most produced breed in the large salmon market. Atlantic salmon and King salmon are produced by ASX-listed companies Huon Aquaculture Group Ltd (HUO) and New Zealand King Salmon Co. Ltd (NZK) respectively.

![Figure 14 world salmon production](image)

Source: Food and Agriculture Organization of the United Nations

The Atlantic salmon is a species of ray-finned fish in the family Salmonidae. It is found in the northern Atlantic Ocean, in rivers that flow into the north Atlantic and, due to human introduction, in the north Pacific Ocean. Atlantic salmon have long been the target of recreational and commercial fishing, and this, as well as habitat destruction, has reduced their numbers significantly; the species is the subject of conservation efforts in several countries.

Supply

Global production/stocks

The global Atlantic salmon industry is an important contributor to the world’s supply of farmed fish, with global production reaching nearly 2.3 million metric tonnes in 2017. The industry has experienced strong growth over the last decade, with a compound annual growth rate (CAGR) of 6% from 2004 to 2013 due to producers expanding operations driven by an increase in global consumer demand.

Australia contributes approximately 2% of the global harvest of Atlantic Salmon. Growing conditions for marine pen farming (floating pens in coastal waters) in Australia are only commercially suitable in Tasmania.
A severe algal bloom in Chile, combined with biological challenges in Norway, have seen global production of farmed Atlantic salmon drop by some 7 percent in 2016, while Chilean harvests of farmed Pacific have also been negatively affected.

Supply of Atlantic salmon has increased by 384% since 1995 (annual growth of 8%). The annual growth has diminished in recent years with 5% growth in the period 2005-2016. Analysts have suggested salmon production to diminish further going forward and has projected a 3% annual growth from 2016 to 2020.

The background for this trend is that the industry has reached a production level where biological boundaries are being pushed. It is therefore expected that future growth can no longer be driven only by the industry and regulators as measures are implemented to reduce its biological footprint. This requires progress in technology, the development of improved pharmaceutical products, implementation of non-pharmaceutical techniques, improved industry regulations and intercompany cooperation.

Australian production/stocks
Due to its ideal climatic conditions, Tasmania is the only state in Australia where Atlantic salmon is commercially farmed. Tasmania is recognised for its pristine waters, low disease risk and ideal water temperatures. Additionally, the Tasmanian Atlantic salmon strain is fast growing, high yielding and has excellent flesh colour.

Australian salmon production for wild-caught fisheries has remained stable only dropping slight from 2,226 tonnes in 2014 to 2,108 tonnes in 2016. Australian salmon produced through aquaculture has risen by 32% since 2013-14. (ARABES)
Due to the rapid growth in the industry, salmonids have emerged as a key farmed fish species in Australia, accounting for 49% of all Australian aquaculture production by value.

**Disease History/Threats**

Salmon farms face the risk that fish will be infected by a number of transmissible diseases that can spread to adjacent farms, causing regional outbreaks. Examples of such diseases are AGD, IsA and Pancreas Disease, which have negatively impacted salmon production in growing regions around the world.

Chile has been severely impacted by IsA in the last 10 years. This led to significantly reduced harvests for a three year period, with harvest volumes falling from over 400,000 tonnes in Cy2008 to approximately 130,000 tonnes in Cy2010. As a result, Chile has had to make significant changes to the structure of the industry and regulations, which has increased costs and resulted in industry consolidation.

Recently Norway, Scotland and Ireland have experienced outbreaks of AGD, which may impact production into the future if the disease cannot be contained. As a result, producers and governments in those countries are investing in research and development to advance AGD detection and treatment methods.

The farming of Atlantic Salmon requires cool water temperatures to maintain fish health and optimise growing conditions. Tasmania has a cool temperate maritime climate with coastal sea temperatures influenced mainly by the sub-Antarctic current (all year) and the warmer East Australian current (during summer). Coastal extremes are typically 9 to 19 degrees Celsius in farming areas.

**Tasmanian Salmonid Diseases**

Disease control and management is a factor critical to fish farming operations.

Tasmania is to date free of major infectious agents that have significant economic impacts in the northern hemisphere, such as Infectious Salmonid Anaemia (ISA) and Infectious Pancreatic Necrosis (IPN).

Amoebic Gill Disease (AGD) Amoebic gill disease is caused by Paramoeba that colonise the gills of salmon and multiply, particularly when the water is warm. Gill function is impaired and if left untreated significant losses can occur. AGD is effectively treated and managed through regular bathing of fish in fresh water. Alternatively, the onset of AGD can be controlled and prevented by keeping salmon in naturally occurring brackish water (water that has a lower salinity than sea water).

Fur seals Australian fur seals are endemic to the south east of Australia and these, together with small numbers of New Zealand fur seals, can cause significant losses to the Salmonid industry. Such losses are direct, when seals maul salmon and indirect, when seals cause holes in the nets leading to stock losses.

Australian fur seals are a protected species. Accordingly, Tasmanian marine farmers employ, amongst other preventative measures, trapping and relocation of fur seals. The relocation of fur seals is carried out by the Tasmanian Government wildlife agency. Various net management practices are also used to control fur seal attacks.

Algal blooms Seasonal nutrient cycles coupled with weather events can lead to conditions where algae blooms occur in coastal waters.

Many of the algae species are of little consequence to salmon but some are considered harmful. Some species of algae irritate the gills of salmon, other species may depress feeding with little other effect, but others can produce toxic chemicals that may lead to the death of the fish.

**Global producers**

The Marine Harvest Group represents the largest total production and produces around one quarter of the salmon produced in Norway, and about one third of the total produced in North America and the UK. In Norway and Chile there are several other producers of a significant quantity of Atlantic salmon. In Chile, several of the companies also produce other salmonids.
Historically, the salmon industry has been made up by many small firms. As illustrated below, this has been the case in Norway, and to some degree in Scotland and Chile.

The higher level of fragmentation in Norway compared to Chile is the result of the Norwegian government’s priority for decentralised structures and local ownership. In Chile the government places fewer demands on ownership structures in order to grow the industry faster.

Australian producers
Non-ASX Listed

Petuna is an integrated producer of trout and salmon, with all marine farms located in Macquarie Harbour; Sealord, a New Zealand aquaculture company, acquired a 50% shareholding of the Petuna business in 2010.
Van Diemen Aquaculture (VDA) is another producer, but its operations are small, relative to the other commercial producers; it is privately owned and based in north Tasmania; Petuna is a majority owner and supplies smolt to van Diemen Aquaculture, which then grows the salmon and sells its back to Petuna.

**ASX Listed**

Tassal, listed on the ASX (TGR), is the largest supplier and operates marine farms in Macquarie Harbour and south east Tasmania; the majority of its sales are through the retail channel.

Huon (HUO) is the second largest supplier.

New Zealand King Salmon Company Limited (NZK) is an aquaculture producer of King Salmon in New Zealand. The Company owns and operates approximately eight seafarms in the Marlborough Sounds, harvesting and processing over 6,000 metric tons. The company offers their products to local and global chefs, retailers and wholesalers.

**Barriers to entry**

There are global barriers to entry for farming salmon. There are only a few coastlines in the world available as seen in figure 17.

**Figure 19 waters available for salmon farming**

A key condition is a temperature range between above zero and 18-20. The optimal temperature range for salmon is between 8 and 14.

Salmon farming also requires a certain current to allow a flow of water through the farm. The current must however be below a certain level to allow the fish to move freely around in the sites. Such conditions are typically found in waters protected by archipelagos and fjords and rule out several coastlines.

There are significant barriers to entry for new suppliers in the Australian salmon industry. Firstly, there is a high barrier in obtaining brood stock as no live brood stock can be import into Australia due to quarantine and biosecurity laws. There is also limited suitability for new hatcheries in Tasmanian rivers, creating a significant barrier and new hatcheries require significant upfront capital investment.

Additionally, marine farms can only be constructed in Tasmania as it is too warm in the rest of nation. Existing industry incumbents control the vast majority of marine leases and it is extremely hard to acquire an approved salmon production site for a new entrant.
Another major barrier for new entrant would be their ability to access market sized salmon year-round, as capital investment for harvesting equipment and processing is high.

Finally, a new industry entrant would need to overcome high set-up costs and long lead times between start up and first harvest, as salmon have a three-year lifecycle.

**Demand**

**Global Demand**

As previously stated, the global population is growing at an unprecedented speed, resulting in an increased global demand for food. As the middle class is growing in large emerging markets, we especially expect consumption of high quality proteins to increase.

Atlantic salmon as a healthy, resource efficient and climate friendly product from the ocean fits well with these global trends.

Europe (incl. Russia) and North America are by far the largest markets for Atlantic salmon. However, emerging markets are growing at significantly higher rates than these traditional markets. As all harvested fish is sold and consumed in the market, the demand beyond 2016 is assumed equal to supply (estimated by Kontali Analyse). The market for Atlantic salmon has on average increased by 5.7% in all markets over the last 10 years and by 7.3% over the last 20 years.

**Figure 20 Farmed Salmon by market**

![Graphs showing farmed salmon production by market: EU (CAGR 4%), USA (CAGR 4%), Russia (CAGR -1%), Brazil (CAGR 14%), Asia (CAGR 10%), Global (CAGR 5%)](source: Marine Harvest Investor Presentation)
Australian Domestic/Import Replacement

As evidenced in the chart below, consumption of salmon in Australia has increased significantly in the last several years. Per capita consumption has almost doubled from 1.06kg in 2006 to 2.09kg in 2013, an increase of over 97%.

Figure 21 domestic consumption of salmonids per capita

![Graph showing domestic consumption of salmonids per capita from 2006 to 2013.]

