Improving the efficiency of Southern Squid Jig Fisheries

McKINNA *et al*
Strategic Insight
Global Outlook

Australian Government

Fisheries Research and Development Corporation

Project No. 2009/221

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OUTCOMES ACHIEVED TO DATE

This project has produced an assessment of the Southern Jig Fishery and in particular the channels facing the future development of this sustainable fishery. The report identifies and discusses possible industry strategies to overcome the challenges confronting the industry. The report will be of benefit to fishers, processors and industry leaders in formulating future strategies

This project has involved an assessment of the Southern Squid Jig Fishery (SSJF) with a focus on identifying the factors affecting the economic viability of the SSJF for arrow squid in southern Australia, and to canvass a broad range of solutions to improve efficiency and profitability of the industry.

This report identifies the key performance issues affecting efficiency and profitability including:

- Increased costs, particularly with diesel fuel and labour.
- The inability to pass on cost increases because of the highly competitive nature of the global market.
- The strong and increasing competition from imports due to large global supplies and which is exacerbated by the strong $AUD which reduces the cost of imports.
- The inability of jig caught squid to achieve a price premium despite the fact that many consider it to be a superior product.
- Following on from the above, the inability of the SSJF to differentiate the product.
- The extreme variability of the catch, both for year-to-year and catch-to-catch.
- Mislabelling whereby Australian consumers believe they are buying a local product when in fact it is an import.

The project methodology has included:

- An industry familiarisation and briefing.
- A cost analysis of the fishery operations based on a typical boat and various scenarios regarding catch level.
- A review of the supply chain.
- An analysis of global trade in squid.
- A domestic market review.
- The drafting of an industry development strategy.

The report concludes that the only real potential opportunity to reduce costs per se is by adopting LED lighting technology that has the potential to substantially reduce diesel costs. LED technology is unproven in the SSJF application and needs to be proven.

The bigger potential to improve industry profitability is in improving jig fishing efficiency and catch yield. The two potential solutions here are the adoption of satellite tracking technology and collective fishing models. In the case of the former, again the technology has had limited trials and the effectiveness is not proven. The potential to adopt cooperative or collective fishing models where fishers prospect in different waters and share information and perhaps the catch, requires a high degree of cooperation which is not a characteristic of the SSJF.

The above option however is worthy of further investigation by the industry, as it would allow the Australian industry to emulate the corporate fishing model used overseas.

The ability of the SSJF to influence market price is extremely limited because of the miniscule volumes in the context of a large global industry. The only real opportunity to improve pricing is for SSJF to achieve a premium over market price through product differentiation. This report highlights a number of tools that have been successfully applied by other industries to differentiate the product including branding, packaging and product development.

The report highlights the fact that the SSJF faces unfair competition from imports due to alleged mislabelling whereby product caught and processed outside of Australia is passed off as a product of Australia. The issue is common across a range of food products. The SSJF needs to draw the issue to the attention of the authorities.

The report recommends that the SSJF establish a formal and incorporated body to further advance the issue and investigate potential solutions as highlighted in the report.

KEYWORDS: **Southern Jig Fishery, arrow squid.**

1.2 Acknowledgements

The assistance of the fishers, processors, traders and chefs consulted for this research is gratefully acknowledged. In particular, the contribution of Lisle Elleway is noted.

1.3 Background

The primary method used in the SSJF is jig fishing. A jig is a specific type of fishing lure that comprises of a lead sinker with a hook moulded into it and is generally covered by a soft body to attract fish. The method of jig fishing involves these jigs being dropped along the sides of the boat on lengths of line. These are attached to machines that pull the line up and down, creating a jerking motion in an attempt to imitate the likeness of a prawn to attract squid. When the machine controlling the line senses that the strain in the line has gone above a certain point the line is hauled in.

The SSJF for arrow squid (*Nototodarus gouldi)* is currently facing a number of challenges. While the industry has tackled issues of sustainability, it has not yet dealt with the economic and marketing issues that are impinging on its profitability and growth going forward. The intention of this project was to investigate the causes of the economic drivers of poor performance and to develop a range of potential solutions for improving profitability by either driving costs out of the supply chain or by increasing value.

The problems facing this industry are becoming increasingly common in the wider agrifood sector and have been brought about by a culmination of factors as outlined below:

1. The increase in costs, including diesel fuel, labour and other inputs; coupled with an inability to pass these price increases on to customers because of the competitive environment and the commodity nature of the product.
2. Strong competition from other fisheries such as trawlers for whom squid is a bi-product from much larger catches, giving these fisheries a substantial cost advantage.
3. Strong and increasing competition from imports, which are likely to continue given the ongoing strength of the Australian dollar (AUD). The Australian dollar reached parity with the US dollar this year and is likely to stay high in the foreseeable future. In 2006-07, imports of squid were $48.7m, compared with exports of $1m for the same period. This imbalance will be difficult to address in a high AUD environment.
4. Although squid caught by the jigging method is generally considered to be of better eating quality, this fact is not reflected in premium pricing to the extent that it should be, because of the lack of an effective branding and marketing strategy that differentiates the product for consumers.
5. Because squid consumers are relatively uninformed, despite the fact that they may have a preference to buy Australian product, they are not capable of differentiating it (usually they are not offered the choice anyway).
6. Australian consumers are not well educated about buying and preparing squid, limiting its at home consumption.

During the 2009 fishing season, 308 tonnes of arrow squid was caught with a gross value of AU$0.5 million. There were 58 permits active during this season in the SSJF.[1] It is important to note that the SSJF produces a relatively small squid catch in global terms. In 2008, total global squid exports amounted to US$2.9 billion.[2] In contrast, the SSJF catch of squid that year had a total gross value of AU$0.2 million.[3] Thus, while the SSJF only supplies the domestic market, its pricing is strongly influenced by global price dynamics.

The primary customers for the SSJF fishers are the processors of value-added squid products (who produce processed rings, tubes, tentacles and wings). The SSJF product is usually processed along side imported squid and looses its identity in the supply chain. The processed product is sold through domestic food service channels such as pubs, clubs, casual restaurants, bars and take away food outlets. Unlike many other seafood products, it is not considered a premium protein source.

A minor secondary market exists for smaller arrow squid (less than 300g), which are well suited as bait for commercial line fishing. The smaller squid is usually a by-product of the main catch.

1.4 Need

The essence of this project is to find a means to restore the SSJF to sustainable economic viability. Essentially the SSJF is a boutique industry competing in a global commodity market against formidable competitors. The reason that cost reduction alone will not provide the solution to its profitability challenges, is that SSJF's competitors have a greater opportunity to reduce costs and/or invest in industry development.

Building a premium market positioning will be challenging requiring the industry to develop strategic supply-chain alliances into the targeted channels, based on long-term mutual benefit, to ensure improved returns and stability. Any targeted marketing program will need to be underpinned by a quality assurance regime based on a voluntary industry code of practice. The point of difference with the product will then need to be communicated to the consumers through industry-wide branding. At the same time, there needs to be a rigorous review to identify opportunities for cost reduction and innovation to improve industry efficiency.

Potentially, by applying these time proven methods, the SSJF could re-structure itself to become a profitable and sustainable industry. However, in reality, there are many barriers constraining success with these strategies.

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[1] Australian Government Department of Agriculture, Fisheries and Forestry, *Fishery Status Reports 2009 – Status of Fish Stocks and Fisheries Managed by the Australian Government*, 2010.
[2] FAO FishStat database, 2008
[3] Australian Government Department of Agriculture, Fisheries and Forestry, *Fishery Status Reports 2009 – Status of Fish Stocks and Fisheries Managed by the Australian Government*, 2010.

1.5 Objectives

1. To assess the range of factors affecting the economic viability of the SSJF for arrow squid in southern Australia.
2. To canvass a broad range of practical solutions that will increase both the profitability and efficiency of the industry. These solutions should be in areas where the SSJF industry can focus efforts to improve profitability, as distinct from factors endemic to the wider fishing industry and other sectors of the economy.

1.6 Methodology

The research methodology undertaken followed six different stages:

1.6.1 Familiarisation and briefing

This involved discussions with the Fisheries Research and Development Corporation and AFMA project team to fully understand the project context. This stage also included significant background desk research to discover and review related documentation and market databases.

1.6.2 Cost analysis

Discussions were held with key vessel operators, processors and traders to collect relevant data concerning the various costs associated with squid fishing. A review was also undertaken of emerging technologies with regard to squid fishing.

1.6.3 Supply chain review

A supply chain review was conducted from the point of catch through to the final consumer. This stage involved charting the current seafood supply chain for the overall squid industry, plotting volume and value at each link in the supply chain including: on-boat collection, cleaning and tenderising, packaging, retailing and foodservice distribution and retail and foodservice merchandising.

1.6.4 Global trade analysis

This stage involved a review of the Australian trade in squid and cuttlefish covering both exports and imports from and into Australia.

1.6.5 Domestic market review

This process drew on the insights gained from a series of industry interviews with major food service seafood users, distributors, buyers and major seafood retailers on the eastern seaboard. Analysis was made of the current market including a review of usage and consumption patterns of squid.

1.6.6 Industry development strategy

A comprehensive industry development strategy was devised using the output from each of the above stages of research and analysis.

1.7 Project challenges

This study has been made more challenging than most industry analysis assignments due to the following factors:

1. There is a lack of current global data specific to squid markets.
2. Vast movement of squid products around the world makes it difficult to track trade patterns accurately.
3. There is a lack of differentiation of the species in the available data (i.e. squid commonly referred to as 'calamari' and 'squid' are very different products traded at very different price points).
4. There is virtually no market data available about value-added arrow squid specifically.
5. Stakeholder consultation is challenging as there is no longer a central body for the SSJF and only a very small number of stakeholders are currently actively engaged in the industry.

These challenges are typical of many undeveloped industries and are not insurmountable. Notwithstanding the challenges, the learnings from this exercise still provide useful context. The situation does necessitate that some assumptions be made in the interpretation of the data that is available. Where assumptions have been made, these are noted as the author's opinion. It should be understood that McKINNA *et al* opinion is based on over 25 years of insight, gained from working across numerous emerging industries in seafood as well as other agrifood sectors.

2 GLOBAL TRADE ANALYSIS

This section of the report examines the global trade situation for squid and cuttlefish, highlighting where practicable, the competitive position of the SSJF.

The main data source for this section has been the Food and Agriculture Organization (FAO) of the United Nations' database FishStat, which contains time series data on fish production, export, import and re-export. However, this data is somewhat limited in that it is not current and does not always differentiate the species or the stage of value-adding in detail.

In the past decade, there has been a dramatic shift in global fisheries. Fish that is caught and frozen in one part of the world is often thawed, processed, re-frozen and repackaged in another. For example, a key competitor to SSJF's arrow squid *Nototodarus gouldi* is Argentine squid *Illex argentinus*, which is caught in Argentina yet processed largely in China or Thailand; and New Zealand squid *Nototodarus sloani* which is processed in Asia or Australia. The data recording mechanisms have not kept pace with this trend of moving fish around the world, meaning it is difficult to track import/export flows and processed/value-added differences, or to determine the true origin and destination of products.

In light of the limitations of the data, some assessment has been made of the global market dynamic based on the authors' international market research for other seafood categories.

2.1 Market dynamic

The global market dynamic for squid can alter drastically from season to season. Indeed, some of the world's most established squid fisheries have reported lowering stocks over time. For example, the recently banned driftnet fleets of Japan, Korea and Taiwan once took more than 300,000 tonnes of red ocean squid annually. This has been especially attributed to the ban on drift netting due to its adverse affect on other ocean fauna that would be caught in the process (such as dolphins and whales). Catches from the jig and trawl fishery in the southwest Atlantic (which commenced in the early 1980s) and the jumbo squid jig fishery off Peru have shown significant variability.[4] However, large volumes of squid are still being fished and overall, over the last 20 years squid catches have increased worldwide, although the main species caught have varied.

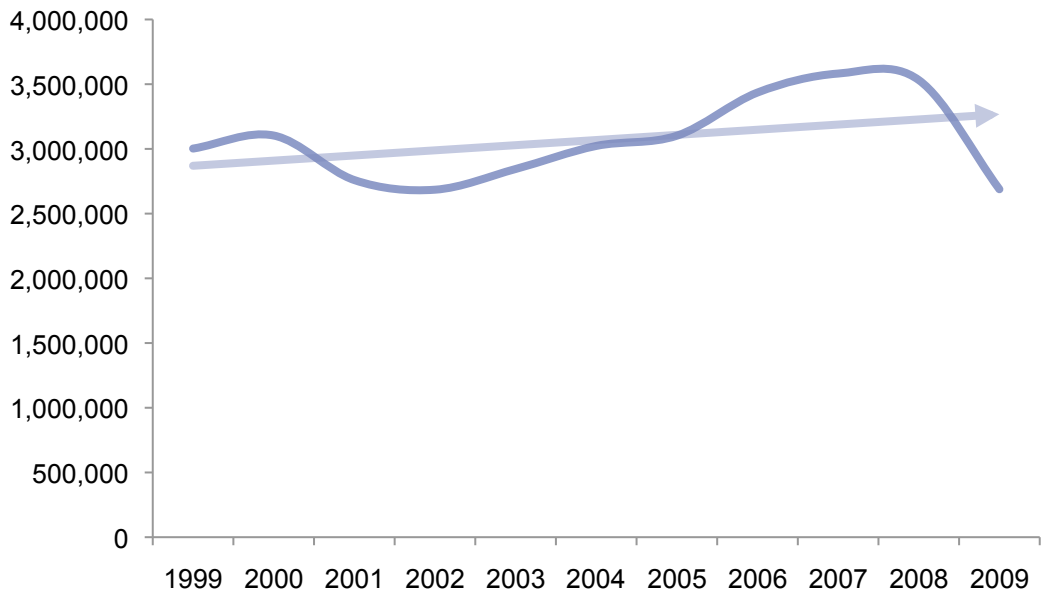
Notwithstanding this fluctuation in supply, the demand for high quality squid has steadily increased, in line with the growing demand for seafood generally (which is analysed later in this section). This inconsistency in supply and demand makes for a volatile market dynamic with corresponding swings in market prices, illustrating the point that this industry is a challenging one.

[4] Dunning, M. et al., *Development of northern Australian squid fishery*, FRDC Final Report, 2000, http://www.frdc.com.au/documentlibrary/finalreports/1994-017-DLD.pdf

2.2 Global Catch

As **Figure 1** shows, the global quantity of squid caught annually can vary significantly. Between 1999-2009, annual catches varied by as much as 1 million tonnes through that time period. The trend line indicates that up to 2009 there has been a general increase in annual catch, which is reflective of the continual growth in demand for the product globally, although there is a notable dip between 2008-09.

Figure 1: Total Global Squid Caught (tonnes), 1997-2009



Source: *FAO FishStat database*

As **Table 1** indicates, *Illex argentinus* and *Todarodes pacificus*, both from the *Ommastrephidae* family like arrow squid, comprised 46 percent of the global squid catch in 2002. The *Ommastrephidae* family contributes approximately 70% of the total world squid catch in volume terms.

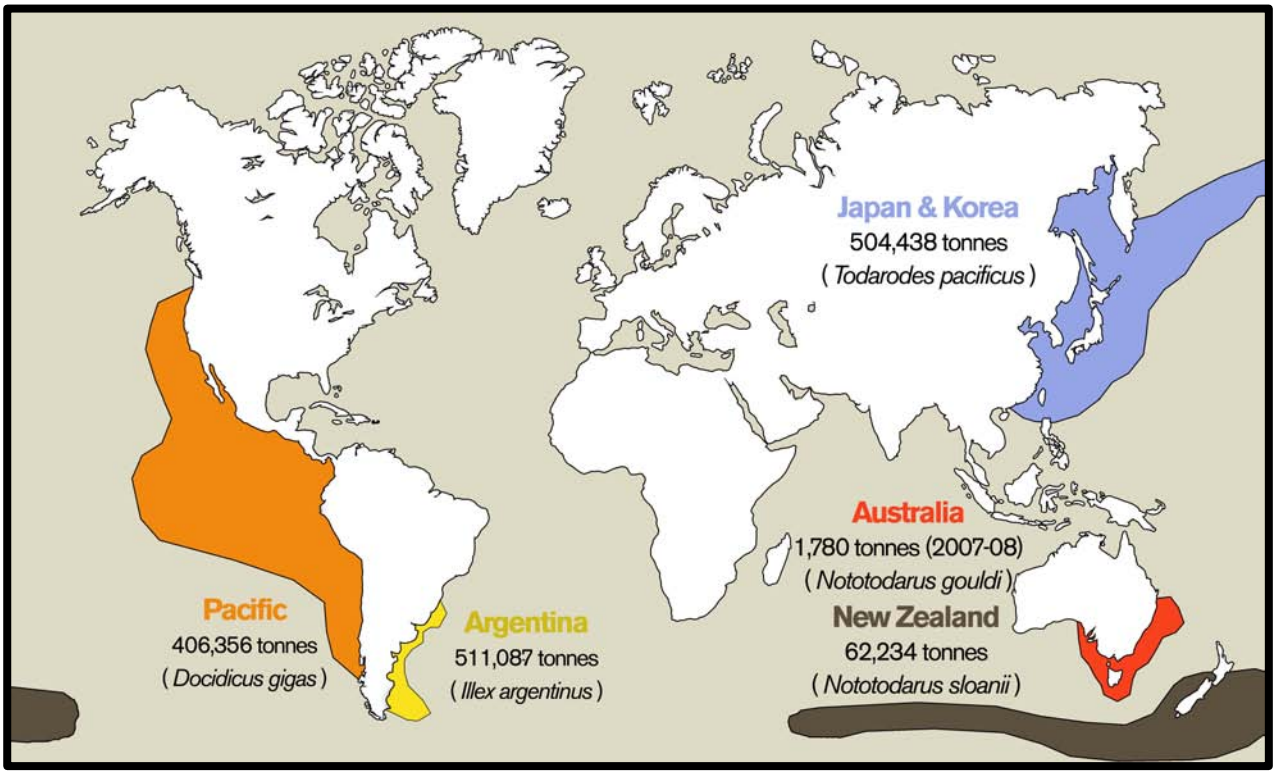
Table 1: Summary of Global Squid Catch, 2002

Species	Family	Common Name	Nominal catch in tonnes	% of World Cephalopod Catch
Loligo gahi	Loliginidae	Patagonian squid	24 976	0.8
Loligo pealei	Loliginidae	Long fin squid	16 684	0.5
Loligo reynaudi	Loliginidae	Cape Hope squid	7 406	0.2
Common squids nei	Loliginidae		225 958	7.5
Ommastrephes bartramii	Ommastrephidae	Neon flying squid	22 483	0.7
Illex illecebrosus	Ommastrephidae	Northern short fin squid	5 525	0.2
Illex argentinus	Ommastrephidae	Argentine short fin squid	511 087	16.1
Illex coindetii	Ommastrephidae	Broadtail short fin squid	527	<0.1
Dosidicus gigas	Ommastrephidae	Jumbo flying squid	406 356	12.8
Todarodes sagittatus	Ommastrephidae	European flying squid	5 197	0.2
Todarodes pacificus	Ommastrephidae	Japanese flying squid	504 438	15.9
Nototodarus sloani	Ommastrephidae	Wellington flying squid	62 234	1.9
Martialiahyadesi	Ommastrephidae	Seven star flying squid	-	-
Squids nei	Various		311 450	9.8
Total squids			2 189 206	75.8
Total Cephalopods			3 173 272	100

Source: *FAO*, 2003 (in Rodhouse, 2005)

Notably, Australian arrow squid, *Nototodarus gouldi* did not register in the global statistics, indicating the miniscule magnitude of the SSJF in the international market place. The map in **Figure 2** below highlights where the four most prominent species of squid are fished and indicates the relatively of Australia's catch.

Figure 2: Relativity of SSJF in the global context (Note: 2002 and 2008 data sources are not comparable)



2.3 Global Exports

Cuttlefish/squid is exported globally in many forms. There are four standard categories of exports that are recorded:

1. Frozen
2. Fresh
3. Salted/dried/brine
4. Other.

In 2008, of these four categories, frozen cuttlefish/squid accounted for 61.6% of the global export market in value terms. The FAO classifications do not differentiate frozen value-added products from unprocessed.

Table 2: Cuttlefish/Squid Global Exports by Classification, 2008

Classification	Value (US$ '000)	% Share
Frozen	$1,796,204	61.60%
Other	$741,522	25.40%
Fresh	$336,069	11.50%
Brine/salted/dried	$41,402	1.40%
Total	$2,915,197	100%

Source: *FAO FishStat database*

Table 3 presents the top ten cuttlefish/squid exporting nations in 2008 in value terms. Most notable is the fact that these top ten nations account for 67% of the global export trade in cuttlefish/squid. In the same year, Australia exported $245,000 worth of squid/cuttlefish, rating as the 62nd exporter for that year. Australia is not a significant exporter of squid/cuttlefish products, as our own fisheries cannot meet local demand.

Table 3: Top 10 Cuttlefish/Squid Exporters based on Value, 2008

Rank	Country	Export Value (US$ '000)	% Share
1	Thailandkyl Cold	$356,024	12.2%
2	Vietnam	$258,274	8.9%
3	Spain	$237,740	8.2%
4	China	$233,853	8.0%
5	India	$206,806	7.1%
6	Argentina	$156,866	5.4%
7	Morocco	$133,778	4.6%
8	Korea, Republic of	$130,749	4.5%
9	Peru	$126,378	4.3%
10	Falkland Is (Malvinas)	$112,550	3.9%
Top 10 Total		$1,953,018	67%
Global Export Total		$2,915,197	100%

Source: *FAO FishStat database*

Notably, in 1997 Argentina was the top exporter of cuttlefish/squid products and Peru only exported $47,000 worth of cuttlefish/squid products, indicating the scope of change in the squid market. Significant shifts in export value over the previous 10 years between countries may be explained by a combination of factors:

1. The shift of value to the nations where processing is a growth industry (e.g. Thailand, Vietnam and China);
2. Increased value-adding activity generally (i.e. more cutting and crumbing is being done before the product enters the food service supply chain);
3. The highly variable nature of the fishery stocks generally due to their unpredictable migration habits;
4. Some fisheries being more intensely fished than others.

However, it is increasingly difficult to interpret data such as this or to make meaningful assessments of its implications, because:

- Fleets are fishing outside their own territories, freezing at sea and then

landing the catch elsewhere;

- Product is being moved all over the world for multiple stages of processing; and
- International trade is prone to volatile swings driven by exchange rates as well as local supply and demand.

2.4 Global Imports

The top ten importers of Cuttlefish/Squid in value terms accounted for 79.6% of the global import trade.[5] Australia is the 15th largest importer of the commodity, with 2008 imports at $35.5 million. **Table 4** presents the top ten importers of cuttlefish/squid in 2008.

Table 4: Top 10 Cuttlefish/Squid Importers based on Value, 2008

Rank	Country	Value (US$ '000)	% Share
1	Spain	$670,926	21.5%
2	Italy	$485,797	15.6%
3	Japan	$399,934	12.8%
4	China	$352,906	11.3%
5	United States of America	$185,859	6.0%
6	Korea, Republic of	$96,690	3.1%
7	Thailand	$76,134	2.4%
8	Greece	$72,163	2.3%
9	Portugal	$71,408	2.3%
10	France	$670,926	2.1%
Top 10 Total		$2,478,384	79.6%
Global Import Total		$3,113,932	100%

Source: *FAO FishStat database*

By way of illustrating shifts in the market, it can be noted that in 1997, Japan was the biggest squid importer, followed by Spain and Italy; and Thailand and the Netherlands were the fifth and ninth biggest squid importers, respectively. However, the above import figures are by no means a reflection of national consumption. Barcelona and Amsterdam are the key ports for the entry of seafood products into European markets, indicating why Spain and The Netherlands have both been significant importers over time; and given Thailand's current dominance as a processor and value-adder, the combination of decreased imports and increased exports is logical, suggesting that more product is being landed there for processing.

