

A Study on the Status of Aquaculture Production and Trade in South Africa

Volume 1

Industry Status and Diagnostic Report

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For:

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Executive Summary

Over the last three decades, the levelling off in world's wild fishery production has stimulated the boom of many national aquaculture industries to supply the growth in demand for fishery products. Global aquaculture production has grown at a rate of 9% per annum over the last 20 years, and is expected to continue to grow at a rate of 4.5% over the next two decades if per capita consumption of fish is to be maintained. While South Africa possesses suitable environmental conditions for aquaculture, and opportunities for the commercial culture of various species, the local aquaculture sector has performed below its potential and remains a minor contributor to national fishery production. This is due to a number of constraints including access to water and land, access to technology, high transaction costs, a lack of supporting policy and legislation, and barriers to entering certain markets. Total production has been fairly stable in recent years with 3,907 tons of products worth R211 million being produced in 2006, compared to approximately 500,000 tons from South Africa's harvest fishery worth R1.8 billion. Due to aquaculture's relatively high production costs, commercially cultured species are mainly high value species which include;- abalone, trout, mussels, oysters, catfish, tilapia, kob, seaweed, and freshwater crayfish. Species on the threshold of commercial production include prawns, yellowtail, sole, spotted grunter and scallops. The greatest increase in production was in the abalone sub-sector where production (mainly for export to Asia) increased by 61% - from 515 tons in 2003, to 833 tons in 2006.

The opportunity for developing the South African aquaculture sector is nonetheless very positive, as the increasing short supply of traditional fish products on the local market, (e.g. hake and linefish), have resulted in a sharp rise in prices making aquaculture an increasingly viable production option. In the short to medium term it is unlikely that aquaculture will meet the deficit in supply in the local market due to the relatively long lead time required to establish new operations (3-5 years), and imports of fishery products are therefore likely to rise. There are thus opportunities for growing aquaculture production to substitute imports. A growing shortage in the global supply of high value fish products is expected to push up real prices over the next two decades and opportunities for the export of high quality, fresh fish to the European Union exist, which are readily accessible as the South African fishing industry is a well established exporter to this market. South African aquaculture is however not expected to be competitive in the production of frozen, white fish fillets as large volumes of cheap tilapia fillets (as low as \$1.50/kg) from China and Vietnamese Catfish currently dominate the market.

Although much of South Africa's coastline and freshwater environment is not ideal for aquaculture, significant opportunities for developing aquaculture exist at certain localities. A major constraint is however access to suitable land and water. Difficulties prospective investors experience include rezoning processes, onerous permitting requirements, and an obstructive bureaucracy in respect of compliance with environmental regulations. State intervention is thus required to zone suitable areas as 'aquaculture development nodes' in order to facilitate access to land and water for aquaculture.

South Africa possesses a generally conducive infrastructure and set of supporting institutions for the development of large scale commercial aquaculture. This includes strong R&D capacity, state aquaculture facilities, aquaculture support staff in certain government departments, financial institutions, fishery export capacity (including SABS certification), and most of the general industrial services required to develop the sector.

The main constraints to aquaculture development are a lack of sector level institutional coordination and strategy, and certain specific infrastructure and capacity requirements that individual firms cannot overcome. For example: the state veterinary service needs to develop aquaculture health management capacity, aquaculture investors have difficulty accessing the development finance institutions, information and technology is not easily accessible to prospective investors, and sector level strategies to overcome constraints are lacking. Good progress has been made by certain government departments in addressing the needs of the aquaculture sector, for example, draft national policies for fresh and marine aquaculture have been published, aquaculture staff appointed within several departments, sector working groups established, development projects promoted (including aquaculture SME's), and aquaculture development strategies drafted at provincial level. What is lacking is a comprehensive set of national strategies and Key Action Plans (KAP's) to address the potential of the sector as well as the constraints that need to be removed.

If the aquaculture sector is to grow to its potential, an urgent investment in human resources is required as a lack of aquaculture skills both within the private and public sector is a significant constraint to development. Because the existing commercial sector is largely white owned and managed, the growth potential of the industry provides an opportunity to achieve a racially representative sector. But an up front investment in the necessary skills at all levels is required. Currently, no tertiary level technical courses in aquaculture exist, nor do SETA accredited in-service training courses for aquaculture technical skills. While University level courses in aquaculture exist, targeted bursary funding is required to attract black students.

Global experience and the current diagnostic analysis shows that since aquaculture is a new production sector based on novel technology, state intervention is required create an enabling environment for investment. South Africa's National Industrial Policy Framework (NIPF) provides guidance in this regard and suggests that for high growth potential sectors such as aquaculture an equivalent set of support measures to competing nations should be provided. The industrial policy support measures available to the aquaculture sector in South Africa were compared with those of Australia and Chile, two countries with analogous geographic, environmental and economic conditions which have very successfully promoted the development of their aquaculture industries. In Chile, a country with a relatively undeveloped local market and R&D base, state facilitated technology transfer, capital grants, aquaculture water concessions, and export marketing assistance have helped the sector to take advantage of Chile's exceptional environmental endowment and become a leading global producer of products such as salmon and scallops. Australia's extensive set of industrial incentives reflect policies which emphasise local technology development, extensive support and promotion of SME's, skills development, access to export markets, product innovation in the seafood sector, access to information and technology, and public – private sector level collaboration. While South Africa possesses many equivalent industrial support measures, they have mostly not been accessed by aquaculture sector. While the SMEDP support measures have encouraged some company level investment in aquaculture, support for sector level strategic and industry cooperative actions have been lacking. The aquaculture sector has benefited from state funded R&D through company and university driven research, but lacks a dedicated R&D strategy (equivalent to Australia's Cooperative Research Centre Model) which addresses the technology needs of the sector in a comprehensive way. In conclusion, the industrial incentives available to the South African aquaculture sector are "patchy" and do not form part of a national strategy to realise the potential of the sector and systematically address constraints to

development. Suggestions for an appropriate set of industrial support measures and strategies to promote aquaculture sector development are made which could be used to develop a set of Key Action Plan's (KAP's) as envisaged in the NIPF.

Section 1 Overview of the Current Status of Aquaculture in South Africa

This section provides an overview of the aquaculture sector in South Africa including the species that are currently under cultivation, the geographic scope of production, the technologies that are used, and current production figures. The status of the existing infrastructure that is available to the industry is assessed, and an overview of the quality standards that are applied to the industry provided. The figures and information provided are based on interviews with key stakeholders (listed in Appendix 1) and on the sources cited in the reference list.

1.1 National production data

National aquaculture production data (2003-2006) is presented in Table 1. In 2003, the sector accounted for 3,474 tons of production and increased slightly to 3,564 tons valued at R210 million in 2006. The greatest increase in production was attributed to the abalone sub-sector where production increased by 61% - from 515 tons in 2003, to 833 tons in 2006. The oyster, mussel and trout sub-sectors reported declines in production of 19.2%, 39.5% and 18.4% respectively, and prawn production ceased.

Table 1. 2003 / 2006 Production Data

Species	Production			
	2003		2006	
	Quantity (Tons)	Value (Million R)	Quantity (Tons)	Value (Million R)
Marine				
Abalone	515	134	833	178.3
Oysters	250	1.6	202	8.0
Mussels	900	5.1	542	4.7
Prawns	130	11.8	0	0
Finfish	10	0.4	0 ^f	0
Freshwater				
Trout	1,300	-	1,100	33.4 ^b
Tilapia	160	-	50 - 80	0.75 - 1.2
African Catfish ^d	50	-	66	0.99
Common carp ^d	30	-	40	0.6
Mullet ^d	15	-	20	0.3
Largemouth Bass ^d	9	-	12	0.18
Marron crayfish ^e	8	-	30 - 40	5.5 – 7.4
Koi carp	77	-	1.4 million fish	7.0
Aquarium species ^a	30	-	2,600 boxes	2.86
Totals	3485		3564	R210 million

^a Including goldfish

^b Assuming a live price of R36.5 / Kg and a gutted price of R28 / kg (300 tons of live product sold)

^c Source: Chairman of the Western Cape Tilapia growers Association (Mr G.Thomas)

^d Source: Mr Adian Piers, University of Stellenbosch

^e There are no formal grower associations / inventory of producers. Since 2003, it is unlikely that there have been major increases in the production. Certainly, there have been no major commercial developments. Therefore, a conservative assessment of a 10% increase in production per annum has been used to estimate the 2006 production figures.

^f Espadon Marine (Pty) Ltd initiated production of Kob in 2006, however, volumes were very small and do not register on MCM inventories.

1.2 Culture species

1.2.1 Freshwater species

1.2.1.1 Trout

Trout farming is the oldest aquaculture sub-sector in South Africa, and is by volume the largest. The first trout ova were imported in 1896, and the first dry pelleted feeds produced in 1956 (Hecht and Britz, 1990). The development of pelleted feeds stimulated growth in production by 1989, 1,023 was being produced. In recent years, production has been relatively stable, and in 2006, approximately 1,100 tons was produced, slightly down from the 1,600t produced in 2005 due to high temperature and low flows. The majority of production is split between the Western Cape and Mpumalanga. In 2006, the Western Cape farmers produced approximately 500 tons of trout that was destined for human consumption. In contrast, of the 600 tons of trout produced in Mpumalanga, approximately half was sold as fingerlings to the recreational fly-fishing industry. In addition to the production of fish for the table and flyfishing markets, there is also a small market to export disease free ova to the European producers – this is a relatively small (in 2006, 4 million ova), but high value seasonal market that ships ova into Europe during the European summer months when some farmers are unable to produce ova.

The technology required for culture is now well developed and typified by raceway, pond and cage culture. Increasingly, recirculation technology is being employed by the industry, that in combination with thermal regulation is preventing the historical losses that were attributed to seasonal fluctuations on water levels and temperature spikes. Nevertheless, many areas in which trout are produced remain to some extent marginal.

Status of existing infrastructure:

Typically, trout producers in South Africa are relatively small family owned operations. Currently, farm production volumes vary between 15 and 300 tons per annum, with the majority being less than 100 tons per annum. There are currently two major processing companies operating, producing approximately 40 different value added products to the restaurant and high end markets. Both processors indicated that supply is currently insufficient to meet demands, and in 2006, the major processor in the Western Cape reported that they had to import Canadian / Alaskan “B” grade and Norwegian / Chilean “A” grade fish to supplement local supplies. At least two feed companies manufacture and supply trout feeds.

Geographical distribution:

Trout culture in South Africa is restricted by the high ambient temperatures that are prevalent throughout much of the country, and the lack of suitable water for culture. In order to culture the species successfully, the culture temperature should remain below 18°C – although the fish can withstand elevated temperatures above 18°C for short periods. This restricts sites to the smaller streams in the higher altitude catchments where cool clear waters predominate, and as a result, much of the country’s trout culture is focused around the foot of the Drakensburg and Midlands areas of KwaZulu-Natal, and the higher regions in Mpumalanga and the Eastern and Western Cape Provinces. A major new trout farm is under development at the Katse Dam in the Lesotho highlands.

1.2.1.2 Tilapia

Tilapia production in South Africa increased from 70 tons per annum in 1998, to 175 tons in 2003 (Brink, 2003). Current estimates suggest that in 2006, between 50-80 tons of product were produced. Potential culture techniques are varied, and include high density intensive cage and raceway culture - in which the entire nutritional requirements of the animals must be met using formulated feeds - to extensive pond and dam culture, in which formulated feeds are either absent or used as supplements to naturally occurring feed stuffs. In recent years, tilapia culture has received renewed interest in South Africa, stimulated in part by the need for alternatives sources of fish to replace the traditional white groundfish stocks that have historically been supplied by the world's capture fisheries. With many of the traditional fisheries in decline, there is a clear marketing opportunity to develop whitefish replacements. Specifically, many potential farmers view the combination of the recent reductions in the South African hake capture fishery and the rise in local fish prices as an ideal opportunity to move into the tilapia industry. Globally, the potential for tilapia to act a groundfish replacement species is well documented (Section 2.1.2.1), and thermally controlled, intensive tilapia farming in South Africa is increasingly becoming viewed as a viable business option that, if developed appropriately, can deliver sustainable returns on investment.

Status of existing infrastructure:

Currently, there are no large scale intensive farms operating in South Africa. Thus, at present the industry comprises of a number of small private operators employing traditional pond and cage culture. The centres for the current industry are the Western Cape and further north in Limpopo, North West province, and Northern KwaZulu Natal. In 2004, there were 10 small scale development initiatives in the Limpopo province (Rouhani and Britz, 2004). The projects are primarily funded by the Department of Agriculture, and in some cases, local government. To date, the projects have been designed to promote food security and develop sustainable livelihood options for local communities, and are not focused on large scale commercial production.

While the sector remains small, there are indications that there is considerable potential for growth. For example, the Eastern Cape Development Corporation (ECDDC) - in collaboration with a private partner - has recently secured EU funding to develop a satellite growers programme in the Eastern Cape. It is anticipated that the project will produce 300 tons of tilapia per annum using intensive culture techniques.

Geographical distribution:

Applying current technology, tilapia culture is generally possible throughout most lowland areas of South Africa. However, as the optimal temperature for the culture of *Oreochromis mossambicus* is in the region of 28 - 30°C, the most thermally efficient areas to culture the species would be in the warmer areas of the country that experience warm summers and relatively warm winters - such as the Northern Province, Limpopo, Mpumalanga and Northern KwaZulu Natal. It should however be noted that as water temperatures fall below 28°C, reduced metabolic activity results in a rapid decline in growth rates. Reduced growth rates result in longer grow-out periods and lower levels of farm production. It is for this reason that many tilapia farms are located in tropical regions where the high ambient temperatures promote optimal year-round production. Under the sub-tropical and temperate temperature regimes that prevail in South Africa, tilapia farming is either restricted to seasonal production (during the warmer summer months), or alternatively, can be undertaken under thermally controlled conditions in highly intensive production systems that allow production

throughout the cooler winter months. Taking the temperature and associated production issues into consideration, it is realistic to suggest that any future expansion of the sector in South Africa will be based on thermally controlled intensive production systems utilising faster growing strains such as *Oreochromis niloticus* or genetically selected/ modified *Oreochromis mossambicus*..

1.2.1.3 Catfish

The catfish industry was initiated during the late 1980's - largely as a result of research and development that was initiated by local research institutions with support from the Foundation for Research Development's "Aquaculture National Programme". In 1987, the first 10 tons of *C. gariepinus* was produced commercially. By 1988, production had increased to 137 tons which rose rapidly to over 1000 tons (Hecht and Britz, 1990). Sadly by 1993, the production figures started to slip into reverse (Uys, 1993) and by 1998, only 40 tons were being produced. While feed, and hence production costs may have played a role in the decline in production (Hoffman *et al*, 1996), it was generally accepted that the major problem was a lack of proper market research and product development (Hecht, 1993; Uys, 1993). A second wave of investment in catfish farming occurred from 2000 onwards driven by companies selling high density turnkey culture systems and the promise of an export market in Thailand. The market evaporated with a strengthening rand and catfish farmers were once again left with fish that they could not sell.

While the culture technology for catfish farming is clearly well developed, and technically, catfish could become a major success story in the South African aquaculture industry, the marketing issues are more problematic. Foremost among these issues are that in comparison with other catfish species that are available to farmers in the Americas (*Ictalurus spp.*) and the Far East (*Pangasius spp.*), the African sharp-tooth catfish (*Clarias gariepinus*) is poorly accepted by the market. Dress out fillets tend to be off-white, and often contain visible traces of blood while the internationally traded *Ictalurus* (USA) and *Pangasius* (Vietnam) catfish products that do not suffer from these poor dress-out characteristics. Clearly, to become a major aquaculture species, significant efforts will have to be made to develop a favourable product image that is acceptable to the consumer.

Status of existing infrastructure

The majority of catfish farmers operate small facilities that produce a few tons of fish per annum. While many of the operations are privately owned, there are some government funded facilities that produce small amounts of catfish for sale to local communities. There are currently no industrial scale facilities in operation, however there are a number of medium scale facilities that have been used to produce catfish (e.g H.D. Hill farm, KZN) that are no longer operational, and in various states of repair.

Geographical distribution

Using current technology, catfish culture is generally possible throughout most lowland areas of South Africa. However, as the optimal temperature for catfish culture is in the region of 28°C, the most thermally efficient areas to culture the species would be in the warmer areas of the country that experience warm summers and relatively warm winters - such as the Northern Province, Limpopo, Mpumalanga and Northern KwaZulu Natal.

1.2.1.4 *Carp and Koi Carp*

Carp production as a food fish is a marginal activity practised by small scale producers for food security. In contrast, there is a well established koi carp production industry that is based on the production of low and high value fish for the ornamental fish trade. The Koi Carp industry is characterised by a large number of small “back yard” producers, and a small number of major producers that produce the majority of the domestic market’s requirement. The South African Koi Trade Association (SAKTA) lists sixteen producers, of which only eight can be considered major suppliers. The major producers each farm in the region of 2-3 million fish a year. Of these fish, each farmer only retains 15-20% for sale and the remaining fish with poor colouration patterns are culled. Of the saleable fish 10% are premium fish sought by collectors, and the rest sold for the “pond market”. Prices range from R1 the cheapest pond fish to as much as R100,000 for show champions.

Farmers tend to specialise in the production of one or more of the 165 varieties of Koi Carp. The paucity of large producers means that many varieties are not available in South Africa, with those varieties that are not available in South Africa being imported from Taiwan or Japan. Clearly, with the production of more varieties in South Africa, there is scope for import substitution. With respect to markets, the SAKTA is currently seeing an increase in demand for fish – this is perceived as primarily a result of the general increases in wealth in the middle classes, and in particular, the rise of the black middle classes. In addition, it is anticipated that moves to declare the country is SVC disease free (currently being investigated) will once again enable access to the European markets, and most notably, the UK.

Status of existing infrastructure:

The existing infrastructure that services the koi carp industry comprises privately owned farms. The larger farms employ pond / tank / raceway based systems, while the smaller operators will predominantly use smaller tank systems. With respect to carp production as a food fish, there are a small number community-based government funded initiatives that are based on pond culture. In addition, there are old government funded research facilities that are no longer operational and are lying dormant. In the past, these facilities were used to promote technology development and supply seed to emergent farmers (including carp production).