Source: HUO prospectus

Imports of salmon into Australia represent almost 20% of domestic consumption. Imports of salmon, fresh chilled and frozen fillets and smoked salmon have all increased recently. As can be seen from the charts below, fresh or chilled fish represent a small proportion of imports due to import restrictions (Australian quarantine controls require importers to remove the heads of fish, which limits shelf life).

Figure 22 Australian imports of salmonids by product and origin

![Chart showing Australian imports of salmonids by product and origin from 2012 to 2013.]

Source: HUO prospectus

Imports into Australia originate from the following countries:

- Denmark: Primarily smoked salmon is imported from Denmark to Australia. Although the salmon is farmed in Norway, it is sent to Denmark for processing before being imported.
- Norway: Imports from Norway currently make up 34% of imports. The salmon from Norway is imported as frozen portions and smoked salmon.
- New Zealand: Salmon from New Zealand are exempt from the quarantine controls, and these fish are typically imported as fresh. New Zealand salmon is a Pacific salmon (and not a variety of Atlantic salmon) and has different characteristics in regard to texture and taste. Pacific salmon production has been declining in New Zealand due to limited access to new sites, licensing issues and disease outbreak concerns. Furthermore, exports into Australia have decreased due to growing domestic demand in New Zealand.

Australian export

Japan

Australia exports salmon to Japan, where there is significant potential for opportunity. Consumption of salmon has increased nearly 40 per cent, while the consumption of mackerel, horse mackerel and squid has slowly declined by 50 per cent over the past 40 years. China, the US, Chile and Thailand are the largest exporters of seafood to Japan.
Tasmanian salmon continues to attract a higher price at markets than its main competitor, Norway (one of the largest producers).

**China**

Australian exports of salmon to China have increased significantly in. According to latest Chinese customs figures (HS Code 030214), China imported 5,137 metric tons of whole fresh Atlantic salmon from Australia between January-October of this year, up 477% compared with the corresponding period last year.

However, in 2015 China imported 5,323t of whole fresh Atlantic salmon from Australia. Hence, the rise from 2016 to 2017 is not as significant because 2016 was a poor year for Australian salmon production.
Murray Cod

The Murray Cod is a freshwater fish indigenous to the Murray Darling basin. It is not uncommon for wild Murray Cod to have a length of 80-100cm, with the largest ever caught spanning 1.8m and weighed 113kg.

Irrigation schemes implemented throughout the Murray Darling basin caused further Murray Cod reductions, resulting in the fish becoming critically endangered. Faced with the Murray Cod’s extinction, Fisheries NSW, developed a method of producing juveniles during the 1960’s, so that Murray Cod fingerlings could be released back into the basin to repopulate.

A number of challenges, such as weaning the fish onto manufactured feed and preventing cannibalism, inhibited full lifecycle aquaculture of Murray Cod, until the early 90’s. By 2016, a cottage industry consisting of a small group of Murray Cod farms had emerged, which produced circa 205 tons of the fish that year; below 1% of domestic consumption of barramundi.

Supply of Murray Cod

Global production/Stocks

Murray Cod is globally unique to the Murray Darling River System in Australia and hence is only produced in Australia.

Australian Production/Stocks

Intensive production of Murray cod is a new sector, pioneered by industry with government agencies taking a recent role in R&D. Interest has been fuelled by reports of high market prices, however production in NSW has been moderate to date, with production dominated by 1-2 growers. Most production comes from intensive tank systems with some finishing in earthen ponds, however limited production also comes from extensive ponds.

Recent downward trends in market price for small fish (<1kg) has deterred some new growers, however industry is still in its infancy, and there is potential for further expansion. A number of production issues still need to be resolved e.g. feed development, disease management etc.

The total production of Murray Cod in Australia for 2016/2017 was 264,750kg. There has been significant increase in production of Murray Cod since 2013/2014.

![Graph of land based aquaculture production by species and year](image)

Source: NSW Government Department of Primary Industries

The growth of Murray Cod production is expected to continue as the main producer Murray Cod Australia (MCA) aims to be a 1 million kg per year producer by 2021 and 10 million kg by 2030.

The wholesale price of Murray Cod can be over $20/kg and cost as much as $33/kg for premium quality.

Disease History/Threats

Evidence is mounting that there is serious competition for food between larval/early juvenile introduced carp and larval/early juvenile native fish. Introduced carp dominate the fish faunas of lowland Murray-Darling rivers; the sheer amount of biomass carp now take up, and the large numbers of larvae carp produce, causes serious
negative effects on river ecosystems and native fish. Carp are the main vector of the introduced Lernaea parasite and serious vectors of the introduced Asian fish tapeworm.

Murray cod have soft skin and very fine scales that leave them vulnerable to infection from exotic disease organisms. The following exotic disease organisms all seriously affect wild Murray cod; all have been introduced by imports of exotic fish.

Wild Murray cod populations across their range suffer extremely severe infestations of Lernaea or "anchor worm", a parasitic copepod vectored by introduced carp and that burrows into the skin of Murray cod. Lernaea puncture wounds are often secondarily infected by bacteria. Severe Lernaea infestations probably cause the death of many more adult Murray cod than commonly recognised. Ebner reports a young adult Murray cod seemingly killed by severe Lernaea infestation.

The keys to minimising disease problems in ornamental tanks and ponds are to manage the fishes’ environment to minimise stress, to maintain water quality, ensure there is no over-crowding, and to always quarantine live foods and new fish before adding them to the tank.

Great care must be taken in disposing of dead fish, waste water or other materials from fish tanks, as many diseases of ornamental fish can spread into the wild and affect native fish populations. It should be noted that Australia has some of the highest aquaculture production standards in the world and are conscious in avoiding outbreaks.

Australian Producers
ASX Listed

Murray Cod Australia (MCA) is the only significant producer of Murray Cod in Australia.

Barriers to entry

The Murray Cod market in Australia is still in its infancy stage with existing production limited to small scale private enterprises and family run farms.

Murray Cod is globally unique to the Murray Darling River System in Australia, due to the river systems ideal conditions. Additionally, commercial fishing in the river’s system is banned as Murray Cod is listed by the Department of the Environment and Energy as vulnerable.

Australia has limited spawning production facilities in existence making it hard for new businesses to obtain initial stock.

Ideal environmental growing conditions are limited to the Murray darling basin. Intellectual property of “cage/pond system” is unique to Murray Cod Australia.

The barriers to entry into these markets is considered to be consistency of supply and quality.

Demand of Murray Cod

Global Demand

There is promising export demand for Murray Cod, particularly in Asia. MCA Chairman has expressed concerns that the farmed cod industry will have trouble fulfilling domestic demand given the volume of inquiry his business fields from potential export buyers.

Currently MCA can only supply limited export to Singapore however they have received significant interest from Hong Kong, Korea and China and have grounded plans of expansion.

Australian domestic/import replacement

It is believed that an opportunity exists to capture a major market share in the developing Murray Cod industry, as well as capture market share from other white flesh table fish such as Barramundi, which had an estimated annual consumption in Australia of approximately 20,000 tonnes in 2014.

Murray Cod is considered to be a species well suited to aquaculture that has a large body of research and farm production history in order to support high growth rates of up to 600 grams/year. Domestic and international demand is generally for sizes between one and two kilograms, which in well managed production facilities, can be achieved within two years.

The Murray Cod domestic market price currently is believed to be between $13.50 per kilogram and $20.00 per kilogram, with the lower priced fish generally received for sales of recirculation aquaculture system (RAS)
produced Murray Cod. Not including undeveloped export markets, the local demand is estimated to be well in excess of current production in Australia.

ASX-listed company Murray Cod Australia (MCA) believes this supply and demand difference, combined with the taste, texture and fat content of Murray Cod, has created the opportunity to market Murray Cod as a 'premium' product compared to other white flesh table fish in Australia. The Victorian Government undertook a series of taste tests of Murray Cod in Singapore, Taiwan, Hong Kong and Tokyo by seafood wholesalers, importers, chefs and food journalists as part of an export market evaluation in 1999, with results being generally well received and Australian Murray Cod perceived as 'healthy', 'safe' and 'high quality'.

Hong Kong and Mainland China also present promising markets, where farmed Giant Groper (a close relative of the Murray Cod) wholesales for US$30-40 per Kg. The 13,000t marketplace for Groper and other reef species in the region is worth more than US$1bn and is classified by Ocean Recovery Alliance as being unsustainable. Thus, a gap is emerging for aquaculture to fill demand spurred by growing regional affluence.

Australian Export

The increasing demand for Australian native species and the proximity to Asia, together with internationally recognised seafood quality and standards, means Australian aquaculture is competitively positioned to deliver high value aquaculture products.

Taste tests, conducted by the State Government of Victoria, Department of Natural Resources & Environment as early as in 2001, have indicated that the taste profile of Murray cod is especially pleasing to the consumer markets of Japan, Hong Kong, Taiwan and Singapore. This is also confirmed by the feedback that Uarah Fisheries have independently received from taste testing initiatives in the Chinese market over 2015 and 2016.

Although there is significant potential for demand, the challenge for Murray Cod exports is creating consumer awareness in these markets of the taste and high quality of the fish.

At this point in time there has been very little exports of Murray Cod however there has been expressed interest from overseas consumers and wholesalers.
Abalone

Abalone are a family of reef-dwelling marine snails. There are approximately 90 species of abalone that exist globally. Consumer preferences dictate how sought-after one species is compared to another and hence are priced differently.

Found in the waters off California The four species of abalone endemic to Australia are:

- Greenlip abalone - One of the most, highly sought-after variety. Cultured and harvested in limited locations – the southern coast of Australia being the most prevalent;
- Blacklip abalone - Most commonly exported Australian abalone species.
- Roes abalone;
- Brownlip abalone.