[5] This includes frozen and fresh products.

As with exports, the frozen category of cuttlefish/squid has the highest share of the global import market as seen in **Table 5**.

Table 5: Cuttlefish/Squid Imports by Classification, 2008

Classification	Value (US$ '000)	% Share
Frozen	$2,204,447	70.8%
Other	$587,302	18.9%
Fresh	$191,822	6.2%
Brine/salted/dried	$130,361	4.2%
Total	$3,113,932	100%

Source: *FAO FishStat database*

Although squid is a commodity, to some extent the markets do differentiate product on the basis of species, size, presentation and product preservation state (i.e. fresh, frozen, frequency of defrosting). Generally, traders pay higher prices for squid that derive from the *Loliginidae* family (with characteristics more like species commonly known in Australia as 'calamari'), rather than from the larger and less tender *Ommastrephidae* family (of which the arrow squid derives). Additionally, jigged or lift netted squid fetch marginally higher prices than trawl-caught squid because of their better condition and appearance.[6]

2.5 Global consumption trends

There is no data available that measures the consumption trends of squid species specifically. However, on a global scale, seafood consumption has been rising steadily, both on a *per capita* basis and in absolute terms. Over the period of 1960 - 2005, seafood consumption has increased at an average annual rate of 2.9%, reaching 107 million tonnes in 2005. Average global fish consumption per head has increased from 9.9 kilograms per person (live weight) in the 1960s to 16.4 kilograms in 2005.[7]

[6] Dunning, M. et al., *Development of northern Australian squid fishery*, FRDC Final Report, 2000, http://www.frdc.com.au/documentlibrary/finalreports/1994-017-DLD.pdf
[7] Fishery and Aquaculture Statistics 2007, FAO, 2009

The steady growth in demand for seafood in developed countries is driven by:

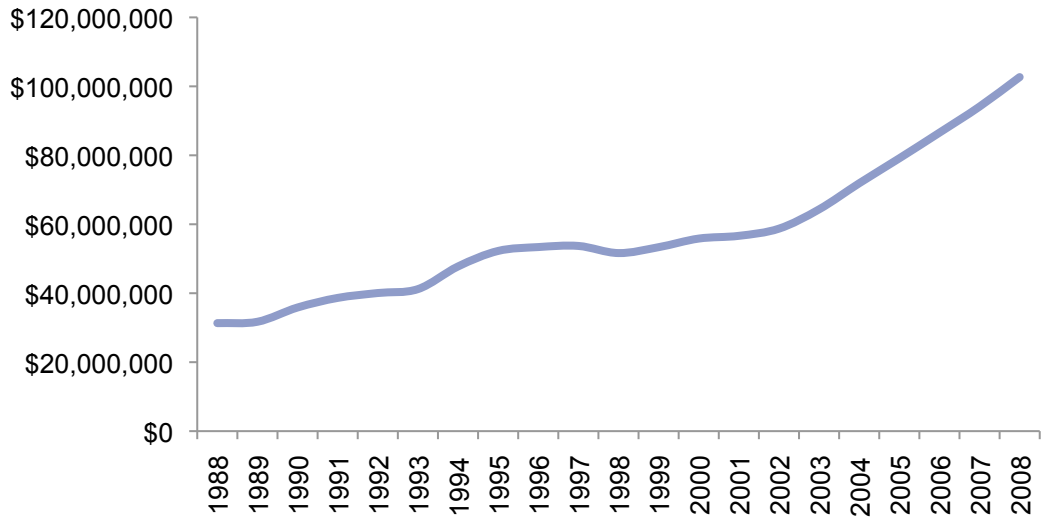
- The proven health benefits.
- Increased accessibility to quality seafood, particularly through supermarkets.
- Increased affordability.
- Growing interest in food and cooking, largely driven by television cooking shows, magazines and cook books.

Rapidly growing middle classes in developing and populous nations such as China, Indonesia and India is driving up the global consumption of protein foods generally. Seafood however, has been one of the strongest growing protein sources globally due to the fact that it is considered an expression of wealth in Chinese culture, making it a fashionable choice for one of the largest population bases in the world. Given the fact that China was facing famine conditions in the 1960s, the increase in seafood consumption there has had a huge impact on global supply and demand.

2.6 Outlook for seafood trade

The global trade in seafood products is forecast to increase in the future, partly as a result of more liberal international trade agreements, together with the rising prosperity that is transforming global food markets, especially in developing economies. Many analysts claim, that this trend may give rise to future food shortages. [8]

Figure 3: World Total Value of Seafood Exports (US$ '000), 1988-2008



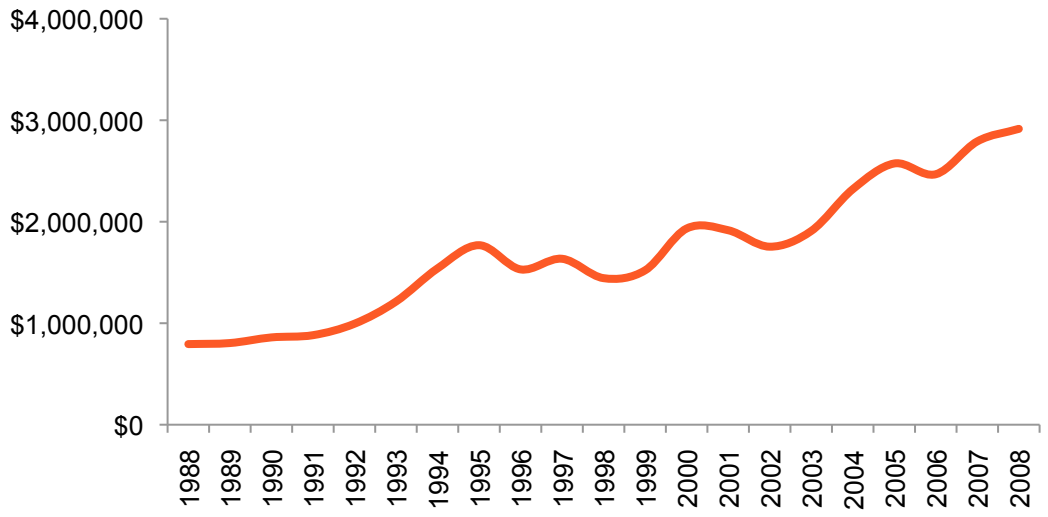
Source: *FAO FishStat database*

Fishery products are generally traded in US dollars largely as undifferentiated commodities. Overall trade volumes have been steadily growing with world fish exports amounting to US$102.6 billion in 2008 (**Figure 3**). Historically, most of this

[8] FAO, *The State of World Fisheries and Aquaculture*, 2008

trade was between developed countries. This upward trend is consistent with the growth of world exports in squid/cuttlefish (**Figure 4**).

Figure 4: World Total Value of Squid/Cuttlefish Exports (US$ '000), 1988-2008



Source: *FAO FishStat database*

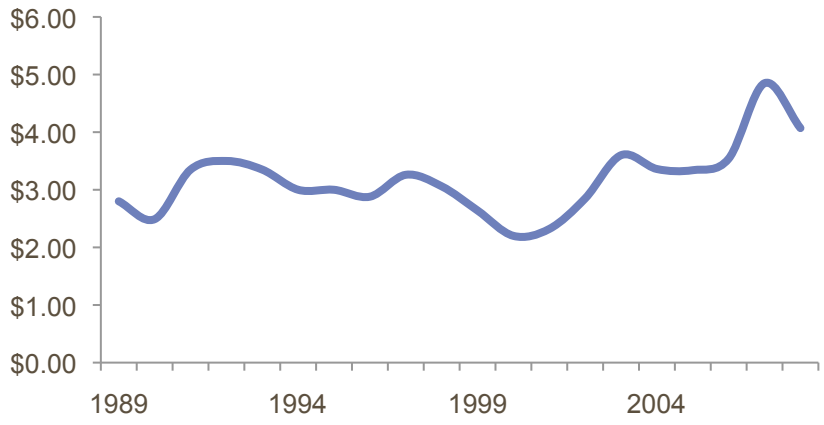
However, a market shift is occurring whereby developing countries are accounting for increased growth in the value of seafood trade in more recent years. Fishery product exports from developing countries have increased in real terms from US$6.6 billion in 1976 to US$24.6 billion in 2007,[9] which is a reflection of fishery product increasingly moving to countries with low labour costs for processing (e.g. China, Thailand and Vietnam). A number of developing countries have also had significant growth in their aquaculture industries.

2.7 Global price trends

Global squid prices are extremely volatile, mainly due to supply variability. Although squid prices seem fairly stable, there has been a general price increase over the past two decades in the Asian product (**Figure 5**).

[9] Mazur, Kasia et al., *Issues Insights: Australian fisheries – the global context*, Australian Bureau of Agricultural and Resource Economics, 2010

Figure 5: Yearly Cleaned Squid Price average between 1989-2008, cost and freight for Europe, origin Asia in US$ price for less than 5kg



Source: *FAO, Globalfish Commodity Update – Cephalopods, 2008*

Between 2000-08, the average price of squid (across all species) in Europe has been US$3.34, a slight increase from US$3.03 between 1989-99. [10] This relatively modest price increase is quite in contrast to the overall trend of the International Monetary Fund world seafood index, which has increased by 42% between 2001-2010.[11] However, the seafood price index does not imply that the prices of all seafood commodities have increased since 2001. For example, the fish price index has increased 74% during 2001-2010, in contrast to the shrimp price index, which has decreased by 26%. Quantum improvements in aquaculture technology have dramatically increased the stocks of many species also lowering the prices of wild-caught as well as farmed stock in some instances e.g. prawns. The combined effect of price upward and downward price trends is a 42% increase in the seafood commodity index.[12] In this context, squid prices lay somewhere in middle spectrum of seafood commodity prices.

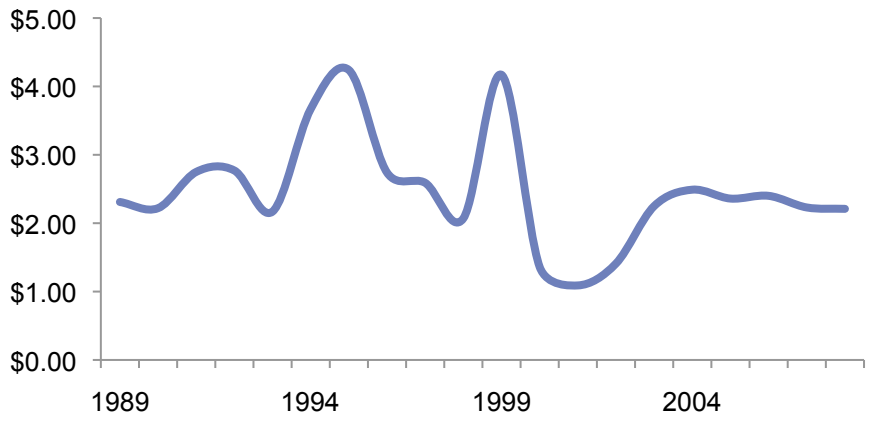
The authors speculate that the lower rate of growth in squid prices could be attributed to a number of factors:

- Much greater volumes of the lower value, trawled species (such as arrow squid) are being traded compared to premium eating line-caught squid.
- Significant increases in aquaculture making alternatives to squid such as prawns more affordable, thereby having a depressing effect on the price of squid.
- Market forces favouring buyers over sellers in this fishery.
- Consumer taste preferences for other varieties besides squid.

In contrast to an upward price trend for squid in Europe, Japan's wholesale price is far more volatile and experienced a notable decrease in the last two decades (**Figure 6**), from US$2.88 per kilo (1989-99), to US$2.23 per kilo (2000-08).[13]

[10] FAO, *Globalfish Commodity Update – Cephalopods*, 2008
[11] Mazur, Kasia et al., *Issues Insights: Australian fisheries – the global context*, Australian Bureau of Agricultural and Resource Economics, 2010
[12] Mazur, Kasia et al., *Issues Insights: Australian fisheries – the global context*, Australian Bureau of Agricultural and Resource Economics, 2010
[13] FAO, *Globalfish Commodity Update – Cephalopods*, 2008

Figure 6: Yearly Wholesale price of Squid between 1989-2008 in Japan, origin Japan (US$/per kg)



Source: *FAO, Globalfish Commodity Update – Cephalopods, 2008*

This fluctuation in prices in Japan may be reflective of catch inconsistency (frequently the case with squid); or the fact that the Japanese squid fishing fleet has many thousands of small boats at sea, meaning the market forces would favour buyers. (A local fisher interviewed for this study suggested that there are over 20,000 squid boats fishing in Japan.) Although more recent data is not available, it would be assumed that Japan's depressed economy in recent years would have softened demand for seafood generally.

The inconsistent nature of the global squid catch would suggest that its pricing would be highly volatile in nature. However, more recent industry history indicates that the price of squid is not always reflective of the catch size. The 2009 squid season in the Southwest Atlantic resulted in a disappointingly low 65,000 tonnes of squid caught, compared to 334,000 tonnes in the previous year. This small catch would have normally led to a substantial price hike, however, the global economic crisis put a dampener on demand which, in turn, kept prices lower than they otherwise would have been given a supply constraint of this magnitude.[14]

Recent years have seen the real prices of general fish products rising. Prices for species from wild-caught stocks are increasing at a greater rate than those of farmed fish species, because of the impact that higher fuel prices are having on fishing vessel operations.[15] Most markets will pay a premium for wild-caught fish with Asian consumers in particular placing a very high value on the provenance of seafood. For example, abalone from pristine waters such as those around Tasmania are perceived to be worth a significant premium.

2.8 Exchange rate impact

While Australia is not a significant exporter of squid, the impact of exchange rates is still felt in our own squid fisheries as a high Australian dollar makes imported competitor products significantly cheaper, forcing local prices down.

[14] http://www.eurofish.dk/dynamiskSub.php4?id=3765
[15] FAO, *The State of World Fisheries and Aquaculture*, 2008

Aside from squid, a large proportion of Australia's overall fishery production is exported, ranging from 60-90% in the past decade. Consequently, changes in the value of the Australian dollar (AUD) against the US dollar (USD) in particular, (the predominant global seafood trading currency), significantly affects the value of overall fisheries production.[16] As most Australian squid fishers also have an interest in scallop or crayfish operations, which are more export driven, the exchange rate dynamic between the AUD and USD impacts the viability of their overall fishing operations.

At the time of writing this report, the Australian dollar had reached parity with the US dollar for the first time since 1982. Analysts forecast that the outlook for the Australian dollar is that it will remain above US 80c for the medium term, certainly as long as Australia's mining boom continues. This will mean all Australian fisheries will face ongoing price challenges from cheaper imports.

2.9 Global trade challenges

Global seafood trade is an uneven playing field by virtue of the fact that the majority of developing countries apply higher import tariffs than those of developed countries. This is mostly done to generate much needed government revenue and to protect local industries. For Australian squid businesses, it means that processed squid can be imported into Australia relatively easily, competing with local arrow squid.

Over time, the trade in fish and fish products between developing countries is likely to become more open, subsequent to a gradual trade liberalisation. A reduction in import tariffs will follow the expanding membership of the WTO and the entry into force of a number of bilateral trade agreements with strong relevance to the trade of fish products.

Some of the major issues concerning international trade in fishery products have been:[17]

- Introduction by buyers and international retailers of stringent standards for food safety and quality, animal health, environmental sustainability and social impact considerations.
- The growing concerns from the general public and the retail sector about over-exploitation of certain fish stocks.
- Proliferation of aquaculture in general.
- Multilateral trade negotiations in the WTO.
- Expansion of regional trade areas, and regional and bilateral agreements.
- Global warming and its impact on fisheries.
- Rising energy prices.
- Rising commodity prices in general and their impact on producers as well as consumers.
- Country of origin labelling.

[16] Mazur, Kasia et al., *Issues Insights: Australian fisheries – the global context*, Australian Bureau of Agricultural and Resource Economics, 2010
[17] FAO, *The State of World Fisheries and Aquaculture*, 2008

Although Australian arrow squid export are very small, it is traded within a global market context; therefore the aforementioned export challenges do impact on the SSJF. The implications of these for the SSJF will be discussed later in this report.

2.10 The global outlook for arrow squid

Generally, Australian arrow squid processors supply domestic markets only. Because of the short fall in the SSJF catch, local processors need to purchase large volumes of squid imports to meet their customer demand. The value of the squid they import is generally many times greater than the value of the Australian fishery.

For 2008-09, ABARES valued squid and cuttlefish imports at $47.2 million. This data does not separate what consumers commonly refer to in Australia as the 'calamari' squid species from processing squid such as arrow squid. However, the principal source countries of imported processed and unprocessed squid products were China, New Zealand and Thailand, all of whom are competitor suppliers to the arrow squid fishery.

Exports of Australian cuttlefish and squid are minimal. In 2008-09, only $0.4 million worth of cuttlefish and squid was exported, mostly to China, Canada and Hong Kong.[18]

In summary, the global outlook for SSJF remains challenging with a high AUD and the fact that Australian processors rely on imports for the bulk of their volume. Options for facing these challenges are outlined later in this report.

[18] Australian Government Department of Agriculture, Fisheries and Forestry, *Fishery Status Reports 2009 – Status of Fish Stocks and Fisheries Managed by the Australian Government*, 2010.

3 DOMESTIC MARKET REVIEW

This section will provide analysis of the Australian squid market, to the extent that available data allows. This analysis will include detailing the various forms and methods employed to sell and serve squid commercially as well as a discussion of market dynamics and consumption trends.

3.1 Market definition

Even within the hospitality sector, there is much confusion about the difference between arrow squid and the various species commonly referred to in Australia as 'calamari'. The word 'calamari' is simply the Italian for squid, but in Australia, at both a consumer and trade level, it has come to mean the species more suited to fresh consumption rather than processing. The main 'calamari' species are outlined in the following table:

Table 6: Squid commonly referred to as 'calamari'

Species	Common Name	Location
Loligo formosa	Loligo Squid	NSW
Loligo chinensis	Loligo Squid	NSW
Sepioteuthis australis	Southern Calamari	SA
Sepioteuthis lessoniana	Northern Calamari	QLD

Although it is understood that there are numerous species of squid traded in Australia, throughout this section of the report, the term 'calamari' will be used to refer to the above types of squid generally.

Although calamari and arrow squid are a continuum of one market category, their vastly different pricing structure and eating quality means they are traded as separate market segments. While arrow squid almost always goes straight to processing for tenderisation, cutting and coating (usually crumbs), the so-called 'calamari' types of squid are sold into the restaurant and retail fresh fish supply chain. The superior eating quality of the calamari types means the culinary uses are far more versatile than arrow squid. However, much processed arrow squid is packaged and sold as 'calamari' creating further confusion with chefs and consumers alike, who do not know the difference in the various types of squid. Consequently, consumers are often disappointed when they are expecting small, tender squid with a natural squid-like appearance and are presented with large, dense rings in an ambiguous manufactured form.

Locally caught, fresh calamari is seen to be at the top of the quality hierarchy in the domestic market and trades in the vicinity of AU$10-15 per kilo, in stark contrast to arrow squid which trades at a range of AU$1-3 per kilo.

3.2 Market profile

A typical industry market review would begin by identifying the market size. In the case of the SSJF this is challenging, as reliable data sources simply do not exist, due to the relatively small size of the industry.

The SSJF estimates the value of arrow squid caught in Australian fishery to be $1 million in value and 307.6 tonnes in volume in 2009. This data suggests that an average wharf price is being paid of approximately $3.25 per kilo. The processors indicated that this volume supplies less than one fifth of the Australian domestic market, with the remainder being processed from around 20,000 tonnes of imported squid.

There are two market uses for arrow squid:

1. Processing mainly for food service distribution.
2. Bait for commercial line fishing.

These are explained further elsewhere in this report.

3.3 Product overview

It is somewhat difficult to ascertain a definitive list of squid/calamari products because they vary by consumption patterns, eating habits and preferences. Nonetheless, most products undergo at least primary processing.

The bulk of imports are block frozen, since most trawl-caught catches are frozen on board ship. Catches frozen ashore may be either block frozen or individually quick frozen (IQF). The main forms in which squid is sold in Australia are:

- Whole, cleaned or uncleaned
- Tubes, plain
- Pineapple cut pieces
- Rings, plain or crumbed
- Tentacles.

In Australia, the vast majority of arrow squid is sold in 10 to 20kg catering packs through food service channels, with little of the locally processed product going into the retail supply chain.

Figure 7: Plain squid rings

The quality of the processed product sold across Australia is highly variable with crumbing and tenderizing techniques greatly influencing the eating quality. A better quality crumb is more costly to produce, but influences eating quality significantly. It also significantly improves value because crumbs significantly increase the weight and sell at a higher price. Likewise, attention to detail and secret techniques in processing produce more tender tubes. Even though these processes are more expensive, those local producers who are delivering a better quality processed product than imports, cannot always get a premium for this effort because there is little brand differentiation in the sector and even less marketing activity.

Smaller 'fish and chip' shops, pubs and low-end restaurants tend to sell cheaper, inferior quality crumbed products, which have been processed in Thailand or China. The better processors in Australia have strong relationships with food service agents/brokers who value the better quality, but only at a marginal price premium.

Figure 8: Cleaned squid tubes

3.4 Domestic consumption trends

As indicated in the FAO data on global consumption, Australia's seafood consumption is at 24.7 kilograms per person, which is above the global average and the per capita seafood consumption in Canada and the United States; but below the *per capita* seafood consumption of New Zealand, the European Union, China and Japan. Consumer expenditure on fish and seafood in Australia has been increasing steadily, from $2.1 billion in 2004 to $3.1 billion in 2009, representing 8% average annual value growth.

Figure 9: Australian Consumer Expenditure on Fish and Seafood (AU$ million), 2004-2009

Source: *Euromonitor*

The increasing trend in Australian seafood consumption is reflective of consumer trends in relation to food generally (**Figure 9**). Food consumption is now increasingly motivated by the following factors: Convenience, Health and Enjoyment.[19] Time poor households are shifting to pre-packaged food products. An increase in health consciousness is also having an influence in determining food consumption patterns. However, ultimately food must deliver on taste or it will not sell with Australian consumers, no matter how healthy it is. Seafood is perceived to deliver well on all three of the required attributes.

There is no definitive information on squid consumption particularly in Australia, as the reporting data does not breakdown categories to that segment level. However, there is an anecdotal trend noted by processors that arrow squid consumption is rising across the board domestically. All processors interviewed in this research reported sales growth, with some claiming that this growth was in the vicinity of 20%.