Geographical distribution:

The environmental conditions for koi culture are good throughout much of the lowland areas of South Africa, and successful culture operations could be developed in all the provinces. Despite the potential the farmers report a paucity of good sites available to the industry – this is primarily an issue of access to suitable land and water.

1.2.1.5 *Ornamental fish*

The culture of ornamental fish and aquatic plants for the aquarium trade has a long history in South Africa. For many years the industry was dominated by hobbyists and backyard operators. However, recent years has seen a shift in focus to more established commercial farms that specialise in bulk production. The production technologies that are currently employed vary between semi-intensive flow-through systems using tunnel and pond grow-out, to super-intensive recirculating systems employing glass tank / tunnel and pond grow-out. Generally, as the super-intensive

systems are costly to install and maintain, they are used to cultivate the higher value species.

The international market for ornamental fish is worth about US \$4.5bn per annum, and growing at a rate of about 10-15% per annum. Europe, the USA and Japan are the main markets for ornamental fish. In most countries, the industry operates via importers that derive product from across the world. Generally, wholesalers buy from the importers and distribute to the retailers. The bulk of the world's wild caught fish originate from the tropical regions of South America, Africa and Asia. In many areas the supply of wild caught fish is dwindling or threatened – principally this is due to habitat change or over-fishing. The major areas where ornamental fish are reared commercially include South Eastern Asia, Florida and Eastern Europe. Florida is the hub for the trade on the North American continent - there are over 300 ornamental fish farms in Florida alone and many more fish are imported. A large proportion of the retail fish outlets are dedicated solely to selling ornamental fish.

The South African ornamental fish industry represents less than 1% of the international trade. Concomitant with the koi carp sector, the ornamental sector comprises large small “backyard” or “hobbyist” producers and a small number of large scale commercial producers. At present, the majority of the fish that are sold on the domestic market are imported, and the larger producers typically supplement their production with imported product, and are in effect market wholesalers. It is difficult to assess the numbers of fish that are imported, however it is estimated that approximately 300 boxes are imported a week (15,600 per annum) worth R1000 - R1200 each (R17 million per annum). In addition to the imports, it is estimated that local producers supply the market in the region of 40-50 boxes a week (N. Stallard, *pers com.*). It should be noted that while some of the species that are imported are technically difficult to culture, many require relatively simple culture techniques, and could easily be produced within SA - there is therefore the potential to promote import substitution in this sector.

Status of existing infrastructure:

Existing production infrastructure is primarily owned by the private sector, however a number of government funded demonstration fish farms and seed supply facilities that could be converted to ornamental fish production. At present, many of these facilities are no longer operational (Section 1.3.2). The Amalinda Fish Station in East London, formerly a Nature Conservation breeding station, has been converted into a Koi farm by the East Cape Development Corporation and is operated by ex-MK veterans. Research infrastructure supporting ornamental fish research exists at Stellenbosch, Rhodes and Limpopo Universities.

Geographical distribution:

Using current technology, ornamental fish farming can, and is, undertaken in all provinces in South Africa.

1.2.1.6 *Freshwater crayfish*

Freshwater crayfish (Marron - *Cherax tenuimanus*) was first imported into South Africa from Australia in 1984. The initial translocation to South Africa was a contentious issue as freshwater crayfish are not found on the African continent, and there are serious concerns over the potential ecological impacts of the species. Notwithstanding the conservation concerns, the initial production trials failed to live up to expectations, and

many of the pioneer farmers ceased production. Principal among the problems associated with the culture of the species was a poor understanding of the culture requirements, untested technologies, and the combination of the territorial and cannibalistic nature of the species with a low reproductive output.

In recent years a number of farmers have significantly improved the culture technology, and are now producing crayfish. Most notably, improvements in the breeding technology and advances in predator control has stimulated production which now stands at 30-40 tons per annum. While production techniques vary, they are primarily based around tank culture for the juvenile phase of production, and semi-intensive pond culture for the grow-out phase of the operation.

Status of existing infrastructure

It is difficult to ascertain the true extent of the South African freshwater crayfish industry as a growers association has not been established, and many farmers are unwilling to divulge their production volumes. Nevertheless, it is reported (A. Piers, *pers comm.*) that there are in the region of 20 crayfish farmers operating in South Africa. While the majority of these farmers are small scale or “backyard” producers, a number of the larger operators produce in the region of 10 tons per annum. The product is sold to the high end markets in the urban centres where prices for live animals are currently in the region of R180-190 / kg (A. Piers. *pers. Comm.*). With respect to the international markets, there is a lucrative European market for live product (most notably France) where prices in the region of R400 / kg can be attained. To date, the sector has failed to penetrate these international markets. The failure to access these markets is associated with the requirement to supply high volumes of product at regular intervals. In its current configuration, the industry is incapable of producing the require volumes to penetrate the markets.

Geographical distribution:

“Marron” is a cold water crayfish species, and so the industry is primarily based in the Western Cape. However, suitable conditions also exist in the Eastern Cape and Free State where there are a small number of farms in operation.

1.2.2 Marine species

1.2.2.1 Abalone

Abalone (*Haliotis midae*) farming was initiated in South Africa in the early 1990's, and by 1996, a number of small operators had entered the industry. The first 10 tons were produced in 1997, and production has grown steadily to 833 tons in 2006. At present, there are 15 active commercial farms in operation. The industry continues to grow, and during the 2003/4 period, MCM issued 19 permits to culture the species, and one permit to ranch. By 2007, permit numbers had increase to 24 indicating further growth of the sector. While most of the farms are located in the Western Cape - most notably along the South coast between Hermanus and Danger Point, and around Saldanha bay / St Helena bay area on the West coast; farms are also located as far North as Port Nolloth in the Northern Cape, and as far east as Haga-Haga in the Eastern Cape.

To date, abalone culture in South Africa has been developed as a land based activity that employs pump ashore technology combined with intensive flow-through or recirculation culture systems. Over the past 15 years, considerable efforts have been made to develop appropriate culture technologies for the species. Most notably,

research efforts have focused on issues pertaining to system design, reproduction, nutrition and the development of artificial feeds, and disease control. The reproductive cycle of the animals has been closed, and the technology for the artificial spawning of the animals has been developed. As such, spat are hatchery reared and grown out in tank systems. Spat are initially reared on algal films, and once large enough, they are weaned onto a macro algal or formulated diet (or a combination of the two). Typically, the abalone are harvested at a cocktail size ($\pm 80 - 90$ mm shell length), with grow-out periods ranging between 3-4 years. The majority of the farms have developed their own hatchery operations, and by 2000, eleven of the twelve farms that were in operation had their own hatchery.

Experimental abalone ranching, which involves the release of hatchery reared juvenile abalone into the wild, has been initiated at three sites on the Namaqualand coast (Port Nolloth), the Southern Cape (Rein's nature reserve) and in the Eastern Cape (Cape Recife). The abalone are left to fend for themselves, and harvested once they reach a marketable size. While ranching remains at the research and experimental stage of development, MCM is now considering the deployment of commercial permits to ranch in response to the catastrophic poaching of the resource. A commercial ranching licence has been applied for in the Cape Recife area in the Eastern Cape.

Status of existing infrastructure:

The abalone culture industry has obtained a “critical mass” of production and benefits from a well developed supporting infrastructure of services. This includes:

- HACCP certified processing facilities
- A pelleted feed for abalone produced by a dedicated abalone feed factory
- A air route for the live transport of abalone to Japan
- An abalone health management programme which employs a full time veterinarian.
- Significant production infrastructure on 14 established farms.
- Manufacturers of purpose built tanks, baskets etc. for abalone farming
- Engineering and other services specialising abalone farming.
- A South African Molluscan Shellfish Monitoring Programme through Marine and Coastal Management's laboratories.
- Significant research support via the Universities as well as on-farm.
- A well established producer association AFASA (Abalone Farmers Association of Southern Africa) which represents farmers collective interests.

Geographical distribution:

The natural range of the abalone is between the Mbashe river (Eastern Cape) and St. Helena Bay (Western Cape). Employing current technologies, the farms can be sited along the entire Northern and Western Cape coasts, and along the Eastern Cape coast as far as the Mbashe river in the former Transkei. The Mbashe River represents the most Easterly limit of the species range, and beyond this limit, water temperatures are too high for abalone culture.

1.2.2.2 Marine Finfish

The culture technology and pilot infrastructure for the production of South African marine finfish species has been established by two companies and commercial production is set to take off. Three species;- dusky kob (*Argyrosomus japonicus*), silver kob (*Argyrosomus inodorous*) and yellowtail (*Seriola lalandii*) are now produced in two

hatcheries and pilot commercial growout is underway both in sea cages and recirculating shore based systems.

In 1998/9, research into the culture of Dusky Kob (*A. japonicus*) requirements of the species was initiated at Rhodes University, and following successful preliminary research results, other laboratories and companies have joined the research efforts. To date, laboratory findings have been tested at a pilot scale, and since 2004, the technology has been commercialised. Crucially, the protocols for spawning, larval rearing, fingerling production, and the live transportation of fingerlings have been developed by Espadon Marine Ltd. and Irvin and Johnson (Pty) Ltd., and are now fully established. Grow-out studies under experimental culture conditions have been undertaken at Rhodes University, the results of which have spurred the development of the sector. Research on the nutritional requirements of kob that was initiated in 2002 by Hecht and Daniel (in press) is ongoing at Rhodes University. At this stage a generic 42% protein pellet is used by Espadon Marine Ltd, though indications are that 38% crude protein will suffice, and this would effect significant savings on feed costs, and reduce nitrogenous waste production. Aquanutro (Pty) Ltd – a leading aquafeed manufacturer - has expressed interest in manufacturing a Kob diet, and the research at Rhodes university is being undertaken to develop a kob diet for Marifeed (Pty) Ltd. Parallel work on the silver kob (*Argyrosomus inodorus*) has also been successfully concluded at the I&J abalone hatchery in the Western Cape, and they are now in the process of commercialising the technology. The company has also independently developed spawning and rearing technology for dusky kob, and can now also easily produce in excess of their requirements.

In 2005, the first commercial scale grow-out facility was established by Espadon Marine Ltd. in Johannesburg, and by early June 2006, the company had marketed the first 8 tons of product. While the company is currently the only commercial producer, a number of abalone farms, consortia and private individuals are now seriously considering entering the sub-sector – which is widely viewed within the aquaculture community as the next major prospect for aquaculture sector development in South Africa.

Status of existing infrastructure:

There are currently two commercial kob production facilities in the country. Both are located in the Western Cape - Espadon Marine (Pty) Ltd. operates a dusky kob facility in Hermanus and I&J operate a Silver Kob facility at Danger point, Gans Baai. While Espadon Marine (Pty) Ltd. has developed a land-based grow-out facility in Johannesburg, and is in the process of expanding this operation to a new site (G.Musson, *pers. com*); I&J have elected to develop cage culture operations. I&J are in the process of developing a pilot-scale cage culture operation (50t/ annum) in Algoa Bay (Eastern Cape) with the view that if the technology proves commercially viable, they will develop a full scale production facility (>1000t/annum) off Mossel Bay in the Western Cape.

Geographical distribution:

The Dusky Kob occurs on the east coast of South Africa from Cape Point to Mozambique, and is especially abundant between Cape Agulhas and KwaZulu Natal (Griffiths, 1996). Using current technology, it would be possible to grow the species along the entire South African coastline, and in inland areas using artificial seawater systems. However, recent research has indicated that the optimal culture temperature

for the grow-out of the species is 25°C, and therefore it is likely that most cost effective areas for grow-out would be along the KwaZulu Natal coast.

Scope for Growth in Marine Finfish Production

South African linefish species are well received in both local and overseas markets. Fishing companies such as Irvin and Johnson (Pty) Ltd. and Sea Harvest Corporation have over the years exported various fish products (frozen and fresh) and established recognised South African brands. The emerging marine linefish culture industry is poised to capitalise on this. To be a player in these markets, a volume of thousands of product is required, therefore marine finfish production is really the “next big thing” in South African aquaculture. Currently planned production capacity is for between one and two thousand tons within five years. If the current pilot projects are successful, and sufficient water for offshore cage culture of marine fish is granted to government, the way will be open for production to grow to the order of tens of thousands of tons within 5-10 years.

1.2.2.3 Oysters

Oyster farming represents the earliest recorded mariculture activity in the country. While the first attempts to culture indigenous species were made between 1673 and 1676, it was only in 1948 and the establishment of the Knysna Oyster Company that commercial operations proved successful. Due to problems associated with the culture of the country’s indigenous species, the industry has focused on the culture of the pacific oyster (*Crassostrea gigas*). Oyster production has been fairly stable despite a reduction in production from 250 tons in 2003 (Brink 2003), to 202 tons in 2006 (MCM statistics). There is renewed interest in the sector due to high market demand, and a degree of consolidation among the existing farms. One operator is currently developing a large sea-based culture operation in Algoa Bay in the Eastern Cape. During 2003 / 4, Marine and Coastal Management issued 13 permits to cultivate *C. gigas*, and an additional 9 permits to cultivate indigenous oyster species. By 2007, the number of permits to cultivate *C.gigas* had increased to 18, while the number of permits to culture indigenous species had reduced to 6. Oyster production is limited to the Northern, Western and Eastern Cape provinces.

Oyster production in South Africa is undertaken in both estuarine and marine environments. Oysters are excellent culture animals, attaching to almost any hard surface in sheltered waters (estuaries or bays) in the inter-tidal and shallow sub-tidal zones, to a depth of about three meters. The species has a high rate of growth and reproduction, and tolerates a wide range of environmental conditions. It is valued highly by the seafood industry, and as long as it has access to flowing seawater, it feeds itself on the suspended organisms and nutrients in the water column around it. With respect to the indigenous species, there are no farmers actively spawning these species, however, their permits are often used to enable the farmers to handle and in some case grow-on, and sell wild caught animals.

The majority of producers import their spat from either Chile, France or the United Kingdom. Spat production is currently limited to just one producer. A number of grow-out technologies have been adopted, these include rack culture, Japanese long-line technology, ponds culture (on trays) and onshore tank systems.

Status of existing infrastructure:

The existing farmers in South Africa primarily use rack culture techniques in estuarine environments or decommissioned mining pits. The high energy nature of the marine environment makes it difficult to deploy structures in the intertidal areas. Nevertheless, it has been possible to develop longline operations in sheltered bay areas such as Port Elizabeth and Saldanha Bay. In addition to the grow-out operations, many producers operate small land based purging and holding facilities (tank facilities) that are used to hold and condition the animals prior to transportation to market.

Geographical distribution:

Oyster culture is possible throughout the Northern and Western Cape provinces. In the Eastern Cape, the most westerly farm that is currently in operation is at Hamburg in the former Ciskei. Rouhani (2002) surveyed the former Transkei coast and indicated that there was limited potential to farm oysters in the region. While the high energy nature of the coastline precludes the development of sea based culture, some of the estuarine environments were deemed to possess potential, these included Nqabara and Xora estuaries. It should however be noted that farming oysters in this region can at best be considered marginal – the increased levels of precipitation that are recorded along the East Coast can negatively affect juvenile production. Finally, the higher sea surface temperatures (particularly towards KwaZulu Natal) inhibit production further north.

1.2.2.4 Mussels

Mussel production in South Africa is a relatively recent innovation that was initiated in the mid 1980s. The industry is located at Saldanha Bay in the Western Cape Province, where the authorities have allocated three hundred hectares of the bay to mussel culture. Initially, the industry expanded rapidly, and in 1989, approximately 1,800 tons were produced (Hecht and Britz, 1990) but low market demand resulted in unsold stock. Subsequent years has seen a drop in production and by 2003, reported production had dropped to 900 tons (Brink 2003), and by 2006, production had fallen again to 542 tons. During the early years, production focused on three species – the exotic Spanish mussel (*Mytilus galloprovincialis*), and the indigenous black and brown mussels (*Choromytilus meridionalis* and *Perna perna*). Recently, production has shifted towards *M. galloprovincialis*, and the contribution from the local species to annual production has declined to insignificant levels. In 2003 / 4, MCM issued 4 permits to culture *M. galloprovincialis*, 4 permits to culture *C. meridionalis*, and 2 permits to culture *P.perna*. By 2007, a further three permits were issued for the culture of *M. galloprovincialis*, while the number of permits issued for the indigenous species remained static.

Mussel production in South Africa is based on the Spanish raft system. The system comprises a series of off-shore floating rafts beneath which ropes are suspended. Natural settlement onto the ropes provides the seed-stock that is then sorted during the harvesting process. Harvesting is undertaken once the animals reach a marketable size of 55 – 100mm shell length.

Status of existing infrastructure:

A well established mussel farming infrastructure exists at Saldanha Bay. Water inside the breakwater has been zoned for aquaculture by Portnet, service barges and

wharfage are available, a HACCP compliant processing factory exists at Veldrif, and a good transport and service infrastructure is in place for the supply of fresh and processed mussels to the major urban centres.

Geographical distribution:

Over recent years the distribution of the cultured European mussel (*M. galloprovincialis*) has changed. The species was first recorded in 1984 in Saldanha Bay, and has since moved up the west coast as far as Luderitz in Namibia and south, down to Cape Point. By the early 1990s, it had expanded its range along the coast as far as Port Alfred in the Eastern Cape (SANBI, 2004), and has subsequently moved further East along the former Transkei coast. With respect to the potential to culture the species, it would theoretically be possible to culture it throughout its range. However, the high energy nature of the South African coastline suggests that it can only be viably cultured in the more sheltered areas of the coastline. Thus, it is likely that farms would be limited to the larger bay areas such as Saldana bay, St Helena bay, and Port Elizabeth.