Hybrids between species have also been crossbred for aquaculture. For example, a commercially crossbred between greenlip abalone and blacklip abalone have been produced and exported from Australia. When abalone weight is referred to, it is generally stated in live or in-shell weight, unless specified as meat weight. Meat weight is approximately 29% to 32% of live or in-shell weight.

Supply of Abalone

Global production/Stocks

Wild catch from abalone fisheries have gradually decreased from 20,000 metric tonnes in the 1970’s to about 6,500 metric tonnes in 2015. Over fishing, illegal harvesting, disease, increased predation, and habitat degradation have all contributed to this decline.

During the same period, farmed abalone supply has increased rapidly. In the 1970’s, farm production was almost negligible. Increases in production have taken place in countries such as China and South Korea. In 2015 aquaculture produced 129,287 metric tonnes of abalone.

Abalone is a quota managed fishery with a restricted number of operating licences in the wild harvest sector. These restrictions apply to both recreational and commercial fishers. Greenlip and blacklip abalone make up the vast majority of Australian wild catch species.

Australian Production/Stocks

Figure 24 comparison of each wild catch fishery region

Source: Ocean Grown Abalone Prospectus
Both the Australian fishery and world supply of wild catch has declined over the past 10 years. Wild catch abalone is considered a premium product when compared with abalone produced via aquaculture.

Abalone aquaculture production is primarily conducted out of three states in Australia. Victoria and South Australia account for the majority of aquaculture production with a smaller industry based in Tasmania.

Abalone aquaculture in Australia has increased to a $28.5 million-dollar industry in 2015. Land-based systems are the most popular as they offer a greater degree of control over the growing process.

The land based facilities vary depending on the operating company. They generally consist of a hatchery (either on or off site) and a range a large holding ponds used for the grow out phase. Key inputs include large amounts of water, power, abalone feed and access to transport networks. The feed used is either an artificial feed or specially grown seaweed or a range of both.

Abalone is a quota managed fishery with a restricted number of operating licences in the wild harvest sector. These restrictions apply to both recreational and commercial fishers. Greenlip and blacklip abalone make up the vast majority of Australian wild catch species. These two species exist in the waters around the south coast of Australia as illustrated in the diagram below.

In 2015, aquaculture molluscs production value rose across all species groups, with pearl oysters and abalone being the most significant contributors due to significantly increased production.

**Disease History/Threats**

Abalone Viral Ganglioneuritis is a viral disease that affects the nervous system of abalone. Mortality rates have been high in Victorian wild stocks, but have not occurred in Tasmanian wild stocks. The disease affects both blacklip and greenlip abalone, however has no effect on human health. The first case of the disease was reported in Victoria in 2006.

Tasmania’s wild abalone fishery is the biggest in the world, with around 25% of the world annual harvest. It also supports a very active recreational fishery, involving around 12,500 people. Apart from the environmental consequences, an outbreak of AVG in Tasmania could also have an impact on the economy and on recreational opportunities.

The virus only survives a short time in the water so the most likely method of disease spread is through direct contact between infected abalone (including offal, mucus, shells, contaminated fishing equipment or people) and healthy abalone.

In order to avoid the spread and prevent AVG abalone should not be moved between locations and fishing gear should be disinfected. Companies which take care in following the Fisheries Biosecurity Protocols should be able to manage the disease effectively.

The risk of disease transmission can be mitigated by placing the juvenile abalone in low densities on the artificial ranches which are comparable to wild catch densities. The juvenile abalone sourced from the abalone hatcheries can be screened, quarantined prior to deployment and samples are tested for disease free certification by government animal health authorities prior to release on the abalone ranch.

Abalone farms are highly susceptible to elevated temperatures, losing stock to heat stress during periods of high temperatures. The only method to alleviate this problem is to increase water flow through rearing systems, increasing operational costs. ASX-listed Angel Seafood Holdings is an example of a company who manages this risk with the more expensive farming methods. They receive reduced risk in terms of threats to their stock.

**Australian Producers**

**ASX Listed**

Ocean Grown Abalone Limited (OGA) is the major producer of abalone in Australia.

**Barriers to entry**

The research and development process has ensured a barrier to entry to the greenlip ranching environment.

Site selection and the availability of infrastructure (marina and transport network) is another barrier to entry. Sites must be suitable to sustain high growth rates of greenlip abalone and be close to a port to construct, service, maintain and harvest the ranch. Suitable locations for this method of sea ranching aquaculture are limited.
There are long lead times necessary to acquire and develop new leases. A typical 5,000 habitat ranch takes approximately 5 years to reach steady state/production capacity from deployment date.

Strategic alliances with key abalone hatcheries need to be maintained to secure supply of juvenile abalone. There are long lead times required to secure supply of juvenile abalone which can be costly.

Aquaculture within Australia is a highly regulated industry, with a high level of quarantine and biosecurity oversight.

**Demand of Abalone**

**Australian Domestic Demand**

Abalone produced in Australia is mostly exported as the demand in Australia is very little compared to markets such as China and Hong Kong.

**Global Demand**

The major consumption countries tend to have substantial Asian population bases, particularly significant Asian populations. Hence, Hong Kong, China, Japan, Taiwan, Singapore and the US are major abalone consuming countries. Given the proximity to South East Asia and existing supply chains, OGA will continue to target South East Asian markets with its greenlip abalone products.

**Australian Exports**

**China**

China is both a major producer and consumer of abalone and is regarded as a huge market opportunity. Australian seafood exports to China totalled $105 million in 2015-16. Australian abalone and rock lobster are the leading Australian premium seafood exports to China, with exports worth $24 million and $10 million, respectively, in 2015-16. The China- Australia Free Trade Agreement (ChAFTA) creates an opportunity for Australian seafood in the Chinese market.

Tariffs on all Australian seafood exports are scheduled to be eliminated progressively by 1 January 2019. Key outcomes under ChAFTA include the elimination of the 10 to 14 per cent tariff on abalone by 1 January 2019.

Since the China – New Zealand Free Trade Agreement came into force when China’s imports of seafood from New Zealand have grown six-fold (to $454 million). China imported 208 tonnes of Australian abalone in 2014-2015 valued at over $12 million.

**Vietnam** imported 530 tonnes of Australian abalone in 2014-2015 valued at over $30 million.

**Japan**

Australia’s seafood exports to Japan were worth over $205 million in 2015-16. Japan imported 313 tonnes of Australian abalone in 2014-2015 valued at over $17 million.

**Hong Kong** imported 935 tonnes of Australian abalone in 2014-2015 valued at over $73 million.

**Singapore** is reliant on food imports for over 90 per cent of its needs, having very little agricultural land and limited domestic food production. Singapore imported over S$11.25 billion in food and live animals.

Prawns

There are 4 main species of prawns, which are:

- King Prawns;
- Tiger Prawns;
- Banana Prawns; and
- Endeavour Prawns.

Supply of Prawns

Global production/Stocks

Prawn is the largest internationally traded fish commodity (in value). Total prawn fisheries production in 2011 was about 7 million tonnes with 3.9 million tonnes farmed. Prawn is the top-selling seafood item in many countries (in USA – 33% of all supermarket seafood sales) and is the top seafood consumed on a per-capita basis.

China remained the largest producer of cultured prawn but with lower production compared with 2016 due to persistent disease issues. The majority of China's harvest enters the domestic market.

India is the world's second largest producer of farmed prawn but in contrast to China, its shrimp industry is largely export-oriented. Production has been good in 2017, and is expected to be higher than 2016 due to the growing number of farming sites. However, sporadic disease occurrence (early mortality, stagnant growth, etc.) was reported in many farming areas, forcing farmers to harvest early or partially. The growth in production was mirrored by increased exports (up 7%) during the first half of 2017 compared with the same time period in 2016.

In Indonesia, unfavourable weather has affected shrimp production. Raw materials prices are rising and supplies are low for export processing. In Thailand a reasonable recovery continues in the farmed shrimp sector. The industry reported a 10–20 % rise in production during 2017 compared with 2016.

Australian Production/Stocks

The Australian prawn farming industry is largely based in the tropical zones of Queensland. Prawns are farmed in large-scale pond operations, which operate round the clock and every day of the year. Farms are located in four Australian states—New South Wales, Queensland, Northern Territory and Western Australia.

There are 15 major prawn fisheries around Australia. Many fishers are family businesses, and many families have been fishers for generations. Other fisheries are highly organised vertically integrated businesses employing the latest technology in their fleets.

Prawn production is a major contributor to the overall increase in volume of aquaculture production. Aquaculture crustacean production, predominantly prawns, made a minor contribution to total aquaculture production: 6 per cent of total volume produced in 2015. In 2015, a significant increase in prawn production volume drove a large rise in crustacean gross value of production. Prawns have dominated aquaculture crustaceans over the period 2005 to 2015. Aquaculture prawns can experience some sensitivity to international markets in the form of import competition. Therefore currency fluctuations can have a significant impact on prices.

Figure 25 Aquaculture crustacean species, by value (annual per cent change), 2015

<table>
<thead>
<tr>
<th>Species group</th>
<th>Value</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prawns</td>
<td>$85 million (up 36%)</td>
<td>96%</td>
</tr>
<tr>
<td>Other</td>
<td>$4 million (up 23%)</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>$90 million (up 35%)</td>
<td>100%</td>
</tr>
</tbody>
</table>

Figure 26 Aquaculture crustacean species, by volume (annual per cent change), 2015

<table>
<thead>
<tr>
<th>Species group</th>
<th>Volume</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prawns</td>
<td>5,282 tonnes (up 40%)</td>
<td>97%</td>
</tr>
<tr>
<td>Other</td>
<td>1,431 tonnes (up 11%)</td>
<td>3%</td>
</tr>
<tr>
<td>Total</td>
<td>5,426 tonnes (up 39%)</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: The Australian Bureau of Agricultural and Resource Economics
Novacq

Australian prawn farmers need to feed their prawns with a pellet that includes fish meal or fish oil to ensure the prawns grow fast and are a healthy and high-quality product for consumers. With the world’s wild fish stocks under pressure, our scientists went looking for new and better ways to sustainably boost productivity.