[19] Market Summary of South Australian Seafood, PIRSA, 2009

3.5 Cultural background

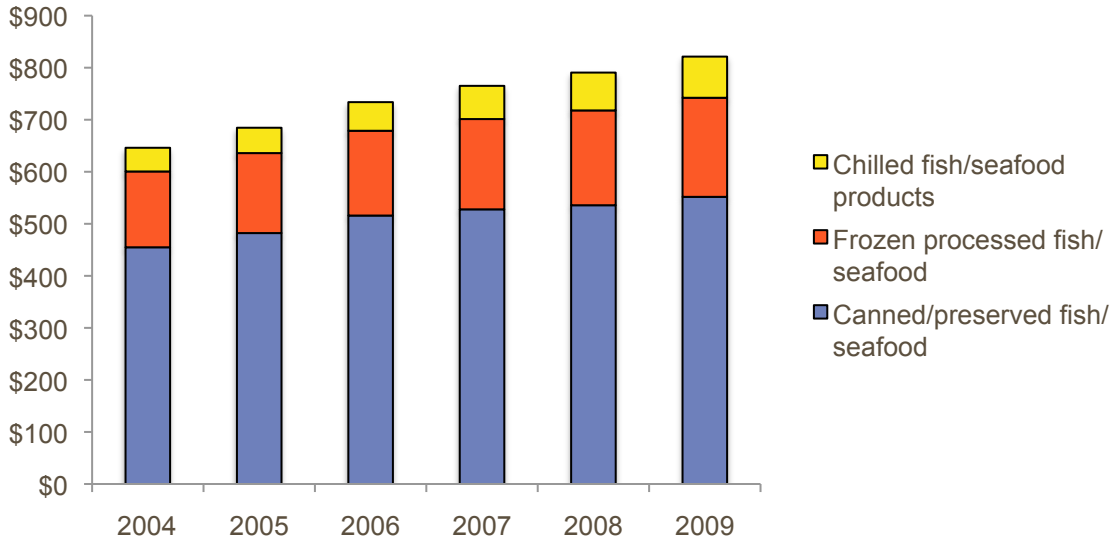
The Greek and Italian communities first introduced squid and calamari to the Australian diet in the post war era. It initially appeared in delicatessens, restaurants and in fish and chip shops. In recent years, successive waves of Asian migration has resulted in additional menu items and new cooking styles being introduced to the Australian palate (e.g. salt & pepper squid), effectively reinforcing squid as a regular menu item across a wide spectrum of food service channels from premium to budget price ranges.

However, 'at home' consumption is a different matter, as squid does not enjoy high penetration in Anglo-Australian kitchens. As such, squid is not on the typical Australian household's weekly meal rotation (outside of Asian and Mediterranean born households). It could be assumed that many Anglo-Australian households simply do not know how to prepare squid or have tried to prepare it in the past and over cooked it with poor results so they have never purchased it again.

3.6 The retail market

As **Figure 10** shows Canned/preserved fish/seafood is the most consumed retail seafood product category in Australia. In 2008-09, 67% of seafood consumed in Australia was canned/preserved products.[20]

Figure 10: Australian Retail Value in various Seafood Products (AU$ million), 2004-2009



Source: *Euromonitor*

[20] Euromonitor, 2010

Interestingly, there has been minimal fluctuation in the consumption of frozen fish as a proportion of all seafood consumed. Industry interviews indicate that there is little retail trade in pre-packaged frozen squid in Australia. Some imported frozen product is evident but grocery databases do not allow detailed analysis of the category, as it is minor and not differentiated from other frozen goods.[21] Retail sales of squid are usually in loose, thawed form from seafood shops, markets, or supermarket deli sections. Supermarket buyers interviewed for this study indicated that volumes of squid sold in this form are minimal. Most supermarkets are gradually phasing out loose seafood categories in preference for pre-packaged, fresh and frozen seafood. Pre-packaged seafood has less risk of contamination, has a longer shelf-life and delivers supermarkets much higher margins. Furthermore, the technology of MAP packaging has added substantially to the shelf life of fresh seafood, making pre-packaging products more viable than they once were.

3.7 The food service market

The restaurant and catering trade is large and extremely important in most markets. Away from home dining commands 34% of the Australian food dollar and this percentage is growing.

Restaurants and other eating outlets usually obtain their supplies of squid from importers, wholesalers or seafood processors, depending on the quantities involved and the type of outlet in question.

Figure 11: Fried crumbed squid rings

High-end restaurants generally serve local, fresh calamari either in ring form or pineapple cut pieces, whereas lower-end eating outlets such as pubs, clubs, fish and chip stores and take away outlets used more processed types of squid. These are generally arrow squid or the imported substitutes. The following table outlines the types of uses for squid:

[21] Food Market Exchange, *Squid Production*, 2003, http://www.foodmarketexchange.com/datacenter/product/seafood/squid/detail/dc_pi_sf_squid_0401.htm

Table 7: Uses for Squid

Restaurant type	Style of preparation
Mediterranean/ European	Preserved or grilled for antipasto Marinara pasta mix Lightly battered, floured, fried Oven-baked, stuffed tubes Rings stewed in tomato base Ink used in flavouring pasta, risotto
Asian restaurants	Battered, deep fried tentacles, rings or pieces Salt & pepper fried tentacles or pineapple cut Stir fried with sauces (e.g. XO sauce) Combination seafood dishes Fried noodle dishes (e.g. Pad Thai, Laksa) Minced wings used in fish balls, Chinese dumplings
Pubs, clubs, bars	Crumbed or battered rings Marinara pasta mix
Fish and Chip shops	Crumbed/battered deep fried rings

In the above dishes, arrow squid or an equivalent imported squid would be less likely to be used in the Mediterranean/European style dishes listed which would be more suited to calamari.

The unfortunate situation for squid is that many chefs also do not know the difference between arrow squid and calamari types because increasingly chefs are becoming less skilled. Increasingly, because of labour costs, the food service sector is moving to pre-prepared food. As a result, chefs now lack knowledge in selection and primary preparation of food, particularly methods for seafood. This means they would not know how to get the best out of arrow squid if it was to become available on the fresh market.

3.8 The Bait Market

A significant market exists in Australia for arrow squid as bait although, again, the traders interviewed were not able to substantiate the size of this market. Users of the bait are commercial long line fishers and suppliers to recreational fishers. Demand for this product is said to be growing.

Smaller arrow squid (e.g. less than 300g size) is usually graded out of the catch for bait. It is regarded as a bi-product of the main catch, but its revenue does contribute to offsetting the fishers' overhead. Australian arrow squid also competes with trawl-caught New Zealand product in the bait market but the smaller arrow squid are better suited to this market, as the integrity of the squid is better from jig-caught squid. With the New Zealand trawl-caught bait, the smaller squid tend to become squashed and damaged making them less effective as bait. Small arrow squid are attractive to the types of larger fish that are commercially line-caught.

Prices in the bait market tend to be 10 to 15% lower than eating fish per kilo.

4 THE AUSTRALIAN SQUID FISHERY

4.1 Industry background

As Australians did not really embrace squid as part of the diet until the post war period, it was not highly regarded as an edible fish and as such an established fishery did not exist in this country until decades later.

In the 1970s, a fleet of 15 Korean squid vessels came into what is now known as the SSJF zone by invitation of the federal government. As one of the acknowledged leaders in squid fishing at the time (along with Japan), the Koreans were permitted to fish the area on the basis of conducting a study of the squid fishery. They mapped out potential fishing areas on the understanding that this information would be used to develop a local industry. The fact that scallop vessels are well suited to jig fishing attracted many to the industry, extending the seasonality of their business and amortising the overhead cost of running the scallop boat.

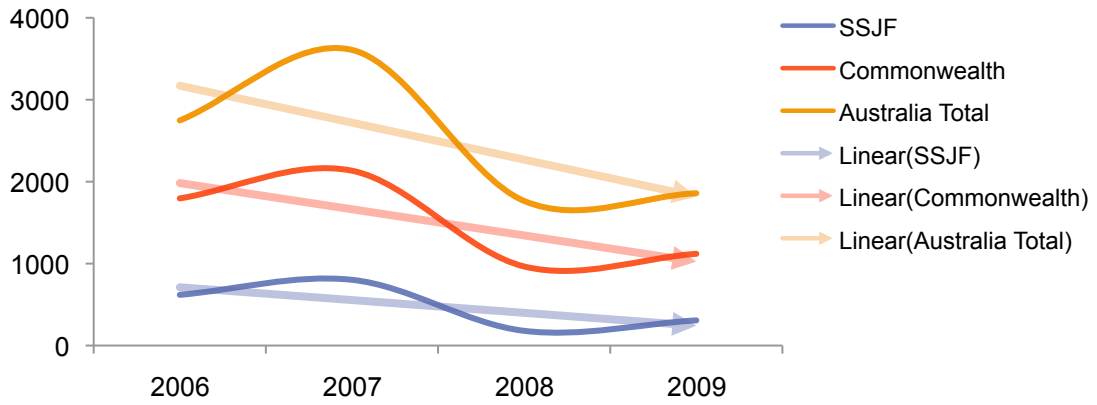
By following the maps outlined by the Koreans, the early 1980s was a successful period for the pioneer fishers in the new squid industry until global market prices began to fall. At the same time, more competition came in locally as increasing numbers of scallop fishers invested in jigging machines and began fishing for squid in the off season. In fact, in 1988 the Victorian government actively encouraged scallop fishers to convert to squid operations when scallop dredging was banned in Port Phillip Bay. During this time imports also increased.

In the intervening years, squid prices have dropped considerably and few fishers remain active in the fishery for reasons already explained.

4.2 Australian production

Squid production in Australia is following a general decline. **Figure 12** demonstrates that the country is declining at a far shaper rate than the SSJF. Between 2006-2009, national production dropped by -32%, with an average decline of 18.9% each year. In comparison, the SSJF for the same period has only had an average decline of 4.80%.

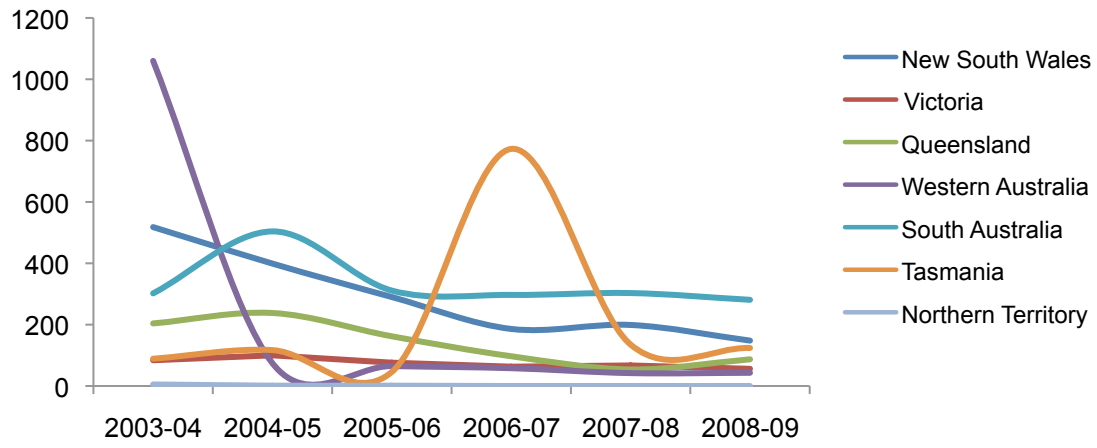
Figure 12: Comparison of production between SSJF, Commonwealth fisheries and Australia overall (tonnes), 2006-2009



Source: ABARE

Figure 13 shows the declining trend in production continues when broken down by state between the 2003-09 period. South Australia has generally had the highest squid production in terms of volume between 2003 and 2009, with the exceptions of 2003-04 (WA) and 2006-07 (Tas). It was really the only state that actually grew in production over that period, with an average growth rate of 4%. Tasmania did experience the highest average rate of growth (292%) in production but this is skewed by the 2006-07 season that is largely inconsistent with the previous and future seasons. Indeed, for every other season for that period, Tasmania had an average rate of decline of 30%.

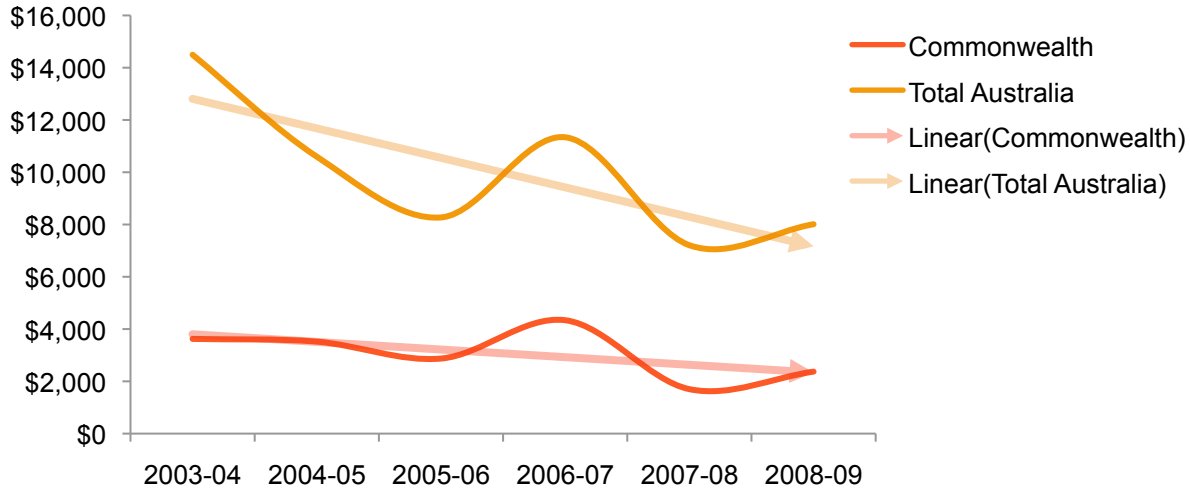
Figure 13: Squid production by state between 2003-09 by volume (tonnes)



Source: ABARE

New South Wales has generally been the second highest production volume, followed by Western Australia. However, these same two states have also experienced the highest average rate of decline in production volume over this period. Western Australia had an average decline rate of 28%, but this may be mostly reflective the significant decline in the 2004-05 season (-93%). In contrast, New South Wales has had a more consistent rate of decline, with an average decline rate of 21%.

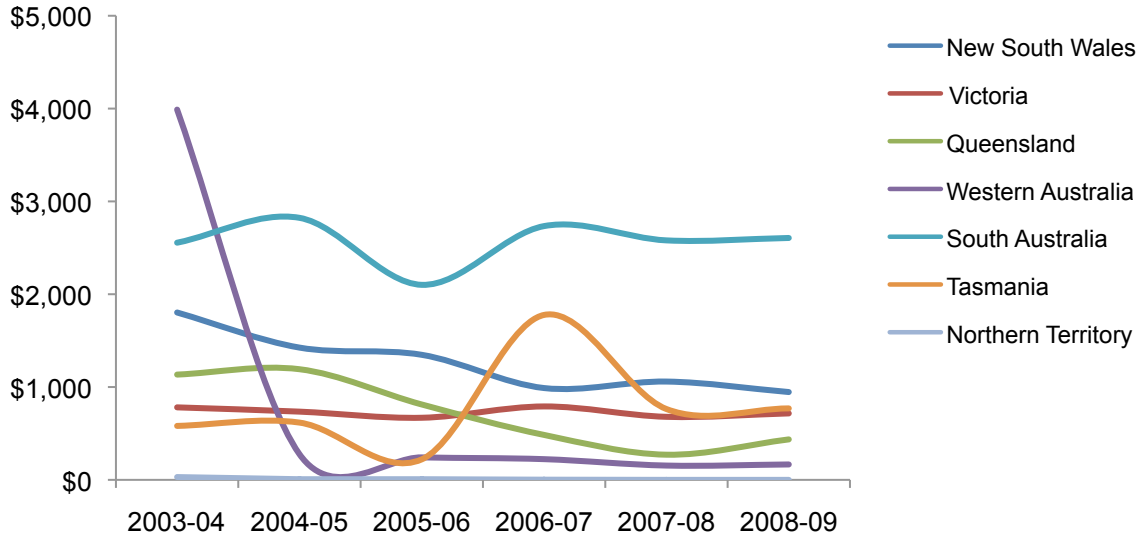
Figure 14: Squid production of Commonwealth and Australia overall between 2003-09 by value ($ '000)



Source: ABARE

Indeed, the value of production has steadily followed the trends of production by volume (**Figure 14 and 15**). As **Figure 14** shows, squid production value decreasing much faster nationally when compared to just Commonwealth fisheries.

Figure 15: Squid production of all states between 2003-09 by value ($ '000)

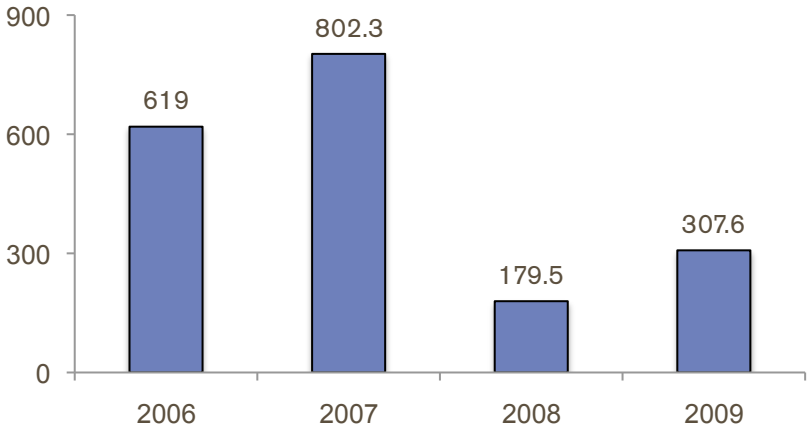


Source: ABARE

It is no surprise that Western Australia (27%) and New South Wales (11%) share the highest average rates of decline in production value, followed by Queensland (10%). Following its modest growth in volume, South Australia's production value grew by an average of 2%.

Thus, we can see in the context of the rest of the country, the declining rate of the SSJF is relatively small. In 2006-07, the estimated catch from the SSJF was 802.3 tonnes, which equated to a 4.5% share of total Australian processed squid production that year. This volume declined to 179.5 tonnes in 2007-08 equating to a 10% share of total Australian squid production for that period. The estimated catch in the SSJF has since recovered back to 307.6 tonnes in 2008-09.[22] These dramatically changes in the catch are characteristic of the SSJF.

Figure 16: Southern Squid Jig Fishery, 2006-09 estimated catches in tonnes



Source: *Department of Agriculture, Fisheries and Forestry*

[22] Southern Squid Jig Fishery at a glance, http://www.afma.gov.au/fisheries/scallop_squid/squid_jig/at_a_glance.htm

As **Figure 16** demonstrates, a key industry development issue is the fact that the annual catch is very inconsistent and unpredictable. A major factor influencing the variability in the catch is the fact that jig fishing specifically for squid is somewhat opportunistic. Because locating the squid is difficult (due to their habit of migrating vast distances very quickly), fishers need to be confident that they will receive a reasonable price in order to risk investing in the cost of sending out a boat. Conversely, squid caught from trawlers tends to be a bi-product, so there is a greater chance of some return on investment, because the trawl boat is likely to bring in a catch of some other species, which is its prime revenue source.

Virtually every jig boat in the SSJF also fishes for scallops due to the complementary nature of the seasons, so the propensity to fish for squid depends on the relative economics of the two fisheries. When squid prices are relatively high and the catch is reported to be good, the boats go out; otherwise the boat overhead is borne solely by the fisher's counter seasonal enterprise (i.e. scallop, crayfish, etc.). In recent years it is believed that less than a dozen licence holders regularly fish for squid.

However, because this data does not differentiate between the calamari species and arrow squid, the information distorts the situation somewhat, as calamari species sell at $10-14 per kg premium, which is much higher than squid. Calamari is largely caught in New South Wales and South Australia, whereas arrow squid are predominantly caught in Victoria and Tasmania, clearly highlighting the data distortion.

Research with stakeholders indicates that the majority of arrow squid is caught off the coasts of Hobart, Portland, Queenscliff, Port Welshpool, and Lake Entrance.

A major portion of total squid production (including calamari) in Australia is caught in Commonwealth fisheries, mostly due to the fact that much of it is a by-product of trawl fishing, particularly in the Southern and Eastern Scalefish and Shark Fishery (SESSF). Commonwealth fisheries accounted for 54% of total squid catch and 23% of all squid production value in 2007-08.

While there were 5,800 Commonwealth Statutory Fishing Rights in the fishery held by 50 individuals or companies, the stakeholder research suggests that less than one dozen vessels actually fished for arrow squid during the 2009 fishing season. The jig squid catch is taken between January and June each year with March and April as the peak catching period, as compared to trawl catching which remains at a relatively constant level throughout the year. This accounts for the small share of jig squid fishery to the overall squid catch.

With arrow squid in particular, the processor usually dictates the fishing agenda. Processors have limited weekly capacity in their small factories and need to schedule their supply from the boats to suit their freezer and processing line capacity as well as responding to market demand. When the global price is low and stock is abundant, it can be easier and cheaper for processors to handle frozen imported product and store it until needed.

This fact, coupled with the elusive nature of the arrow squid, means that production of value-added squid varies greatly from year to year. To some extent, squid jig fishing is opportunistic, depending on prevailing global market prices. When prices are relatively high, such as they are at the moment, boats have greater incentive to go out for more days.

Due to the small catch volume; Australia is very much a price taker on arrow squid.[23] This is discussed in more detail in **Section 7**. As the large fisheries of Argentina and New Zealand determine the volume available on the market, they also set the global market price.

4.3 Jig squid fishing method

A jig is a specific type of fishing lure that comprises of a lead sinker with a hook moulded into it and is generally covered by a soft body to attract fish (**Figure 16**). Jigs are intended to create a jerky, vertical motion. The method of jig fishing requires keeping the jig moving constantly in the water. Jerking the line, quickly pulling in the slack, jerking once again and so on, usually does this. This motion is an attempt to imitate the likeness of a prawn right down to the way a prawn swims when it is retreating from danger. When prawns swim normally they swim forward slowly. But when startled they retreat by swimming backwards in short bursts, with a halt in between.

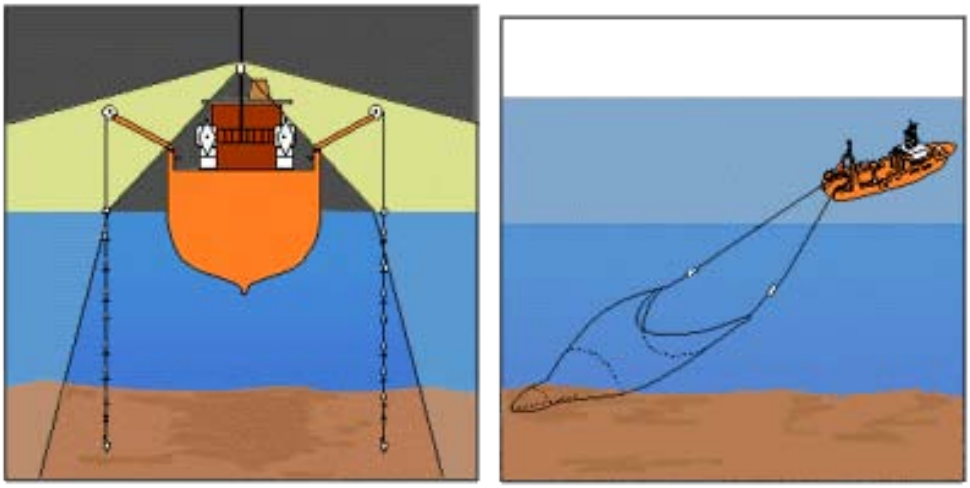
Figure 17: Squid jigs attached to line

The lures are dropped along the sides of the boat on lengths of line with lures set at short intervals (**Figure 18 and 19**). These are set through a pulley arrangement and automatically jigged up and down. When the machine controlling the line senses that the strain in the line has gone above a certain point the line is hauled in. The hooks on the lure do not contain any bards so that as the lures are recovered over the end rollers, the squid fall off into collecting areas.