1.2.2.5 Prawns

Prawn culture operations were first initiated on the Amatikulu River estuary in 1991. Initial attempts to culture the tiger prawn (*Penaeus monodon*) proved unsuccessful, and production was switched to the indigenous white prawn (*Penaeus indicus*). Due to the high ambient water temperatures required for prawn culture, the industry was restricted to the Northern Coast of Kwa-Zulu Natal. Until recently, the sub-sector was restricted to a single producer (Amatikulu Holdings (Pty) Ltd) who developed a hatchery and two grow-out sites at Amatikulu and Mtunzini. Production figures reveal that in 2003, the operation produced 130 tons of product. Unfortunately in 2004, the farms ceased operations. There were a number of factors that attributed to the closure of the operations. Primary amongst these were the strength of the Rand, and the poor price of shrimp on the local and international markets. In addition, the profitability of the farms (and hence their ability to absorb global price and currency fluctuations) was directly affected by the size of the operations and the production technology that was in use. It is probable that improvements in production technology and the development of production based economies of scale could resurrect the operation, and once more, ensure the economically viable of the venture.

Status of existing infrastructure:

The former prawn farms at Mtunzini and Amatikulu are no longer operational, and the original hatchery and 24ha of ponds remain underutilised. Nevertheless, over the past couple of years there have been proposals to develop both sites using new high density culture technologies. While there is certainly scope for these developments, to date, these projects have as yet failed to yield results. In contrast, at the Coega IDZ in the Eastern Cape, a pilot prawn farm based on the Pacific White Prawn (*Litopenaeus vannamei*) is currently undergoing production trials. Production is based on bio-secure high density raceway culture under thermally controlled conditions. To date, unconfirmed reports suggest that the pilot project has proved a success, and that the developers (SeaArk Africa (Pty) Ltd) are initiating the Environmental Impact Assessment for the up-scaling of the project. Initial reports suggest that should the full

project be implemented, the development's footprint will cover 663 ha, and lead to the creation of 7-10,000 employment opportunities.

Geographical distribution:

While ambient temperatures restrict traditional semi-intensive open pond prawn culture to the northern coast of KwaZulu Natal, there have in recent years been technological breakthroughs in high density bio-secure production. High density culture using active and passive thermal regulation systems enables farms to be located beyond the natural distribution of the species, and thus theoretically, the application of this technology opens all coastal regions to this type of activity. In addition, in combination with novel technologies that use saline ground waters as the water source, the activity need no longer to be restricted to the coastal zone.

1.2.2.6 Seaweed *Gracilaria* and *Ulva*

Seaweed (*Gracilaria* and *Ulva* species) is cultured on abalone farms in South Africa as abalone food. Pilot scale of *Gracilaria* cultivation for agar extraction, which was attempted in Saldanha Bay and St Helena Bay employing simple rope and raft culture, had ceased by 2006 due to environmental and permitting problems. Three abalone farms culture *Gracilaria* and *Ulva* as abalone feed in their nutrient rich farm effluent waters and reported production of 664 wet tons in 2006. These systems have the advantage that they strip nutrients from the farm effluent waters, and provide an additional food source for the abalone. The nutritional quality of the cultured seaweed is superior to that of wild harvested kelp and supplementation with it boosts abalone growth rates (Troell, et al 2005).

Geographical distribution:

Gracilaria verrucosa is a naturally occurring seaweed that is found along the entire Western Cape coastline and east along the Southern Cape coastline as far as East London. Technically, it would be possible to culture the species throughout its natural distribution. However, due to the high energy nature of the coast and the difficulties associated in placing production structures in the water, it can only be commercially grown in sheltered bay areas (e.g. Saldanha bay, St Helena bay, and Port Elizabeth) and in shore based operations – using waste water from other aquaculture activities, for example, the waste waters from abalone farms. *Ulva* is a widespread species along the entire coast.

1.2.3 Potential aquaculture species

1.2.3.1 Salmon

For the past 14 years, Salmo Salar Sea Farmers (Pty) Ltd. have been attempting to initiate cage farming of Atlantic Salmon in Gansbaai. The project was privately funded by a Norwegian investor with experience in cage aquaculture. Salmo Salar Sea Farms (Pty) Ltd planned to import standard salmonid culture technology, and market their product locally. In 2005, the company estimated a local demand for fresh salmon to be approximately 700 tons p/a. This was expected to grow to 7000 tons in the future as the eating culture of South Africans changes. It was anticipated that the salmon would be marketed directly to the retailers. The company estimated a production cost of

R20/kg. Furthermore, they predicted that due to the high regional sea temperatures salmon farming in South Africa will have a significant competitive advantage over other areas of production - growth rates of 4kg/year could be achieved locally as opposed to 3kg/year in Norway. Ideal conditions for salmon farming exist from Cape Town to Mossel Bay. Harmful algal blooms present an excessive risk on the West coast. According to the company, the factors limiting salmon production in South Africa will be: fresh water facilities for smolting juveniles and the poor quality of locally manufactured feed and fishmeal. Unfortunately, in 2006, the farm ceased operations due to technical problems with their sea cages and to date, there is currently uncertainty as to the future of the enterprise.

1.2.3.2 Tuna

In recent years, significant advances tuna mariculture in Australia (Tasmania) and the Mediterranean has made the sub-sector an economic reality. At present, Stellenbosch University is pioneering a project that combines several internationally established technologies for utilizing our indigenous tuna stocks more effectively - the local long-line tuna fishery is struggling as a result of the strong rand, international price fluctuations and unsustainable fishing practices. Much of the tuna captured locally is either frozen or canned, and as such, receives a poor price at the marketplace.

Tuna farming is essentially a short-term value adding process. Schools of big-eye (*Tunnus obesus*) and yellowfin (*Tunnus albacares*) tuna are sighted by airplane. The tuna are purse seined or caught with rod and line and transferred to floating cages. The cages are towed to offshore sites within serviceable distances from the shore, and are either moored to the substrate or maintained in position with boats. The fish are maintained in captivity so that they can be harvested at periods of high market demand. During the captivity period, the fish are fed high-fat diets to improve their fat content. Once optimal market conditions prevail, the fish are delivered to the Japanese sashimi / sushi markets.

An alternative technology involves the use of floating platforms from which net cages are suspended. The platforms are self propelled, allowing them to escape poor weather conditions. The concept is that tuna caught on rod and line (from the platforms) are stocked into the cages.

1.2.3.3 Other potential indigenous species

The potential to culture a number of other marine species are currently under investigation at government, university and private facilities. Amongst these are broodstock experiments that are being undertaken at on white stumpnose (MCM), red roman and geelbek (Espadon (Pty) Ltd), yellowtail (Espadon (Pty) Ltd and I&J), and sole (Rhodes University). To date, various degrees of spawning success have been achieved with these species.

Another potential culture species is the cobia (*Rachycentron canadum*). The Cobia is an indigenous fish that occurs globally in the tropical ocean environment. The production technology for cobia is well established, and the fish have proved suitable species for cage culture off the coast of Taiwan. Recent trials in the South-Eastern United States have demonstrated that juveniles can be grown to a weight of 400g in ponds, and there is some prospect for production in raceways. The species performs

extremely well in open ocean cages, growing to more than 8kg in a single year. This is significantly better than the red snapper (*Lutjanus* sp.), or red drum (*Sciaenops ocellatus* - similar to cob). With respect to markets, the current farm gate prices for Cobia are approximately US\$6-8 /kg, and there is an established market for cobia sushi in Japan. The fish produces a clean white fillet with a high lipid content that is well suited to processing.

1.3 Infrastructure

Concomitant with other emergent industrial sectors, basic infrastructure and services are required to promote the development of the sector. While the sector-specific infrastructure that is required for each aquaculture sub-sector, and its current status is outlined in Section 1.2; this section investigates the more general infrastructure requirements that are required to promote sector development, the current status of government funded facilities, and introduces the concept of developing sector specific infrastructural interventions through the introduction of development nodes.

1.3.1 General Infrastructure

In general, South Africa has excellent basic infrastructure to support the development of the sector. In comparison with other SADC states, South Africa has an excellent transport and logistical infrastructure, telecommunications, and power generation networks. Industrial support capacity in terms of suppliers to the industry is also well advanced and includes the necessary feed supply networks, feed mills, plastics, manufacturing and construction capacity.

1.3.2 Government funded infrastructure

As with the other agricultural sectors, the South African government has a long history of implementing initiatives that have been designed to develop the sector. These initiatives have resulted in the development of infrastructure, some of which is currently to greater or lesser degree available to the industry. Historically, government led interventions have focused on the development of government run research and development facilities, facilities to provide fingerlings to emergent farmers, and finally, university research groups.

1.3.2.1 Government funded facilities

Government funded facilities to promote aquaculture represents an important resource that can be used to develop aquaculture. In the freshwater arena, there remains considerable, and often redundant capacity, at the old provincial hatcheries and R&D facilities that were originally set up by the nature conservation authorities to produce exotic species for angling purposes; and in the former homelands, where hatcheries were developed to supply fingerlings to rural farmers. In contrast, in the marine sector, the facilities are restricted to Marine and Coastal Management's Sea Point Aquarium. In addition, there are also the country's two major commercial aquarium's that while not strictly government funded, represent significant infrastructure that could be utilised by the industry.

Freshwater facilities

Rouhani and Britz (2004) undertook a baseline survey of the current status of the country's government funded farming projects and associated research and seed supply facilities. It was established that of the eighteen provincial / government funded facilities, only seven remain operational, and the remaining eleven are at present not operational (Table 2). Essentially, those government funded facilities that have not been privatised are no longer functioning, and there are therefore no government funded facilities that are producing fingerlings for the stocking of rural aquaculture projects or water bodies.

Table 2. Provincial and Government funded aquaculture facilities (Rouhani and Britz, 2004).

Facility	Operational Status	Purpose	
		Original	Current
Western Cape			
Jonkershoek Hatchery	Yes	Fingerling	Fingerling
Eastern Cape			
Amalinda Hatchery	Yes	Fingerling	Private
Umtata Hatchery	No	R&D and Fingerling	No Function
Tsolo College of Aquaculture	No	R&D and Fingerling	No Function
Pirie Hatchery	No	Fingerling	Private
Mabeleni	Yes	Fingerling	Private
KwaZulu Natal			
Makatini Research Centre	Yes	Research	Research
Nagle Dam Hatchery	No	Fingerling	No Function
Cambrey Trout Hatchery	No	Fingerling	No Function
Royal Natal Parks Hatchery	No	Fingerling	No Function
Underberg Trout Hatchery	No	Fingerling	No Function
Limpopo Province			
Dzindi Fish	No	Fingerling	No Function
Tompi Seleka College	Yes	Training	Training
Turfloop Breeding Station	No	Fingerling	No Function
Mpumalanga Province			
Lydenburg Fish Production	Yes	Fingerling	Table Fish
Marble Hall	Yes	Fingerling	Fingerling
De Kuilen	No	Fingerling	No Function
Orange Free State			
Gariiep Dam Hatchery	Yes	R&D and Fingerling	R&D and Fingerling

While those facilities that have not been privatised are in various states of disrepair, many have potential to be resurrected. Clearly, while restructuring would be site specific, there is potential to develop many of the sites once more as either fingerling production facilities to supply small-scale rural farmers, research and training facilities, or as privatised fish farms. An initiative to revitalise the provincial aquaculture hatcheries, commissioned by the Water Research Commission in partnership with the National Department of Agriculture, is currently underway facilitated by Rhodes University. This forms part of the implementation of a national aquaculture policy drafted by the National Department of Agriculture.

Mariculture facilities

Marine and Coastal Management's Sea Point Aquarium

The primary research facility for finfish mariculture in the country is Marine and Coastal Management's Seapoint Aquarium. The aquarium represents a dedicated research facility, and has some of the best facilities available to scientists in the country. While the facilities are fully operational, and have been used to assist industry in the development of dusky cob mariculture, it has remained understaffed, and in many respects, the facilities have been underutilised. Nevertheless, Marine and Coastal Management have taken cognisance of this issue and in recent months have been actively recruiting suitable scientists to operate within the facility.

1.3.2.2 University led research and development facilities

There is significant infrastructure and capacity at the country's tertiary institutions, Rhodes University has the strongest aquaculture research capacity. The Department of Ichthyology and Fisheries Science has worked with a wide variety of species, and was responsible (in collaboration with UCT) for the development of abalone culture technology. The department works in close collaboration with the Departments of Microbiology and Pharmacy, and has developed close ties to research institutions world-wide. The Department also works closely with the Institute for Aquatic Biodiversity in Grahamstown (SAIAB - formerly the JLB Smith Institute). In addition to a number of small labs on the Grahamstown campus, the university has a (basic) marine research facility at Port Alfred (60km away).

The aquaculture division at Stellenbosch functions in an interdisciplinary way - through the participation of various departments from the faculties of natural sciences, agriculture and forestry sciences. Traditionally focused on freshwater research (particularly trout genetics and the development of sex reversed tilapia (including YY genotypes), they have increased their capacity in mariculture research. The post harvest technology centre has capacity in terrestrial meat science. This facility can be used to assist mariculture by improving product quality, adding value to waste products, and developing mechanisms with which to improve product quality (effect of stress, season, vaccine residue, etc.), accessing new markets, improving cold chains, HACCP capacity, and leverage for small scale fisheries.

Other tertiary institutions that have infrastructure and capacity that can be utilised by the sector include the University of Cape Town (seaweed mariculture research - Department of Botany). The University of Potchefstroom (animal physiology), the University of the North (freshwater aquaculture) and the University of Natal (Seaweed biotechnology).

In addition to the tertiary institutions, the Institute for Animal Production, Western Cape Department of Agriculture, has experience in freshwater aquaculture extension. In recent years, it has increased its involvement in mariculture - through the provision of veterinary support services and cooperative work with Universities.

1.3.2.3 Miscellaneous commercial facilities

South Africa has two large-scale commercial aquaria, viz, Two Oceans in Cape Town and Ushaka Marine Park in Durban. Both these facilities have the potential to play an

important role in the development of breeding technology for indigenous species. The Two Oceans aquarium is home to a variety of commercially important species which are maintained under simulated natural conditions. Several species spawn prolifically at the aquarium. These include yellowtail, musselcracker, cob, geelbeck, white steenbras, Cape and white stumpnose. The display tanks are fitted with egg collection devices. The large tanks can accommodate large adult specimens, and offer scientists an opportunity to observe spawning behaviour.

The aquarium has an open policy toward mariculture companies - so long as that openness is shared with the aquarium and others in the mariculture industry. In addition, prospective farmers are given access to eggs produced by the fish. The aquarium is well positioned to collect broodstock from the wild - they have developed an experienced team of aquarists and have excellent facilities.

The priority of the Two Oceans aquarium is to fill its exhibits. For certain species this is only possible through captive breeding. The aquarium has a small but sufficient larval rearing facility that is used to rear eggs collected from the display tanks. The facility is not used as efficiently as it could - due to insufficient personnel and time. Better use could be made of the facility if a dedicated scientist were involved. However, in its present form, the aquarium is an excellent facility for the screening of potential species for aquaculture. The facility cannot however be used for establishing aquaculture techniques as very little intervention - such as improving the nutrition of the feed or manipulating environmental conditions - is possible.

The Ushaka marine park and the associated South African Marine Biological Institute in Durban, act in a similar way to the Two Oceans. Scientists have developed breeding techniques for marine ornamental fish species and soft corals for display purposes, which has resulted in a commercial pilot project supported by Eskom.

1.3.3 Infrastructural Requirements - Development nodes

A major constraint to aquaculture development is recognised as site availability, both on land and in the sea. It can take years to rezone land for aquaculture activities, and in the sea there is no legal instrument for zoning offshore areas for aquaculture. A key intervention by government should thus be facilitated access to suitable sites to stimulate investment into the sector. For various economic and environmental reasons, the establishment of aquaculture “development nodes” or “development zones” which are analogous to industrial parks has been accepted within various policy documents as being an efficient way to promote aquaculture sector development.

The only readily accessible water for sea based aquaculture are the areas within the jurisdiction of Portnet which has total control of all activities in the waters surrounding its ports. Portnet leases water for aquaculture at Saldanha Bay and Port Elizabeth. However, deeper water is required for cage aquaculture of fin fish, and other bays such as St Helena Bay are suitable of seaweed culture. There is currently no policy or procedure for acquiring water outside the Portnet areas for aquaculture purposes, which is a major constraint to investment. At present parliamentary approval is required for zoning of sea space for aquaculture outside of the Portnet areas of jurisdiction. An important legislative step forward is the impending enactment of the Coastal Zone Management Bill which will empower the minister of Environmental Affairs and Tourism to zone sea areas for aquaculture. To facilitate the rational development of the aquaculture sector and minimise conflicts with other activities, government should

facilitate the zoning of sea water areas for aquaculture. This would include a strategic environmental assessment (SEA) to determine where best to site aquaculture zones, as well as parliamentary approval of such zones. Site specific environmental impact assessments (EIA's) will also be required for each operation, which could also be facilitated by government as these are a major constraints to setting up an aquaculture venture, particularly a small or medium size one. The East Cape Development Corporation has made a start by commission a SEA to identify suitable offshore aquaculture sites in the Eastern Cape Province.

With respect to land based aquaculture, access to land that has sufficient suitable water resources (fresh or sea water) for large scale production may also be difficult to acquire. Even if the financing for a land-based operation is in place, finding suitable sites reasonably close to market exit points is often costly and difficult - this is particularly true for mariculture operations as a premium is placed on coastal land in South Africa. Furthermore, finding suitable land is no guarantee that it may be used for the project, and the process for having a site rezoned for aquaculture use is relatively complex, and at the very least will require a costly Environmental Impact Assessment (EIA). Thus availability of zoned land with access to water and a basic service infrastructure is a key to attracting investment.

The “development node” concept is a potential approach that that has been indorsed by Marine and Coastal Management’s policy on mariculture development (MCM, 2006), as well as the Department of Agriculture’s fresh water aquaculture policy (referred to as “aquaculture development zones”). The concept is to create an environment which is conducive to establishing viable mariculture businesses, and developing technologies that could add capacity to the industry. The basic concept involves some form of partnership between the private and public sectors to set up a mariculture site - probably around an anchor mariculture operation, where all the regulatory and land use issues have been taken care of, and the core infrastructure has been put in place. This site would act as a node to which other mariculture and support industries would be attracted. Benefits accruing from the proposed clustering of mariculture projects into nodes would include:

- Readily available, partially developed sites, which would minimise land preparation costs;
- Basic on-site infrastructure (electricity and other municipal services);
- Ready access to a source of seawater or fresh water;
- Lower individual operating costs - through shared resources, marketing and support services, and thereby achieving economies of scale;
- On-site expertise, in the form of scientific support or practical experience from the other operations in the park;
- On-site staff training programmes supported by R&D personnel;
- A limited requirement for an environmental impact assessment (EIA), since a general assessment would have already been conducted for the park.