CSIRO researchers have developed a prawn feed which will grow prawns 20-40% faster, are healthier and can be produced with reduced wild fish products in their diet. This means more profit for prawn farmers and less pressure on our precious marine resources. It has also stimulated a whole new industry in Australia: the production of a sustainable prawn feed ingredient.

The first of a series of patents for the Novacq production technology was granted in 2009. Since then, the CSIRO Novacq team has worked closely with Australian and Asian feed manufacturing companies to implement a global commercialisation strategy.

The production of Novacq commenced under licence in Australia, and in China and Vietnam, two of the world’s largest producers of farmed prawns. As of early 2017, license arrangements for Novacq technology with Ridley Aquafeeds were extended to the rest of the world (excluding China and Vietnam).

Australia’s leading animal feed producer, Ridley, has signed a research development alliance agreement with Australia’s leading scientific research institute, the CSIRO for the prawn feed ingredient, Novacq. Under the new licence agreement, Ridley can now produce and market Novacq globally, where as previously it only held the rights for Australia, Thailand, Indonesia, Malaysia and the Philippines.

Disease History/Threats

White spot disease (WSD) has significantly affected prawn farms in Australia in recent years. The disease has reduced prawn farm productivity by up to 20 per cent overseas and had not affected Australia until recently.

White spot disease is widespread throughout prawn farming regions in Asia and has become established in prawns farmed in the Americas where it has caused severe losses on prawn farms.

In November 2016 prawns were found to have the disease in Logan River, Queensland. The outbreak of WSD in Queensland is the biggest biosecurity outbreak to hit Australia’s aquaculture industry. The outbreak cause is still being investigated but it is assumed to be a matter of biosecurity failure for which Australian officials are working to quickly improve.

In order to manage WSD there are several methods of control in place. Firstly, there is restriction on the movement of crustaceans on commercial and recreational fishers and others using the affected waterways. Secondly, there are disposal and decontamination procedures for the infected premises. Bird mitigation is used for the infected premises to stop the spread of the disease.

Prawns infected with white spot disease do not pose a risk to food safety or human health, but rather deplete stocks and significantly reduce production.

Australian Producers

ASX Listed

Seafarms Group (SFG) is Australia’s only listed and largest prawn farm. Approvals are in place for SFG to undertake its major prawn operation, involving 10,000ha of production ponds on a portion of Legune Station in Western Australia. Once completed this will be the world’s largest prawn production facility.

Barriers to Entry/ Project Sea Dragon

The main barriers of entry for new prawn farmers in Australia is the limited water suitable for farming prawns and the strict regulation and process of obtaining an approval or licence which may turn out to be unusable.

One ASX-listed company is overcoming the barrier on high volumes of production. SFG implemented a new strategy entitled Project Sea Dragon, which is a large-scale land-based prawn aquaculture project in northern Australia designed to produce high quality, year round reliable volumes for export markets. The development will be the biggest aquaculture development in Australia.

Once finished the development will be capable of producing 100,000 tonnes of high-quality Australian black tiger prawns annually.
Japanese and Chinese investors are keeping a close watch on the project’s progression, looking at guaranteed prawn supply offtake agreements, while there is also interest from investors linked to Norway’s salmon farming industry and Scandinavian sovereign funds.

**Demand of Prawns**

*Global*

India and Ecuador continue as the top two exporters in the world market with a 35% and 18% increase in supplies respectively during the first half of 2017. Among the other top exporters, Viet Nam and China reported higher shipments during January-June 2017, whereas exports declined from Thailand.

**Australian Domestic/Import replacement**

Most of Australia’s prawn production is consumed domestically. Australia exported between 18% and 29% of local production during the period 2010/11 to 2013/14 and relies on imports of prawns to meet domestic demand.

In line with the global trend, demand for seafood in Australia (including prawns) is above natural supply from wild caught fisheries. Therefore, imports and aquaculture production are required to fill the gap between supply and demand. Imports made up approximately 66% of Australian seafood consumption in 2012-2013.

Current Australian consumption of prawn products is in the order of 55,000 tonnes pa ($750 million) with a current shortfall in supply estimated at 30,000 tonnes pa ($420 million).

**Domestic market opportunity:** There are opportunities to replace imported seafood in the domestic Australian market.

**Australian Exports**

*China*

Prawn imports into China, declined by 11% to total 49 200 tonnes during January–June 2017, where Canada, Argentina, Ecuador, Greenland and India were the top sources.

Frozen shrimp imports into Viet Nam increased by 30% during the first half of the year, totalling nearly 200 000 tonnes. Most of these imports are then re-exported to China and re-processed for other markets. The top suppliers to Viet Nam were Ecuador, India, Thailand and Argentina.

*Japan*

The favourable economy supported the growth in consumer demand for raw and processed prawn, with imports increasing during the review period. For the first time since 2014, half-yearly imports of prawn in Japan reached 100 000 tonnes, which was 7% higher than last year’s same period. Viet Nam, Thailand, Indonesia, India and China were the top suppliers to the Japanese market.

Demand for processed prawn remains strong in Japan. Its share of total shrimp imports increased from 28% in 2016 to 30% during this year’s review period. Thailand, Viet Nam, China and Indonesia together held 97% of this market share.

Australian exports of fisheries and aquaculture products to Japan declined at an average annual rate of 5 per cent in volume terms and 7 per cent in real value terms between 2004–05 and 2014–15. This decline is linked to a number of factors, including the appreciation of the Australian dollar against the yen, a decline in per person seafood consumption in Japan since 2001 (FAO), increased Asian prawn aquaculture production displacing some exports of Australian prawns to Japan, and the redirection of Australian seafood trade towards the China, Hong Kong and Vietnam region.
Oysters

Australian oyster growers farm three species of oyster in Australia’s coastal waters: Pacific Oyster in SA, Tasmania and some in NSW. Sydney Rock Oyster in NSW, QLD and some in WA. Flat Oyster in small volumes across all states.

Supply of Oysters

Global production/Stocks

The following pie chart shows that the Southern Hemisphere accounts for only a small percentage of the world’s oyster production which is why demand for clean shelled, parasite free South Australian oysters in peak condition from June to November (while the condition of oysters in the Northern Hemisphere declines) will continue to be beyond what can be supplied. It is estimated that the value of the world’s oyster production is in excess of US$4 Billion per year.

Figure 27 World Oyster Production. 2010 (all species) 4.6m Tonnes

Source: Angel Seafood Holdings Prospectus

Australian Production/Stocks

The Australian oyster industry includes over 550 individuals and businesses located mostly in three states, NSW, South Australia and Tasmania. The industry is predominately a family owned, owner-operated industry and including owner operators, the industry employs in the vicinity of 2,000 full and part time employees and owners.

The oyster industry in Australia is concentrated in the southern half of the continent. The two-main species cultivated are the native Sydney rock oyster and the introduced Pacific oyster. Sydney rock oysters are farmed in NSW and southern Queensland as well as in southern Western Australia. Pacific oysters are farmed in Tasmania, South Australia and Port Stephens, NSW.

Oysters in Australia are produced for the half-shell market. Exports of both Sydney rock and Pacific oysters amounts to only 6% of the value of oysters produced. However, the industries in NSW, Tasmania and South Australia are hoping to expand the export market. It is thought that this will have the added advantage of improving the price of oysters on the local market.

The oyster industry in Australia, and specifically South Australia, is still in its infancy and extremely fragmented made up of family run businesses. This presents a number of attractive opportunities going forward.
The NSW oyster industry in 2017 produced close to 70 million oysters, with an overall value of $47 million at farm gate. There are 300 oyster farming businesses in NSW, spread across 32 coastal estuaries.

In 2017 the South Australian pacific oyster industry experienced a shortage. This was due to SA relying on Tasmanian hateries for at least 80 per cent of its spat, and this supply being cut-off when TAS was hit by POMS early in the year.

The opening of the Cowell hatchery in SA in November 2017 is thought to relieve the shortage of spat, allowing for farmers to produce more and fulfill the demand expressed by other parts of Australia and overseas.

In 2016, the South Australian oyster industry produced 5.4 million kilograms of oysters. Based on a price of $7/kg, this equated to a total industry value of $37.8m. The vast majority of these oysters were sold into the domestic marketplace. The table below highlights the South Australian oyster industry over the past 4 years.
The lack of availability of spat is currently an impediment to the commercial development of this sector in WA. The Aquaculture Council of WA has identified an opportunity for the establishment of a multi-species mollusc hatchery with the capability of providing commercial quantities of seed stocks for these species and funded a review of the feasibility of a hatchery.

ASX-listed producer Angel Seafood Holdings in February 2017 received approval to develop a new oyster hatchery which will see approximately 100 million spat produced. The spat will be used by the company and sold to local farmers.

Disease History/Threats

Pacific Oysters

Australian Pacific Oyster have experienced a history of disease outbreak of Pacific Oyster Mortality Syndrome (POMS). It causes rapid and high mortalities in farmed oysters (up to 100% within days of being detected) and can spread quickly if introduced. It is currently found in three estuary systems in NSW - Georges River, Parramatta River and the Hawkesbury River. A suspect case has also recently been detected in association with mortalities of farmed Pacific Oysters in Tasmania.