This method is very different to trawling. Trawling involves one or two boats towing a very large net along the ocean floor. Fish enter the net through the mouth and then make their way to the other end. This part of the net contains the smallest mesh size (**Figure 18**).

[23] Phone conversation with Gerry Long, SE Australia Manager, Frank Mason and Associates

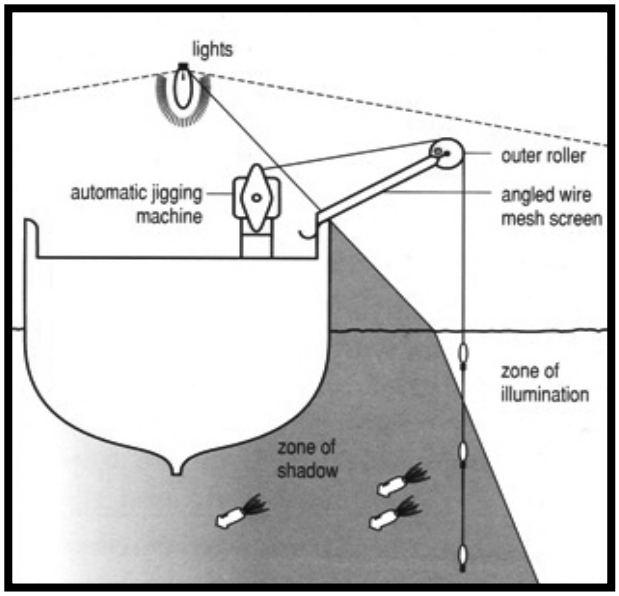
Figure 18: Squid jigging and trawling fishing methods



Squid jigging is most commonly undertaken at night, although at certain times in the season they may be caught in Tasmania during the day. The fishing usually relies on attracting squid using lights from the vessel. Although squid are difficult to find, large populations can be located by a characteristic mark on an echo sounder when steaming. Once squid are located, a parachute sea anchor is set, to remain close to the squid and to keep the vessel in the wind, improving stability.

At sunset, overhead lights are turned on to attract squid. The purpose of the lights is to attract the krill and other bait, which in turn attract the squid. The light configuration for squid jigging is critical to effective operation. Lights are usually arranged in one or two lines parallel to the side of the vessel and must be mounted in a position high enough to create a shadow over the water at an angle of about 40 degrees (**Figure 19)**. The height of the lamp usually ranges from 2.2 to 5 metres above the deck. A full moon tends to reduce the pulling power of the lamps and consequently, catch rates fall. In Tasmania, fishing can occur during daylight hours because the water is clearer and light levels are lower.

Figure 19: Boat and light arrangement for squid jigging



Source: *Australian Fisheries Management Authority, 2004*

Catches usually increase according to light intensity, up to a certain limit. Squid congregate in the shadow of the vessel's hull and dart into the lit area to feed on the various marine organisms that have been attracted to the light.[24] The squid are very tentative about being in the lit area, meaning that the position of the lights and the shape of the boat hull are important to lure them near the jigs.

Jigging is usually conducted using automated jigging machines. A line with several barbless lures is run off an elliptical spool. The rotation of the spool as the line is wound creates the jigging action. Squid attack the lures from under the vessel as they pass from the zone of shadow into the zone of illumination (**Figure 19).** The squid are wound over an outer roller and fall off the barbless lure onto an angled wire mesh screen. Automatic machines may continue this process all night.

Squid jigging is highly automated, allowing an operator to use few crew. Once jigging commences and squid is being landed, the crew start to collect the catch and prepare it for chilling. The depth of the water is usually the deciding factor when selecting the number of lures to place on a line. A teardrop shaped weight of 0.5-1kg is used on the end of the line. The shape of the weight is important, as the line needs to descend vertically to avoid tangling other lines.

Most boats run 8-10 jigging machines with a maximum of 10 allowed as a condition of the license. The boat length impacts the number of jigging machines possible with most of the boats operating in Australian waters being in the range of 18-24 metres.

4.4 Handling and Stowage

Squid are generally not gutted at sea; they are simply washed and packed in ice or frozen. Unlike white fish, squid is more vulnerable to damage if not handled carefully. Arrow squid are usually left ungutted because they are processed on land where more labour is available. For fresh squid markets, stowage in boxes is generally better than bulk stowage because there is less risk of crushing and bursting the ink sac.[25]

4.5 Grading

Ungutted squid kept on ice keep will remain in first class condition for up to 8 days. After that time, the flesh begins to redden, musty odours develop, and the squid become inedible in 13-14 days. **Table 8** (found at 6.3) shows the scoring system used to assess the flavour of cooked squid after chilled storage of the raw material.[26]

Commercial grading can vary by supplier and region, but is generally done according to number of tubes per kilogram. When referring to squid tubes, terminology such as U-10 or U/10 refers to the number of tubes per kilogram (in this

[24] Australian Fisheries Management Authority, *Draft Assessment Report – Southern Squid Jig Fishery*, 2004
[25] G. D. Stroud, *Squid - Torry Research Station Advisory Note No. 77*, Ministry of Agriculture, Fisheries and Food (UK), 2001, http://www.fao.org/wairdocs/tan/x5948e/x5948e00.htm
[26] G. D. Stroud, *Squid - Torry Research Station Advisory Note No. 77*, Ministry of Agriculture, Fisheries and Food (UK), 2001, http://www.fao.org/wairdocs/tan/x5948e/x5948e00.htm

case, fewer than ten tubes per kilogram).[27] There is debate within the industry as to whether smaller squid (U10 and greater) are better quality. The experience by some processors is that chefs prefer smaller squid and are prepared to pay a little more for them because of superior eating quality and plate presence. However, the larger U5 size makes bigger crumbed rings giving a basket or plate of rings a fuller appearance when served, for a lower kilo weight.

The industry tends to promote U5 as the core product largely because it is more economical to process into rings which is the volume SKU. Essentially, U5 squid takes the same amount of time and effort to process as U10, meaning that on a per kilogram basis, the larger squid is more economical to process.

The catch is chilled on board and returned to port for processing and freezing within 24 hours of landing. Even for processing squid, the quality of the final product is significantly impacted by how it is treated after it is caught. If the squid is not well handled, discoloration can occur and eating quality can be compromised. Some larger boats have freezing capacity at sea and only bring in the last day's catch fresh, others have brine ice tanks. The squid is soft and easily damaged, both internally and externally, which causes rapid loss of quality and of appearance.

The consistency of arrow squid in terms of eating quality could theoretically be improved by the introduction of a grading scheme. Grading schemes are common practice in the agricultural sector.

Apart from size, there is also the potential to grade arrow squid by colour, shape, whether jig-caught or trawl-caught and other predictors of eating quality. The benefit of grading is that it enables the marketer to gain price premiums for superior quality product as a strategy to improve overall returns. This is explained in more detail in **section 11**.

Unfortunately, the introduction of a comprehensive grading scheme would probably not be productive for the SSJF because of the small and inconsistent volumes and due to the fact that the vast majority of fish is processed and crumbed making most customers believe it is the processing technique rather than the catch technique that influences the eating experience. Without volumes, a grading scheme would probably disadvantage the industry. In times of low supply, processors need to maximise prices of all stock. At certain times, processors would only have lower quality grades, which would undermine the selling price.

4.5.1 Trawl-caught squid

As already mentioned, a large amount of arrow squid processed in Australia is caught by trawler as a bi-product. Processors generally acknowledge that jig-caught squid is superior to trawl-caught in terms of ease of processing and final presentation. Although some claim that the eating quality of jig-caught is also superior, this advantage is said to be negligible when squid is processed and crumbed.

The quality issue is often not related to the catching method *per se* but rather how the squid is handled when caught. Trawl fisheries give priority to handling their prime catch (e.g. prawns) and squid gets secondary attention. If left too long, the squid becomes discoloured and appearance and eating quality suffers. One advantage of

[27] Seafood Experience Australia, *Gould's Squid*, http://www.australianseafood.com.au/species-index.php?f=232&v=f&p=1

the trawl method for processors is that the trawling process actually produces a higher marketable yield of squid because the internal parts of the squid are squeezed out in the nets when the squid are crushed by the weight of the catch. Overall however, processors would prefer jig-caught over trawled due to its ease of skinning and better appearance (less discolouration). The issue is that there is insufficient volume of jig-caught squid for them to gear up their businesses accordingly. There is generally no difference in the buying or selling price of jig versus trawl-caught squid and there is no differentiation on how the squid is labelled.

4.6 Australian Fishery Licensing

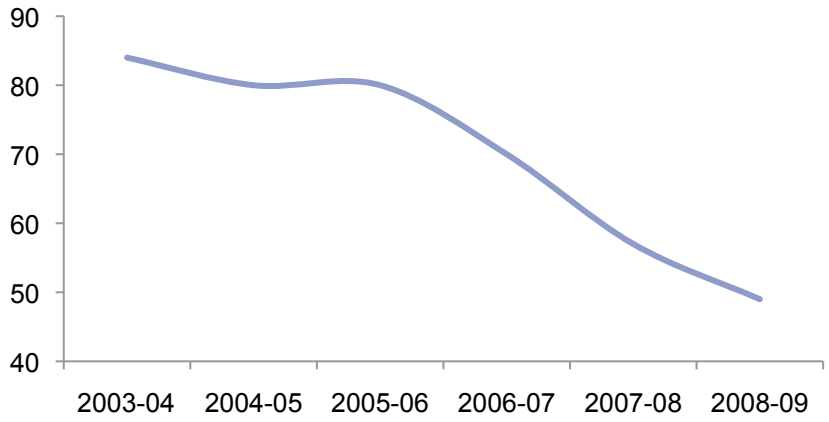
4.6.1 Statutory Fishing Rights

Statutory Fishing Rights (SFRs) are granted under Section 31 of the *Fisheries Management Act 1991* (the Act) where statutory management plans, determined under Section 17 of the Act, exist for a Commonwealth managed fishery. The SSJF is one such fishery. SFRs can only be nominated to an Australian boat, as defined in the Act.

4.6.2 Statutory requirements for squid jigging

A person may engage in squid jigging in the fishery if that person holds a gear SFR (which means SFR entitles the holder to engage in squid jigging in the fishery) that has been allocated at least for 1 standard squid jigging machine. They also must only use an Australian boat nominated for the SFR and comply with certain conditions as not interfering with certain types of ocean species.[28]

Figure 20: Number of SSJF SFRs/permits holders between 2003-2009



Source: ABARE

4.6.3 Total allowable effort and jigging machine allocations

The Australian Fisheries Management Authority (AFMA) at the beginning of every year determines the Total Allowable Effort (TAE) for the fishery for the fishing year. This directly effects how many jigging machines will be allocated to a gear SFR owner for a fishing year. This is ascertained by dividing the TAE for the year by the total number of gear SFRs in force at the beginning of the year.[29]

[28] *Southern Squid Jig Fishery Management Plan 2005* (Cth)
[29] *Southern Squid Jig Fishery Management Plan 2005* (Cth)

For 2008, the TAE was set at 640 standard squid jigging machines. This number was divided by the total number of SFRs in the fishery (6400), which gave each SFR a value of 0.1 standard squid jigging machines in 2008. For an operator to use a standard squid jigging machine, 10 SFRs would have to be nominated to their boat. To use 2 machines, operators must have at least 20 SFRs nominated to their boat. Having 19 SFRs nominated to a boat in 2008 would only allow the use of 1 standard machine. A person can hold any number of SFRs but must nominate enough to their boat to cover the machines they will be using.[30]

In 2009, the TAE was 590 squid jigging machines, which is a decrease from 640 in 2008. However, this reflects reduced number of gear SFRs that were surrendered during the 2008 season.[31]

4.6.4 SFR Trading

AFMA will not be issuing any further SFRs in the fishery but people can participate in the fishery by either permanently buying or seasonally leasing SFRs from an existing SFR holder in the fishery and nominating these SFRs to their boat.

Even if the TAE remains constant, there is a wide range of different boats in the fishery, all able to run different numbers of squid jigging machines. If someone is authorised to use 10 machines, but their boat is only set-up to use 6, they can either sell or seasonally lease their additional SFRs to another person.

4.6.5 Areas allowed to fish

The area of the fishery includes a specific segment off the coast of Queensland and all waters adjacent to New South Wales, Victoria, South Australia, and Tasmania, excluding costal waters.

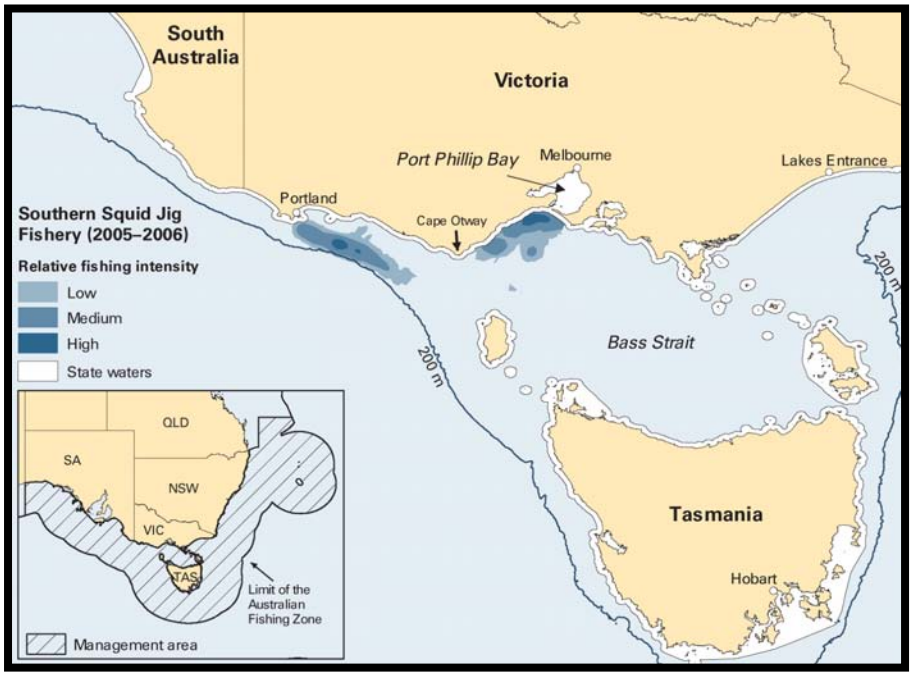
[30] Australian Fisheries Management Authority, *Statutory Fishing Rights – Total Allowable Effort and the Southern Squid Jig Fishery*

[31] Australian Fisheries Management Authority, *Southern Squid Jig Fishery Total Allowable Effort Determination 2009*, 2008

Figure 21: Map of the Southern Jig Fishery boundaries

Source: *Australian Fisheries Management Authority, 2005*

Figure 22: Relative Fishing intensity in the Southern Squid Jig Fishery area 2005-06



Source: *Department of Agriculture, Fisheries and Forestry, 2006*

4.6.6 The inter-relationship with scallop fishing

As already indicated, in Australia there is a strong overlap between the jig squid and scallop fisheries. Boats install their squid gear around November and fish through until June.

Although squid can be caught all year, in most cases boats trawl for scallops during the winter months because historically scallops produce a greater return and are a much larger part of their incomes.

The same scallop processors also process the squid catch. A fisher usually supplies only one processor and the relationships tends to be founded on the basis of the scallop catch.

The economies of the squid and scallop fisheries are also inextricably linked. Fishers need to generate a certain minimum revenue each year to service the fixed costs associated with boat ownership. In seasons where scallop prices are high and the catch is strong, there is less pressure on boats to fish for squid. Conversely, when scallop prices are low (as they are at the time of writing this report) there is more pressure on businesses to fish for squid. This is one factor contributing to the relative volatility of the Australian jig squid catch.

When the price of squid is low and the scallop price has been good or better, many of the squid license holders don't fish for squid as the risks are too high. In many years only a fraction of the licensed boats fished for squid. In most seasons the boats that do fish for squid fish only from 12 to 20 days per year.

4.7 Under-commercialisation of the Australian squid fishery

At a time when the majority of Australian fishery stocks are at or near full exploitation (several have been over-exploited), the arrow squid fishery is under-utilised. There are potentially very large stocks in southern waters relative to the current catch.[32] Furthermore, the jig fishing method is more environmentally friendly than other methods.

The under-utilisation of the resource is mainly due to the economics of the industry. The price of squid is determined by global factors, over which the SSJF has almost no influence, because the size of the industry in Australia. The small scale of production does not give fishers any market power in what is a global commodity. Hence, in seasons when global squid prices are depressed (and scallop prices are high), the incentive to fish is greatly reduced. The key to improving the commercialisation of the resource is to improve the returns, which is the very subject of this report.

[32] Jackson, George D. & McGrath-Steer, Belinda, Arrow Squid in Southern Australian Waters – Supplying management needs through biological investigations, FRDC Report, 2003, http://www.afma.gov.au/fisheries/scallop_squid/squid_jig/publications/pdf/frdc_report_200504.pdf

5 NEW ZEALAND SQUID FISHERY

An understanding of the New Zealand fishery is important because it is effectively one of the price setters for the Australian market. New Zealand is a significant global player in the squid market, which is frequently one of their top seafood export earners.[33] New Zealand squid exports in the year ending December 2009 were worth $NZ 75 million, the three key export destinations being the three major markets of Europe, Korea and China.[34]

Due to changes in the international marketplace since the mid 1990s, squid jigging is no longer economically viable in New Zealand, and thus the primary harvest method is by trawl. The New Zealand fishery is more suited to trawling as the fishery is closer to shore and the trawlers are not exposed to the risk of not finding squid as they catch other species as well. New Zealand commercially catches primarily two species of squid, *Nototodarus sloanii* and *Nototodarus gouldi*[35], the arrow squid.

There are two fishing areas – a small area around the Auckland and Campbell Islands and an area covering the rest of New Zealand's exclusive economic zone.[36] Both of these fisheries are fished mainly by Korean and Ukrainian vessels that have been chartered by New Zealand companies who hold the squid licenses. This is because it costs less to charter a vessel than it does to own one.[37] The foreign vessels are large 'factory ships' which can stay out at sea for long periods and have freezing and packing capability on board which vastly reduces their cost base.

New Zealand's squid fishery is managed by strict quotas, which allow only a set amount of squid to be taken commercially each year.[38] This situation differs to Australian jig licenses which do not have volume quotas.

A further contrast is that only New Zealanders or New Zealand-owned companies can own fishing quota. Foreign ownership of shares in New Zealand quota-owning companies is strictly limited. However quota holders can lease foreign vessels to catch their allowance on their behalf.

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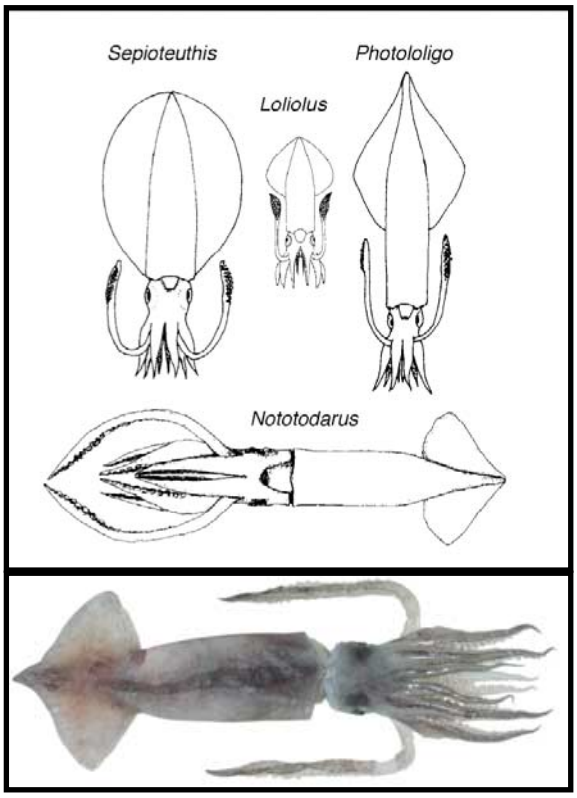
[33] Ministry of Fisheries (NZ), *The State of Our Fisheries 2008*, 2008.
[34] New Zealand Seafood Industry Council, Squid Fact File, http://www.seafoodindustry.co.nz/squidfacts
[35] New Zealand Seafood Industry Council, Squid Fact File, http://www.seafoodindustry.co.nz/squidfacts
[36] Ministry of Fisheries (NZ), *The State of Our Fisheries 2008*, 2008
[37] Ministry of Fisheries (NZ), *The State of Our Fisheries 2008*, 2008
[38] Ministry of Fisheries (NZ), *The State of Our Fisheries 2008*, 2008

6 PRODUCT CHARACTERISTICS, USES & NUTRITIONAL BENEFITS

6.1 Arrow squid characteristics

Arrow squid (*Nototodarus gouldi*), also variously known as Gould squid, Seine Boat squid, Aero squid, Aeroplane squid and Torpedo squid. It is an oceanic and neritic squid endemic to southern Australia and northern New Zealand. For most of its distribution, it inhabits waters less than 500m deep on the continental shelf and slope, and its most common depths are from 50-200m.[39]

Figure 23: Arrow Squid



Like most squid stocks, arrow squid stocks are notorious for having extreme natural fluctuations in numbers, which can have a great impact on commercial operations. Research shows this species has a life span of one year to eighteen months, with especially variable growth rates heavily influenced by environmental factors. Since the fishery targets a new generation of squid every year, there is concern that the combination of a year of high fishing effort coinciding with low replenishment could lead to over-fishing.[40]

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[39] Jackson, George D. & McGrath-Steer, Belinda, Arrow Squid in Southern Australian Waters – Supplying management needs through biological investigations, FRDC Report, 2003, http://www.afma.gov.au/fisheries/scallop_squid/squid_jig/publications/pdf/frdc_report_200504.pdf

[40] Jackson, George D. & McGrath-Steer, Belinda, Arrow Squid in Southern Australian Waters – Supplying management needs through biological investigations, FRDC Report, 2003, http://www.afma.gov.au/fisheries/scallop_squid/squid_jig/publications/pdf/frdc_report_200504.pdf

Approximately 80% of the whole arrow squid is recoverable. Edible parts of the squid include the flesh of the mantle, fins, arms and tentacles. Only the very small arrow squid is tender enough to be used for dishes such as seafood marinara, BBQ and in salads. The full sized arrow squid is quite tough and must be tenderised during processing to become edible. Therefore, arrow squid tends to be fished for processing, so fishers prefer to catch it in a larger size and leave smaller fish for their own personal consumption or for the bait market.

6.2 Nutritional characteristics

The health benefits of regular seafood consumption are numerous and well documented. Although it is suggested in some studies that squid is relatively high in cholesterol, it does offer ten specific health benefits:[41]

Helps the body absorb and utilize iron

Squid is a good source of copper, a trace mineral that plays a role in the absorption, storage and metabolism of iron and the formation of red blood cells (RBC).[42]

Lowers inflammation

Squid contains 51.8 mcg of selenium (per 100g cooked serve)[43] which would highly benefit arthritis sufferers. In previous studies, it has been shown that individuals with rheumatoid arthritis have low selenium levels. Selenium is also an antioxidant, which may help relieve symptoms of arthritis by controlling free radicals.