A number of aquaculture development nodes already are under development. The “Namaqualand Mariculture Park” under development by the Northern Cape Provincial government in partnership with the Port Nolloth Municipality is the first example of dedicated aquaculture development node. It is expected that the intervention that will have a positive effect on the growth of the mariculture sector in the Northern Cape. The industrial land around the New Harbour at Hermanus has all been taken up for abalone aquaculture and forms a *de facto* aquaculture park. Aquaculture ventures have been established in the Industrial Development Zones at Coega an the East

London West Bank. Other potential sites indentified as marine aquaculture development nodes include Kleinzee in the Northern Cape Province, Toothrock and Saldanha Bay in the Western Cape, and the Amatikulu site in Kwa-Zulu/Natal. Mossel Bay (Western Cape) and Richard's Bay (Kwa-Zulu/Natal) also have promise for the development of mariculture nodes, although no specific sites have yet been identified.

In the freshwater arena, no sites for “aquaculture development zones” (ADZ's) have as yet been identified, however it is expected that some of the old state run hatcheries such as Dzindi and Turfloop (Limpopo) and Lydenburg (Mpumalanga) could be developed into ADZ's.

The development of sites and infrastructure of development nodes/ zones is essentially a provincial competency which requires technical and financial support from a national level.

1.4 Quality standards and readiness status

South Africa is well prepared in terms of its institutions and programmes to comply with international product health standards as applicable to aquaculture. Although South Africa may not currently export shellfish products to the EU, a South African shellfish monitoring programme has been set up under supervision of the SABS which will open the way to EU certification of shellfish exports.

1.4.1 SABS

The South African Bureau is accredited as the competent authority to audit the application of standards (mainly HACCP and ISO standards) for the export of products to the European Union and other countries. It also issues “health certificates” for products such as abalone which are exported to Asian countries.

1.4.2 HACCP and ISO standards

The SABS is responsible monitoring and auditing the application of the HACCP (Hazard Analysis Critical Control Point) standard which guarantees the health of food products through the whole production process from the “farm to the fork”. In the case of aquaculture the SABS certifies live, fresh, frozen and canned products and the HACCP process includes the entire production process from the live production tank/ cage to the processing plant to the buyer. The SABS has negotiated an auditable aquaculture CODEX of on farm practises acceptable to the EU which it uses for the application of HACCP in aquaculture. The SABS makes use of agents such as Marine and Coastal Management and the state veterinarians to provide guarantees in respect of specialised analyses such as the monitoring of shellfish toxins and anti-biotic residues in fish.

No farms currently subscribe to ISO standards such as the ISO 14000 standard for environmental sustainability, however, the aquaculture CODEX covers most aspects of environmental sustainability of aquaculture.

1.4.3 South African Molluscan Shellfish Monitoring Programme

An EU ban on South African shell fish (mussels, oysters and abalone), imposed because South Africa did not have an EU accredited water quality monitoring programme, prompted the establishment of the “South African Molluscan Shellfish Monitoring Programme” some years ago. Marine and Coastal Management, as the appointed agents of the SABS responsible for implementing the programme, which comprises the inspection of aquaculture facilities and collection of water samples for various analysis including phytotoxins (from red tide algae), microbiologicals, heavy metals, PCB's etc. The programme is inspected and audited by the SABS. The responsibilities of MCM are contained in a memorandum of understanding with the SABS which specifies what guarantees MCM is expected to provide in terms of product health. An inspection of the programme was carried out by the EU in 2005, and once certain aspects have been finalised it is expected that the EU will allow the export of certain South African shellfish products. There appear to be no particular obstacles to exporting fresh and processed products, however, the export of live products (such as abalone) is seen as problematic as the EU is becoming increasingly concerned about the transmission of diseases and parasites associated with live animals.

Section 2 Market Analysis

Forecasts of global demand for fishery products suggest that aquaculture output will continue increasing to meet the projected demand. Most capture fisheries are at or near their limit of close to 100 million tons. Demand for food (and food fish) is primarily determined by four variables: demography, living standards, urbanization and price. Global consumption of fish as food has doubled since 1973 (from 45 million tonnes to over 90 million tonnes) due to population growth and increases in per capita consumption (from 12 kg/year to 16 kg/year). Global fish production is projected to increase from 93.2mmt in 1997 to 130.1mmt in 2020. During this period, over two thirds of the projected 37mmt increase in production will come from aquaculture, which by 2020, will represent 41% of global food fish production (Delgado et al., 2004).

Fish consumption in Africa is relatively low (6.7 kg/year), and population growth, urbanisation and income induced demand are expected to increase the size of the market for fishery products (Brugère and Ridler 2004). It is projected that Sub-Saharan Africa will increase total imports from 54,000mt in 1997 to 429,000mt in 2020. The region will continue to import low value finfish and export high value finfish, crustaceans and fishmeal. By 2020, high value fin fish exports will be 40% of their current levels – due to declining fishery harvests -, and the importation of low value finfish will have nearly doubled.

The only way in which more fish can be produced regionally is by enhanced aquaculture production. The recent FAO country surveys of aquaculture in sub-Saharan Africa (SSA) revealed that commercial aquaculture is taking off spontaneously in many African countries in response to rising fish prices (Hecht, 2006). The FAO surveys do indeed reveal a sharp increase in the price of fish with an average prices of \$1.92 (Range \$0.86 – \$4.60), in the southern African countries (Hecht, 2006). Total aquaculture production in the 17 target countries between 1998 and 2003 had increased by 61% from 44,962 mt to 72,334 mt equivalent to only 2.03% of the total fisheries yield (3.6 million mt). It is projected aquaculture production will rise of this low base to between 208,600 and 380,400 mt per annum by 2013 (Hecht, 2006).

South Africa is particularly well placed to take advantage of aquaculture production opportunities in both the local and export markets for fish products due to its well developed infrastructure, institutions and small but established aquaculture production sector. The main opportunities are for the production of high value products for import substitution on the local market and for export into niche markets overseas.

An overview of the market conditions and opportunities for South African aquaculture products is provided below.

2.1 Freshwater aquaculture

2.1.1 Local markets

South Africa is not a traditional fish eating nation. There is not a strong fishing tradition amongst most of South Africa's indigenous people - as is the case in much of the rest of Africa; and descendents of the colonial cultures generally do not regard indigenous fresh water fish species as desirable for consumption. Consequently, demand and price for indigenous fresh water species such as tilapia and African catfish is low

making aquaculture generally non-viable. An exception is the introduced trout species which has excellent flesh quality and is part of the traditional British/ European fish eating culture that has been adopted in South Africa.

Anecdotal evidence points to an untapped urban black market which will readily buy fresh water fish if the price is low (less than R15-20/kg). The growing population of African immigrants from other traditional fish eating countries (Nigeria, Mozambique, Malawi, Zaire etc) knows and places a premium on good quality fresh water fish species such as tilapia and catfish. The key to these markets is low cost production, and/ or more efficient distribution and marketing. Market research is needed on the scope of the urban black market for fresh fish.

Trout

The local market for large scale freshwater aquaculture products is mainly restricted to trout at present for which local production has been relatively stable over the last decade. This is in part due to the very restricted suitable environmental conditions for trout culture in the higher lying regions of the country with clear, cold flowing streams year round. The market for salmonid products (trout and salmon), particularly fish larger than 1.5kg, is considerably larger than what the local industry can supply, and consequently there is a growing importation of Canadian / Alaskan “B” grade and Norwegian / Chilean “A” grade trout as well as wild and cultured salmon.

Local demand for trout and salmon is thus expected to grow steadily with the trend to eating more high value fish. The ability of the local industry to increase local production is constrained by the environment, however, opportunities do exist for limited expansion of fresh water trout production in cool water dams, particularly in the Eastern Cape Province. A major trout farm is currently under development in the Katse Dam in Lesotho which will also boost local supply. Due to the established demand for trout, any expansion of local production should find a ready local market.

Tilapia

Tilapia is not well known in the local market, but it is likely that imports of tilapia, both frozen fillets and whole fresh fish, will increase due to the growing local demand for quality fish products and the ready availability of tilapia internationally. The ability of local producers supply tilapia competitively to the local is questionable due to:

- The low cost of tilapia production in China.
- The low winter temperatures in South Africa restricting production of these warm water species to the summer months.
- The relatively slow growth rates of indigenous tilapia species.
- The relatively high cost of producing tilapia in high intensive, temperature controlled recirculating systems.
- The availability of high quality, fresh tilapia from regional African producers such as the Lake Harvest operation in Zimbabwe.

Possible opportunities for local production of tilapia include:

- The direct sale of whole fish into the urban black market.
- High quality, large fresh Nile tilapia (if permitted where this fast growing exotic species already exists) produced in intensive temperature controlled systems into the restaurant trade and fresh fish counters of supermarkets.

Catfish

There have been two waves of investment in the late 1980's and post-2000 into large scale African catfish culture in South Africa. In both instances production has risen and then collapsed due to inability of the producers to market their product at a price higher than their production costs. South Africa has an almost unlimited environmental capacity to produce catfish but the product is largely unknown in the market place, and the redish (bloody) appearance of the fillet and the strong flavour of the fresh meat problematic. The product lends itself well to value adding, but the pushes up costs considerably and to date no producers have been able to create a substantial and sustainable market niche. Producers who invested in the post-2000 catfish boom were hoping to export catfish to Asia but a strengthening rand made exports unviable.

There is a potentially untapped black urban market for fresh, live catfish, provided the price is low (ca. less than R20/kg) and a distribution network is established. African immigrants from Nigeria, Zaire and other countries will readily buy catfish which is a traditional dish. In Nigeria, farmed catfish is now a major source of fresh fish (production ca. 35,000 ton/annum) and it is marketed live, whole for an average of US\$4.50/kg.

Marron Crayfish

Freshwater marron crayfish production is growing (ca. 30-40tons in 2006) and is sold into the up market restaurant trade. The product sells for R180-190/kg into this limited but profitable niche market. The product has export potential but the export of live crayfish is problematic due to diseases and parasites associated with freshwater crustaceans.

Ornamental fish

There is an estimated local market for ornamental fish worth ca. R22 million per annum of which local producers only supply and estimated 14%. Therefore there is a good opportunity for import substitution. It is expected that the application of the National Environmental Management: Biodiversity Act will make it increasingly difficult to import ornamental species and will create further demand for locally produced fish.

Ornamental Koi carp production in South Africa is very successful and the market is growing steadily. Increased middle class spending power and investment in homes and gardens should sustain the demand for koi carp. Export opportunities for koi carp have been developed but the presence of the SVC virus has resulted in a three year ban on exports. Provided the virus does not re-emerge during this period, a significant export market will again open for local producers.

Carp

The production of common carp for food effectively suffers from the same problems as African catfish. While the environmental capacity for carp production is large, it is not a traditional fish product and the bony flesh is a deterrent to consumers. Fresh fish are readily accepted in the informal market but at a low price (ca. R10-15/kg). An opportunity for marketing fresh, whole fish into the urban market exists but market research is required.

2.1.2 International markets

2.1.2.1 Finfish

Over the past 15 years, the emergence of tilapia as an internationally traded commodity has stimulated producers to invest in the species. In addition to the existing markets in the traditional tilapia growing countries (principally South East Asia, Latin America and Africa), significant new markets have been established in the USA and to a much smaller extent the EU. In the USA, tilapia markets have grown from less than 4,000 tons in 1992 to 158,000 tons in 2006. In contrast, while market penetration in Europe remains fairly limited, it has expanded rapidly from 1,917 tons in 1996 to 10,000 tons in 2006 (Globefish, 2007a,c).

Traditional tilapia markets have been dominated by three product types, *vis*, frozen whole, frozen fillets and fresh fillets. In recent years, the fillet markets have remained buoyant and in many markets have increased their market share at the expense of frozen whole fish. New value added product lines (e.g breaded, spiced) originating from China have dramatically changed the marketing landscape. Indeed in 2006, more than half of all the tilapia product originating from China was classified as value added.

An analysis of the global markets for tilapia reveals that Chinese production dominates world supply, particularly in the frozen whole and frozen filleted sectors of the markets. Indeed in 2006, China exported 103,844 tons of frozen product to the USA representing 65% of the country's total tilapia imports. With whole frozen tilapia currently selling at a unit price of US\$1.50 / kg, it represents one of the lowest cost white fish materials, and as such, the remarkable growth in imports is due to the fact that the product provides an excellent cheap raw material to develop into value added white fish products. Interestingly, the advent of cheap Chinese frozen product has forced the traditional Latin American tilapia suppliers to move away from frozen tilapia products and move into the high value fresh fillet sector, where current (February 2007) wholesale prices are approximately US\$3.20 / kg – this allows them to take competitive advantage of their geographic location that enables them to move high value fresh product cheaply into the North American markets. It is interesting to note that while tilapia imports and production have increased significantly in recent years, the price has fallen markedly. In 2003, the average wholesale price of fresh fillets on the US market was US\$5.72 / kg (Globefish 2004), approximately 78% higher than current prices.

The economic efficiency of Chinese production

In 2006, China exported 33,000 tons of tilapia products to Mexico. Traditionally, Mexico is a tilapia producing country that has developed a mature tilapia aquaculture sub-sector to supply the country's domestic markets. The recent advent of cheap Chinese imports selling frozen product at an average of US\$1.80 / kg has reduced margins in the domestic industry to untenable levels. It is likely that the domestic industry will only be able to survive by improving culture technologies and refocusing products on the high quality, high value fresh sector that, due to China's geographic distance from Americas and the concomitant high airfreight costs, will preclude Chinese products (Globefish 2007b).

With respect to the EU, in 2006, China supplied 3,400 tons representing 34% of tilapia imports (Globefish 2007b). However, it is important to note that while imports to the EU

are relatively low, they are expanding very rapidly with a five fold increase in imports between 2005 and 2006. Taking into consideration the strength of the Chinese production, economies of scale and low production costs, it is highly likely that the anticipated growth within the EU for frozen Tilapia products will be dominated by supplies from China.

While the UK is considered the major European outlet for tilapia, it is also marketed in France, Belgium, Germany, the Netherlands, and in smaller quantities in Austria, Italy, Switzerland, Denmark and Sweden. Tilapia consumption follows the conventional regional distribution pattern of fish consumption - the Northern Europeans prefer fillets, while their Southern counterparts generally prefer whole fish.

The main European markets are the cities where large communities of African, Chinese and Asian people live, in particular London, Paris and Amsterdam. Recently, consumption of tilapia has also increased in the non-ethnic markets. Nearly all the tilapia marketed in Europe comes from imports. Until five years ago only Belgium farmed tilapia, but now the UK and France have also started production. Germany, Norway and Denmark are also experimenting with tilapia farming (Globefish, 2004g). Significantly, in 2006, a Belgian consortium invested US\$18 million in an enclosed recirculating tilapia farm that is designed to supply the EU market with 3,000 tons fresh product per annum (Globefish 2006a). Clearly, significant financial investments suggest that there are those who believe that there is significant scope for the growth of the European tilapia markets.

With respect to the European markets, it is instructive to consider whether demand will follow the American model that in recent years, has seen a dramatic increase in demand for tilapia products. Essentially, the reduction in the traditional groundfish fisheries that supply both the North American and European markets with whitefish has provided an aquaculture opportunity to supply whitefish replacement products to these markets. In north America, tilapia and to some extent catfish have filled the supply vacuum. In contrast in Europe, tilapia sales have remained relatively small and supply issues are being resolved by dramatic increases in catfish imports from Vietnam (*Pangasius*), and to some extent Nile perch from the countries bordering Lake Victoria. Indeed in 2006, Europe imported 123,212 tons of *Pangasius* from Vietnam valued at US\$343 million – approximately twice the volume imported in 2005 (Globefish, 2007d). Current prices are relatively high with the average price of frozen fillets being sold at US\$ 2.80/kg, up from US\$ 2.50 in 2005. Prices as high as US\$ 3.30/kg have been reached on the Spanish markets. Significantly, fresh fillets are now becoming available on the European markets. While there are some concerns over the quality and environmental sustainability of Vietnamese production, it is likely that the imports will continue. As the major competitor to tilapia products in this market segment, it is reasonable to suggest that frozen tilapia filets entering the European market will have to compete at parity i.e. the US\$2.80 – US\$3.30 / kg levels.

With respect to the current status of Nile Perch, the fish stocks in Lake Victoria are currently in decline, with exports to the EU declining from 56,089 tons in 2004 to 48,945 tons in 2006 (Globefish, 2007e). The poor state of the fishery has resulted in declining catches, increased fish costs to processors, and in many instances, processors operating at sub-optimal capacity. In the absence of fishery control interventions, it is likely that landings will decline further. In response to the current situation, some of the countries surrounding Lake Victoria are actively investigating the possibility of Tilapia culture, processing the product using spare capacity from the Nile Perch processing industry, and exporting through the existing channels into Europe.

The majority of exports to the EU are in the form of chilled fillets (76%, Globefish 2007e), and the product is therefore in direct competition with fresh tilapia and catfish fillets. The reduction in supply and increases in fish prices to the processors has elevated current EU prices to US\$7.50 / kg, putting the product at the higher end of the fresh fillet market, and making competition with fresh tilapia and catfish products increasingly problematic.