The first reported POMS mortality outbreak was in France in 2008. POMS affects Pacific Oysters - it cannot be transmitted to humans and there are no human health implications. POMS has not affected the Sydney Rock Oyster or the Native Flat Oyster.

POMS was first detected in NSW in November 2010 when oyster farmers in the Georges River reported mortality of wild and farmed Pacific Oysters. Immediate reporting of these mortalities resulted in rapid action by NSW DPI to investigate the cause and implement controls on movement of oysters and equipment from the area to help prevent further spread of the disease. In January 2011 the disease was also found in wild Pacific Oysters in Parramatta River.

In late January 2013, high mortality was observed among farmed triploid Pacific Oysters from the Hawkesbury River and POMS was detected. In February 2013 the virus that causes POMS was detected in wild Pacific Oysters from Brisbane Water.

It is not known how POMS arrived in NSW. Researchers are continuing to monitor Georges River to elaborate key factors affecting disease expression, such as oyster size and age, and water temperature.

POMS was first detected in Tasmania on 1 February 2016. The detection led to ban on the movement of live Pacific Oysters, oyster spat and used farming equipment originating from Tasmania into South Australia. This ban is necessary to ensure the disease doesn’t enter SA and is in place until 31 March 2018.

To combat future outbreak movement controls and strict biosecurity conditions have been put in place to prevent movements of oysters and oyster farming equipment from the Georges and Hawkesbury Rivers, and Brisbane Water to any other NSW waterway. Strict biosecurity protocols are also in place for researchers and their equipment entering and leaving affected locations. A policy has also been developed that outlines management actions and legislative provisions that may be used in response to suspected or confirmed further outbreaks of POMS in NSW waterways.

Sydney Rock Oysters

QX disease

QX disease affects Sydney Rock Oysters and is often responsible for the deaths of large numbers of oysters. QX disease is seasonal; infections usually occur from January to April, with diseased oysters losing condition and dying through the winter and early spring.

QX disease historically occurred repeatedly in the estuaries of southeast Queensland and northern New South Wales.

In 1994 it was first diagnosed in the Georges River in Sydney, an area in which it established and caused major stock losses. In 2004 the Hawkesbury River suffered its first recorded outbreak of QX disease with massive stock losses, initially mostly on upriver leases, but by 2005 QX was found on downstream leases too.

Current NSW DPI quarantine regulations for QX disease prohibit the movement of oysters from QX recurrent estuaries into disease-free estuaries. Movement restrictions were first put into place in 1986. At present, NSW DPI, in collaboration with other researchers, NSW Farmers Association and the oyster industry, is developing a QX-risk based approach to managing inter-estuary oyster movements.
**Winter Mortality**

Winter mortality is caused by a protozoan parasite which occurs over the southern or cooler half of the range in which Sydney rock oysters are farmed.

Winter mortality may kill up to 80% of oysters in a local area and, in general, oysters in their third winter (just before they reach market size) are most susceptible.

Farmers can, to a large extent, reduce the impact of this disease by moving oysters further upstream to areas of lower salinity before the end of autumn (May), and by increasing the growing height of the oysters to 150 mm above normal growing height. Alternatively, farmers may sell their oysters for consumption before the onset of the disease.

NSW DPI has developed breeding lines that are resistant to two major diseases of Sydney rock oysters. Winter mortality disease-resistant breeding lines are available for commercial production. So far (April 2007), mortality from this disease has been cut by half through selective breeding.

**Mudworm**

The mudworm is thought to be the most damaging of four species of polychaete worms which infest and kill large numbers of oysters. Mudworms can also infect Pacific oysters to a lesser extent.

Losses of oysters due to mudworm are often very high, and the remaining infested oysters become unsaleable because of their poor condition and unsightly, foul-smelling mud blisters, which rupture easily when the oysters are opened.

Mudworm is straightforward to manage. Some farmers have successfully used the following method to kill mudworm: Oysters are left out to dry for 4–5 days, followed by a 2–3 hour bath in an iodine-based disinfectant solution at 0.1 g of active iodine per litre of seawater, prior to returning oysters to the lease.

**Flatworm**

Also known as wafers or 'leeches', flatworms are common predators of oysters and other commercial bivalves around the world.

In NSW, the flatworm was identified as a threat to oyster production as early as the 1890's, and more recently has been observed to feed directly on oyster tissue.

Exposure to freshwater or saturated brine solutions is an effective means of controlling flatworms, with baths of 15 minutes sufficient to kill adult flatworms.

**Australian Producers**

**ASX listed**

Angel Seafood Holdings Limited (ASH) is Australia's major producer of oysters operating in four specific geographical locations on the Eyre Peninsula, being Coffin Bay, Haslam, smoky bay and Cowell. They have also executed an acquisition agreement to purchase the existing oyster farming assets in Cowell, involving 10 hectares of fully developed, proven water leases.

**Barriers to Entry**

There is only a limited number of Government Approved Oyster Leases. In order to enter a business must acquire a farm with an existing lease or get a new lease.

The South Australian Government strictly regulates the aquaculture industry with rigorous assessment measures in place through the industry's mandatory accreditation program. Strictly managed water allocations and strategic location planning protects the ecosystems while also being a key factor in driving oyster lease prices.
**Demand of Oysters**

**Global**

Oyster production was 4.6M tonnes in 2010, the dominant production countries being China, Japan, Korea, USA, France and Mexico.

China is by far the largest oyster production country, producing over 2 million tons per annum. In China, half of oyster production is used to make oyster sauce.

Recently, oyster production in the USA and France has been affected by disease and coastal water pollution. The dominant trading countries for oysters are China, Korea, Japan, USA and Canada.

Historically peak demand for Coffin Bay oysters in Asia (and the northern hemisphere more generally) coincides with peak condition of South Australian oysters. Hence, during Australia’s winter months there is still demand for oysters.

By June each year export demand to Asia exceeds what can currently be supplied by the Company. When export demand starts to slow in November the domestic demand in Australia picks up which ensures constant demand for oysters all year round.

*Figure 30 Northern Hemisphere & Southern Hemisphere Condition vs Demand*

![Graph showing Northern and Southern Hemisphere Condition vs Demand](image)

*Source: Angel Seafood Holdings Prospectus*

**Australian Domestic/Import Replacement**

**Australian Market**

Australia’s total imports of oysters in 2017 was 775,000 tonnes.

In 2010 the Australian total oyster production was around 14,800 tonnes, SA making up 6,100 tonnes, making oyster the second most plentiful aquaculture product.

Additionally, in 2010 edible oysters contributed the second most ($100m) to total gross value of Australian aquaculture. (Australian Bureau of Agricultural and Resource Economics and Sciences, 2010).

Currently South Australian oyster production is estimated to be $50 million per year which makes up less than 1% of the world’s production.

As seen in the graph below the real value of edible oysters has remained reasonably constant from 2004 to 2014, whereas pearl oysters have decreased due to the global financial crisis of the late 2000s, reducing the global demand for pearls.
Over 97% of oysters bought by Australians are fresh in the ½ shell. The remainder are bought either live whole or frozen in the ½ shell. It is estimated that 56% of Australian oysters are bought from food service outlets, 32% from fishmongers, 7% from chain retailers and 2% directly from growers.

In 2007 Australian production of oysters was estimated at 16.446 million dozen and only 0.5 (3%) million dozen were exported and 1.25 (7.6%) million dozen were imported, mostly from New Zealand. Over 80% sold to Hong Kong, Singapore and Japan.

Oyster farmers rely on a complex supply chain, involving wholesalers, distributors and retailers for oysters to reach the market.

Australia continues to enjoy a position as a supplier of high quality, fresh, safe seafood. A challenge for businesses within the Australian oyster industry is in relation to their supply chain, particularly for exports.

Most often, seafood is purchased from a distributor, who buys form a range of sources, local and overseas.

Fresh catches can spend days in transit between being unloaded to markets or storage facilities and then on-sold and delivered to kitchens. In order for Angel to have success in the Australian and international markets they must construct a fast supply chain.

**Australian Exports**

**Hong Kong Market**

Hong Kong relies heavily on seafood imports, with 90 per cent of fish and seafood products imported. Hong Kong are generally free markets however there are some restrictions imposed on certain products from individual regions/countries due to hygiene or food safety concerns.

The Hong Kong SAR Government does not currently regulate the import of aquatic products for human consumption but is in the process of proposing legislation.

Home to a population of 7.2 million Hong Kong imports large amounts of fish and seafood products due to both high demand and the relatively small and diminishing local fishing industry.

In 2012, mainland Chinese exports comprised 21.2% of Hong Kong’s seafood market, becoming the lead suppliers of farmed shrimp, crab, squid and other lower-value fish and seafood products including freshwater species.

Japan has the second largest market share at 14.3%, comprised of high-value seafood such as oysters. Respectively, Australia has 7.0% market share also exporting high-value live seafood.
In order for Australia to establish a place in the market, companies need to identify a niche that will pull substantial sales from competing countries and products.

The mainland Chinese government launched an anti-corruption campaign in early 2013 and is limiting official spending on luxury goods and services. This is affecting high-end Chinese restaurants serving this customer category in Hong Kong.

Oysters have a strong market presence in Hong Kong and are particularly well received by the food services sector, which prefer high-quality, imported products for their menus. Although Chinese suppliers have the advantage of proximity to Hong Kong, Hong Kong buyers are renowned for sourcing the best and highest value products from all over the world. The increasing number of food safety incidences in China and Hong Kong also drive buyers to look for reliable sources of supply that have a track record for safety. Another trend is the increased demand for sustainably sourced products. Importers require products to have the MSC certificate.