Helps maintain healthy skin, muscles, hair and nails

Protein has many health benefits such as keeping skin, muscles, hair and nails in top condition. A 100g serve of cooked squid has 17.94 g of protein.[44]

Helps ease migraine headaches

Squid is rich in vitamin B2 (riboflavin); a nutrient that several studies have shown lowers the frequency and duration of migraines.[45]

Builds bones and teeth

Just like fish and shrimps, squid is also packed with the mineral phosphorus. A 100g serve of cooked squid has 251mg of phosphorus[46]. Phosphorus aids calcium in building bones and teeth. Helps lower risk of heart disease.

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[41] 10 Health Benefits of Squid, http://healthmad.com/nutrition/10-health-benefits-of-squid/
[42] US Department of Agriculture Nutrient Data Laboratory, http://www.nal.usda.gov/fnic/foodcomp/cgi-bin/list_nut_edit.pl
[43] US Department of Agriculture Nutrient Data Laboratory, http://www.nal.usda.gov/fnic/foodcomp/cgi-bin/list_nut_edit.pl
[44] Grams of Protein in Squid, http://www.highproteinfoods.net/fish-shelfish/1939
[45] Breen, C et al, *High-dose riboflavin for prophylaxis of migraine*, http://www.cfpc.ca/cfp/2003/Oct/vol49-oct-critical-1.asp
[46] US Department of Agriculture Nutrient Data Laboratory, http://www.nal.usda.gov/fnic/foodcomp/cgi-bin/list_nut_edit.pl

Squid is a good source of vitamin B12, one of the nutrients, which is shown to lower homocystein levels in the body.[47] Individuals with elevated homocystein levels have shown to have higher rates of stroke, heart attack and death from heart disease compared to those with normal levels.

Helps stabilize blood sugar levels

Squid helps stabilize sugar levels with their supply of vitamin B3[48].

Boosts immune system

A 100g serve of cooked squid contains 1.74mg of zinc.[49] Individuals who are deficient in zinc have shown to be susceptible to a range of infectious organisms.[50]

Relaxes nerves and muscles

Magnesium is often referred to as the *"smoothie mineral"* because of its ability to relax nerves and muscles[51]. A 100g serve of cooked squid contains 38g of magnesium.[52]

Helps lower blood pressure levels

Being a good source of potassium (279mg per 100g cooked serve)[53], squid helps regulate blood pressure levels.[54]

6.3 Flavour profile

For most consumers, tenderness is the key parameter on which squid is judged. Arrow squid is not by nature a tender species and therefore relies on processing to make it palatable. The skin is tough and stringy and must be completely and skilfully removed. The skill of the processor will determine how well tenderness is achieved. Each processor has their own tenderizing method which they guard closely. Natural compounds such as those found in kiwi fruit are often used. However, the very small arrow squid which can be caught at the start of the season (especially in Tasmania) are far more tender and comparable to the species referred to as 'calamari'. Like the calamari varieties, these small arrow squid may be cooked with their skin on. Because the SSJF is geared to supplying possessors who area seeking large tubes to facilitate manufacture of crumbed rings, this smaller catch is not valued and there is no developed market for it.

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[47] Homocysteine, *Folic Acid and Cardiovascular Disease*, http://www.americanheart.org/presenter.jhtml?identifier=4677
[48] Niacin (vitamin B3), http://www.nlm.nih.gov/medlineplus/druginfo/natural/patient-niacin.html
[49] US Department of Agriculture Nutrient Data Laboratory http://www.nal.usda.gov/fnic/foodcomp/cgi-bin/list_nut_edit.pl
[50] Zinc, http://ods.od.nih.gov/factsheets/zinc.asp
[51] Magnesium, http://www.whfoods.com/genpage.php?tname=nutrient&dbid=75
[52] US Department of Agriculture Nutrient Data Laboratory http://www.nal.usda.gov/fnic/foodcomp/cgi-bin/list_nut_edit.pl
[53] US Department of Agriculture Nutrient Data Laboratory http://www.nal.usda.gov/fnic/foodcomp/cgi-bin/list_nut_edit.pl
[54] Potassium and High Blood Pressure, http://www.americanheart.org/presenter.jhtml?identifier=3025146

A difficulty for the industry is that cooking skills for squid are not well developed in Australia, even among professional chefs. Most squid must be cooked either very quickly or very slowly and incorrect handling can toughen the product, resulting in an extremely poor eating experience.

The other issue impacting the eating quality is the handling of squid in transit. Thawing and refreezing squid once can be tenderizing however, the supply chain for foreign squid is less reliable than in Australia and frequent thawing and refreezing can affect the integrity of the fish. A concern of some traders is that squid is often stockpiled by Asian processors when prices are low and there is a belief that some of this product is re-entering the market when it is two or three years old.

Well handled, processed and skilfully prepared squid, should have the flavour profile as per 9 or 10 rating on the grading system below, which was developed in the UK.

Table 8: Scoring system for Squid

Score	Cooked Flavour of Squid	Days in Ice
10	Fresh, characteristic of shellfish, sweet, meaty	0-1
9	Slight loss of freshness, creamy, sweet, meaty, metallic	
8	Slightly sweet, slightly meaty, creamy, milky	6-8
7	No sweetness, caramel	
6	Neutral	8-10
5	Slightly sour	
4	Sour, musty, cabbage	
3	Slightly bitter, overripe cheese, oily, slight sulphide	13-14
2	Bitter, sulphide	
1	Strongly bitter, putrid	

Source: *Ministry of Agriculture, Fisheries and Food (UK), 2001*

7 PRICE DETERMINATION

7.1 Australian squid prices

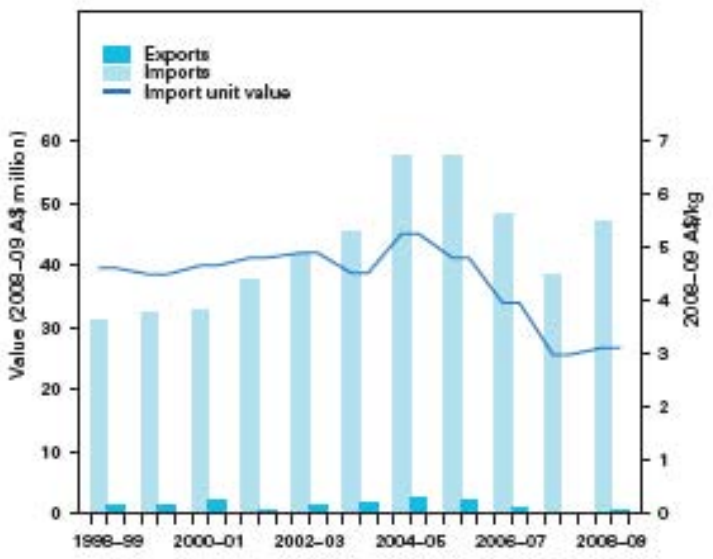
As already explained, due to the larger fisheries in Argentina and New Zealand setting the global price, the wharf price of arrow squid in Australia has historically been rather volatile within a range of around $1/kg to $3/kg.

Overall, squid operators have received a low price return for arrow squid over the last decade.[55] However, underpinning this trend there has been much price volatility with some above average years. Over time, there has been a consistent decline in real gross value of production since 1994. The price per kilo for squid fell from $2.30/kg in 1994 to $1.30/kg in 2001 and as low as 94c in 2003.

As already indicated, there have also been large fluctuations in the tonnage of squid caught per year in the SSJF. The annual tonnage has ranged from 107 tonnes in 1990-91 to 1971 tonnes in 1996-97. In the 2002-03 season, 1236 tonnes of squid was caught and the gross value product (GVP) from the fishery was then $1,158,300. However, it is also important to note that, 30 years ago, more than 8000 tonnes were landed by the visiting Asian jig fleet- evidence that this fishery can be much larger.

Wholesale value represents the price received by the processors when selling to their food service and retail customers, whereas wharf value is the price received by the fishers (from the processors) upon landing the catch. This means that the fishers received less than $0.94 per kg in 2002-03.[56] The outlook is far more promising for the forthcoming season, as wharf prices of around $3 per kg are being received for New Zealand product due to shortages in the South American catch.

Figure 24: Real value of squid and cuttlefish exports, imports and import unit value by financial year, 1998-99 to 2008-09



Source: *Australian Government Department of Agriculture, 2009*

[55] Dunning, M. et al., *Development of northern Australian squid fishery*, FRDC Final Report, 2000
[56] Dunning, M. et al., *Development of northern Australian squid fishery*, FRDC Final Report, 2000

As noted, Australia is a 'price taker' with arrow squid, in that Australian prices are largely influenced by global supply and particularly influenced by New Zealand supply. End user demand does not influence price as demand is considered to be reasonably constant and not particularly price elastic. As indicated elsewhere in this report, the New Zealand catch is many times larger than Australia's, however the price received for Australian product is equal to or less than the landed cost of New Zealand product. Because the New Zealand price is in turn determined by global supply, at the time of writing this report, a shortage of supply of Atlantic squid was increasing the price of New Zealand product dramatically which in turn, is likely to impact the price of Australian product in the coming season.

Because volumes of Australian arrow squid are small and supplies volatile, the Australian processors are heavily reliant on product imported from New Zealand to keep consistent throughput in their factories and maintain supply to their customers. Although the New Zealand squid is mostly a different species, the characteristics are almost identical and effectively the market does not differentiate between them.

7.2 The processor dynamic

Processors have a degree of market power over fishers. There are only a small number of processors who handle squid (approximately ten) and these are predominantly located in greater Melbourne, Geelong and Portland. This means that fishers have a few customers to sell to, giving the processors a significant buying advantage. Most processors handle a number of fish species and their competitive advantage comes from a strong customer network and distribution capability.

Predominately, fishers sell through one processor only, with whom they often have an ongoing relationship for scallops as well. There is an implied sense of loyalty that processors will take the catch when the fishers need to move product, particularly in difficult times. Because most of the SSJF boats do not have a freezing capability, they rely on their processor to take the fresh squid immediately when it is landed – processors are only too aware of this need and sometimes leverage this situation in negotiations.

Processors also have the ability to leverage the scallop market conditions against squid, depending on the market circumstances of the two. For example, in the current market, where the scallop price is depressed and the squid price is looking more buoyant, boats have to pledge their squid catch to processors in order to move this season's scallops. This behaviour is quite common in the seafood industry. The only way to break the nexus is for boat owners to process their own product, an option that is beyond the reach of most for capability as well as financial reasons. Some processors have their own boats or are aligned with boat owners through family or historic ties, which deepens the connection.

7.3 Price setting

The essential point in understanding the arrow squid pricing dynamic is that processors dictate the agenda from the outset, usually telling the fishers when to fish and for how much, then nominating the price.

Processors establish the price for squid based on their ability to secure supply rather than on market demand as occurs in other markets. The amount that the processors are prepared to pay fishers is influenced by:

- The global supply dynamic (which dictates the price of New Zealand product).
- The price of New Zealand product.
- The quality of local product available.
- The strength of local demand.
- Their own factory and storage capacity.
- Levels of stock on hand.

7.4 Pricing of processed squid

Although the Australian and New Zealand squid price follows the global price, once processed, the imported Atlantic catch (which is usually processed in China or Thailand), generally receives a lower wholesale price, relative to the squid processed in Australian factories. Chinese product is claimed to be usually 20 to 30% cheaper than squid processed in Australia. This is because there is a market perception among Australian traders, fish mongers and end users that the quality and integrity of product processed in China, Thailand, Vietnam or other parts of Asia is generally inferior to the standards produced in Australia. However, as discussed later in this report, country of origin is not always easy to determine once the product is packaged. Essentially, the processors are able to leverage a premium for Australian made product, but the fishers are not benefiting from this.

7.5 Size and quality impact on price

As with any market, buyers are usually prepared to pay a premium for superior quality. However, this does not appear to be entirely the case with arrow squid as the quality is not determined by any industry grading system. This industry gap is most evident on the issue of size.

Most industry stakeholders interviewed, personally prefer to eat smaller arrow squid because it has better taste and is more tender, even when unskinned. However, this isn't reflected in market price. Smaller squid (U10 size or smaller) do not necessarily or consistently achieve a price premium over large squid (U5). There are two explanations for this.

1. The first is that the quantities of smaller squid are not sufficient or consistent over the whole season to support a size differentiation marketing program. Smaller squid tend to be more abundant early in the season. (One processor interviewed indicated that in seasons past, when there are sufficient quantities, he marketed a premium small, U10 product, from Tasmania in the fresh fish market achieving at 10-15% price premium over processing prices. The product was iced and boxed at sea from the last day's catch.)

2. The second explanation is that because the bulk of the Australian processed product goes to squid rings, which are virtually a commodity, processors have a vested interest in buying large squid (U5) because it is more economical to process. It takes the same amount of time, effort and cost to process a large squid as a small one and consequently the profit per kilogram is greater with large squid. Furthermore, the very small, and more tender baby arrow squid can be more difficult to process into rings.

7.6 Benefits of jig-caught squid over trawl-caught squid

There are varying opinions in the industry regarding the relative merits of jig-caught squid over trawl-caught squid. The general opinion is that, when jig-caught squid is handled carefully it is superior in presentation and eating quality. Some in the industry believe that jig-caught squid has a discernibly better eating experience and therefore justifies a premium price, however others feel that the difference is not significant enough to represent a unique selling proposition. Generally, at present, jig-caught squid does not enjoy much of a price premium, if any, over trawl-caught squid.

One of the reasons why trawl-caught squid is considered to be inferior is that it is often caught as a by-catch of another more valuable species which gets priority in terms of the handling. In the trawl net, the squid becomes squashed so internal organs are squeezed out and the skin damaged. This makes the squid quicker to clean for processing but harder to skin completely. The skin on U10 size and above is the part of the squid that is tough and unpalatable and must be fully removed. Damaged skin is difficult to peel easily through the skinning machines.

Some processors believe that trawl-caught product has a higher marketable yield because during the trawling process much of the gut is squeezed out, meaning that there is more marketable product per kilogram of product purchased.

Jig fishers in comparison are dedicated to providing optimal handling of the catch so that fish are of a better appearance and the skin is easier to remove as it remains in tact. However, because most of the catch is processed into rings anyway, this superior presentation quality has little perceived market value with end users. Therefore, to the extent that there is a perceived quality advantage for jig-caught squid, this does not necessarily or consistently translate into a price premium.

A further point of difference that has not been marketed, is the fact that the jig fishing method is more environmentally friendly than trawl fishing which can be damaging to the sea bed.

There is a body of opinion that suggests that in light of the growing popularity and willingness to pay a premium for line-caught fish over netted, there should be an opportunity to similarly achieve a premium for jig-caught squid over trawled. The challenge is that most arrow squid is processed into commodity rings and tubes and therefore is indiscernible from imported product once processed. It would appear that potentially there is an opportunity to develop marketing and pricing strategies based around differentiating on quality, size, provenance or environmental sustainability. This opportunity is developed further in **Part D** of this report.

8 THE COSTING & ECONOMICS OF JIG SQUID FISHING

Like most other fishing businesses, the economics of jig fishing is largely driven by overhead recovery. Fishing businesses involve very large overhead expenses and the profitability (or lack thereof) is determined by the value of the catch. The value of the catch in turn, is a function of both the quantity as well as the unit price, both of which fluctuate markedly. Therefore, a small catch of a high value item can deliver the same returns as a large catch of a low value item.

8.1 Overhead costs

In fishing enterprises, costs accrue at two levels:

1. Annual overheads
2. Per voyage costs

8.1.1 Annual overheads

The annual overheads are the ongoing overheads of being in business. The main annual overhead expenses for jig fishing include:

- Boat ownership costs
- Depreciation of boat value
- License fee for jig machinery
- Interest on borrowings
- Various boat operating licenses
- Mooring fees (permanent and itinerant)
- Maintenance costs
- Boat service costs
- Insurance
- Compliance fee (marine and food safety)
- Opportunity cost of the capital employed in the enterprise.

8.1.2 Per voyage costs

These are the costs associated with each fishing trip:

- Diesel for engine and generator power
- Ice costs
- Consumable items: e.g. lures, lines, jigs and snoods.
- Delivery costs to send the catch to the processor.
- Harbour costs

For the jig fishers, there is also an inter-relationship between squid and scallops that impacts the overall business profitability. Because the two are usually co-fished, the annual overheads for running a boat are covered by both catches. If the boat is only used for scallops for 6 months of the year, the whole overhead would have to be carried by one fishing season for one species. This dual catch strategy can also mitigate market risk to some extent as, if the scallop season is poor or price is low, and the squid season is stronger with a better price, there is a chance to recoup losses. Luckily for squid fishers, there is no systematic connection between the scallop and squid economic cycle (other than abnormal events such as SARS or a GFC event). At the moment the low scallop prices look likely to be followed by a season with relatively high squid prices.

In most markets a low catch season usually results in higher market prices, which to some extent reduces the variability in return. However, in the case of both scallops and squid in Australia, the local price is predominantly determined by global forces, meaning that in both cases, there is no reason why a high price can also coincide with or offset a low catch. In the unfortunate situation where both price and catch are low, there is a devastating impact on profitability.

8.2 Cost analysis

8.2.1 Boat ownership costs

The following table provides an estimate of annual ownership costs for typical squid/scallop boats. The estimates have been based on information provided by a survey of boat owners during the stakeholder consultation process for this research. The costings are based on the following parameters:

Boat size:	18-24 metres
Jig machines:	7-10
Personnel:	1 skipper, 2 crew

It must be stressed that these costings are estimates for a typical boat, and that costs will vary from boat to boat depending on location, age and design of the boat, local circumstances, etc. It should also be stated at the outset that there is a large variation between boats in terms of size, facilities, fuel efficiency, number of lights and so on. Consequently, the cost ranges are very wide. For example, some of the larger and newer boats have freezer capacity on board.

A boat of the above sample size has a replacement value of around $1.5m. Assuming a straight-line depreciation over 20 years, this would equate to a depreciation cost of $75,000 per year. In addition, the opportunity cost of this capital (i.e. the interest that would otherwise be generated if the money was invested[57]) calculated at 8% per annum, represents $120,000.

License fees for the fishing licenses plus the various registration fees associated with owning and operating a boat are estimated to range between $2000 - $30,000 per year.

[57] Opportunity cost is the return on the investment that would be generated in the best alternative use, which is notionally calculated at the prevailing interest rate.

The boat needs be surveyed for seaworthiness every year at a cost of around $5000 $7,500. It also needs a major engine overhaul every three years, which usually involves a service to the engine and generator and upgrade of electronics and other equipment. The cost of this can vary enormously, depending on what is involved and the age of the vessel, but for purposes of this calculation the range of this cost has been estimated at $5,000 - $20,000. The maintenance service costs have been estimated to be $5,000 - $20,000. Mooring fees are estimated to be $5,000 - $14,000 p.a.

Table 9: Annual average boat overheads survey 2010

Boat Overhead	
Depreciation of boat value	$75,000
Interest (opportunity cost)	$120,000
Mooring fees	$5,000 - $14,000
Boat survey cost	$500 - $7,500
Boat maintenance service cost	$5,000 - $20,000
Licence fees, fishing licence and various operation licences	$2,000 - 30,000
Insurance	$0 - 30,000
Globes (replaced on average every 3 years)	$366 - $666
Total (range)	$206,000 – 298,000
Total average cost	$252,000

A difficulty in conducting this survey was the small number of participants and the disparity in boat size. Based on the estimates given, the cost of owning a boat (without the running costs) can range from $206,000 - $298,000, with an average of $252,500 per annum. This amounts to around $690 per day. In reality however, a boat can only operate for a limited number of days per year because of weather, market conditions etc. Realistically, in most years a boat operates for less than 100 days per year. Assuming 100 days per year of operations, the daily cost of the fixed overheads of the business is around $2,500 per day.

With regard to lighting costs, typically boat operators will stock 40-50 globes for a three-year period. However, the cost to replace these can be variable depending on failed globes. But assuming they are maintained properly, the average life of a globe is three 3 years and each globe costs $100 to replace.

Given that virtually every boat in the SSJF also fishes for scallops or crayfish, these overhead costs need to be amortised across multiple fisheries. For most boats in most seasons, scallops occupy more fishing days than squid, hence scallops should carry a greater share of the cost attribution.

8.3 Voyage fishing costs

In addition to the ownership overheads, the per voyage costs must be calculated. These consumable items are highly variable and extremely inconsistent so are very difficult to measure. This cost does not include steaming to distinct fishing zones (e.g. Lakes Entrance to Hobart). The large range reflects boat size and fishing products.

Table 10: Average cost (per voyage) based on a 2 tonne catch

Overhead	Value
Diesel (depending on cruise time)	$500 - $7000
Jigs ($1.2 to $2) and snoods (80c) (although can lose 1,000 jigs in 1 night in extreme cases)	Approx. $100 - $500
Ground transport of catch at $0.25 per kilo	$500
Total (range)	$1100 - $8000

8.3.1 Diesel costs

Diesel is by far the greatest variable cost. Squid boats are large users of diesel for the engines, power generators for the light sets as well as freezers for those who freeze at sea.

The biggest contributor to diesel costs is the fuel required for searching. Squid are notoriously difficult to find and boats spend many hours cruising which burns litres of diesel. Some Victorian based boats fish out of southern Tasmania, which takes around 60 hours for the voyage to the fishing zone. The cost of fuel for this voyage is a significant up front expense. It is common for boats to spend hours cruising without finding any squid. Fuel use is also dependant on the size and efficiency of the boat, the number of lights in use and whether the boat freezes at sea. Boats consume between 600-1,200 litres per day or $1,200-$7,000 per voyage.

Most smaller boats, without freezing capability, go out on an overnight voyage; the factor limiting the length of the trip is the boat's holding capacity. Smaller boats can hold around ten tonnes and must return to port once they have reached capacity. The advantage of big boats with greater on-board storage and processing facilities, is that when they do find an abundant fishing area, they can stay out longer. This means that their steaming cost, as a percentage of catch is much lower. The converse is however also true in that their cost of cruising per hour is much greater and hence, their loss from a low yield voyage is significantly higher.

8.3.2 Jigs and line costs

Each machine has jigs which are attached to lines known as snoods which need to be frequently replaced as they are often lost to barracuda and other predatory fish. The level of loss varies dramatically depending on fishing conditions, so it is difficult to assess this cost as an average cost per voyage.

8.3.3 Labour

The typical squid boat has a skipper and two crew members. These crew members are remunerated on the basis of a share of the catch. The skipper typically retains 25% and crew members receive 9%. Although labour is not a sunk cost on each voyage, it is hard to retain crew in a fishery such as squid, when the catch is so variable.