The potential for South African products to penetrate the European markets will depend upon the product type, production costs (FoB cost), and distribution costs. At the outset it is important to note that it is unlikely that in the near-term, South Africa will develop sufficient economies of scale to compete in the high volume, low value frozen section of the market – even large scale South American Tilapia producers have failed to compete effectively with the Chinese tilapia producers exporting frozen product. It would therefore be prudent to focus on the high end products such as the fresh fillet markets and the value added products. It is however important to realise that even these markets may be difficult to access. Geographically, South Africa is as far or if not further than the other major tilapia producing countries (Johannesburg (SA) – London (UK) – 9,062km; Quito (Equador) – London (UK) – 9,219 km; Beijing (China) – London (UK) – 8,493km), and thus it is reasonable to suggest that transportation costs to these markets will be comparable. To gain a competitive advantage in what is already a very competitive market, South Africa must develop a world class industry with production costs that can compete with the existing established global industry. In this respect, it is interesting to note that in 2007, Ecuador exported it's first 1,000 tons of fresh tilapia fillet into Europe demonstrating that despite relatively high transport costs (in comparison to other producer countries), product can be cost effectively supplied to the market.

Diagnostic Analysis

South Africa's geographic location makes it highly unlikely that the country will be in a position to supply the North American finfish markets. The low production costs and economies of scale that characterise the Chinese and Asian producers would make it very difficult to successfully compete in the frozen market segment. With respect to the North American fresh fish segment, assuming that South African and Latin American production costs prove comparable, and the product reaches FoB status at parity, the relatively low airfreight costs from Latin American producers to the market would put the African product at a distinct price disadvantage. Taking this into consideration, it is unlikely that South African products will be in a position to successfully compete in the North American markets. This being the case, it would make economic sense to focus on the major markets that are geographically closer to South Africa, visibly, the European and Middle Eastern markets. Nevertheless, in comparison to other producer countries, South Africa remains geographically isolated from these markets, and so to effectively compete, South Africa will have to develop niche markets that distinguish themselves from other brands, for example, value added fresh products, organically or fair trade certified products.

Finally, there is precedence for the export of tilapia products to the EU from Southern Africa. In 1997, Lake Harvest Ltd. (Lake Kariba, Zimbabwe) initiated tilapia (*Oreochromis niloticus*) farming, and produces approximately 2,500 tons of product per annum. While the company supplies much of the Southern African region with product (mainly whole frozen fish), it has also developed a major supply chain for fresh tilapia

fillets to the EU markets. However, increasing competition from frozen tilapia and *Pangasius* imports have impacted and undercut the fresh market sector. In response, a number of African producers have joined forces to explore the potential to differentiate their product in the marketplace by eco-labelling their product, and one company has gone as far as exploring the possibility of attaining “fair trade” status for their product.

2.2 Marine aquaculture

2.2.1 Local markets

Finfish

Decreasing supply from local fisheries.

A growing shortage of traditional local fishery products, particularly hake and “linefish” (e.g. kob and yellowtail), is driving up local and prices and opening up opportunities for aquaculture of marine finfish. The prognosis for these fisheries is not good and supply is expected to decline steadily due to overfishing and poor fishery management. Thus sellers of fish products are increasingly being forced to source alternatives with similar product characteristics and price.

The major buyers of seafood in the service sector report that hake, once a guaranteed standard, is becoming increasingly difficult to source. A representative of Pick and Pay stated that they used to buy baby hake by the container load and move large volumes through their township stores but that it hard to obtain more than 3 tons at present. Similarly, chains such as Ocean Basket now substitute hake with alternative white filler products such as Nile perch and Vietnamese catfish (*Pangasius*). These products are prepared in a similar way to hake and seem to be readily accepted by consumers. Although tilapia fillets have not yet been included in this niche, it is probably just a matter of time before they become a feature on local menus.

Increasing local demand.

There is a steadily growing local demand for seafood, due to growing exposure of South Africans to an increasing variety of fishery products.

Seafood has now become a well established commodity in the service sector and is well established on restaurant menus. The South African public is becoming familiar with an ever growing range of seafood products prepared in accessible dishes at affordable prices. Restaurant chains such as Ocean Basket, Spur, and Dros, as well as take away franchises such a Captain Dorego’s have made seafood widely available to the South African public. Items such as calamari, mussels, oysters and sardines which were regarded as exotic foods some time ago are now standard menu items. “Hake and chips” or combo’s of hake, calamari and mussels are popular choices.

In the retail sector, fresh fish counters at the major supermarkets have been improved, and many independent retailers specialise in seafood, both fresh and frozen. The majority of consumers remain ignorant of the product characteristics of various fish species and are wary of purchasing whole fresh fish as they don’t know how to prepare them. Freshness is always an issue with non-frozen fish and a further deterrent to many consumers. Consequently there is a trend to pre-packaged fresh and value added fresh fish products. Advances in aseptic packaging now make it possible to present fresh fish in evacuated plastic with a shelf life of fourteen days. This is seen as a growth area for local demand for fish products and it is expected that producers

culturing marine linefish will target this market niche to capitalise on their product characteristics.

In restaurants “linefish of the day” is a well established menu standard, but is much abused term reflecting the shortage in supply of traditional South African linefish. While the title implies that the fish was sourced the same day from a fishing boat without being frozen, the reality is that the fish are often not “linefish” (i.e. fish caught using hook and line), but are often trawled species such as kingklip. Also, “linefish of the day” is often a frozen product that may have been in the freezer some time. Aquaculturists report a ready demand for “fresh linefish” and prices of R35-60/kg for fresh cultured kob direct to upmarket restaurants.

Up market restaurants are increasingly specialising in seafood as a result of a growing trend to eating seafood and the growing tourist sector is also driving demand for quality, fresh fish. In the major centres sushi bars are now included in many restaurants e.g. the Cape Town Fish Market, and are further fueling demand for a greater variety of good quality, fresh fish. Fresh, cultured Norwegian salmon has now become a standard in sushi bars, mainly because of its readily available supply. The sale of other species suitable for sushi such as tuna, yellowtail, and other white fish is largely determined by availability.

The increasing spending power of the black middle class is also a factor that is expected drive up demand in urban areas, as these consumers become more aware of the health and lifestyle benefits of eating seafood.

Aquaculture prospects

Hake and other imported white frozen fillets are still relatively cheap and it is not expected that cultured local fish such as kob will be cost competitive in the frozen fillet niche of the local service sector.

However, higher prices can be obtained for whole, fresh linefish both in the restaurant and retail sectors and prospective producers are targeting this market. The volume of fish that the local market will take is estimated at around 5000 tons, but it is expected that the market will initially be supply limited due to the relatively long start-up period for aquaculture production. The growing deficit in the supply of hake and linefish species is of the order of tens of thousands of tons. Therefore, in the short to medium term it is expected that there will continue to be shortage of supply in good quality fresh fish, and that steadily growing aquaculture production will fuel organic growth in demand for these cultured products in the local market.

The local aquaculture industry has a comparative advantage over international competition in its ability to supply fresh, traditional linefish species. Attempts to culture exotic species such as turbot and salmon locally have not met with much success due to the lack of a comparative advantage over international producers. Thus, the strategy of local aquaculturists to target indigenous species such as kob, yellowtail, sole and spotted grunter for aquaculture is a sound one.

Oysters

Local producers report buoyant demand for oysters and local prices for fresh oysters are high in international terms. Production of oysters is expected to grow sharply as new producers at Port Elizabeth and Walvis Bay scale up operations. Oysters are a traditional delicacy in up market restaurants, but are increasingly available in seafood franchises, as well as in selected retail outlets. Once again the increasingly acceptance

of a variety of seafood by South African consumers, as well as the tourist boom is growing demand. Given the market demand and sunken capital already invested in production facilities is reasonable to see at least a doubling in the production of oysters in the next five years.

Local and Namibian producers have reported plans to penetrate export markets for oysters with fresh and individually quick frozen products in the half shell. Relatively small local production volumes and high local production costs, dynamic international market conditions, and a volatile rand however make local producers relatively vulnerable. Unless local producers are able to secure a comparative production advantage, it is questionable whether oyster exports are financially sustainable.

Mussels

The local production of mussels, mainly by one major producer and processor, for the local market has been relatively stable for some years. A steady demand for fresh and processed products is reported and local demand for mussels is increasing along with the demand for other seafood products.

Production constraints and available water for aquaculture in Saldanha Bay have limited the supply to the local market. Local production currently supplies probably less than half the demand for mussels in South Africa. Imports such as the half shell frozen green lip mussels from New Zealand make up the balance of supply. There is thus scope for expansion of mussel production for the local market to substitute imports. An application to the National Ports Authority for an additional 50Ha of water in Saldanha Bay for mussel culture is likely to boost local production output.

Projected production for 2006 is 1000t of product with 300t sold fresh live and the balance processed in the factory into 300 -400t of frozen half shell mussels

The local market is sensitive to price and not quality conscious. Thus, the local industry competes against low quality C-grade mussels imported from New Zealand, which are effectively a by-product. During periods of rand strength mussels imports increase putting a downward price pressure the local producers.

Local producers do not believe they can be competitive in the export market due to the large scale and lower cost production in the major mussel producing countries such as Chile and Zealand. Therefore their strategy is win local market share by import substitution.

Abalone

Traditionally a product exclusively for export due to high demand and prices in Asia, cultured South African abalone is now being marketed in small volumes to up market restaurants. A small but steady growth in demand is expected with the trend to eating in upmarket seafood restaurants and the growth in the tourist market.

2.2.2 International markets

2.2.2.1 Marine finfish

Assuming that the South Africa mariculture industry focuses on the development of high value marine finfish species, and taking cognisance of South Africa's geographical position with respect to other fish producing nations (Section 4.1.2.1); it is reasonable

to suggest that most likely high value markets that could be accessed by South African producers are to be found in Europe. Taking this into consideration, the following analysis is designed to investigate the current market status for cultured marine fin-fish products across the EU.

In comparison to freshwater finfish, marine finfish should be viewed as a high value product capable of realising higher market prices. Significantly, the product vacuum that has resulted from the dwindling white groundfish fisheries supplying both the USA and European markets is primarily being taken up by the relatively cheap tilapia and pangasius alternatives. At the outset, it is important to note that European fish markets are culturally diverse with a multitude of different national preferences. For example, and as a generalisation across many species, the Mediterranean countries tend to show a preference for whole fresh fish while their northern European counterparts have a preference for fish that are in some way processed. Clearly, while market demand will change throughout the region, it indicates that there is significant scope for the development of niche markets.

While the principle farmed marine finfish that is available to the European consumer is salmon, there have been recent technological developments that are bringing new species such as cod, turbot, and the sea bass and sea breams to the market place. Realistically for South African producers, the initial penetration of the European markets is most likely to be successful with a relatively high value linefish species such as kob, or yellowtail. Taking this into consideration, it is instructive to investigate the recent introduction of similar farmed linefish species such as the European sea bass (*Dicentra labrax*) and the gilthead sea bream (*Sparus aurata*) into the European markets, and the examine the potential for South African products to compete within the market.

The Salmon markets

The global salmon industry is a mature industry, dominated by the Norwegian, Chilean and Scottish producers. Historical data suggests that prices fluctuations as a response to supply and demand issues are significant. Indeed, in April 2006 prices for Norwegian fresh, gutted head on 3-5 kg animals reached a record €6 / kg as anti-dumping measures, supply problems, and the threat of bird flu increased consumer awareness of the advantages of fish consumption with positive effects on salmon demand in the major global markets (globefish, 2006c); by April 2007, many of these issues had been resolved and the price for the same product class had reduced to €3.35 / kg (globefish, salmon July 2007). While there have been efforts to develop a salmon farm in South Africa (based on the Atlantic salmon, *Salmo salar*), it is unlikely that South Africa will ever become a major player on the global scene, nevertheless, the price fluctuations provide an indication of the inherent market dynamics that potential South African marine finfish exporters will have to work within.

Over the past 10 years there has been a dramatic increase in the culture of both seabass and seabream. Production is centred around the Mediterranean countries (principally Greece, Turkey, Spain and Italy), and in 1996, stood at 54,000 tons per annum (33,000 tons seabream; 21,000 tons seabass). By 2006, initial production figures reveal that production had grown to almost 200,000 tons (87,000 tons seabream; 88,500 tons seabass;). In March 2007, the price for whole fresh fish (300-450g) was in the region of US\$3.25 / kg (Globefish, 2007f), down from US\$3.96 / kg in July 2006 (Globefish 2006b). The major markets remain the traditional markets around the Mediterranean where there is a history of consuming the fish. While there are some

indications that some of the traditional markets are becoming saturated (e.g France, Italy), to date, there has been limited market penetration into the Northern European states – it would appear that seabass is the more acceptable species in the Northern European markets and in the UK, and seabream is still considered by many consumers as an exotic species. Nevertheless, it is evident that consumer perceptions are crucial to the successful development of these markets. In recent years, the demand for cultured product has been boosted by the improved marketing image of the product – in the past, preferences were for wild caught fish, however, the introduction of competitive prices, freshness, and improved logistics associated with farmed product has increased its acceptability to the consumer.

Increases in consumption patterns across Southern Europe have largely been driven by developing production economies of scale allowing for lower costs and prices, thus expanding the market (FAO, 2006). In addition, better logistics and distribution, and most notably, the development of supermarket retail outlets have enabled levels of market penetration that would not have been possible 15 years ago. Nevertheless, it would appear that product differentiation, a clear product image in the market place, and the development of niche markets is the key to marketing success. For example, seabass and seabream products tends to be sold in the round – fillets are not only hampered by cost considerations as yields are low, there are also many cheaper fillet alternatives on the market. Furthermore, the consumer often perceives fillets as a less species specific product than round fish, thus comparisons are made on a fillet basis – as opposed to species basis. Naturally, this brings the product into direct price

Diagnostic

Entry into the international marine finfish markets is most likely to occur through the development of marketing channels to Europe, where markets are culturally diverse and a multitude of different national preferences provide significant scope for the development of niche products. While it is reasonable to suggest that marketing opportunities arising from the decline in the traditional groundfish fisheries will primarily – and are currently - being absorbed by cheap freshwater alternatives (for high volume processed product where product differentiation is of little importance to the consumer), there is scope for the development of high value marine finfish products. The recent introduction of farmed seabass and seabream across the Mediterranean suggests that European consumers are prepared to pay a premium for high value fresh cultured fish. However, the penetration of these markets has primarily been restricted to the traditional consumer countries, and there has been little or no development in non-traditional markets across Northern and Eastern Europe. The implication is that while farmed fish are now readily accepted by European consumers, and it is relatively easy to replace wild capture fish with cultured fish in traditional markets, it is more difficult to introduce new species to the market. Fortunately, some South African fish products and brands are well known in Europe as a result of exports by companies such as Irvin and Johnson (Pty) Ltd. and Sea Harvest Corporation. Indications are that South African cultured kob and yellowtail will be well received. Production volumes are important and will have to be of the order of thousands of tons if South Africa is to be a player in these markets.

competition with the cheaper alternatives such as the tilapia and pangasius imports from the Far East. Finally, the issue of labelling and the development of unique product lines is becoming ever more relevant, and while it is anticipated that there is room for expansion of the Seabream / seabass markets in Northern and Eastern Europe, their

development will require dedicated marketing campaigns to educate consumers and promote product recognition.

2.2.2. Abalone

The culture of abalone from South Africa is based on demand in the Asian market. Abalone are consumed as fresh sashimi in Japan, or prepared from canned, dried or frozen products in China. South African abalone is a well established premium product, with South African abalone fetching higher prices than competing Australian, Chilean, or USA products. The average price for live farmed South African abalone is US\$35.50/kg and US\$720 for a case of 24 tins of canned abalone.

Cultured abalone are increasingly substituting the decline in supply of wild harvested abalone (Figure 1). As a result the worlds abalone production is rising, and is now back at historical levels. Prices have remained relatively firm over the last decade, however, inflation in South Africa is increasing faster than the abalone price which is a cause for concern to local producers. Local farms have offset this trend by becoming more efficient and producing larger volumes of abalone per farm. Initially, South African cultured abalone was mainly targeted at the live Japanese market, but this is a limited niche (18% of the total market) and in recent years there has been a diversification of South African products into canned and frozen to supply the Chinese market. It is estimated that South African farmed abalone currently supplies 21% of the global market for farmed abalone, and this proportion will probably decrease slightly in the next five years as abalone farm production comes on stream in Chile.

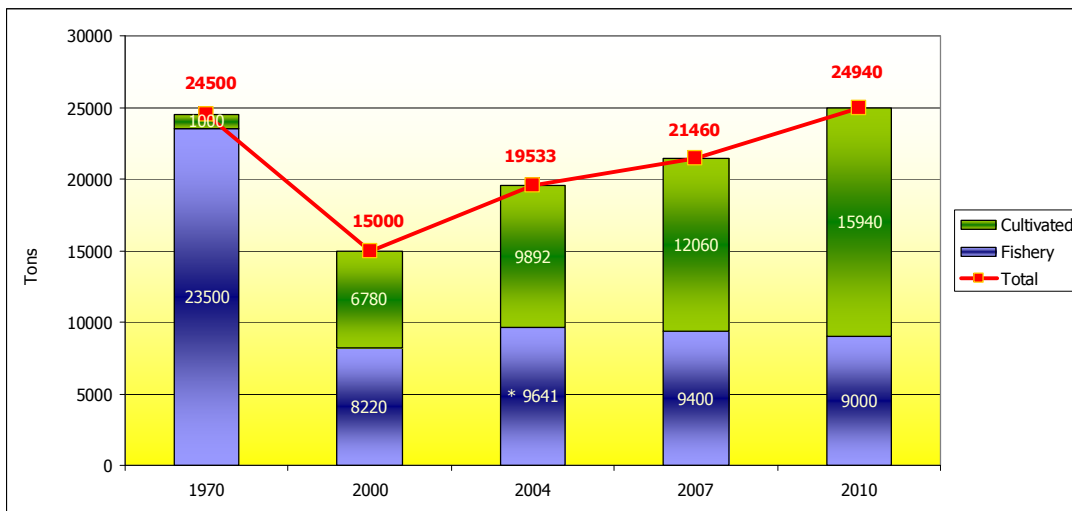


Figure 1. Global production of farmed and fished abalone, illustrating the growing proportion of farmed abalone. Figure prepared by Nick Loubser, Irvin and Johnson (Pty) Ltd.

With the growth in the Chinese economy, demand for abalone is expected to continue to grow. Increasing farm production in Chile, Australia and New Zealand may place pressure on prices, but for established farms which have paid back most of their loans there is still a good margin in abalone farming.