Seafood distribution channels maintain traditional methods of distribution and sales. The importers normally distribute direct to retailers (e. g. supermarkets, wet markets, online food stores) and the food services sector (hotels, restaurants and institutions). Importers also play an important role in the re-export distribution to China and Macau. However, the importer, wholesaler and distributor are often the same company.

**Singapore Market**

Singapore imports over 90 per cent of food consumed throughout the country due to limited land available for agriculture. Australia, China, Indonesia, Malaysia and United States are Singapore’s main suppliers of food.

Singapore allows free import of food supplies and products but as a country reputed for food safety and hygiene, it has strict regulatory regimes to ensure the safety of food and food supplies that are being imported into the country.

The Agri – Food and Veterinary Authority of Singapore (AVA) and Food Control Department are the major governing bodies of Food trade. The exports to Singapore are primarily controlled through regulations imposed on the importers.

The main supermarket chains may obtain products via direct import or through local importers/distributors. When product lines are sufficiently large in volume and have fast turnovers, supermarket chains are increasingly opting to import directly. Retailers may also have appointed consolidators in specific countries, including Australia. Exporters supplying to consolidators can deliver orders that are in smaller volumes, as compared to the direct export model.

Distribution to wet markets, hawkers, small grocery and mom-and-pop stores is usually handled by distributors and intermediary wholesalers. The larger distributors usually have their own facilities to handle perishable goods and capabilities for re-packing and distribution to their customers.

**Japanese Market**

Japan is well known for its fish-eating culture. Japanese seafood such as sushi, sashimi and tempura has become popular in global markets due to its healthy, low fat and low-calorie content. However, younger generation Japanese have started to lower their consumption of fish in preference to ready-to-eat meals.

In 2015, the volume of Japan’s seafood imports decreased by a further two per cent to 2.5 million tons from the previous year. This was due to an increase in costs caused by exchange rates, a weakened yen, and increasing global demand for seafood.

Japanese manufacturers, processors, wholesalers, restaurants chains and supermarkets are all interested in clean, safe, price-competitive and value-add products from overseas. Oysters are currently sold through specialty food stores, supermarkets and the internet which gives access to a growing number of Japanese consumers.

Japanese importers must ensure imported products comply with the strict regulations of Japan Agricultural Standards, Food Sanitation Law and Product Liability Law.

The traditional distribution channels for seafood are relatively complex with personal, historical and financial relations playing their part in the decision-making process. Seafood distribution channels maintain traditional methods of distribution and sales and major wholesalers in fish markets continue to play a key role in auctions and distribution.
Chinese Market

Oysters are well-known for their superb taste and high nutrition, valued by Chinese consumers. The quality of Chinese oysters is worrisome because of water pollution. Therefore, buyers turn their attention to oysters from overseas. France, New Zealand, Australia and the United States are the main oyster exporters to China. In China while oysters from Australia and New Zealand are popular, the French-origin Gillardeau retains a very strong brand consciousness among Chinese consumers.

Manufacturers of seafood are subject to even stricter accreditation for the registration process. On the spot accreditation by Chinese government officials may be also required. Certification and Accreditation Administration of the People’s Republic of China (CNCA) publishes latest lists of approved foreign manufacturers or facilities of seafood.

Chinese certification systems and foreign organic certification systems are not mutually recognised. Organic products that have not been certified by China or products that have only been certified by an overseas organic certifying body cannot be labelled as ‘organic’ or ‘in-conversion to organic’ or other labelling terms claiming to be organic.
**Yellow Tail Kingfish**

The Yellow tail Kingfish is also known as great amberjack. With few bones and a good recovery rate, it is often sold as cutlets or steaks but can be cooked whole.

The Yellowtail Kingfish occurs in tropical and temperate waters of the southern hemisphere and the northern Pacific.

Yellow Kingfish has been voted “best fish” at the Australian Food Awards in 2016 and 2017.

**Supply of Kingfish**

**Global production**

Commercial production of Japanese amberjack began in the 1940s, and production began to expand rapidly in the 1960s, exceeding 43,000 tonnes by 1970. By 1995 it had reached a peak of nearly 170,000 tonnes but ranged between 139,000 and 162,000 between 1996 and 2003, as seen in the chart below.

However, it should be noted that fish farmers have been able to maintain total production level at these significant levels despite a fall in the number of wild caught juveniles.

**Figure 32 Global Aquaculture Production for species (tonnes)**

Source: The Food and Agriculture Organization of the United Nations

Japan is the global leader in producing Yellowtail Kingfish.

The Japanese industry is around 160,000 tonnes pa but is mostly a wild catch model with only a relatively small portion using hatcheries for aquaculture. The industry is made up mostly of many small farmers producing around 100 tonnes each. Additionally, the vast majority of Japanese production (circa 95%) is for local domestic consumption.

**Australian production**

The Yellowtail Kingfish occurs in tropical and temperate waters of the southern hemisphere and the northern Pacific. In Australia, it is recorded from North Reef, Queensland to Trigg Island, Western Australia, and as far south as Tasmania.
Figure 33 Showing the distribution of Wild Yellowtail Kingfish

Source: Atlas of Living Australia

Yellowtail kingfish is farmed off the coast of SA in sea cages. There have been investigations into the feasibility of yellowtail kingfish aquaculture in NSW and WA, with both states hoping to begin farming in coming years. Broodstock (fish eggs) are produced in hatcheries and grown out in the ocean.

There are intentions to triple production of yellowtail kingfish in SA in coming years. The environmental impacts of this increased production on a broad ecological scale are not clear.

Clean Seas Seafood Ltd (CSS) is Australia’s main commercial producer of Kingfish with no significant competitors in Australia. They have released guidance for production in 2018 of circa 3,100 (600+ tonnes growth over FY17).

Partnering with Australia’s Seafood Cooperative Research Council (Seafood CRC), research and development projects have successfully improved product quality including fish flesh quality, juvenile survival, aqua-feeds and fish mortality. In recent times, Clean Seas has partnered with Danish aquaculture technology expert, Uni-Aqua, to research the viability of halving the grow-out phase to further improve propagation.

Disease History/Threats

Flatworms affect Kingfish causing a loss of appetite and in some cases death of the fish. Mild infections can be treated with hydrogen peroxide or with praziquantel or formalin. These treatments in cage culture systems present major time, manpower and cost burdens. A breeding project is ongoing in Japan, which uses genetic Quantitative trait Locus (QTL) markers to indicate broodstock resistant to the diseases.
Australian Producers
ASX Listed

CSS started as a producer of Southern Bluefin Tuna however its secondary research on Yellowtail Kingfish meant that their efforts were refocused in 2009.

Barriers to Entry
Significant barriers to entry include high research and development cost, availability of farming sites, limited leases and capital needed to set up necessary infrastructure.

Sustainability
Public reporting on the impacts of yellowtail kingfish farming in SA is limited to studies of direct environmental effects from fish waste; for example, producers do not provide detail on the amount of wild fish required to grow farmed fish.

There are intentions to triple production of yellowtail kingfish in SA in coming years. The environmental impacts of this increased production on a broad ecological scale are not clear.

Demand of Kingfish
Australian Domestic/Stocks
CSS, Australia’s producer of yellowtail kingfish says that there is significant scope per capita to increase sales across Australia. Hence, they have focused their sales to the domestic market.

Australian Exports
Australian Kingfish producer CSS is also looking into relatively underdeveloped markets for the fish across major cities in Europe, USA and China. This will be increasingly feasible due to newly introduced rapid freezing technology for new product capabilities and reducing transport costs when exporting.

Japan

There is significant demand in the Japanese market for Yellowtail Kingfish as it is regarded as the best fish in the world for sashimi by most chefs.

The market for cultured Japanese amberjack can be divided mainly into three categories: demand from high-class Japanese restaurants that deal mainly with live fish; wholesale stores and supermarkets dealing with fresh and frozen fish; and direct delivery of processed fillets to individual restaurants and homes.

However, Japan is currently the leading producer of the fish with 95% of production fulfilling domestic consumption.
Southern Bluefin Tuna

The SBT are large, highly migratory, pelagic fish that live largely between the latitudes of 30 and 50 degrees south. They live up to 40 years, reaching a maximum weight of about 250kg and a maximum length of about 220cm.

The main SBT spawning ground is the Indian Ocean south of Java, Indonesia. SBT spend most of their lives in their feeding grounds off of the southeast, southern and southwest coasts of Australia.

Supply of SBT

Global production/Stocks

SBT is commercially farmed in Australia, Japan, New Zealand, Korea, Taiwan, the Philippines, Indonesia and South Africa.

In 1984 Individual Transferable Quotas (ITQs) were allocated by the Australian Government to fishermen to recognise historical catch and investment and to prevent further exploitation and growth in the industry. Japanese and New Zealand governments also agreed to limit catches. As SBT catch was significantly below quotas set by Australian, Japanese and New Zealand governments between 1984 – 1988, all three countries agreed to further reduce catch limits with annual reviews.

In 1989 a trilateral conference was held between Japan, Australia and New Zealand where it was agreed that the total combined yearly quota for all three countries would be limited to 11,750 tonnes. A harvest strategy was put in place by the Australian Government and they began contributing data towards stock assessments conducted by an international scientific committee. With this in mind, it became very clear to the fishermen of Port Lincoln that to survive financially in the face of fishing restrictions and over capitalisation that they had to increase the value of their fishery.