8.4 Critical cost influencers

There are five critical factors that influence the economics of arrow squid fishing:

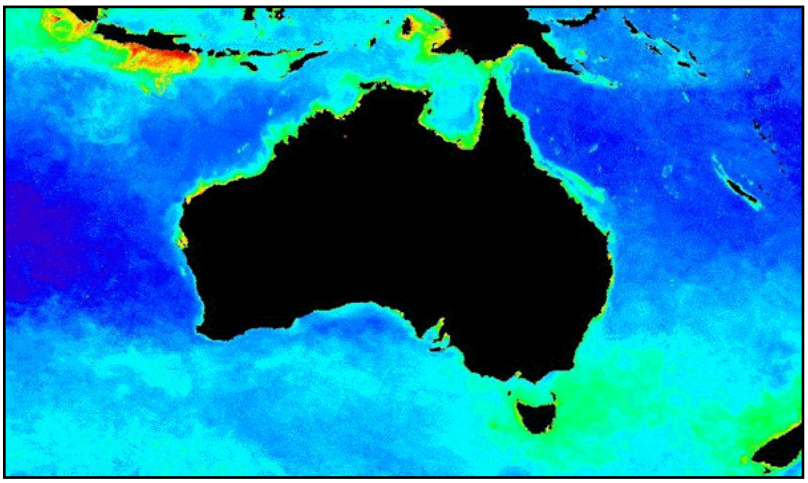
1. The time taken to find the squid
2. The volume and speed of the catch
3. The lighting requirement
4. The price of squid
5. The economic performance of the scallop fishery.

These points are expanded upon below.

8.4.1 The time taken to find the squid

One of the biggest costs and limiting factors to profitability is the time taken to find a fertile fishing ground. When squid can be found as close as 3 miles off shore, they can be an extremely profitable catch. However, in some cases boats can cruise for several days (burning a great deal of fuel) and find nothing. Boats usually go to areas that they know have previously harboured squid. They then use depth sounding and temperature monitoring equipment to help identify squid populations.

Figure 25: Satellite imagery of Chlorophyll in surface waters around Australia (4 Sept - 31 Dec 1997)

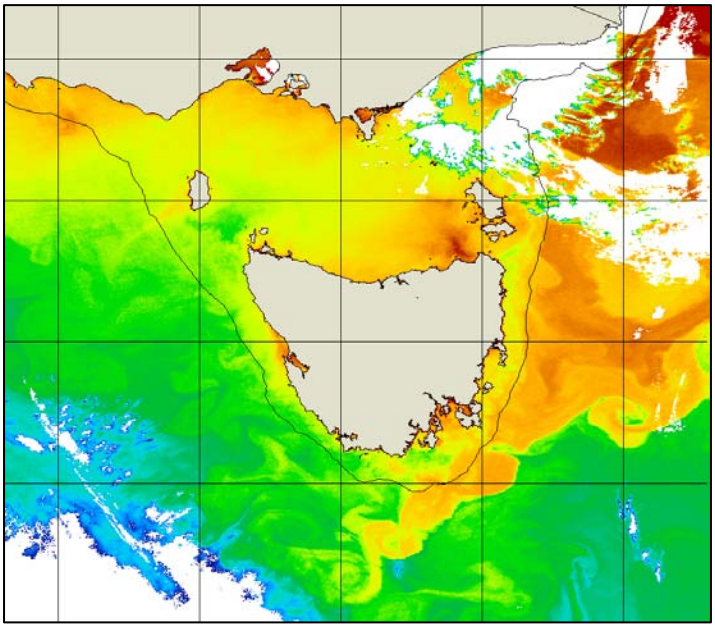


Source: DAFF

It is believed that squid are sensitive to water temperature and in some seasons stay in the deeper water. Common practice is to plot abundant areas on the GPS, which works to some extent from year to year but not always. There has been an informal practice in some countries for boats to fish as a fleet, testing different waters and notifying each other of progress. This does not generally happen in Australia because of the competitive nature of the industry. In Australia, if a boat finds a good area they generally keep it to themselves, however, the processors and other players around the harbour soon learn of a strong catch.

Some of the Australian jig boats are experimenting with Orb satellite technology, which senses water temperature. However, this technology comes at a high cost for the satellite access fees, which are around $800 per month. Tools such as remote-sensing and remote-imaging satellites produce a wide range of oceanographic and biological information useful for locating fish schools.

Figure 26: Satellite imagery of surface water temperature around Tasmania (6 January 2003)



Source: CSIRO

Similarly, ocean colour may be used to monitor the movement of water bodies and to map the primary productivity of the ocean surface. As seen in **Figure 17**, chlorophyll is determined by sensing ocean colour with satellite imagery and is an indicator of primary production. Ocean-colour and sea-surface temperature satellite imagery is used to target tuna and other pelagic species. This type of technology could be adapted to conditions conducive to squid.[58]

Changes in water temperature (**Figure 18**) are also a very good indicator of water activity, e.g. currents, up swellings, etc. Moving water carries nutrients, which fosters plankton growth (evident in sea colour), which brings the baitfish, which in turn brings other larger fish. These movements can be viewed by a temperature break, (which is a sharply defined boundary between regions of two different water temperatures), or by small scale temperature variability in a region.

[58] Department of Agriculture, Fisheries and Forestry, *Fishing Technology*, http://www.daff.gov.au/brs/fisheries-marine/info/technology#satellite

According to DAFF research, existing and future remotely sensed imagery has substantial potential benefits for fishing fleets in both the inshore and offshore environments, but remains largely unused by industry in Australia.[59]

8.4.2 The volume and speed of the catch

The second factor impacting the economics of squid fishing is the volume and speed of the catch. This varies from year to year. Unlike most other species where the price of the fish becomes depressed in times of high catches, because the price of arrow squid in Australia is determined by global factors, there is no such relationship. It is possible to have good catches and good prices coinciding. However, because processors are limited as to their capacity to handle too much fresh squid, bottlenecks can occur at port when catches are high. In such cases, fishers who do not have a freezing capability are at the mercy of processors to take their total catch and therefore prices can drop quickly. Because of the overhead recovery nature of fishing, the level of catch per days of fishing is a major factor influencing returns. Even at low market prices, a high volume catch can be extremely profitable if all of the variable conditions are right.

8.4.3 The lighting requirement

One of the largest costs items is the fuel for running the generator to power the squid boat lights. When conditions are ideal and limited lighting is required, this can significantly improve margins. For example, in Tasmania at certain times of the season it is possible to fish during the day without lights. Also in clear shallow waters, limited lighting is required.

One of the methods that has been flagged to minimise lighting costs, is adopting light emitting diode (LED) lamps. The key advantage of LED lights is reduced power consumption. When designed properly, an LED circuit will approach 80% efficiency, which means 80% of the electrical energy is converted to light energy. The remaining 20% is lost as heat energy. To put this into context, incandescent bulbs, operate at about 20% efficiency (80% of the electrical energy is lost to generating heat). In financial terms, if a 100-Watt incandescent bulb is used for 1 year, with an electrical cost of 10 cents per kilowatt an hour, $88 will be spent on electricity costs. Of the $88, $70 will have been lost to heat. If an 80% efficient LED system had been used, the electricity cost would be $23 per year.

The operational life of current white LED lamps is 100,000 hours. This is 11 years of continuous operation, or 22 years of 50% operation. The long operational life of LED lamps is a stark contrast to the average life of an incandescent bulb, which is approximately 5000 hours. Another advantage with LEDs is that they are more robust. They have no filament that can be damaged due to shock and vibrations. They are subject to heat, however, and being overdriven by the power supply.

LED technology is not without limitations. One of the main limitations is their high initial cost of purchase. Although the cost has been reducing, LED light bulbs are still expensive. But this cost is recouped over time and in energy cost savings. Thus overtime maintenance and replacement lighting costs would be minimised by using LED lights.

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[59] Department of Agriculture, Fisheries and Forestry, *Fishing Technology*, http://www.daff.gov.au/brs/fisheries-marine/info/technology#satellite

A significant limitation of LED is that the light output is smaller so they have not had a wide uptake with squid fishers. Even in Japan where the squid LED technology has been developed, the take-up of LED has not been widespread. However, in recent years, LED technology has improved rapidly, wherein high power LEDs with higher lumen outputs are being produced which at the current innovation rate, could meet the light intensity required for squid jiggers. LEDs lamps have advanced to replace higher wattage bulbs, such as a 13-watt LED bulb, which has the brightness equivalent of a 100 watt incandescent. LED technology is improving rapidly, and new energy-efficient lamps are consistently being announced from three of the lighting industry's largest producers, Osram Sylvania, Philips, and General Electric.

8.4.4 The price of squid

The price of squid is a major factor effecting returns. As was mentioned previously, price is linked to global supply factors. At the time of writing this report the wharf price was forecast to be over $3 per kg, making the prospect of squid fishing attractive and profitable for the first time in some years. For a typical boat with a holding capacity of ten tonne, the catch return can vary from $10,000 to $30,000 depending on the prices received. The price and volume variables are inextricably linked as even in low price years, when the catch is easily and cheaply landed, fishing can still be very profitable.

8.4.5 The economic performance of the scallop fishery

The final factor impacting the profitability of squid operations is the economics of the scallop (or other off season) fishery. The economics of scallops and squid need to be considered as one, because they both contribute to the overhead recovery of the fishing enterprise. When returns from scallops are low there is a lot more pressure on squid for overhead recovery.

8.5 Profitability of jig squid fishing

The profitability in jig squid fishing is difficult to determine because of the large amount of variability across all five of the above factors, however, price is clearly the pivotal factor that motivates fishers to look for squid. As has been highlighted previously, boat owners have a sunk cost and need a certain value of catch to break even, when the price is attractive, they are more inclined to take the risk of squid fishing. The higher the price, the lower the breakeven point and even a small catch can enable fishers to return a profit.

The following are some examples to demonstrate the costing economics. The examples are based on a 20 metre boat with 20 jig machines and an average overnight voyage. Labour cost is based on 25% of the catch value and freight from boat to processor has been estimated at $0.25/kg which includes ice cost.

With a 2 tonne catch and a $3.00 per kilo buying price, the boat owners generate $6,000 in gross revenue. The table below indicates that when costs are deducted, net returns are $2,100 or $1.05 per kilogram.

Table 11: Profitability Example 1: 2 tonne catch $3/kg sell price

Catch	2 tonne
Price	$3.00
Revenue	$6,000
Cost	
Labour	$1,500
Diesel	$1,700
Jigs and lines	$200
Freight @$0.25/kg	$500
Total Cost	$3,900
Total net earnings	$2,100
Earnings per kilo	$1.05

Table 12: Profitability Example 2: 1 tonne catch $3/kg sell price

Catch	1 tonne
Price	$3.00
Revenue	$3,000
Cost	
Labour	$750
Diesel	$1,700
Jigs and lines	$200
Freight @$0.25/kg	$250
Total Cost	$2,900
Total net earnings	$100
Earnings per kilo	$0.10

Table 13: Profitability Example 3: 10 tonne catch $3/kg sell price

Catch	10 tonne
Price	$3.00
Revenue	$30,000
Cost	
Labour	$7,500
Diesel	$1,700
Jigs and lines	$200
Freight @$0.25/kg	$2,500
Total Cost	$11,900
Total net earnings	$18,100
Earnings per kilo	$1.81

Table 14: Profitability Example 4: 2 tonne catch $1/kg sell price

Catch	2 tonne
Price	$1.00
Revenue	$2,000
Cost	
Labour	$500
Diesel	$1,700
Jigs and lines	$200
Freight @$0.25/kg	$500
Total Cost	$2,900
Total net earnings	-$900
Earnings per kilo	-$0.90

Table 15: Profitability Example 5: 10 tonne catch $1/kg sell price

Catch	10 tonne
Price	$1.00
Revenue	$10,000
Cost	
Labour	$2,500
Diesel	$1,700
Jigs and lines	$200
Freight @$0.25/kg	$2,500
Total Cost	$6,900
Total net earnings	$3,100
Earnings per kilo	$0.31

8.6 Opportunities to reduce cost

The two big ticket cost items and therefore the area where there is the greatest opportunity to reduce cost are the costs associated with searching and the cost of lighting.

8.6.1 Searching costs

If large pockets of squid could be found more reliably and productively it would greatly reduce cost. There are two potential opportunities here. When fishing as a fleet, as occurs in other fisheries by agreement, boats search in different areas and notify each other when they are successful. Boats then assemble in the bountiful areas and share the prize. Such a practice has historically been absent in Australian fisheries where fishers see themselves as fierce competitors.

The second alternative is the adoption of satellite imaging technology which has been trialled previously. This technology is in its early days in the SSJF, with at least one boat conducting trials. It is too early to assess its potential.

8.6.2 Lighting costs

The Japanese squid industry is still refining the use of cheaper lighting alternatives involving LED lighting. This technology has not been deemed a success to date but future developments may mean that this is a longer term possibility for cost savings.

8.7 Summarising the economics of the jig squid fishery

The fundamental economics of any traditional fishing enterprise is that the boat needs to generate sufficient annual catch value to cover the annual overheads plus the per voyage costs, i.e. there is effectively an annual breakeven point and a per trip break even point.

As already mentioned, with squid fishing, the break even point on each trip is not necessarily related to the price per kilo or the catch volume. There are a number of cost factors at play, i.e.:

- Distance from shore that squid were found.
- Distance steamed to find the squid
- Diesel costs required for lighting
- Diesel costs for freezing/chilling
- Extent of damage to consumables
- Market price

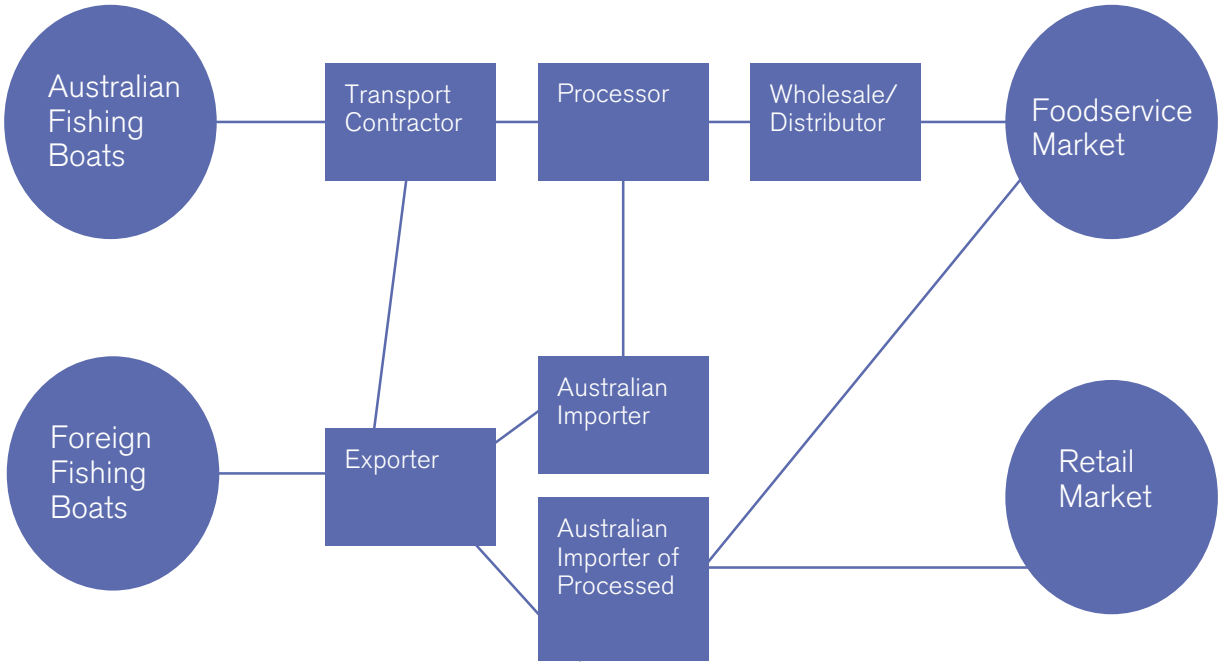
For example, a one day trip that has hauled the maximum tonnage of squid, close to shore, without the need for lights or freezing at a wharf price of $2 per kilo can be far more profitable than a longer trip that required lights and hauled a smaller catch at $3 per kilo.

9 SUPPLY CHAIN STRUCTURE & DYNAMICS

9.1 Supply chain linkages

The supply chain for squid is depicted in **Figure 19**. The functions of the key links are outlined below.

Figure 27: Supply chain – squid



9.1.1 Licence Holders/ Fishers

Licences are usually held by boat owners. Licences are based on numbers of jigging machines per boat; the total number of machines for the fishery is determined annually. There is no volumetric limit on the catch within a season. Theoretically, a licence holder can lease out their licence to another boat every fishing season, as occurs in New Zealand. In practice however, this doesn't happen because of the highly variable nature of the fishery, which would make this a risky purchase.

9.1.2 Transport companies

Specialised chilled transport companies ship squid from port to processor on a per kilo basis, usually supplying the ice and crates for shipment.

9.1.3 Processor

The processor buys the squid from the boat owner or skipper at a negotiated price. Product is received in either fresh or frozen form. It is thawed (if frozen at sea), processed and refrozen.

Most processors also import squid, mainly from New Zealand, but sometimes from other countries, either directly from an exporter or via an import agent.

The Australian processing sector produces squid products in the following formats:

- Cleaned tubes
- Rings – coated or uncoated
- Pineapple cut tube pieces
- Tentacles
- Tails/wings (which are mainly sold for bait or mincing)

Usually processors handle a number of other seasonal lines such as scallops. Some sell direct to food service outlets and retailers or on to distributors. Australian processors also compete with imported processed product. Often the market becomes flooded with imported product, which puts downwards pressure on prices paid to processors.

9.1.4 Wholesalers and Distributors

Wholesalers typically buy from processors as well as handling imported product, which they import directly or buy through importer's agents. Most wholesalers also perform a distribution function, servicing daily orders and delivery to retail and food service outlets.

Wholesalers generally buy and sell a range of seafood and frozen goods. Many operate out of wholesale fish markets in capital cities. Most wholesalers also process and value-add some seafood themselves. Some of the larger wholesalers (e.g. De Costi Seafoods) manage the retail seafood programs for major supermarkets or retail groups.

Wholesalers are often exposed to market risk by virtue of the fact that they can hold large inventories of frozen product. On a falling market they are exposed to considerable financial losses.

9.1.5 Food service

The food service sector encompasses all away-from-home dining including restaurants, QSR (quick service restaurants), conventions/banquet function operations, contract caterers (e.g. sporting venues, functions, etc.) and take-away food outlets. As outlined in earlier sections, Asian restaurants use a high proportion of squid products but the largest volume goes to pubs, clubs, bars and take-away outlets in the format of coated rings.

9.1.6 Retail

The retail trade for locally processed squid consists of unpackaged product sold through supermarket delicatessens, specialty seafood outlets and market seafood stalls. Imported processed squid is sold in retail packs, although this is believed to be a minimal quantity, as the data is not captured separately.

9.2 Spread of value along the supply chain

McKINNA *et al's* standard practice when analysing supply chains is to apply a 'Profit Pool Analysis' framework that indicates the spread of the sales dollar across the supply chain and the indicative profit that goes to each player in each link in the chain. This framework is almost impossible to apply with squid, and indeed most seafood, because of the volatility in the selling and buying price for boats and processors. The profitability of squid for the catch and processing sector is highly volatile.

Table 16: Sample profit pool analysis based on $3/kg sell price

Supply chain link	Boat	Processor	Wholesaler	Retailer
Buy Price $/kg	N/A	$3.00	$5.30	$6.63
Sell price $/kg	$3.00	$5.30	$6.63	$8.01
Gross Revenue	N/A			
Margin ($)	N/A	$2.30	$1.33	$1.99
Margin (%)	N/A	43%	20%	23%

9.2.1 Boat owner returns

For reasons outlined in the previous section, the boat owner's return is totally dependant on the size of the catch, variable costs and the price per kilogram. Catches can vary from zero to the full capacity of the boat, which can be 5-20 tonnes. Over the past five years prices have varied from $1 to $3. The volatility of the boat earnings was highlighted in the previous section of the report.

With a 2 tonne catch per voyage and a $3 per kg selling price, the boat makes a gross margin of $2100 or $1.05 per kilogram. This gross margin does not include overhead costs such as insurance, administration expenses and so on. With a catch of 10 tonne per voyage, the margin increases to $18,100 or a $1.81 per kilogram. At $3.00 per kilogram, the boat has to catch 1.3 tonne to break even.

The situation is very different at $1.00 per kilogram where with a 2 tonne catch, the boat loses $900 or $0.45 per kilogram. On the other hand, with a catch of 10 tonne and a sell price of $1.00 per kilogram, the boat earns $2,000 per voyage or $0.20 per kilogram. At $1.00 per kilogram, the boat must catch 7 tonnes to break even.

9.2.2 Processor returns

The processor's margin is more difficult to calculate because processors are buying whole squid and processing into components which all sell at different price points. The average yield of a whole squid by key components is:

At a $3.00 per kilogram wharf price, the typical sell price for the components would be:

Component	$/kg
Tubes	10.5
Tentacles	5
Tails/wings	2

This situation produces a weighted average sell price of $5.30 per kilogram and a gross margin of $2.30 or 43%.

The processor's main cost components, apart from the squid and other raw materials such as tenderising and coating ingredients; are labour (which is around $0.45 per kilogram), electricity, factory overheads, repairs and maintenance and waste disposal. Processors also have relatively high compliance costs, particularly for food safety compliance. It is beyond the scope of this study to determine processor profitability, but processors sell into a competitive market and must compete with imported products, therefore processor margins would also be under constant pressure.

At times when there is a strong supply of cheap imported product, processors struggle to reach their selling prices and are exposed to market risk and losses.

9.2.3 Wholesaler

With a $3.00 per kilogram wharf price, wholesalers buy at a weighted average price of $5.30 per kilogram and sell their value-added product at an average of $6.63. Typically, wholesalers work on a 25-30% gross margin. Out of this margin they must cover labour, freight and distribution as well as overheads such as office and sales staff.

9.2.4 Retailer

At a buy price of $6.63 per kilogram, retailers would sell with an average gross margin of 25-30%. This margin would mean the average retail sell price is around $8.61 per kilo. Retailers often have to sell perishable stock that is close to use-by date at a discounted price to move it, which impacts their margin. The main costs for retailers are real estate, labour and power.

10 INDUSTRY ANALYSIS & KEY PERFORMANCE ISSUES

This section of the report summarises the state of the industry and the critical performance issues that are impacting on the performance of the SSJF. The purpose of this analysis is to provide a basis for general conclusions and strategic recommendations.

The SSJF is in a precarious position and if the current circumstances prevail, the industry is likely to continue to decline. Although there are 52 active licences, only around 12 boats had been fishing the season prior to this report. Furthermore, of those boats that are working, most are only fishing for small number of days.

The key industry issue is profitability for both fishers and processors, which at the moment is low and over time has been highly variable to the point of threatening the economic sustainability of the industry in the longer term. The profit levels are not sufficient to encourage the reinvestment necessary for long term industry sustainability. The key factors that are impacting on the industry performance are:

1. Declining and highly variable levels of profitability.
2. Lack of critical mass in the SSJF.
3. Variability and unpredictability of the catch.
4. Lack of differentiation between the southern arrow squid and other squid species.
5. Trading relationships between fishers and processors.
6. Growing and unfair nature of competition from imported product.
7. Processing of the product for low value uses.
8. Lack of industry governance and funding framework.

Most of these factors are closely interrelated and have a cause and effect relationship. They are explained in further detail in the following pages.

10.1 Declining and highly variable levels of profitability

The central issue confronting the SSJF is the declining and variable nature of profitability both for fishers and, to a lesser extent, processors. The issue is not the cost of fishing *per se*, but the cost relative to the catch value. Whilst the cost of fishing is relatively high, there are few options for cost reduction so the key to improving profitability is not so much about reducing costs but more about increasing the value of the catch.