A wild card in the supply of South African abalone has been the significant supply of poached abalone into the Chinese market. Import statistics into Hong Kong in 2002 reveal that 2600 tons wet weight equivalent was imported of which less than 1000t was

legal product from the South African abalone farms and fishery. As wild abalone stocks are fished out by unsustainable poaching, abalone farmers are set to benefit from the deficit in supply of South African abalone.

2.3 Institutional issues and challenges to penetrate markets

2.3.1 Product Health Certification

In order to meet EU standards, the SABS must certify that South African aquaculture products are compliant. This requires guaranteed from 1) Marine and Coastal Management in respect of shellfish health monitoring and 2) state veterinarians in respect of products health, for example anti-biotic residues and disease free certification. Marine and Coastal Management has set up a shellfish health monitoring programme to comply with EU requirements, but the programme has not yet been finally approved by the EU and the ban on South African shellfish remains in place. There is an urgent need to develop aquaculture health management and diagnostic capacity in the state veterinary services.

2.3.2 Access to Export Assistance

There is a lack of awareness in the aquaculture of support facilities available from the DTI to promote exports. Initiatives to promote these facilities should be made for the aquaculture sector.

Information on seafood export markets is also a constraint which results in sometimes poor investment decisions. Promotion of access to information on markets by means of state supported studies, as well as trips by industry to visit countries with target markets are required.

2.3.3 Poor Market Information and Analysis

While South Africa's larger fishing companies are established players in the local and export markets and understand market dynamics, new entrants into the aquaculture industry do not have this benefit.

2.3.4 Competitive SME's in the Seafood Industry

There is no national strategy or institutions to promote the competitiveness of SME's in the seafood industry, equivalent to those in Australia for example (see Section 4 below). South Africa's seafood sector, which includes both fishing and aquaculture, operates in a very dynamic production and market environment has great potential to realise opportunities for new products based on new technologies and new market niches. In effect, demand for seafood is increasing in South Africa, but the range of products supplied by the local fishing and aquaculture industry is quite narrow. An organised institutional approach is required to create a greater range of products and hence entrepreneurial opportunities. For an example of an appropriate approach, see Australia's "Sustainable Seafood Initiative".

Section 3. Finance

3.1 Availability and Accessibility of Development Finance

The availability and accessibility of development finance for aquaculture will clearly be a major determinant of the rate of development of the sector. From a commercial financing point of view, aquaculture poses many challenges. While certain technologies are proven and markets for related products have been established, thereby reducing risk to levels where commercial providers of finance are willing to lend, this is not the case for a range of candidate species that could be the future backbone of the South African aquaculture sector. Commercial financial institutions are therefore reticent when it comes to financing pioneer mariculture ventures. As a result, innovative ways will have to be found to make available a range of financial products and instruments to finance the development of what is in essence an infant industry with proven growth potential.

A range of financial products by a combination of para-statal and private commercial financial institutions with varying appetite for risk are potentially available, but few have been accessed by the aquaculture sector due to:

- A lack of awareness of them in the aquaculture sector
- Staff of the DFI's not having exposure and experience in aquaculture
- The poor quality of many individual applications for finance
- The lack of planned major projects including infrastructure for aquaculture development nodes

The parastatal Development Finance Institutions (DFIs) take more of a developmental outlook when it comes to financing aquaculture ventures, particularly where doing so is consistent with their mandates to promote agricultural and rural development, BEE, infrastructure development and geographic spread.

3.2 Provincial Governments and Provincial Development Agencies

The four coastal provincial government have some budgetary capacity to promote aquaculture development through the provision of development finance usually through a third-party agency such as the Eastern Cape Development Corporation, the KwaZulu Finance Corporation, the Western Cape's Aquaculture Institute of South Africa, or the Northern Cape's Fishing and Mariculture Development Association. The Northern Cape Provincial Government's provision of development finance to catalyse the Namaqualand Mariculture Park in response to a regional economic imperative is an interesting case in point. However, funding from these sources is limited in extent and is likely to be orientated towards high-priority strategic projects.

3.3 Industrial Development Corporation

Introduction

Established in 1940, the Industrial Development Corporation of South Africa (IDC) provides financing to entrepreneurs engaged in competitive industries. Even though the IDC is state-owned, it functions as a private enterprise, following normal company

policy and procedures in its operations, paying income tax at corporate rates and dividends to its shareholder, while reporting on a fully consolidated basis.

The IDC is a self-financing state-owned development finance institution whose primary objectives are to contribute to the generation of balanced sustainable economic growth in southern Africa and to further the economic empowerment of the South African population, thereby promoting the economic prosperity of all citizens. The IDC achieves this by promoting entrepreneurship through the building of competitive industries and enterprises based on sound business principles.

As an investment partner, the IDC offers broad experience in Africa, a developmental focus a strong balance sheet, in-depth industry knowledge across the economy, in-house due diligence competencies and sixty years of experience as a development finance institution.

Of all the DFI's the IDC has probably the most experience and exposure in financing the aquaculture sector.

Operational Arrangements

The IDC consists of two operational and client-oriented Divisions being the Sectors-and Projects Divisions. The objective of the Sector's Division is to provide medium to large enterprises as well as emerging entrepreneurs from the previously disadvantaged communities with medium term finance for the establishment of new enterprises or the expansion of existing concerns. On the other hand, the objective of the Projects Division is to continue making a measurable impact on the regional economy by utilising its expertise in evaluating project ideas, participating in and co-funding of project pre-feasibility and/or feasibility studies, as well as providing project finance for viable new and/or expansion projects. Both Divisions are organised into Strategic Business Units (SBUs) to ensure an industry specific focus and delivery of high-quality, innovative services to both traditional and new customer bases.

Financial Products, Services and Requirements

The IDC offers a range of financial products and services. Typically the IDC does not seek shareholding control or management participation in businesses that it finances. Instead, it seeks to assist the entrepreneur financially and participation is usually by way of loan finance, although other financial instruments include equity, quasi-equity, wholesale finance, share warehousing, guarantees, export/import finance and short-term trade finance are available.

Finance assistance is only made available after comprehensive risk management assessments. In the case of small, privately-owned ventures or high risk ventures with substantial development impact and profit potential finance might be based on quasi equity. In the case of equity investment, the IDC typically takes a minority stake of 25-49%. With debt financing, which usually takes place over 3 to 10 years, own contributions will depend on risk profiles and funding will be tailored to suit cash-flow requirements. When it comes to empowerment transactions involving a change of ownership to empowerment parties, a cash contribution from empowerment parties and managerial involvement of empowerment parties is required.

Preference for financing is given to:

- Financing fixed assets and the fixed portion of growth in working capital requirements.
- Greenfield projects, expansions and rehabilitations.
- Relatively sizeable projects.
- Projects which have economic merit in terms of profitability and sustainability.
- Projects which have developmental impact in terms of jobs, exports, spatial, empowerment and downstream opportunities.

The IDC also requires:

- Security
- Compliance with environmental requirements
- Reasonable financial contributions from owners.

In general, IDC finance is available for projects within South Africa, the SADC region and the rest of Africa. The organisation has only limited exposure to the mariculture sector in the Northern Cape and KwaZulu-Natal provinces. In discussion with representatives of the IDC it is evident that there are no absolute guidelines for aquaculture projects and applications for financial assistance are treated on their own merits.

3.4 Development Bank of Southern Africa

Introduction

The Development Bank of Southern Africa (DBSA) was established in 1983. In 1996 it was transformed to ensure it met the needs of the new South Africa and the Southern African Development Community (SADC) region as a whole. The DBSA's key purpose is to address socio-economic imbalances and help improve the quality of life of the people of South and Southern Africa.

Its mandate is to:

- invest in infrastructure and facilitate the provision of infrastructural development finance
- finance sustainable development in partnership with the public and private sectors
- respond to development demands and act as a catalyst for investment

The DBSA performs a triple role as financier – by contributing to the delivery of basic services and promoting economic growth through the funding of infrastructure development; advisor – by building institutional, financial, technical and knowledge capacity for development; and, partners – by leveraging private, public and community players into the development process.

Areas of competency

The DBSA has a wealth of experience in promoting infrastructure development projects and its core areas of competency are:

- Development with a focus on sustainable investment
- Project management and mitigation of risk
- Identification and selection of projects

- Preparation and appraisal of projects
- Monitoring implementation of projects
- Mobilisation of private sector involvement

Investment Focus

Although the focus of the DBSA is on the financing of infrastructure, it has adopted a wide definition of infrastructure for the purpose of guiding its activities. Examples of the various elements of infrastructure funded by the DBSA include:

- Regional infrastructure – water, sanitation, energy, transport, ICT, etc
- Municipal infrastructure – roads and water reticulation, municipal facilities, etc
- Rural infrastructure - water schemes (including irrigation), sanitation, energy and roads, input depots and distribution points, markets, community-related infrastructure, etc
- Social infrastructure - clinics, health centres and hospitals, education facilities and community learning centres, etc
- Eco-tourism infrastructure - municipal infrastructure for open spaces, fencing, walking trails, game-stocking, buildings, cultural centres and heritage sites, etc
- Enterprise infrastructure - physical infrastructure for small, medium and micro enterprises (including hives, manufacturing incubators and multi-purpose storage facilities), markets, market stalls and small shopping malls , technology transfer facilities, etc
- Institutional infrastructure - including the institutional infrastructure for borrowers, specifically if it is project- and programme-related and builds capacity in a DBSA target area

Partnerships

The DBSA works with donors and its other partners at international, national and provincial levels to build relationships with all key role players in development and to promote the best possible use of resources in order to reach the goals of development initiatives. To fulfill this catalytic role, the DBSA:

- helps to mobilise additional investment by co-financing public and private-sector investments
- promotes public and private partnerships for infrastructure
- provides technical assistance focused on strengthening policy, institutional capacity and environmental management in support of Bank projects and programmes
shares skills and knowledge with institutions and clients to maximise the development impact and quality of specific project interventions
- provides professional and administrative resources for managing special infrastructure development initiatives on behalf of government and/or development institutions.

The DBSA has had limited exposure to the aquaculture industry in South and Southern Africa supporting a single venture at Hawston in the Western Cape. The DBSA has however pledged support to the Northern Cape Province for the Namaqualand Mariculture Park through its Targeted Infrastructure Programme in partnership with the Port Nolloth Municipality. Theoretically, mariculture projects can be supported through

a number of different divisions and support measures at the DBSA but it is clear that the client community remains largely oblivious to this opportunity.

3.5 Land Bank

Introduction

The Land Bank is an agricultural development bank that provides retail, wholesale, project and micro financial services to agriculture and related rural services through a diverse range of clients including companies, trusts, established farmers and rural entrepreneurs who have traditionally been denied access to credit. In so doing the Land Bank is supporting the growth of the whole agricultural sector. The Land Bank does not receive any financial subsidy from the government and sources its finance from the money markets.

As a specialist financier guided by a new mandate from government, the Land Bank is required to promote agricultural and rural development by:

- Developing and providing appropriate products for commercial and development clients;
- Leveraging private sector investment into the agricultural sector;
- Developing partnerships with intermediaries for on-lending
- Developing techniques for financing high-risk agriculture and new business areas;
- Support the programmes of the Ministry of Land Affairs and Agriculture;
- Contributing to rural development by linking and aligning Land Bank activities with those of other government structures.

Approaches to Financing

Although the Land Bank is focused on broadening access to finance while managing risk, new loan criteria developed by the Bank has reduced the collateral needed by people in higher risk categories. Farming, managerial ability and access to resources, including land and equipment are taken into account when appraising financing request although the limitations of saleable assets as a measure of potential in a development context is recognised.

A risk fund, loan ceilings and a firewall between low-risk, and the medium to high-risk category clients limit the Bank's exposure to bad debts. These measures give medium to high-risk clients access to the same range of medium and short-term loans as low-risk clients.

Financial Products and Services

A range of financial instruments has been developed by the Land Bank. They include:

- Long-term mortgages – fixed term instalment loans for capital expenditure for the acquisition of land, machinery and other agriculture related capital goods
- Medium-term loans - collateralised loans in the form of cash credit accounts for supplementing working capital

- Short-term loans – tailored to meet important financing needs in the agricultural cycle
- Guarantees - for the purpose of guaranteeing the meeting and fulfilment of corporate clients' obligations in connection with their agriculture related activities
- Establishment loans - to Farming enterprises from large scale commercial farms to small-scale farms for establishing perennial crops
- Social Discount – incentives, in the form of a discount on interest rates, for existing and new clients to initiate development projects with previously disadvantaged communities resident on their farms or in surrounding rural communities
- Installment Finance - a type of medium-term loan where the goods financed secure the loan
- Micro Finance - to resource-poor individuals and farmers (unsecured loans ranging from R250 to R18 000) planning to engage in any legal income generating activity

The Land Bank does not have a track record of lending or providing support to the aquaculture industry. Projects that are evaluated by the Land Bank are evaluated on their own merits and there are reports of empowerment projects being rejected due to the limited business experience of the applicants. The Land Bank should however be regarded as a potential source of development capital for mariculture.

3.6 National Empowerment Fund

The National Empowerment Fund Act No.105 of 1998 established the National Empowerment Fund Trust (NEF), for the purposes of promoting and facilitating economic equality and transformation. The NEF operates under the umbrella of the Department of Trade and Industry. Its objectives are:

- To redress the economic inequalities bequeathed by apartheid by providing historically disadvantaged persons (HDPs) with opportunities to acquire shares in both restructured state-owned assets and private business enterprises, and by encouraging a culture of savings and investment among HDPs and to foster entrepreneurship.
- To achieve its goals of sustainable empowerment and transformation by promoting and supporting business ventures pioneered and run by HDPs.
- To promote a better universal understanding of equity ownership. Each of its activities are calculated to redress the inequalities of the past, and promote a competitive and efficient economy capable of generating employment opportunities.

As a catalyst for Broad-Based Black Economic Empowerment in South Africa, the NEF enables, develops, promotes and implements innovative investment and transformation solutions to advance sustainable Black economic participation through a range of products and services provided through two main divisions.

The **Market Making Division** focuses on creating a secondary market for BEE-owned equity stakes (where existing BEE shareholders will be able to on-sell to other BEE investors), warehousing of equity until suitable BEE investors are found, underwriting initial public offerings (IPOs) by BEE companies and acquiring direct equity in mega-projects. The NEF's ability to warehouse equity and initiate a secondary market for

BEE-owned equity to ensure it remains in BEE hands addresses the earlier market failure of BEE equity reverting to financiers and previously advantaged hands. The NEF's support in this division is provided through three main funds:

The **Capital Markets Fund** (CMF) will invest in BEE enterprises, including those owned by women, that seek to list on the JSE or its junior AltX market. The CMF will also help companies already listed to raise additional capital for expansion (for example, by way of rights issues). The qualifying investment range per transaction is from R1million to R10million.

Because BEE shareholdings in unlisted businesses can be difficult to sell, the **Liquidity and Warehousing Fund** (LWF) will assist HDP sellers by acquiring and temporarily warehousing their shares before on-selling them to new HDP shareholders. The LWF will also assist in refinancing BEE shareholdings where existing financing structures are inefficient and may result in a dilution of the existing BEE shareholding. Qualifying transactions should be between R10 million and R50 million.

The **Strategic Projects Fund** (SPF) will acquire equity in large strategic projects and assume the role of the BEE partner. These projects will usually be undertaken in partnership with other development finance institutions such as the Industrial Development Corporation (IDC) and Development Bank of Southern Africa (DBSA) and commercial investors. The SPF will warehouse the BEE equity and will help drive transformation within the project. The SPF will transfer its shareholding to BEE groups through a transparent tender process once the initial project risks have been reduced to acceptable levels. The minimum qualifying transaction is R25 million and this may limit its applicability in the mariculture sector.

The purpose of the **Group and Entrepreneurial Schemes Division** is to deliver support to entrepreneurs in the small and medium-sized enterprise (SME) sector and to foster sustainable enterprise development. In addition it provides capital to act as a catalyst in community and rural development projects. Furthermore it seeks to promote an equity and savings culture through its support of BEE retail equity ownership.

The purpose of **Entrepreneur Support** targeted at SMEs and providing a combination of debt and equity funding instruments, is to stimulate and foster HDP entrepreneurship, to help existing HDP enterprises expand and grow, and to facilitate transformation in non-HDP owned and operated enterprises. Entrepreneur Support favours those enterprises where there is, or will be, active participation by HDP's in ownership and management of company enterprise. This means a significant proportion of the HPD's interests must be controlling, reflecting genuine participation in decision-making at board, executive, managerial and operational levels. Its targets include funding for start-ups, expansion and HDP buy-ins and buy-outs. Entrepreneur Support offers three main products, namely: **Generator** - for the creation of start-up businesses that require funding from R 250 000 to R1 million; **Accelerator** - for the development and expansion of existing businesses requiring funding from R 1 million to R 3 million; and **Transformer** - to facilitate transformation of existing enterprises at ownership, decision-making and control levels through funding ranging from R3 million to R 10 million.

Rural and Community Development and grassroots transformation cannot succeed in the absence of vastly improved access to funding and business support services targeting the most impoverished and deprived members of society. The focus on supporting community and rural development projects, particularly those involving

groups of women, youth and to disabled, aims to remedy this lack of access to funding. This unit of the NEF provides catalyst capital for development projects where there is strong community ownership and participation to allow community and organized groups to acquire shares in income generating projects. Where the NEF provides funding, it will encourage other Development Finance Institutions (DFI's) to undertake projects that would otherwise fail to achieve necessary investment hurdle rates. Other interventions will include specific projects targeted at rural women which are undertaken in conjunction with other DFI's and partners who will bring with them necessary skills and support infrastructure.

From the above, it is apparent that NEF funding is particularly suited to financing BEE participation in the aquaculture sector. Full details regarding the products and services offered by the NEF as well as eligibility criteria are available at www.nefcorp.co.za.

3.7 Khula Enterprise Finance

Khula's mission is to ensure improved availability of loan and equity capital to Small, Medium and Micro Enterprises (SMME's) by offering loans, guarantees and seed funds to Retail Financial Intermediaries (RFI's) in need of capital and capacity. Khula is a limited liability company with the Department of Trade and Industry (DTI) as its major shareholder. Khula's operations are divided into two divisions: Loans and Credit Guarantees.