Figure 34

Source: Commission for the Conservation of Southern Bluefin Tuna

Australian Production/Stocks

Based in Port Lincoln, the Southern Bluefin Tuna ranching industry employs 4,000 people each year and is a key tourist attraction for the area. The ‘ranching’ season runs from December to September.

Southern Bluefin Tuna are captured live in the Great Australian Bight between December and March and transferred to tow pontoons, which hold approximately 9,000 fish. Fish are then towed to the farms and transferred to smaller pontoons located in the clear waters of Spencer Gulf, east of Boston Island, for the rest of the season. Flights coming into and out of Port Lincoln pass over the pontoons, providing a great aerial view of the operation.
The majority of Port Lincoln Southern Bluefin Tuna are exported to Japan, with some fish also sent to Korea, China, United States, Singapore and the EU, as well as being available locally.

Much like global production, Australian production decreased dramatically in 1985 following the introduction of Australia’s Individual Transferable Quota.

**Figure 35**

Australian Production of Southern Bluefin Tuna

Source: Commission for the Conservation of Southern Bluefin Tuna

**Disease History/Threats**

The risk of parasite and disease spreading for southern bluefin aquaculture is low to negligible; the modern SBT aquaculture industry has total catch to harvest mortalities of around 2-4%. A diverse range of parasite species has been found hosted by the southern bluefin tuna, with most of the parasites examined posing little or no risk to the health of the farms—with some southern bluefin actually showing antibody responses to epizootics—however, blood fluke and gill fluke have the greatest risk factors.

Hypoxia is also a significant issue, and can be escalated due to unforeseen environmental factors such as algal blooms.

Currently production and research focuses on a small number of species mulloway, yellowtail kingfish and southern bluefin tuna. Mortalities have been reported, in both juvenile and adult marine finfish, which have been associated with organisms such as ciliated protozoan and monogenean trematodes.

**Sustainability**

In the past, southern bluefin tuna has been overfished and the species is now listed in Australia as ‘conservation dependent’ and has an approved recovery plan. This means that southern bluefin tuna can still be fished, but the amount that can be caught is restricted. Commercial scale is not possible to achieve through wild catch farming.

AFMA manages this species through scientific studies and species assessments and works together with the Commission for the Conservation of Southern Bluefin Tuna, the Department of the Environment and the Department of Agriculture. The most recent scientific studies of southern bluefin tuna show positive signs of recovery.
Overfishing is the greatest recognised threat to Southern Bluefin. With low numbers of spawning adults, natural variation means there is a high risk of further declines. Several years of low juvenile survival, even with little or no change in fishing, can result in rapid decline. There is no buffer of long-lived adults that exists when populations are higher.

Commonwealth fisheries are managed under the Fisheries Management Act 1991 or the Torres Strait Fisheries Act 1984. Southern bluefin tuna is managed under the Southern Bluefin Tuna Fishery Management Plan 1995 in force under national law, in addition to the Fisheries Management Act 1991, in order to support the long-term recovery of the SBT.

The inability for wild catch production of SBT provides a possible opportunity for aquaculture production in Australia.

**Australian Producers**

There are currently no Australian producers of Southern Bluefin Tuna however CSS is interested in re-entering this industry if their current product, Kingfish, is successful in the Australian and international markets.

**Barriers to Entry**

Barriers to entry for new farmers include few available farming locations, the timely and expensive process of obtaining a licence, have the capital to establish the initial farm and infrastructure and obtaining a reliable supplier year round.

Additionally, while negative consumer associations of Blue fin tuna as an endangered species may be viewed as a threat to Australian production, it may offer an opportunity especially if captured and farmed production is a key differentiator.

Source: Australian Fisheries Management Authority
Demand of SBT
Australian Exports

Japan

Japan is the largest consumer of SBT in the world. SBT is primarily used in Japan for sushi and sashimi. Although prices range considerably depending on size, whether the fish is fresh or frozen, and how it was handled, the average farmed SBT currently sells for approximately $500-$750 per 30-40kg fish.

Total Japanese demand for sashimi-grade tuna is estimated at between 450,000 and 550,000 tonnes per year. Approximately 50% of this is sourced from Japan’s own production, with the other 50% being imported. Farmed NBT and SBT represents less than 10% of total Japanese sashimi tuna consumption. Longlined frozen wild catch NBT, Yellowfin Tuna, Big Eye Tuna, Skipjack and Albacore account for the majority of the remaining 90%.

Australian farmed SBT is sold almost exclusively to the Japanese premium sashimi grade markets in either frozen or fresh chilled form. Japanese buyers now contract directly with Australian farmers, with the fish often being collected by freezer boats docking at Port Lincoln. Contractual volumes and prices are usually determined on an annual basis. In addition fresh SBT is sold in the Japanese auction markets.

Hong Kong

The Hong Kong Government has declared Blue fin tuna critically endangered, and has banned it from official government dinner menus. However, Blue n tuna can still be imported for general public consumption.

China

Blue fin tuna continues to command growing demand with the emerging affluence of individuals in China. The Taiwanese industry dominates the market with a smaller industry on mainland China. Currently there are imposed restrictions relating to fisheries in Japanese and Chinese waters in an attempt to stabilize fish stocks.

Singapore

In Singapore, the majority of Blue fin tuna is consumed in high-end sushi restaurants. Japan has placed restrictions on the fishing of immature Blue n Tuna from their waters, impacting Singapore’s supply. There is general consumer awareness in Singapore regarding the endangered listing of Blue n tuna.

South Korea

Blue fin tuna is a highly regarded food in South Korea, and locally known as guromaguro. In line with the increasing wealth of the South Korean population, demand for Blue fin tuna has continued to grow. South Korea is a major producer of Blue fin tuna and has recently agreed to regulate the fishing of juvenile fish. There is a current ban on Blue n tuna imported from Japan.
APPENDICES

Appendix 1: Seafarms Project Sea Dragon

Source: Seafarms AGM Presentation 2017

Overview

Seafarms (SFG) is currently developing Project Sea Dragon (PSD). PSD is a large-scale, integrated, land-based shrimp/prawn aquaculture project in northern Australia. At full production, PSD will become the 7th largest producer of shrimp globally, importantly it will be the only producer from a developed country offering a significant volume of superior product in the market place. Annual revenues are expected to be in excess of US$2.3 billion.

At full production, PSD will produce up to 150,000 tonnes per annum of black tiger shrimp, in 10,000 hectares of production ponds. Full production to be achieved over several incremental stages.

Discussions with potential joint venture partners, bankers, investors and off-takers gathering significant momentum now that new licences to construct and operate PSD have been issued.

SFG has been working with an experienced team of advisors including Lazard, Pareto, Corrs and PwC.

Black Tiger Prawn is a premium product to tap into strong seafood demand. Global seafood demand is expected to exceed supply by >50Mt in 2030, driven by growth in middle class population. PSD was conceived under secular trend of increased demand in protein and will produce up to 150,000 tonnes of prawns per year from 10,000 Ha of production ponds at full production, making it the world’s largest producer of BTPs. BTPs attract a price premium over the most commonly traded White Prawn (WP).

SFG has a strong operational track record. SFG has been operating existing QLD aquaculture operations since January 2014 and has been a major and reliable source of supply of BTPs in Australia. SFG has developed operational expertise and best practice techniques in BTP farming.

There are also significant barriers to entry preventing any competitors attempt something similar to PSD. Only a handful of sites around the world have the tropics suitable for BTP farming; furthermore, the combination of remoteness for improved biosecurity and proximity to the Asian markets of proposed PSD sites cannot be easily replicated. PSD is the only major aquaculture project with major project status in Australia. PSD is vertically integrated enabling PSD to maximise biosecurity, product consistency and to implement genetic research advances.

SFG has developed stringent biosecurity protocols and standards at its QLD operations, with best practice and key learnings to be applied to PSD:

- Separate locations for breeding, grow out and processing activities to mitigate disease risk;
- PSD self-selects healthy and Specific Pathogen Free (SPF) broodstock, eliminating pathogen entry pathway through broodstock;
- Specific project design elements (e.g., buffer zones, water treatment, access protocols) lead to improved biosecurity;
- Established emergency action protocol that “ring fences” any disease outbreak
- Farms can be restarted quickly after any disease event with SPF stock, further ensuring that losses are minimized.

China-Australia Free Trade Agreement enacted by both governments in June 2015 which eliminated Chinese tariffs on Australian prawns within 4 years to further improve PSD’s relative cost position. SFG has signed Indigenous Land Use Agreement (ILUA), the last step in securing the support of the traditional owners, and NT Project Development Agreement (PDA), providing the pathway for development for all 9 stages.
Black Tiger prawn market

Despite being a premium product, global volumes of BTP have remained in a 600-800 Kt range since 2000.

Until the beginning of this millennium, BTP was the main species for prawn aquaculture due to its strong natural growth rates and premium pricing. However since 2000, producers have been shifting away from BTP to WP as WP has proved easier to domesticate and capture better biological performance. In addition, an outbreak of white spot disease in Thailand led to the introduction of a government ban on BTP farming in inland areas.

More recently, BTP selective breeding programs have resolved a number of these historical issues with BTP farming, leading to some recent increases in BTP production.

The increasing concentration of WP production as the dominant farmed species has led to biological challenges, including most recently Acute Hepatopancreatic Necrosis Disease (AHPND).

The more advanced breeding techniques, larger optimal size and premium prices make BTP the ideal species for the Australian aquaculture industry.

The Urner Barry shrimp indices are based on the previous week’s prices achieved across a select group of US based seafood traders. As such, it represents only a guide to global prices for open market traded products on a spot basis.

Majority of prawns are traded on a bilateral basis with premiums for security of supply, quality of product and size.