The profitability for fishers is a function of wharf prices and catch levels, two factors which vary independently of each other. The confluence of large catches at high prices produces strong profitability, whereas the converse produces large losses.

As the section of the report on price determination indicates, the price of squid is highly volatile mainly due to global prices, which the SSJF is too small to influence. Essentially, the Australian price is set by New Zealand prices, which in turn are influenced by the global situation.

Both the fishers and processors are at the mercy of the global market dynamic, which fluctuates mainly due to the supply situation. Interestingly, prices in 2010 have not followed the usual trend whereby a shortage of supply is usually reflected in significant global market price increases. This is believed to be because of the large amount of stock currently in freezers around the world. Creation of artificial shortages and gluts is a tactic international traders use to manipulate global prices making market prices very difficult to forecast and respond to. The current situation of low prices may also be partly explained by the strong $AUD which has reduced the landed price of imported product in $AUD terms.

The issue of profitability is important for the future of the industry because consistent profitability is necessary to provide the confidence for ongoing reinvestment in latest technologies for both fishers and processors. The point is, that while the fishery may be environmentally sustainable, unless there are improved and more consistent profit outcomes, the industry may not be. The situation is exacerbated by the relatively low returns from scallops recently, which are co-fished with squid.

10.2 Lack of critical mass in the SSJF

A major limitation of the SSJF is its size relative to the total squid sector. The SSJF is a minor player in a large, undifferentiated commodity market with no real ability to influence global pricing outcomes. The lack of critical mass impacts in two important ways:

1. The local industry is at the mercy of global prices.
2. There are not sufficient volumes and consistency of volumes to support product differentiation and marketing strategies.

This lack of critical mass would not be so much of an issue if the product could be differentiated to the point of becoming a specialist, niche line that appealed to a discrete market segment who were prepared to pay a premium for it. Such circumstances do occur in other seafood markets (e.g. wild-caught abalone over farmed or line caught fish over trawled). There does not appear to be any real prospect for differentiating the arrow squid unless a unique processing technology could be developed. Even though the species is different, the market treats it the same as the New Zealand species because, ultimately the end-user buys it in processed form anyway where its species and provenance is disguised. There are no real prospects of the SSJF achieving the critical mass levels to be able to influence the market. Even a ten-fold increase in production levels would have no real impact.

10.3 Variability and unpredictability of the catch

A third factor, significantly impacting on the industry, is the large amount of variability in the catch. Although the SSJF may be environmentally sustainable, over time, there are significant year-to-year fluctuations in catch size. There are some question marks over the sustainability of the industry with anecdotal suggestions from fishers that in some seasons the species may be overfished with claims that fishing areas that were abundant one season can be found to have greatly reduced numbers in the next season. There are differences of opinion within the industry as to whether this is due to the fact that the fish stocks get depleted and take a year to replenish (given the arrow squid have an 18 month lifecycle), or whether their

migration patterns are not well enough understood and they are simply not found that particular year. The variability in catch has a number of important consequences:

1. It causes great variability in profitability for fishers for reasons explained elsewhere.
2. It adds to fishing costs because boats spend time and money searching for the squid.
3. The situation makes it extremely difficult for processors to schedule their production. In times of peak catch they do not have the capacity to process the catch as it is landed so they place limits on what they will accept from boats. Boats therefore lie idle in times where squid are abundant. In times of short supply, processors must rely on imported fish from New Zealand or other regions to service their customers' needs and keep their throughout to the levels required to retain their staff and cover their costs. As a consequence, most processors hold stock of frozen unprocessed product. No processor can afford to totally rely on Australian squid only.
4. In times of heavy supply, boats are put onto a schedule by the processors, meaning that they can't take advantage of good weather or a strong supply season because they are only working for part of the time when they could be fishing. If they could fish more when the squid are running it would further reduce their overheads.
5. The above situation results in increased price variability. When a processor can't accept all of the product, skippers have to try and sell into a buyers market which depresses prices.
6. Inconsistency of supply of the Australian product means that 'Australian caught' can never be a marketable proposition for the industry as the processors would not be able to meet demand.

10.4 Lack of differentiation between the Southern Jig arrow squid and other squid species

Under some circumstances where there is an industry sector with a small supply of differentiated product there is often the opportunity to create a premium niche market. However, a necessary condition for this to occur is that the product has a differentiating feature (real or perceived) which is attractive to a segment of the market, and for which this segment is prepared to pay a premium price. If the level of differentiation had sufficient strength, it could provide a degree of insulation for SSJF from the variability of global prices and ensure a price premium. Unfortunately, this condition does not exist for arrow squid (*Nototodarus gouldi),* which is seen by the market to be the same as the New Zealand species. Although arrow squid caught in Australia are slightly different from the main species caught in New Zealand (*Nototodarus sloani)*, the market treats them indifferently with the same pricing. The eating quality of southern squid to most peoples' palate, has no discernable difference to other species.

As was mentioned in the main body of this report, some processors have successfully trialled marketing young, small, unprocessed baby squid in the fresh market and achieved very positive customer reaction and premium pricing. The challenges with the baby arrow squid product are:

- The supply is in small volume.

- It is not consistently available within a season (small squid tend to be at the start of the season only).
- It is not consistently available from year to year.
- Only the last day's catch can be landed fresh.

For the above reasons, it is not feasible to build a marketing strategy around the more tender baby squid. As is highlighted in the next section, the opportunities to differentiate by employing the commonly used strategies of value-adding, grading and branding are also limited.

10.5 Trading relationships between fishers and processors

As with any trading situation, there is a competitive tension between fishers and processors. Fishers tend to be of the view that processors control the market. The processor position on the other hand, is that they are tied to global market prices, which they must relate back to the prices they pay the fishers.

Processors do have market power over SSJF fishers to the extent that most skippers have exclusive (albeit non-written) processing agreements based on undertakings of mutual obligation that apply to the other fisheries they work in. The tendency to enter into this type of agreement is essentially driven by the highly variable nature of the supply and demand balance in all fisheries. In times of short supply, fishers will remain loyal on the understanding that in times of oversupply the processors will continue to buy their product. As a consequence, fishers tend to honour these exclusive supply arrangements with one processor. Processors on the other hand have a number of suppliers plus the option to buy and store imported frozen product. To this extent, processors have greater market power over fishers. There is, however, a limit as to the extent to which processors can exploit this arrangement due to market pressures on them.

10.6 Growing and unfair nature of competition from imported product

The profitability of the SSJF is currently being impacted by cheap imports. Being a globally traded commodity with a large part of the Australian market supplied by imports, the squid market is accustomed to global competition. However, beyond the basic issue of importer competition, there are two additional mitigating factors.

The first factor is the integrity of labelling. Some observers in the industry are of the opinion that there are quantities of product caught in the Northern Hemisphere waters, that are processed in China (or other Asian locations) and then shipped to the southern hemisphere and re-packed and sold as '*Product of Australia*' or '*Product of New Zealand*'. During this study it has not been possible to ascertain to what extent this problem is occurring, but processors believe that it is becoming more common, particularly in recent times with the strong Australian dollar. Processors indicate that Australian customers would prefer to buy Australian or New Zealand caught product (because of the perception of better quality and also because of concerns about the integrity of processing and food safety issues in Asia). However, consumers are not given accurate information because imported product is being

passed-off as being local. By re-packaging and mislabelling, it is possible for unscrupulous processors to pass off Chinese processed product for local. This further undermines the price premium available to local product.

The Australia New Zealand Food Standards Code 1.2.11(2) governs the labelling of seafood concerning country of origin. It is to be closely read in conjunction with the *Trade Practices Act 1974*. There are conditions for the prescribed use of wording such as *"product of"* as well as representations and other statements as to the country of origin, such as *"made in"* or *"manufactured in"* or similar statements. These statements may be used lawfully under the following circumstances:

1. Using the terms *"product of"*, *"produce of"* and *"produced in"* as a premium claim and the country of origin claim, must be the country of origin of each significant ingredient of the food and all or virtually all the processes of production or manufacture of the goods must have happened in the country.[60]

2. The terms *"made in"*, *"manufactured in"* or *"Australian made"* require that the goods in question must have been substantially transformed in the country claimed to be the origin and 50% of the costs and production must have been carried out in that country.[61]

However, if there is uncertainty as to where substantial transformation has occurred, manufacturers may make a qualified claim. These take the form of *"made in Australia from imported ingredients"*, or *"packaged in Australia from local and imported ingredients"*. Either way, the labelling is vague.

Thus, if manufacturers are catching squid in the Pacific Ocean, processing them in China, and then packaging them in Australia with the labelling *"produce of Australia"*, this is a direct contravention under section 65AC of the *Trade Practices Act 1974*. All, or virtually all, processes involved in the production or manufacture of the product must take place in the country claimed.

If however, the product is claimed to be *made* in Australia, even though it is caught and processed elsewhere, as long as 50% or more of the cost of producing the squid is attributable to Australia, it meets the requirements. This is likely to be a situation that foreign manufacturers of squid can exploit as the cost of production overseas is quite minimal, for example the difference between cleaning, cutting, grading in China may still be far cheaper than simple packaging in Australia, thus fulfilling the requirement of using the statement *'Made in Australia'*, while giving the false representation that it is a product of Australia.

The second issue with imports is the relatively high exchange rate which is reducing the landed price of imported product in $AUD. Because squid is an international, natural commodity, it is exposed to $AUD fluctuations. The general consensus among economists is that the $AUD will remain high whilst Australia's mining boom continues which is a foreboding scenario for local fishers and processors alike.

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[60] *Trade Practices Act 1974*, s 65AC.
[61] *Trade Practices Act 1974*, s 65AB.

10.7 Processing of the product for low value uses

The vast majority of squid in Australia is processed for low end uses i.e. crumbed rings for deep-frying typically served in pubs, clubs, café's and bars.

In the absence of any natural product differentiation, this only alternative is to differentiate through processing techniques. The big market need and opportunity is to improve tenderness. Currently processors use various methods (some of which is classified as secret know-how) to skin and tenderise their squid. There are also some questions marks over the safety and integrity of some of the chemicals used for these processes, particularly through Asia. The opportunity is for the industry to collaborate to develop a unique method or technology with protectable IP to process squid which delivers a distinctly and consistently more tender product. Such an initiative would require cooperation at the processor level, rather than the fisher level (where industry development initiatives have more traditionally occurred).

10.8 Lack of industry governance and funding framework

Arguably, one of the biggest constraints to the development of the SSJF is the lack of a governance, leadership and funding framework to drive and manage the industry development.

Previously, there was a dedicated Squid Management Advisory Committee (Squid MAC), but in 2009 this was merged into the larger South East Fishery Management Advisory Committee (SEAFMAC) under the AFMA framework. Because the squid industry is so small relative to the large South East Fishery, its voice has effectively been lost. However, reinstating the Squid MAC would not correct the problem. The decision to collapse Squid MAC into the SEAFMAC was made because of the lack of industry activity and interest - it was left up to volunteers to drive the agenda. Ultimately, time constraints and lack of industry interest sapped the enthusiasm of the volunteer 'industry champions'.

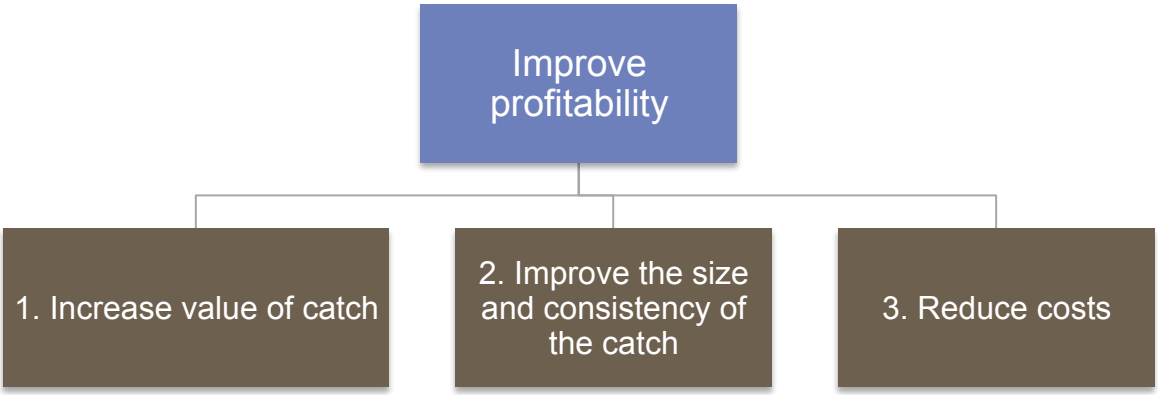
This issue is common across most of the fishing sectors. Some of the large fisheries such as Southern Rock Lobster have addressed this problem by appointing a full time executive officer to drive the industry development agenda. This then raises a second issue, i.e. the need for a funding mechanism to support paid staff. Most agrifood sectors such as meat and horticulture have the ability to establish an industry and market development levy using the DAFF framework. Under the current FRDC regulations, there are limitations on the ability to introduce such funding mechanisms for fisheries. FRDC funds must be used exclusively for research and extension activities. Most of the needs of the SSJF fall into the category of industry development activities, some of which enter into the sphere of agri-politics. The fallback position, which occurs in some other industries, is voluntary contributions. Such an approach is problematic for the SSJF because of the size of the industry, the high cost per operator (as there are so few) and the highly variable industry profitability. Only a handful of the licensed boats are operating and it is unlikely that inactive boats would be willing to contribute to a voluntary levy scheme. With regard to processors, in virtually every case, they are heavily involved in processing imported product and as such wouldn't have a lot to gain from supporting the local industry.

11 STRATEGIC DIRECTIONS

This section of the report discusses the potential strategies that the industry could adopt to address the fundamental performance issues outlined previously. It must be stated at the outset that many of the strategic options that have proven to be successful for other agrifood industries facing similar issues are, in the authors' view, not really practical solutions for the SSJF for reasons that will be explained. It is important however, to put forward some options for consideration by the industry.

11.1 Strategy platforms

The three possible strategic directions available to the SSJF are summarised in the schematic below:



As already ascertained, the central issue for the SSJF is profitability both for fishers and processors. It is not so much the level of profitability *per se*, but the stability of profitability over time. This is a 'boom and bust' industry dynamic with windfall profits in some years and large losses in others. Like any fishing sector trading in this sector is essentially gambling; i.e. investing a substantial amount in fuel, in the hope that there will be a bountiful catch. The situation is magnified for jig squid fishers because their fuel costs are so much higher due to the cost of light generators, consumables such as jigs and snoods and the elusive nature of the squid. For these fishers, the profit level not only varies from season to season, but also from voyage to voyage.

Profit levels sufficient to service overheads and support continuous reinvestment in the latest in technology are essential to the success of any industry. Without sufficient profits, current players will leave the industry and there will be no incentive for new investment or new entrants. What this means for the SSJF is, that even though the fishery may be environmentally sustainable, the industry itself may not be. There are already signs that the industry is in decline.

11.2 Strategies to improve and stabilise profit levels

Reduced to simple terms, there are three base strategy platforms that can be employed to improve and stabilise industry profitability. These are:

1. Increase the value of the catch.
2. Improve the size and consistency of the catch.
3. Reduce costs.

Ideally, the industry strategy should be based on simultaneously addressing all three platforms.

Platform 1: Increase the value of the catch

It needs to be emphasised at the outset that the focus must be on building value rather than simply trying to reduce costs. From the fishers perspective, the solution is simple, increase wharf price. But given the global nature of price setting, the ability to influence price is limited. Building value is about increasing the selling price by enhancing the value proposition for the customer – it is not just about negotiating price rises. In other words, achieving a premium over the prevailing market price by adding value to the product.

Realistically, the SSJF is in no position to influence global market prices because of its size. It is a miniscule player in a huge global industry whose price is set by global forces. There are however, proven tactics that have been successfully employed in the agrifood sector to increase value, these are:

- Value-adding
- Quality assurance and grading
- Branding
- Truth-in-labelling

Value-adding

The industry is heavily involved with value-adding the product through skinning, tenderising and producing rings (crumbed or un-crumbed), pineapple and other cuts. Perhaps there may be other opportunities for value-adding. Other protein categories have moved into modified atmosphere packaging, pan-ready and microwaveable retail products as well as adding sauces and marinades. To this end, there could be merit in industry investment in further product development by initiating an R&D projects with a food service/technology consultants. Because consumers do not know how to cook squid successfully at home, a fool-proof retail solution to this e.g. 'easy cook squid' or 'guaranteed tender' would be attractive propositions for them.

As mentioned, another way to value-add the product could also be to improve the skinning and tenderising processes. Many consumers avoid squid because it has a perception of being tough and inconsistent in its eating quality. Food technology R&D investment into developing cheaper, easier and more effective preparation processes that produces a discernable eating difference, would give the whole Australian industry an edge over imports. If this could be achieved with a 'chemical free' or 'all natural' claim, this may offer another advantage, as many processors

claim the Chinese tenderising process is unhealthy. By protecting the IP, the SSJF could have a sustainable competitive advantage, which if supported with a branding strategy, could produce premium pricing. Such an initiative would require a cohesive and forward-thinking processing industry to be involved.

Quality Assurance and Grading

In situations like this, where local product is competing with cheap imports, there is an opportunity to differentiate through enhanced quality assurance. In the case of SSJF, there is the further opportunity to differentiate from trawl caught fish through introducing higher levels of on-board product handling to produce a noticeably and consistently better product. For the trawl fisheries, squid is a by-catch, therefore it is given second priority in terms of product handling. This situation provides an opportunity for the SSJF. The adoption of 'best practice standards' in terms of on-board handling, including state-of-the-art on-board freezing equipment and a HACCP type product handling protocol, would greatly improve product quality. Obviously, such an industry quality standard would require a commitment by fishers to further invest. To do this, they would need to be confident of getting the level of price premiums to justify this investment.

A QA system could be taken to another level through the introduction of a uniform industry grading system. Potentially, grading is a very powerful tool for products of nature where there is natural variability in the product attributes that influence eating quality. The red meat industry, for example, has had spectacular success in improving the predictability and consistency in eating quality through the Meat Standards of Australia (MSA) scheme which grades meat in terms of its suitability for particular intended end use. The theory behind grading is that by improving consistency and predictability, customers/consumers will pay more because of improved eating quality which lifts the overall value of the industry. Again, a unique tenderising technology would give the Australian industry an advantage, if it could safely achieve a superior grade of tenderness.

Grading is however a double-edged sword; while it lifts the value of better quality product, it can devalue sub-quality product. The theory is however that grading lifts the average value, in other words, the premium paid for the high quality product offsets the devaluation for the lower quality product.

There is a case for grading squid on the basis of the large amount of natural variability in terms of size, shape, colour and tenderness. Squid is usually only graded by size, (U5, U10, U20, etc). Consumer research should be undertaken to determine what the appropriate grading parameters should be. There may be potential to then introduce a standardised grading system based on:

- Colour
- Shape
- Tenderness (measuring some predictor for tenderness; for example, pH which is used for red meat)
- Crumb quality

It is beyond the scope of this report to specifically recommend a grading scheme on the basis that it could be counterproductive to the SSJF. Because volumes are relatively small and highly variable, it will be difficult for the industry to consistently supply a full range of grades. Grading would also add cost, but without necessarily raising value. In some seasons the devaluing impact of the lower quality product may be greater than any upside gains.

Unfortunately arrow squid does not appear to have any real redeeming features which are recognised in the market place and for which customers are prepared to pay a premium. A decision about introducing a uniform industry wide grading scheme needs further research but in the view of the authors is probably a questionable proposition.

Branding

Branding is a proven tool for raising value of agrifood products. Examples here include King Island dairy products, Lilydale chicken, Angus beef, Brocollini, Blush Tomatoes, etc. Regional branding strategies based on provenance have also been successfully employed with agrifood, an example being Food Barossa which covers a range of products produced in the Barossa Valley region, Batlow apples or Young cherries.

Recently branding has been successfully applied to fresh seafood with Simplot's John West brand in a fresh format gaining spectacular consumer uptake and supporting premium pricing.

There are two levels of branding:

1. A **trade brand** (as displayed on the delivery carton) which is recognized by wholesalers, retailers, chefs or food service customers, but not necessarily consumers.

2. A **consumer brand,** which appeals to the end consumer and is usually used on retail packaging.

All squid processors have their own trade brands, which achieve varying degrees of loyalty and price premiums in the trade because of the processor's reputation for tenderising skill or crumb quality. Consumer brands would only work in the case of squid if there was demand for pre-packaged retail products. Because the vast majority of squid is sold either through food service outlets (restaurants, fish & chip shops, etc.), or as a loose commodity (in retail markets, supermarkets and seafood shops), consumers don't see any squid branding which makes the development of a consumer brand difficult.

Potentially, the SSJF could develop an industry wide brand, either as a trade brand or a consumer brand. An example of an industry brand is Sunkist Citrus, which is packed under licence by multiple packing sheds and marketed under one brand globally. A per case levy is collected to support a marketing program that promotes the Sunkist brand. Sunkist started as a trade brand and evolved into a consumer brand when it was extensively advertised in Asia particularly. Under this scenario, processors would pack under one brand to a standardised quality standard.

In the case of squid, an industry brand would provide the critical mass levels that are not possible for individual companies of the size of most Australian squid processors. It would give the Australian industry the critical mass needed to start to grow consumption of squid domestically through recipe promotion or nutritional messages. It would require a great deal of cooperation and pooling of resources at a processor level, which would be difficult to achieve.

Potentially, the SSJF could base a branding strategy around being 'jig caught'. Increasingly, high-end markets are differentiating 'line-caught' seafood on the basis of better eating quality, taste and environmental sustainability. High-end restaurants often indicate 'line-caught fish' as a selling feature on their menus.

There have been a number of recent notable examples where brands have been successfully launched through food service channels. One example is the McDonald's Certified Angus Beef program, which has been a great success. However, for such a strategy to work, there needs to be a point of differentiation. The problem is that at present, notwithstanding some potential quality advantages, the squid market doesn't differentiate between trawl and jig-caught. In fact 'jig caught' is a concept that would have to be explained to many ender users and consumers as it is an unfamiliar word to most outside the industry. For the jig-caught brand to have any presence it would also be necessary to improve quality and grading, a point discussed later.

There is potential to use the Marine Stewardship Council (MSC) certification as a basis for branding. The focus of the MSC certification scheme is to recognise and endorse fisheries and businesses within these that comply with sustainable fishing practices. We understand that the SSJF, along with many others, has undergone the first stage of certification. A second full assessment would be required to gain eligibility for certification and the use of the brand. Certification is a costly exercise both to gain the initial certification and also for the on-going use. Again, given the small size of the fishery, MCA certification may be hard for the SSJF to justify, quite apart from its affordability.

Critical to the success of any branding strategy is consistency. A brand is a double-edged sword and can be a negative if the buyer has a bad experience. A successful branding strategy for a natural product needs to be underpinned by a grading and quality assurance scheme.

Although there is the potential opportunity to develop an industry wide brand for SSJF, there are four critical success factors that must be considered. A successful branding program needs:

1. A high level of industry support.
2. A uniform quality grading standard.
3. Willingness by industry to contribute to a marketing fund.
4. A redeeming selling feature (real or emotional).

The authors have strong doubts that these critical success factors could be met by the industry currently due to the following facts:

1. The processing sector is made up of strong willed individuals who are fiercely competitive.
2. The profitability of the industry is not consistent enough to support a marketing levy.