Khula's Loans Division provides financial support to Retail Financial Intermediaries provided they meet Khula's minimum qualifying criteria; these accord with generally accepted business selection protocols. Products and services comprise business loans, capitalisation loans, seed loans, institutional capacity building, and RFI mentorship. Khula also finances private equity funds, the Khula Start programme for the micro enterprise sector, the Thuso Mentorship Programme and the Land Reform Credit facility.

Khula Credit Guarantee provides a range of guarantee products to registered commercial banks and other private sector financial institutions that offer financial services to the SMME sector. The guarantee scheme is based on a risk-sharing arrangement, whereby Khula assumes a portion of risk associated with lending in the SMME sector.

The extent to which Khula's products and services have been, or could be, deployed in support of entrepreneurs in the aquaculture sector is difficult to ascertain given the wholesale financial intermediary function that the organization performs. Theoretically it should be possible to access finance through either the regional equity funds that Khula has been instrumental in establishing or via those retail financial intermediaries that it has financed.

3.8 Diagnostic analysis of DFI Support for Aquaculture

Trade and industrial policy and the support measures and instruments that the public sector can avail to entrepreneurs contemplating investments in aquaculture and the export of marine products will obviously be a key determinant of prospects for mariculture sector development in South Africa. It is readily apparent that while there are a number of support measures available to entrepreneurs, these are often fairly

generic and not necessarily tailored to the requirements of the aquaculture sector. As a result of this, and the fact that these measures are not adequately marketed to the industry by those agencies responsible for administering them, most of them remain undersubscribed. Administrative and bureaucratic inefficiencies also appear to deter aquaculture industry players from accessing these measures. The promulgation of South Africa's National Industrial Policy Framework provides an opportunity to holistically assess the aquaculture sector's potential and design a coordinated set of interventions aimed at realising opportunities for growth and removing constraints.

The aquaculture industry has not generally been able to access development capital/project finance from the Development Finance Institutions (IDC, DBSA, Land Bank, NEF) to the extent that it perhaps could. While the requirements of the DFI's for BEE participation have increased, this should not deter entrepreneurs contemplating new investments in aquaculture from accessing capital from this source. It appears however that there is a great deal of uncertainty on the part of entrepreneurs regarding what financial products and services are available from the DFI's and how to access them. Applications for finance are also constrained by poorly conceived business plans and concepts that do not pass due diligence appraisals. This reflects a lack of aquaculture skills in the private sector. A more "engineered" approach to aquaculture development, for example, promotion of proven opportunities in aquaculture development nodes would produce more realistic business plans

There are many constraints to aquaculture development that individual companies find difficult to overcome. Besides a set of financial and industrial support measures that companies can apply for, there is a need for more sector level, strategic support to promote industrial competitiveness and exports. Examples of what support could be provided are outlined in the next section which compares support measures available to aquaculture in Chile, Australia and South Africa.

Some general recommendations on these issues are outlined below:

Development Finance Institutions: Like any other growing industry, entrepreneurs contemplating investments in the mariculture sector face the challenge of raising development capital / project finance for the ventures they wish to promote. The Development Finance Institutions remain a potential sources of such development capital, particularly for projects that fall within their developmental mandates. Whilst the mandates of the key DFI's in question are different, they also overlap in certain areas. If the DFI's are to be an important source of capital for the development of the mariculture industry, then there is a need for the aquaculture industry to initiate an engagement with them so as to "demystify" how and on what terms and conditions such support can be availed to industry stakeholders. Through such an engagement, the DFI's in turn should take the opportunity to generate new business by assisting prospective borrowers/equity partners to expedite application and evaluation procedures.

Promotion of Available Support Measures to the Aquaculture Industry: There are a broad range of financial and non-financial industrial development support measures that could be better utilised to support investment and growth in the mariculture sector. However in those cases where mariculture is a qualifying sector, effort needs to be made to improve access to such support measures. Dissemination of information about the availability of these measures has historically been inadequate and better marketing of what is available would be helpful. At the same time, the mariculture

industry needs to lobby for improved access through improvements in administrative and bureaucratic efficiency

Flagship Project Promotion: Consideration needs to be given to prioritising and co-ordinating project-level support for priority/flagship aquaculture projects, such as aquaculture development nodes, initiated by national, provincial and local government. Where such projects are included either in Provincial Growth and Development Strategies or municipal Integrated Development Plans there needs to be some mechanism to ensure prioritised access to public sector financial and industrial development support measures (subject to them meeting the necessary eligibility criteria).

SME Support: A concerted effort needs to be made to improve support for enterprise development in the mariculture sector which has historically shown low levels of involvement on the part of historically disadvantaged South Africans. This is primarily the responsibility of those public and parastatal agencies responsible for SMME development which could be discharged through local business service centres or sector specific development agencies such as the Northern Cape Fishing and Mariculture Development Association. The aquaculture industry could play a role in this through business partnerships, mentoring arrangements and the like.

Market development: both domestically and internationally and support through which to access those markets is clearly an area where the public sector can support private sector entrepreneurs in the aquaculture sector to grow the industry through the promotion of export trade. While a useful range of support measures for export promotion do exist, it appears that the aquaculture industry has so far largely failed to access this support. Whether this is a function of ignorance about what is available, or, that what is available isn't useful is not clear. However, DTI has representatives in a number of countries that are likely to be the target markets of the aquaculture industry. Through an active engagement with DTI it should be possible to enlist their support to reinforce efforts to develop markets for South African aquaculture products internationally.

Industrial Support Measures for Aquaculture: Consideration should be given to developing a comprehensive set of industrial support measures for to enable the aquaculture sector to realise its potential. By and large the Micro-economic Reform Strategy and the Integrated Manufacturing Strategy led by the Department of Trade and Industry are designed to remove obstacles to competitiveness and promote economic efficiency and equity as well as grow output, jobs, exports and value-addition. However, the specifics of what needs to be done in order to achieve these outcomes for the aquaculture sector needs to be articulated. Recommendations in this regard are made below in Section 4 comparing Australia, Chile and South Africa's support measures for aquaculture; and in Volume 2, "Growth Potential of the South African Aquaculture Industry and Recommendations for Sector Development".

Section 4. Comparison of Industrial Incentives Available to the Aquacultures Sectors of Australia, Chile and South Africa

4.1 Introduction

Aquaculture is globally a young sector which has emerged as the major contributor to the growth in fishery production since the 1980's. Typically, successful aquaculture industries are based on the development of new technologies to farm species whose harvest fisheries have collapsed or can no longer supply market demand. It usually takes 5-10 years to develop a new aquaculture species to full commercial production. The growth of emerging national aquaculture sectors is often constrained by the "new kid on the block" syndrome, as supporting policy, legislation and institutions are usually lacking. Global experience shows that without state intervention to provide an enabling for investment into aquaculture, organic industrial growth is slow due to constraints that are difficult for individual firms to overcome. The South African aquaculture sector is a good example of this where growth has been constrained by permitting issues, access to land and water, access to technology, a lack of skilled people and barriers to entering markets such as the EU health standards.

In countries where a national strategy to facilitate the establishment of the aquaculture sector has been put in place, sectoral growth has been more rapid. State led interventions to promote aquaculture sector development in Chile and Australia, - two countries with analogous geographic, economic and environmental conditions to South Africa - have been highly successful, resulting in their aquaculture sectors attaining a "critical mass" of production, infrastructure and services. Concomitant with this has been a reduction in transaction costs, and the establishment of internationally competitive production. South Africa's National Industrial Policy Framework (NIPF), suggests that in respect of industrial finance "in certain strategic areas it will be important to at least match what is available elsewhere". In this section the industrial incentives available to the aquaculture sectors of Australia, Chile and South Africa are compared, and diagnostic comments provided on what incentives could be provided to stimulate aquaculture sector development in South Africa. Cognisance is paid to principles for industrial financing outlined in the NIPF.

The industrial incentives available to the aquaculture industries of Australia, Chile, South Africa were obtained from "The Australian Fishbook II" (Fitzgerald and Kowalski, 2006), Flores-Aguilar, R. (2006), and the Department of Trade and Industry's website (www.dti.gov.za). The information obtained did not cover all incentives and instruments available, but is sufficient to characterise each countries suite of support measures.

Industrial incentives and support for aquaculture may take various forms including:

- Aquaculture Production grants
- Imports/ exports, quarantine grants and advice
- Innovation, research and development grants
- Business and taxation assistance
- Employment and training grants and facilities
- Environmental management assistance
- Key information sources
- Key contact points

4.2 Synoptic Comparison of Support Measures

A review of available support measures reveals that South Africa, Australia and Chile possess substantively equivalent sets of industrial incentives and institutions to promote the establishment of new, technology based industries, but specific differences do exist reflecting varying policy approaches to development. While aquaculture has benefited substantially from available industrial incentives in Australia and Chile, South Africa's aquaculture industry has only accessed a small range of industrial support measures and significant constraints to industry development remain. A comprehensive strategic approach to identifying instruments could unlock key growth opportunities and overcome constraints has been lacking. Public sector institutions that have attempted to support aquaculture sector development have done so in isolated "pockets" of activity, and have ultimately been constrained in their effectiveness by the lack of a comprehensive vision and set of supporting institutions. South Africa's recently published National Industrial Policy Framework provides a means to address the potential of the aquaculture sector in a more rational and systematic way.

The aquaculture sector in Chile has benefited from a very comprehensive, and quite generous, set of industrial support measures, particularly for regions where economic growth is a high priority. Chile's incentives work both at a sectoral level to set up infrastructure and services, and at a company level to promote investment, innovation and competitiveness. Chile is still in the process of developing its R&D base and hence has placed strong emphasis on instruments which facilitate technology transfer. The experience of Chilean aquaculture producers reveals that a reasonably high level technical competence is required to write the various grant application documents, and that the application process requires a major time investment. Grant applications have a high chance of approval if the submitted document is well written, the company conforms with the legal requirements and has good background in the subject. The evaluation process is regarded as fair and clear. On average, it takes about 3 months for an applicant to formulate a project, and then another 4 to 6 months for the result to be made known by CORFO. Our research revealed that a South African aquaculture company that invested in production in Chile was successful in obtaining a grant for a canning plant. They reported that the application process was relatively straight forward and efficient, and that they were awarded a no-strings attached up front capital grant on the basis of their application.

While Australia does not offer the generous capital grants available in Chile, it provides a comprehensive set of industrial incentives that emphasize technology innovation, product development, skills development, export capacity, and access to information and markets. There is good support for collaborative industry actions to development technology and services to support the growth and competitiveness of Australian aquaculture.

Although South Africa possesses a number of instruments which could potentially be used support the aquaculture sector, consideration has not yet been given to a customised or comprehensive system of industrial finance and support measures. Our research revealed some evidence that the SMEDP grant encouraged individual investments in aquaculture, but that industry development remains fundamentally constrained by some sector level constraints that individual companies cannot overcome by themselves. In the absence of a well targeted and comprehensive state led interventions to remove these constraints, development of the aquaculture sector has been patchy and its growth rate below the international average.

4.3 Recommendations for Support Measures Required for South Africa to Achieve Parity with Chile and Australia

Based on the comparison of support measures available in Chile, Australia and South Africa below, a series of brief suggestions on required support measures for South Africa is made below.

Joint Industry Actions

Chile and Australia both have useful sector level grants for joint industry actions. Equivalent grant support and facilitation of joint industry actions would greatly enhance the growth trajectory of the South African aquaculture sector by encouraging development of critical infrastructure and services.

Research and Development

South Africa's possesses a R&D base with great depth and some capacity in aquaculture, but lacks a comprehensive or sector level system of research grant finance. While company level facilities such as THRIP, the Innovation Fund and the 150% research tax deduction are useful, a programme managed, sector level facility, equivalent to the Australian Cooperative Research Centre system, is required if technology development for specific species or technologies is to be developed in a systematic and efficient way.

Skills

A major gap exists in aquaculture skills development. While University level aquaculture courses are well catered for, there are no technical courses for in-service or tertiary level training equivalent to those offered in Australia and Chile. A particular "special need" is to support skills training of individuals from disadvantaged backgrounds participating in aquaculture SME's. Experience shows that while these individuals are usually competent in production skills, a lack of business management and planning skills often causes their ventures to fail.

Technology Transfer

Industry is hungry for information and technology and support for technology transfer and company level skilling in new technology – equivalent to the support measures in Australia and Chile - would be readily taken up by local aquaculture firms.

SME Development

Where South Africa is performing relatively well is in the extension of aquaculture technology to create SME's for previously disadvantaged individuals through the Department of Science and Technology's "Technology for Sustainable Livelihoods" programme. The South African aquaculture sector requires more examples of state led "engineered" approaches to aquaculture development in high priority localities. Experience to date makes it clear that local firms will generally not promote SME development on their own initiative, but are quite willing to participate in facilitated schemes where capital grant support, risk sharing and some leadership by the state supported agencies is provided.

Regional Development

Both Australia and Chile have successfully used aquaculture as a means to bring development to economically depressed regions. The concept of promoting regional development through the establishment of "aquaculture development nodes" is a key

opportunity to unlock South Africa’s aquaculture production potential. An “aquaculture infrastructure fund”, as well as staff capacity within the national and provincial government agencies to plan and promote development nodes, is required.

Exports

Chile and Australia have a well organised and efficient system of support for encouraging exports – including assistance with health monitoring and certification of products, export training, marketing, electronic documentation, and export advice help lines. In South Africa bureaucracy and a lack of capacity in state institutions constrain the ability of local aquaculture producers penetrate export markets and raise transaction costs. Serious attention is required to remove this constraint to industrial competitiveness and good examples are available from Chile and Australia on how to achieve this. A lack of aquaculture capacity in the state veterinary services to certify the health of fresh and live products is a particular constraint to the exports.

Seafood Industry Promotion

Both Chile and Australia have industrial strategies to develop their seafood industries. Comparison of support measures reveals thus is an area of distinct neglect in South Africa both in respect of our fishing and aquaculture industries. In contrast to the emphasis that has been placed on redistributing fishing rights to smaller and medium size enterprises, there have been no programmes or initiatives to build the competitiveness of our seafood sector – which has great potential due to our natural resource endowment. There has been an implicit reliance on the established, larger fishing companies – with their in house R&D and marketing capacity – to maintain the competitiveness of South Africa’s seafood industry. It is suggested that a national approach to developing an internationally competitive SME sector in the seafood industry (both in aquaculture and fishery production sub-sectors) is required.

Assistance with Environmental Management and Legislation

Australia, Chile and South Africa have all promulgated recent legislation and regulations to ensure that the utilisation of the natural resources is sustainable. Australia and Chile have ensured that support measures are in place to ensure that aquaculture farmers are able to comply with environmental legislation without unduly increasing their transaction costs. In South Africa, compliance with recently promulgated environmental legislation and regulations has become increasingly difficult for the aquaculture sector, and producers now complain that this has become the single biggest constraint to industry development. This is exacerbated by fragmented, bureaucratic and inefficient permitting processes. Very little has been done to assist producers to comply with legislation, for example, by means of streamlined permitting and EIA processes, strategic environmental assessments to zone certain areas of land and water for aquaculture guidelines, and implementation of self-regulation by means of best practise protocols.

Access to Information

Australia in particular has very effective measures to promote access to information required by industry by means of information resources, advisory services and contact points. Available information for aquaculture in South Africa is very patchy – especially for prospective new entrants into the sector. Established industry tends to be rather closed, guarding proprietary information, and beyond permitting and regulatory requirements, only rudimentary and very general information on aquaculture is available from government sources, for example;- the MCM and Department of Agriculture websites. South African aquaculturists complain that it is very difficult to penetrate government for advice and opinion, and respondents interviewed mostly

regard the DTI as “impenetrable”. The Aquaculture Association of Southern Africa and Aquaculture Institute of South Africa provide general information on aquaculture, but these sources are at best a starting points for anyone seriously interested in investing in aquaculture.

4.4 Summary of Australian, Chilean, and South African Industrial Incentives for Available for the Aquaculture

4.4.1. Capital Grants for Industrial Development

Chile and South Africa provide capital grants for aquaculture development as part of their regional or sectoral development strategies. In Australia capital grants are only available for the commercialisation of “innovative” technologies which are at “proof of concept” or in early commercial production.

Australia:

Commercial Ready Program

Commercial Ready is a competitive merit-based grant program supporting innovation and its commercialisation. Commercial Ready provides grants from \$50,000 (R300,000) up to a limit of \$5 million (R30 million) for eligible projects of up to three years’ duration. See “Innovation, Research and Development” section below for more detail.

COMET — Commercialising Emerging Technologies

COMET supports companies in their early growth stages, spin-off companies from private or public institutions and individuals to commercialise their innovations. The total financial assistance available under COMET is capped at \$120,000 (R600,000) for each customer. See “Innovation, Research and Development” section below for more detail.

Chile:

Pre-Investment Studies

A grant for pre-investment studies: This varies from 50% of the cost of a study in the Arica and Austral areas to 80%.

Investment Costs

A grant towards investment costs: Grants are available for the acquisition of land, for construction and equipment costs and, in some cases, for the installation of basic utilities. The terms of these grants vary significantly depending on a project’s location; details are available from CORFO offices in Santiago and provincial capitals. A South African company investing in Chile reported that it successfully applied for grant of \$40,000 dollars towards the capital costs of a cannery.

South Africa:

SMEDP Grants

The now suspended SMEDP grant scheme was the main industrial grant financing facility available to the aquaculture sector. While producers complained that it was difficult to access, very rule bound and required that own capital was raised up front for the investment, it did nonetheless attract several applications. One investor interviewed reported that his investment decision was dependent on a successful SMEDP grant application. Up to 30% of capital investment costs was reclaimable under the SMEDP scheme.

Technology for Sustainable Livelihoods

The Department of Science and Technology has made a major contribution to aquaculture development in South Africa through its “Technology for Sustainable Livelihoods Programme”. Grants are made available for the development and capital requirements of small and emerging farmers to develop aquaculture enterprises in partnership with established firms. DST uses the national system of innovation to source technology, and works in partnership with service providers to transfer technology and implement projects. Funding is determined on a case by case basis and approximately R15 – 20 million has been disbursed to fund various trout, abalone, kob, tilapia and catfish projects.