Much of the recent success in domestication and genetic breeding programs for BTP have been led by Australian researchers, working in conjunction with SFG. BTP breeding programs have improved the biological performance of this species for use in aquaculture. Most estimates of growth rate gains in aquatic species are 10–20% per generation of selection.

The historical performance increases that have been obtained in WP since 2004 illustrate the further benefits that are available to BTP as a domesticated species.
Biosecurity is the key risk factor in the seafood industry. Disease has a severe impact on aquaculture production, given the intensive nature of the industry, and will spread fast once established in a region.

Countries with the highest disease challenges are characterised by:

- Poor husbandry practices and hygiene and limited understanding of and compliance to biosecurity;
- High industry fragmentation, such that small farmers have limited resources to focus on biosecurity;
- Close proximity of farms, allowing disease to spread quickly between them;
- High degree of geographic movement of live biomass, allowing disease to spread.

**Project**

The core facility of PSD, Legune Station in the Northern Territory, has been a carefully selected location. SFG holds an Access and Option Agreement over Legune Station.

Complete end to end control of operations will allow SFG to ensure absolute biosecurity and process control.

Stage 1 of PSD will involve the construction of 1,120 Ha of ponds as well as all supporting infrastructure for Stage 1 and subsequent stages.

Stage 1 of PSD will comprise of:

- Founder stock centre
- Breeding facilities
- Hatcheries
- Grow out facility totally 1,120 Ha of ponds
Project Status

SFG has received key environmental approvals and the Northern Territory Government Project Development Agreement (PDA), and has agreed the Indigenous Land Use Agreement (ILUA) with the traditional owners. The start of significant construction is expected to commence in the dry season of 2018.

SFG has received all required environmental approvals for Stage 1 at Legune Station with the receipt of the Federal Government’s approval made under the Environment Protection and Biodiversity Conservation Act in May 2017. Key conditions of the approval include:

- Developing and implementing a water quality monitoring and management program
- Establishing a scientific advisory group to advise on matters relating to threatened and migratory waterbirds, including a waterbird impact mitigation and monitoring program
- Specific precautions during construction and operation to avoid potential impacts to marine life, including turtles, sawfish and river sharks

Secondary licences expected to be approved in accordance with EPA recommendations. The Northern Territory Government Project Development Agreement (PDA) has been executed. SFG has agreed the Indigenous Land Use Agreement with the Traditional Owners.
Delivery Strategy

The project delivery strategy of PSD as a modular project underpins is scalability for future stages.

Stage 1 of PSD is designed to be constructed mainly during the dry season (May – November each year). Project delivery will comprise two main phases:

- **Execution Phase**: Includes detailed design, engineering, procurement, construction and commissioning of all the required capital works.
- **Operational Ramp Up Phase**: Includes handover, commencement and progressing increase in production.

The development of Stage 1 will require the concurrent detailed design, construction and commissioning of the facilities at each location.

The key strategies proposed for the Execution Phase include:

- Procurement packaging to optimise the buying effort versus supplier performance;
- The contract packaging to be designed to maintain competitive bidding with sole-source awards only adopted when justified;
- Maximise the use of local and indigenous contractors/suppliers where appropriate and as agreed in the ILUA;
- Australian and offshore sourcing, to offer the best solution for cost, quality, schedule, reliability, commissioning, warranties and ongoing technical support;
- Recognition that the capital expenditure will be over an extended period, providing opportunities for PSD to self-perform certain scope and term contracts for other parts of the scope.
This Research Report has been prepared by Russell Wright ("Mr Wright") in his capacity as a Corporate Authorised Representative (CAR: 422117) and issued in (in Australia) by EverBlu Capital Pty Ltd (ABN 23 612 793 683) (AFS Licence No. 499 601) ("EverBlu Capital") and remains the property of EverBlu Capital Pty Ltd. No material contained in this Research may be reproduced or distributed, except as allowed by the Copyright Act, without the prior written approval of EverBlu Capital. This Research Report is subject to the disclosures and restrictions set out below.

**Analyst Certification**

The research analyst(s) identified on the cover of this report individually certify that in respect of each security or issuer that the research analyst covers that: this report accurately reflects his or her personal views about any and all of the subject issuer(s) or securities; and no part of the research analyst’s compensation was, is, or will be directly or indirectly related to the specific recommendation(s) or views expressed by the research analyst(s) in this report.

EverBlu Capital provides research services to its client. Mr Wright is General Manager of Research and has over twenty (25) years’ experience in the financial services industry, particularly in financial analysis and research report writing. Mr Wright joined the EverBlu team in 2017 where he has been involved in the research and publication of reports. Prior to this Mr Wright worked at a number of entities where he held Director/Head of Research and General Manager of Research positions. Mr Wright holds a Bachelor of Mathematics (Honours) from Edinburgh University and has completed the SIOA Accreditation Program (RG146) through DeakinPrime.

**General Disclosure**

EverBlu Capital and its associates (as defined in Chapter 1 of the Corporations Act 2001), officers, directors, employees and agents, from time to time, may own or have positions in securities of the company(ies) covered in this report and may trade in the securities mentioned either as principal or agent or may be materially interested in such securities.

EverBlu Capital does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

EverBlu Capital provides research on all ASX200 stocks as well as on other sectors (i.e. artificial intelligence, crypto currencies, food, healthcare, marijuana, mining, payment platforms and technologies) and/or entities which EverBlu Capital considers to be of interest to both EverBlu Capital’s clients and the broader financial markets.

**Disclaimer & Warning**

This report may contain general advice or recommendations which, while believed to be accurate at the time of publication, are not appropriate for all persons or accounts. This report does not purport to contain all the information that a prospective investor may require. Before making an investment or trading decision, the recipient must consider market developments subsequent to the date of this document, and whether the advice is appropriate in light of his or her financial circumstances or seek further advice or should form his/her own independent view given the person’s investment objectives, financial situation and particular needs regarding any securities or Financial Products mentioned herein. Information in this document has been obtained from sources believed to be true but neither EverBlu Capital nor its associates make any recommendation or warranty concerning the Financial Products or the accuracy, or reliability or completeness of the information or the performance of the companies referred to in this document. Past performance is not indicative of future performance. This document is not an offer, invitation, solicitation or recommendation with respect to the subscription for, purchase or sale of any Financial Product, and neither this document or anything in it shall form the basis of any contract or commitment. Although every attempt has been made to verify the accuracy of the information contained in the document, liability for any errors or omissions (except any statutory liability which cannot be excluded) is specifically excluded by EverBlu Capital, its associates, officers, directors, employees and agents. The securities of such company(ies) may not be eligible for sale in all jurisdictions or to all categories of investors.

Analysts’ Compensation: The research analysts responsible for the preparation of this report receive compensation based upon various factors, including the quality and accuracy of the analyst(s) research, client evaluation feedback, independent survey rankings and overall firm revenues, which include revenues from, among other business units and corporate finance.

Other International Investors: International investors outside the US, UK, UAE or Canada are encouraged to contact their local regulatory authorities to determine whether any restrictions apply to their ability to purchase this investment and should seek their own advice.

Recipient Representations/Warranties: By accepting this report, the recipient represents and warrants that he or she is entitled to receive such report in accordance with the restrictions set out in this report and agrees to be bound by the limitations contained herein. Any failure to comply with these limitations may constitute a violation of law.

**Meanings of EverBlu Capital Stock Ratings**

- **Buy**: Describes stocks that we expect to provide a total return (price appreciation plus net yield) of 15% or more within a 12-month period.

- **Hold**: Describes stocks that are neither a buy nor a underperform.

- **Underperform**: Describes stocks that we expect to provide a total return (price appreciation plus net yield) of less than minus 10% within a 12-month period.

**NR**: The investment rating and price target have been temporarily suspended. Such suspensions are in compliance with applicable regulations and/or EverBlu Capital policies.

**Speculative Buy**: Describes stocks we research with a positive bias, whose company fundamentals and/or financials are being covered, but for which there is insufficient information for EverBlu Capital to assign a Buy or Underperform rating.

**Valuation Methodology**

EverBlu Capital’s methodology for assigning stock and credit ratings may include the following: market capitalisation, maturity, growth/value, volatility and expected total return over the next 12 months. The price targets are based on several methodologies, which may include, but are not restricted to, analyses of peer comparisions, market risk, growth rate, revenue stream, discounted cash flow (DCF), EBITDA, EPS, cash flow (CF), free cash flow (FCF), EV/EBITDA, P/E, PE growth, P/CF, P/FCF, premium (discount)/average group EV/EBITDA premium (discount)/average group P/E, sum of parts, net asset value, discounted dividend model (DDM), franking credits and return on equity (ROE) over the next 12 months.

**Conflicts of Interest**

EverBlu Capital declares that it acted as Lead Manager in the Initial Public Offering of Angel Seafood Holdings Limited announced to the ASX on 13 December 2018 for which it received fees.

EverBlu Capital declares that they have received during the past 12 month’s compensation for financial and advisory services from the company, its parent or its wholly owned or majority owned subsidiary.

EverBlu Capital and its associates also declare that they deal in securities as part of their securities business and consequently may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

**EverBlu Capital Recommendation Proportions**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy</td>
<td>43.1%</td>
</tr>
<tr>
<td>Speculative Buy</td>
<td>0.8%</td>
</tr>
<tr>
<td>Hold</td>
<td>26.3%</td>
</tr>
<tr>
<td>Underperform</td>
<td>29.8%</td>
</tr>
</tbody>
</table>

(2.8% of stocks with recommendations are EverBlu clients)

(100.0% of stocks with recommendations are EverBlu clients)

(0.0% of stocks with recommendations are EverBlu clients)

(0.0% of stocks with recommendations are EverBlu clients)