3. Realistically, arrow squid has no outstanding differentiation features, meaning that large amounts of marketing funds would need to be invested to create an emotional difference through branding. Alternatively, product could be differentiated through unique skinning and tenderising processes. As mentioned already, if the industry could collaborate to create a new and protectable processing technology that guaranteed tenderness or some other attribute, this could potentially create a sufficient point of difference that could be marketed.
4. Local catch volumes are insufficient to justify an 'Australian' branding program.

For reasons outlined above, a branding scheme is probably not feasible, unless significant funds could be found to develop the unique processing technology and processors were willing to cooperate.

Truth-in-labelling

There is a need and opportunity for greater integrity in terms of truth-in-labelling for squid.

There are allegations in the industry of widespread mislabelling of seafood. In particular for squid, the issue is that cheap imports of product caught in Northern Hemisphere waters and processed in Asia, are being repacked and labelled as *'Product of Australia'* or *'Product of New Zealand'*. This strongly dilutes the ability of the industry to achieve the premium that customers are prepared to pay for locally caught fish because of perceptions about the quality and integrity of foreign product. Customers are unwittingly buying imported product in the belief that is local. Truth-in-labelling is covered under the FSANZ food code, which is adopted into regulations by state authorities and enforced by local government.

If the mislabelling allegations are correct, this framework doesn't appear to be effective at policing truth in labelling. Although the SSJF would benefit most from higher levels of enforcement, bringing this issue to the attention of the authorities and increasing the level of scrutiny would be beneficial to the Australian seafood industry as a whole.

Platform 2: Improve the size and consistency of the catch

The profitability of the SSJF sector is severely affected by the size and inconsistency of the catch, which produces a 'boom or bust' situation. As has been highlighted earlier in the report, the fishers have high overhead costs, both at a boat ownership level and at an individual voyage level. For each voyage, a skipper must invest a large amount of money (mostly for diesel fuel) regardless of the catch. The level of the catch therefore, underpins the profitability both from year to year and voyage to voyage. The issue here being the highly sporadic nature of the catch due the behaviour of the species. Potentially there are two strategies that could be adopted to improve the yield rate:

1. Fish tracking technologies.
2. Collaborative fishing models.

Fish tracking technology

Historically, fishers use depth sounding technology to locate fish. We understand that this technology is less successful for squid and requires a higher level of skill. Some fishers are experimenting with satellite technology which measures water temperature as a predicator of the presence of squid. Although this technology has potential, it is still largely unproven. However, given the potential of the technology to improve fishing yield and reduce costs, it is worthy of industry R&D investment to further explore and develop the technology.

Collaborative fishing models

A second potential strategy to improve fishing yield is some form of collaborative fishing model. Essentially, collaborative fishing involves little more than sharing information about the location of fish. The cooperating boats cruise in different areas and report catch levels to the fleet, all of whom can then move to the waters which are abundant in fish.

It is understood that this approach is employed in Japan and Korea where fleets are much larger and many are corporatised. Although the collaborative fishing model has potential, again we doubt that this presents a practical solution to the SSJF because the Australian fishing industry is fiercely competitive and skippers guard their knowledge and skills jealously. There are also industry concerns that the squid fishery resource is finite and that collaborative models could cause the fishery to be over fished. Collaborative fishing models do have sufficient merit to put to the industry, but the authors are highly doubtful that it will gain any traction.

Platform 3: Reduce costs

The third strategy platform to improve profitability is to identify opportunities for cost reduction. The biggest cost item, apart from the overheads of owning a boat, is diesel fuel. To reiterate, squid boats burn large amounts of fuel, more than other fishery, because of the need to generate power for lights as well as the likelihood of having to steam vast distances to find squid. Any opportunity to reduce diesel costs would significantly contribute to improving the industry profitability. There are a few potential areas of fuel reduction:

1. LED lighting technology
2. Boat design
3. Labour
4. Boat size
5. Management of licences

LED lighting

The LED technology has been trialled in Japan and at least one boat in the SSJF is experimenting with LED lighting. LED lighting is rapidly taking over in the building sector because of the energy efficiency and environmental friendliness. LED lighting technology requires approximately 20% of the energy required for incandescent equivalents. Therefore reducing diesel generator cost by 80% would greatly improve profitability.

There are some question marks over the effectiveness of LED lighting in attracting squid because of the characteristics of the light emitted. Clearly with the potential to

greatly reduce costs, there is a strong business case to fund further R&D to evaluate the potential of LED lighting and further develop and refine the technology.

Boat design

The opportunity exists to reduce costs through improved boat design. Developments in hull design have greatly improved fuel efficiency. This technology is well known throughout the industry. The issue for SSJF fishers is the cost and affordability of the investment required to adopt this cutting edge technology. State of the art fishing boats can easily cost over $2 million, which with the current profit levels would be hard to justify and finance.

Labour

There is also the potential to reduce labour costs through automated fishing systems, although potentially cost savings are far less than for diesel. Under the current salary awards, labour is renumerated on the basis of the size of the catch with crew members sharing in the fishing risk. As such, under this type of arrangement, labour is not really an overhead cost. Quite apart from this, there are limits to reducing labour on boats because of minimum crew level regulations for safety reasons. Most boats already operate with the minimum allowable crew.

Boat size

Larger boats than those currently used by most SSJF fishers with on-board storage and freezing facilities would be more efficient if squid are abundant. Fuel savings could be made by being able to stay out at sea for longer periods, minimising steaming costs. Again, with industry profits at such low levels, few are likely to make this investment.

Management of licences

A more flexible approach to managing licensing arrangements could potentially improve the efficiency of the fishery. At present there are around 80 licences of which around 10% are active. The ability to lease a trade licence may encourage larger boats and/or provide the incentives for larger, more efficient foreign boats to fish the region as occurs in New Zealand.

Larger boats equipped which have state-of-the-art searching equipment and on-board processing and fishing gear, are more efficient provided that the quantities of squid exist. With a more flexible licensing arrangement, an Australian licensee may be able to justify bringing in larger boats from overseas, following the New Zealand model.

Another alternative is to licence the catch on a quantitative quota basis with a first-in application policy. On this issue, there are three principles that need to be considered:

1. Is the fishery being utilised to its potential?
2. Is the fishery being fished with the greatest efficiency?
3. Does it make sense to have a large number of inactive licenses?
4. Is it acceptable to the industry?

12 BENEFITS AND ADOPTION

The authors acknowledge at the outset that the challenges confronting the SSJF are significant and most of the potential solutions identified may not be practical or economically feasible. Notwithstanding this, we have attempted to exhaustively explore the possible opportunities and discussed the critical success factors that need to be covered off. In the final analysis it will be up to individual fishers and processors to evaluate the options against their own individual situations.

The greatest potential benefit that this report could bring is to stimulate sufficient interest among the industry to establish a formal representative body as a forum to advance the future direction of the industry and advance industry initiatives.

This study may be a sufficient catalyst to encourage the industry to establish a R&D levy specifically to invest in SSJF.

13 FURTHER DEVELOPMENT

Key Recommendations

1. It is recommended that the key findings of this report be presented to an industry forum convened by FRDC. In particular, the potential for industry grading and branding schemes and collaborative fishing models should be put to the industry for consideration.

2. It is recommended that the active fishers form a task force among themselves to further investigate the appropriateness and the effectiveness of LED lighting technology as a strategy to reduce diesel cost for running power generation. Reducing diesel is the best opportunity for cost reduction. It may be possible to encourage LED manufacturers to support a program of trials to assess the effectiveness of LED in a jig fishery application.

3. Similarly, it is recommended that the active fishers also investigate the effectiveness of satellite tracking technology. Again, the manufacturers and marketers of the satellite technology may be prepared to support trials. Improved fishing yields and particularly reduced searching time would significantly improve industry profitability.

4. It is also recommended that the industry provide a R&D project to assess opportunities to further value-add arrow squid to differentiate it from imported product via unique processing or packaging technologies or an industry-wide quality assurance program. In particular, there may be an opportunity to invest in food science expertise to produce a processing compound or process that delivers superior tenderness or is 'fool proof' to cook. Ideally, this would be produced from naturally occurring enzymes so that the Australian process can be marketed as being a far safer and healthier method than that used in Asia as a point of competitive advantage. If industry funds are not available, it may be possible to work with one of the universities with a food technology program as a student research project or a master's thesis.

5. It is recommended that the industry further investigate the suspected occurrences of mislabelling of imported overseas processed product being passed off as product of Australia/New Zealand and work with the appropriate bodies to address the problem.

6. It is recommended that the industry pursue the development plan outlined in the next section.

The key steps in developing the SSJF

One of the passing observations made during the course of researching this report is that there is a lack of enthusiasm and confidence by the industry members to drive the standard industry development agendas that are required for a vibrant and successful industry. The stakeholder consultation process indicated that the members of the SSJF are, to some extent, despondent about the future or simply have a lack of confidence to invest. This attitude is understandable. Notwithstanding this, for the industry to advance, there needs to be a change in attitude and a demonstration by key players of a willingness to invest time and effort to pursue industry development activities.

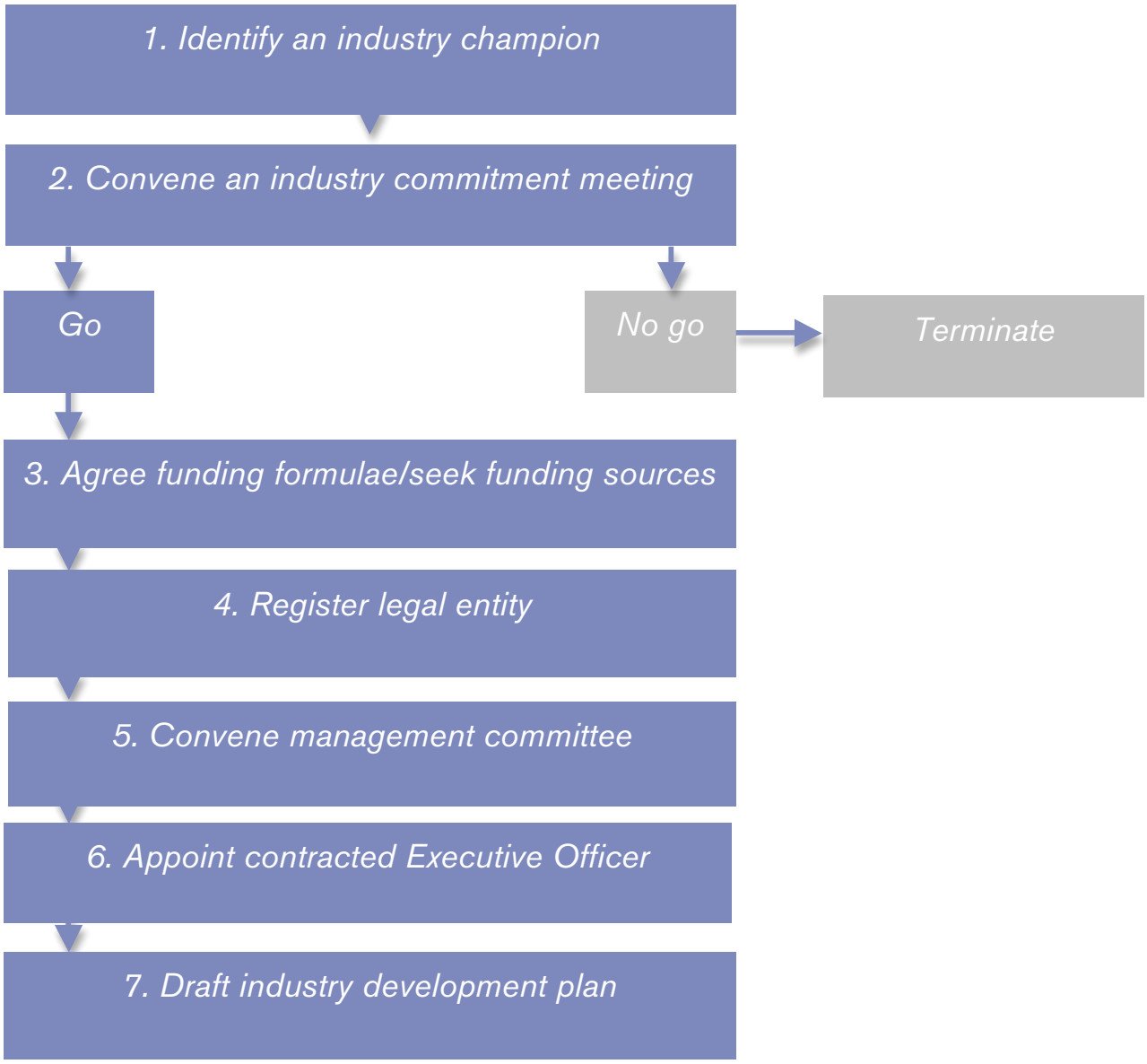
It must be stated upfront that the challenges of the fishery are considerable but not insurmountable; that there is no magic bullet; and there will need to be enthusiastic support from the key industry stakeholders to turn the industry around.

As per section 11 of this report demonstrates, the most fundamental constraint to the future development of the SSJF is the lack of an industry representative body and a funding mechanism. This report has identified a number of projects that potentially could improve the efficiencies of the SSJF. The reality is, that unless the industry forms an effective representative body, these projects will remain good ideas in a report that are never activated.

The purpose of this section is to put forward a road map for industry development.

The key steps required to put the SSJF on an effective industry development trajectory are outlined in the following roadmap.

Roadmap


1. Identify an industry champion
2. Convene an industry commitment meeting
Go
No go
Terminate
3. Agree funding formulae/seek funding sources
4. Register legal entity
5. Convene management committee
6. Appoint contracted Executive Officer
7. Draft industry development plan

Key Steps:

1 Identify industry champion

In the history of virtually every successful industry is an 'industry champion' i.e. a person with the vision, passion and drive to make their industry succeed. Without such a champion, the chances of success are limited. Most industries have a national leader; the task is to identify and anoint this person. The industry itself needs to put forward such a person.

2. Convene Industry commitment meeting

1. The starting point of the journey is to assess the level of commitment by the key stakeholders to support activities, participate in and fund an ongoing industry development framework.
2. A meeting would be convened at an appropriate central location and all significant stakeholders, including licensed fishermen, processors, wholesalers, etc., should be invited to attend.
3. The chosen champion would need to be recruited to convene and facilitate the meeting.
4. At the outset, there would be an outline of the purpose of the meeting, the agenda and the process.
5. The first part of the meeting would involve McKINNA *et al* presenting the findings of this report and the recommended directions.
6. After discussions a formal motion would be put to the meeting based on three key platforms:
7.
   i. *An in-principle commitment to commit to support an industry development program.*
   ii. *A willingness to contribute to a voluntary funding scheme.*
   iii. *An agreement with the general direction of the industry development plan.*

8. Realistically, if there is not a high-level of support for the proposal, the initiative would not proceed any further.

3. Agree funding formulae/seek funding sources

Prior to the industry forum, it will be necessary to assess various funding sources.

As was mentioned previously, because much of the cost required for industry development falls outside of the definition of research and extension activities, the industry would not be eligible for many of the normal funding sources, such as FRDC.

There may be some opportunities for funding from the Victorian state government. Although SSJF covers Commonwealth as well as Victorian, Tasmanian and South Australian jurisdictions, most of the product is landed in Victorian ports and processed in Victoria. The Victorian DIIRD has previously invested in seafood industry development projects. Similarly, the Victorian DPI has from time-to-time invested in market development projects. The new Victorian Government's policy on industry development is not yet clear.

Typically these funding sources require a commitment from industry to match

funding, meaning that the industry would need to develop its own funding source. Almost certainly, this will require a commitment to contribute. Realistically, the industry would need to raise a minimum of $30,000 per annum which at best would support only a minimal program and would require significant levels of supplementary grant funding. This would suggest that a voluntary contribution of somewhere in the range of $500-$1,000 per annum would be required from each active business. With the current economic pressures on the industry, achieving voluntary contributions of this level could be a challenge.

4. Register legal entity

It will be necessary to establish a legal entity to manage the financial affairs of the industry. A legal entity is required to enter into contractual arrangements, receive and manage funds and to provide indemnity to office bearers.

The most appropriate entity would be a company limited by guarantee. This will be a not-for-profit organisation with trustee directors whose liability is limited to a token share value (e.g. $10). Even if little else happens, the formation of this entity is important to provide a vehicle for the industry to be able to enter into funding and other contractual arrangements. Without such an entity and bank account, it can do little.

5. Convene management committee

The new entity will require the formulation of a management board. Obviously, the board will require representation from the fishing and processing sectors. Ideally, the board would be skill-based. In this case, the skill set required would include:

- A deep understanding of the squid fishing sector.
- A deep understanding of processing and global marketing of squid.
- Experience in industry and market development.
- An understanding of funding sources and skills in attracting funds.

It is highly desirable that there be a number of independent directors and ideally an independent chair. Logically, it would make sense to bring in a person with experience and involvement in one of the large and more successful fisheries. For example, the Southern Rock Lobster fishery appears to have been very successful. The appointment of a director from such an organisation would be highly beneficial to a fledgling industry such as SSJF. A fee may be necessary to secure such a person.

6. Appointment of an Executive Officer

Critical to the success of the project is to have a skilled operator with the time and energy to follow through long range projects such as development of new technologies. To date, the industry has relied on volunteers to drive the agenda. These volunteers lack the time to give the job the attention that it requires and they usually get burnt out.

In virtually every successful industry association there is a paid executive officer who is focused on driving and managing the industry development agenda. The appointment of a full time executive officer would almost certainly be beyond the financial resources of the SSJF. It may however be feasible to appoint a part time executive officer.

Perhaps it would be possible to attract grant funding for a part time executive officer position for one to two years. The hope would be that in this time the executive officer position could demonstrate sufficient value to the extent that industry would be prepared to continue to fund the position.

In making this recommendation, the consultants do not underestimate the difficulty in sustaining a paid executive office position. Many industries have attempted this but have not been able to sustain the position on an ongoing basis. On the other hand, in the experience of this consultancy, a paid executive officer position is critical to the future development of SSJF.

7. Draft industry development plan

The next task of the process is to develop an industry development plan that sets out and prioritises the steps in the development process.

The intention would be for the executive officer, on behalf of the advisory committee, to draft a plan. The plan would identify the priority areas, develop action plans and identify potential funding sources.

14 PLANNED OUTCOMES

The project has comprehensively identified and profiled the range of factors affecting the economic viability of the SSJF for arrow squid in southern Australian.

The report has also comprehensively reviewed all of the possible solutions to addressing these factors and has made specific recommendations as to the future actions.

The report goes to some length to point out the difficult position that the SSJF is in and makes a realistic assessment of the challenges that the industry face. Being a small, niche player in a global industry, the SSJF has almost no ability to influence market pricing. This being the case, the industry has two courses of action:

1. To differentiate the product and target a niche market that has a propensity to the product.
2. Drive cost out of the fishery operation to improve profitability.

The report provides a road map to guide the industry to address the performance factors that have been identified.

15 CONCLUSIONS

1. Although the SSJF is considered to be a sustainable fishery in an environmental sense, the long-term sustainability of the industry itself is questionable. At present, the industry appears to be in decline.

2. The central issue is the highly variable nature of industry profitability. The industry, including both the fishing and, to a lesser extent, the processing sectors experience 'boom or bust' cycles which are a consequence of:
    a. The global supply and demand situation, which influences both wharf and market prices in Australia.
    b. The sporadic and unpredictable nature of the catch in the SSJF relative to the overhead cost associated with fishing.

   This variability in profitability is undermining the confidence of fishers and processors in investing in the industry and keeping it at world's best practice.

3. Because of the relatively small size of the SSJF relative to the global supply, it is a 'price taker' with no real influence globally. The SSJF has no real prospects in the short term to grow to the level required to be able to influence global market prices. This situation could change in the future if other Asian and South American fisheries were to become significantly depleted over time.

4. Because of the extreme variability in profitability, it is essential that SSJF fishers have licenses to operate in other fisheries as they could not survive on fishing squid alone. On the other hand, the large number of inactive licences indicates that the resource is not being utilised. The big issue is fishing productivity rate.

5. There is limited ability to reduce fishing costs. Overwhelmingly, the costs are of a fixed nature related to boat ownership and per voyage consumables. The major per voyage cost is diesel. In the case of squid fishing, diesel is a sunk cost in the sense that the expense is incurred regardless of the catch. The key potential opportunities for cost reduction are:
    - Improving LED lighting systems, which have around 20% of the power requirements of incandescent lighting and therefore use less fuel.
    - Implementing state-of-the-art hull design, which applies to the entire fishing industry.
    - Investing in larger boats with a freezing capacity, that can stay at sea for longer

6. There is the potential to reduce costs through improving catch yield, and reducing the amount of time spent locating squid. Potentially, yield could be improved through collaborative fishing models and/or the perfection of fish tracking satellite technology. The practicalities of a collaborative fishing model are challenging because of the highly competitive nature of the Australian fishing sector and due to the fact that few boats are currently fishing squid. The potential of satellite tracking is unknown, but warrants further investment in research and development because of its potential to reduce costs and improve catch levels.

7. Potentially, there is the opportunity to create a more flexible licensing system based on tradeable or leasable licences. This could potentially encourage larger boats to fish squid and will make it feasible for licensees to commission foreign fleets to bring in the catch, as occurs in New Zealand. It could at the same time improve the utilisation rate of current licences.

8. Opportunities to improve profitability through raising the market value of Australian arrow squid appear to be limited. Because the market views Australian and New Zealand squid as substitutable, there is no opportunity to attract a price premium. Also, due to the fact that Australia is a miniscule supplier in a global commodity market, there is no real opportunity to manipulate market price. Furthermore, the opportunities to achieve premium pricing through the proven marketing tools employed in other agrifood sectors such as quality assurance, grading, branding and marketing approaches are minimal. The main limitation of these types of strategies is that the SSJF doesn't have the critical mass or stability of supply necessary for success.

9. Critically, the Australian arrow squid does not have any naturally defining attributes on which a strategy of product differentiation can be built. Therefore, a marketable product feature would have to be created by product development such as a unique processing technology or packaging technology or an industry-wide quality assurance program to discernibly improve quality and on which the processed product could be differentiated. This would require investment and cooperation at the processor level of the supply chain.

10. Australian customers will pay a premium for Australian caught and processed seafood over that caught or processed overseas, particularly in Asia. With mislabelling, imported product is reportedly being passed off as locally processed, eroding the price premium of Australian squid. To the extent that this is occurring, it is undermining the profitability of the Australian industry and warrants closer examination across the wider seafood sector.

11. Any real change in the SSJF needs to be driven by the processing sector. Ultimately, it is the processors who drive the marketing process, wherein lies the opportunity for change. Effectively fishers have no opportunity to influence the supply chain in the current market dynamic. It is the processors who currently hold the market power in Australia.

Closing remark

This report has identified, what we believe to be, priority areas for industry development. These are:

1. Further research and development into LED lighting systems.
2. Further research and development into fish searching technologies.
3. Establishment and enforcement of truth-in-labelling frameworks.
4. Investigation of alternative methods of licence allocation to improve the efficiency of the fishery.
5. Assessment of the feasibility of the introduction of industry-wide quality assurance grading and branding scheme.
6. The development of proprietary protected new technologies or methods of processing and value-adding to improve the eating quality and ease of preparation of arrow squid, which would allow Australian processed product to be differentiated from imports.

There is an opportunity for the SSJF to re-invent itself, however, it cannot be denied that the challenges for this fishery are great.

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