Innovation Fund

Capital grants of up to R15 million are available to support the commercialisation of innovative technologies. See “Innovation, Research and Development” section below. To date one innovation fund grant has been made to a consortium of abalone farming companies and Stellenbosch University for the genetic improvement of abalone.

4.4.2. Collaborative Industry Actions

Joint industry actions co-financed by government to promote the establishment of a new sector can remove critical constraints to sector development and open new opportunities. Australia and Chile have particularly good schemes for collective industry actions financed with matching government grants.

Australia:

Action Partnerships

Action Partnerships assist industry sectors with practical projects that make a significant contribution to their success. The projects will focus on a major issue or opportunity the industry and Government can address by working together. As such, the completion of a project aims to resolve a major issue or capitalise on a significant opportunity. A grant of up to Aus\$350,000 (R2.1 million) with financial and in-kind industry contribution is available. (Fishbook 2, p7)

Taking Stock and Setting Directions

Taking Stock and Setting Directions allows industries to evaluate their performance and situation. This self-assessment will result in industries gaining

the skills required to improve their goals and strategies. It encourages sector-owned actions to create a profitable and sustainable future. (Fishbook 2, p8)

Industry Cooperative Innovation Program (ICIP)

ICIP encourages business-to-business cooperation on innovation projects that enhance the productivity, growth and international competitiveness of Australian industries. (More detail on ICIP is provided under Innovation, Research and Development section below).

Chile:

CORFO supports business modernization, aiming at increasing competitiveness: efficiency in management, innovation, certification to international standards (International Standards Organization and others), partnership practices and specialization to meet the needs of large and demanding global markets; links between large companies and their small and medium-size (SME) suppliers. At a higher level, CORFO also promotes the development of “clusters” based on activities and regions with high potential.

Promotion of Associated Projects (PROFO's).

CORFO provides “PROFO” grants to groups of at least five companies that collaborate to achieve a common goal(s) to increase competitiveness, both for the group and for the individual companies. Grant of up to 50% of total project cost with a maximum of R780,000 per annum.

Suppliers Development Programme

In order to promote the establishment of a competitive service industry, grant support from CORFO is available to partnerships between supplier companies and producer or service companies in a particular sector. It consists of a non-reimbursable CORFO contribution that covers part of the cost of a set of systematic actions such as consultancy, technology transfer, and training. The Suppliers Development Programme activities (PDP) is divided into two stages: 1. a Diagnostic Stage which covers 50% of the cost of the total project, a maximum amount of 400 UF (R104,000); 2. a Development Stage. It is a requirement that a minimum of ten companies participate in the project in the agro-processing sector, and a minimum of twenty companies of the agricultural sector.

Quality Promotion

CORFO grants are available to assist companies to become compliant with recognized national and international management standards, granted by an independent certification body. The grant consists of CORFO's non-refundable contribution that covers part of the cost of a specialist consultant, contracted by the companies, to incorporate appropriate certifiable or verifiable quality standards into their management systems. The standards include ISO 9001, ISO 14001, Best Agricultural Practices (BPA), the System norm of Management SME (NCh2909), PABCO, OHSAS, HACCP, the Staggered System of Continual Improvement (SEMC), and the Clean production Agreements (APL).

South Africa:

No equivalent support measures for joint industry actions were identified in South Africa, although these initiatives do attract state grant funding in a more diffuse way through various institutions. For example, the DTI provided financial assistance to set up South Africa's Shellfish Health Monitoring Programme with which was a collective initiative by a group of abalone farming companies and Marine and Coastal Management to comply with EU import regulations. Abalone farmers also jointly set up an abalone health management company employing a full time veterinarian but this has been entirely private sector funded.

Diagnostic comment: As the South African aquaculture sector has not yet developed a fully fledged service sector, which is a requirement for penetrating markets and reducing transaction costs, state support for "joint industry actions" is a critical intervention to remove constraints to industry development. government co-financed joint industry action schemes, which is equivalent to those in Australia and Chile, could play a significant role in setting up the necessary services and infrastructure for the growing aquaculture industry.

4.4.3. Training

Chile and Australia are particularly well geared to support technical and related business training in aquaculture.

Australia:

AAA FarmBis

The AAA FarmBis program as part of the Australian Government's Agriculture Advancing Australia (AAA) package. AAA FarmBis encourages continuous learning, innovation and improved business management skills to build the self-reliance, competitiveness and capacity of Australia's agricultural and fishing industries. AAA FarmBis financial support helps primary producers, rural land managers and fishers in gaining access to quality learning to improve their business and natural resource management practices. More than 150,000 primary producers, rural land managers and fishers around Australia have attended FarmBis-supported learning activities since the program began in 1998. Training may include people management, financial management, general business management, marketing, production management and natural resource management.

The RIRDC Rural Women's Award

The RIRDC Rural Women's Award was introduced in 2000 to increase the capacity of women to contribute to agriculture and rural Australia by providing them with the support and resources to further develop their skills and abilities. The 2006 Award provides a bursary of \$10,000 to each of the seven state and territory winners. The award supports women with a strong and positive vision

for the future of agriculture, including fisheries and forestry, natural resource management and related service industries.

AAA Farm Help

AAA Farm Help provides financial assistance and decision support for low-income farm families in severe financial difficulty, while they take action to improve their long-term financial situation. The program emphasises the use of strategic information, analysis and advice to support decision-making for the future.

Chile.

Seafood Industry Training Package

The Seafood Industry Training Package sets out national competence standards, assessment guidelines and qualifications for the seafood industry. The Seafood Industry Training Package includes wild catch fishing, aquaculture, processing, sales and distribution and fisheries compliance. Two qualifications with a focus on environmental management systems were added to the package in 1995. A wide range of courses have been designed — from certificates to diplomas. They all conform to the Australian Training Framework. Supporting resources for all qualifications are also available.

New Industries Development Program In-Market Experience Scholarships

The New Industries Development Program (NIDP) offers In-Market Experience Scholarships to small- to medium-sized agribusiness enterprises (SMEs) to develop new skills, contacts and source information to assist in progressing a plan for the commercialisation of new, high-value agribusiness products, services or technologies. The program's objective is to improve the commercialisation rate of new niche agribusiness products, technologies or services. A maximum of \$12,500 for each scholarship. Recipients develop their own in-market visits, and research and select courses suited to their needs. Activities may include formal education, general business and sector-specific training, and attendance at trade shows and conferences, as well as other in-market research and consultancies relating to commercialising new opportunities.

New Apprenticeships

A range of financial incentives is available to employers who take on New Apprentices. New Apprenticeships combine practical work with industry-designed training to give young people formal, nationally recognised qualifications. They include qualifications offered through the Seafood Industry Training Package.

Industry Partnerships Programme — Young People's Development Awards

The Young People's Development Awards are a valuable opportunity for young people in agriculture, fisheries and forestry industries to enhance their career and future prospects, and make a greater contribution to their industry's future competitiveness and sustainability. The award can be used for domestic or international projects. They may include attending conferences, undertaking tours, observing international negotiations or examining world's best practice to

gain information that will be beneficial to themselves, industry, government and other interested stakeholders.

National Training Infrastructure Programme

The Department of Education, Science and Training (DEST) in association with the states and territories administers the \$185 million Australian Government funded National Infrastructure Programme. The National Training Infrastructure Programme has two components — Major Capital and Minor Capital. It supports a range of industries, including the seafood industry, by funding training facilities that deliver accredited training.

Diagnostic comment: Consideration should be given to training infrastructure and funding to support the development of the South African aquaculture industry.

Chile:

A grant for staff training: Investors can claim a grant of up to US\$3.600/employee (US\$780-US\$2.000/employee in the Arica and Austral areas) for training new staff.

South Africa:

SETA. Some Agri-SETA courses for ABET and other general skills are available. The aquaculture sub-sector does not have specific unit standards for key aquaculture skills which constrains the roll out of training in the sub-sector.

Skills Development and Training Programme for the Western Cape

The Aquaculture Institute of Southern Africa (AISA) is in the process of setting up a skills development and training programme for the Western Cape Province in association with the University of Stellenbosch. The recommendations in support of the programme are contained in an AISA report (Botes, 2007).

Rhodes University Public Sector Professional In Service Training

Rhodes University has recently initiated short courses in aquaculture for agriculture extension officers and veterinarians with support for the DoA and Water Research Commission.

Diagnostic comment: There is an urgent need for instruments to address the skills shortage amongst emerging rural farmers being brought into the formal aquaculture industry through schemes such as the DTI's sponsored small farmer development programme implemented by Stellenbosch University.

Given the push to develop small and emerging aquaculture farmers from disadvantaged backgrounds, courses and assistance equivalent to the Australian AAA FarmBis and FarmHelp are vitally needed, as the main cause of failure is a lack of business and management skills.

For in-service training, Agri-Seta needs to urgently define unit standards for aquaculture, so that employers can access the benefits of their SETA remittances.

4.4.4. Food Processing

Australia:

Food Processing in Regional Australia Program (FPRAP)

The FPRAP is a competitive, merit-based grants program that aims to stimulate economic activity and employment by funding food processing activities in rural and regional Australia. Under the program, grants from \$15,000–200,000 (R90,000- R1.2 million) are available on a matched funding basis for small- to medium-sized agrifood businesses proposing a food processing project (including proposals based around wild catch fisheries and aquaculture ventures) in rural and regional Australia.

See also the: Seafood Industry Development Fund (SIDF), under the Innovation, Research and Development below, which provides matching grant funding (50% of total cost) of up to Aus\$30,000 (R180,000).

Chile:

No equivalent customised programme was identified. The capital grants for investment in production could apply (see section 4.4.1).

South Africa:

No equivalent customised programme was identified. The SMEDP grant could apply.

Diagnostic comment: Food processing is an important element in the aquaculture value chain. Industrial finance tends to be focussed on the production side of the industry. It is debatable whether a dedicated finance scheme for food processing is required, or whether it should fit into generic industrial finance schemes, such as the SMEDP grant scheme. In general, the seafood production sector has been neglected in analysis and policy, and there has been an implicit reliance on the inherent ability of the larger and more concentrated fishing companies to maintain South Africa's competitiveness in this field. If the aquaculture sector is to grow and small and medium size enterprises promoted, a more innovative approach will be required to innovate new products and value addition, otherwise the traditional dominance of the big fishing companies with in house R&D capacity will continue. It is instructive to note that Australia, a country whose seafood economy is dominated by small and medium enterprises, possesses a "Seafood Industry Development Programme" with extensive government support for innovation and export.

4.4.5. Regional Development

Australia:

Australia is made up of a federal state structure with many remote, underpopulated areas. The Australian Government's approach to regional development is to work in partnership with communities, government and the private sector to foster the development of self-reliant communities and regions. The approach is consistent with the Government's framework for developing Australia's regions (*Stronger Regions, A Stronger Australia*). The *Sustainable Regions Program* — established in late 2001 — delivers on the Government's approach to regional development. It aims to assist prototype regions undergoing major economic, social or environmental change; support community leadership in developing local solutions; and build a viable foundation for the future.

Regional Partnerships Program

The *Regional Partnerships Program* delivers on the Australian Government's approach to regional development. As announced in the May 2005 Budget, \$360.9 million is available through the *Regional Partnerships Program* over the four years from 2005–06 to 2008–09.

The program focuses on four areas:

- strengthening growth and opportunities by investing in projects that reinforce and provide greater opportunities for economic and social participation in the community
- improving access to services by investing in projects that, in a cost-effective and sustainable way, support regional communities with fewer than 5,000 in their populations

- supporting planning by investing in projects that help communities identify and explore opportunities, and develop strategies for action
- assisting structural adjustment by investing in projects that assist specifically identified communities and regions adjust to major economic, social or environmental change.

An example of successful regional development with aquaculture is seen in remote Tasmania where the Australian government led the setting up of the salmon industry in the 1980's. A public-private shareholding established a company to introduce and breed disease free salmon which then supplied companies to grow out salmon in water that were zoned for aquaculture by means of an "Aquaculture Act".

Chile:

Chile is also a geographically dispersed country (5000km long and about 200km wide), with some highly developed regions, and other very remote, under-developed areas. Complete information on Chilean regional growth strategies was not available at the time of writing. However it was established that higher grants for some industrial incentive schemes in priority regions, particularly the more remote ones such as the Arica and Austral. Also, the zoning of water for aquaculture (e.g. salmon, mussels, scallops, abalone) in remote areas has brought about successful economic development.

South Africa:

In South Africa, the problem of rural poverty persists and population movement is towards the urban areas. Each province has an economic strategy which addresses its regional characteristics and socio-economic distortions by means of various instruments. Some have specifically addressed the potential of aquaculture. Where favourable environmental conditions exist, aquaculture can play a valuable role in creating economic opportunity in key regions, but government intervention is required to zone land and water for aquaculture and provide necessary infrastructure. Some provinces are quite well advanced in developing areas for aquaculture but infrastructure costs are a constraint.

Diagnostic: A key strategy for unlocking the potential of aquaculture in South Africa is the establishment of regional "aquaculture development nodes". A key intervention by the DTI in collaboration with the provincial economic development agencies would thus be to set up an aquaculture "infrastructure fund" in order to establish "aquaculture development nodes" in the target regions

4.4.6. EXPORTS

Many aquaculture products have become global commodities. In order to penetrate export markets state support is particularly vital in a number of areas. Australia and Chile have been particularly successful in supporting their aquaculture producers to develop the necessary capacity for being internationally competitive exporters of quality products.

Australia:

Australia is particularly well geared to support seafood exports. Government support includes information, advice, training, health compliance, and electronic permitting and documentation.

New Exporter Development Program

Austrade, through its overseas network, Australian offices and TradeStart Network, offers a package of free services to help small- and medium-sized Australian companies develop their business overseas and make their first export sale.

Austrade Advisory Service

Austrade is the Australian Government's agency that helps Australian companies win overseas business for their products and services. It does this by reducing the time, cost and risk involved in selecting, entering and developing international markets.

Export Market Development Grants (EMDG) Scheme

The Export Market Development Grants (EMDG) scheme reimburses certain export promotion expenses to eligible small- and medium-sized Australian businesses that have promoted their products to overseas markets. Average grant about Aus\$37,000 (R201,000)

Industry Partnerships Programme — Young People's Export Market Development Training

The Export Market Development Training Course enables 30 young people to increase their contribution to the future sustainability, competitiveness and profitability of their businesses and industries through export. The course's objective is to build awareness of the value of Australian agribusiness exports and provide participants with the knowledge, skills and networks to move effectively into exporting.

Export Documentation (EXDOC) (AQIS)

The EXport DOCumentation (EXDOC) system supports the electronic preparation of export documentation for primary produce prescribed under the Export Control Act and associated legislation. The system has been in place since 1992 for meat exports. It has been redeveloped for use by dairy, fish, grain, horticulture, wool and skins, and hide exports. It forms an integral part of AQIS procedures, which ensure product meets Australian and importing country standards.

Diagnostic comment:

Export permits procedures for aquaculture products in South Africa are extremely slow and bureaucratic being administered by MCM's administration manually. Non-availability of officials, public holidays, and inefficiency often require multiple trips to MCM offices. For South Africa's aquaculture sector to be internationally competitive a much more efficient system is required. Ideally it should be electronically based like in Australia

Chile:

The government is pursuing a very clear policy of promoting exports. The Chile aquaculture industry is export based and the country has been particularly successful in penetrating the USA, European, and Japanese markets with high quality salmon, scallop and other products. A semiofficial agency (ProChile) provides information to potential exporters and assists in discussions with foreign governments or agencies to remove barriers restricting exports.

South Africa:

Effective export marketing assistance is available through the DTI and DFA consulates abroad. The fishing industry has a long history of exporting products and possesses the necessary infrastructure. Particular problems experienced by aquaculture companies in respect of exports include:

- An inefficient export permit system administered by Marine and Coastal Management.
- A ban on South African shellfish by the European Union.
- High costs of complying with export health standards for small enterprises.
- A lack of capacity in the state veterinary service for certifying the health of aquaculture products.
- Market knowledge. Small and medium size enterprises lack the market intelligence, networks and in house research capacity of the bigger fishing companies with established export markets.

Diagnostic comment: Joint industry-state actions and funding are required to remove the constraints to the export of aquaculture products as outlined above.

4.4.7. Innovation, Research and Development

Aquaculture is a technology driven industry. Investment in R&D and access to new technology imparts a competitive edge allowing early entry to markets and the reduction of production costs and risk. Almost all South African aquaculture enterprises undertake some form of R&D as part of their business strategy. Internationally, countries which have heavily supported and aquaculture technology transfer and development have tended to become industry leaders. Chile has relied mainly on technology transfer (and its industrial finance schemes reflect this), while Australia has emphasised both technology transfer and local R&D to develop new technologies for aquaculture under uniquely Australian conditions. South Africa possesses a strong R&D base which can support aquaculture, but lacks any funding programmes specifically targeted at meeting aquaculture sector develop needs.

Australia:

Seafood Industry Development Fund (SIDF)

The Seafood Industry Development Fund (SIDF) is administered by Seafood Services Australia and funds research and development projects. Funding for the project is provided by the Australian Government's Fisheries Research and Development Corporation. The SIDF helps people, businesses and organisations in the seafood industry wanting to: overcome impediments and capitalise on opportunities for developing the seafood industry; focus on industry development R&D throughout the whole seafood supply chain; improve efficiencies by adopting industry best practice and standards; and achieve higher returns on R&D investment. Matching grant funding (50% of total cost) of up to Aus\$30,000 is available.

Commercial Ready Program

Commercial Ready is a competitive merit-based grant program supporting innovation and its commercialisation. Commercial Ready aims to:

- encourage the growth and successful innovation of Australian companies by increasing the level of research and development (R&D), proof-of-concept and early-stage commercialisation by Australian businesses
- increase the international competitiveness of Australian businesses
- foster greater collaboration between industry and industry and research institutions
- generate national benefit for the Australian economy.

Commercial Ready provides grants from \$50,000 up to a limit of \$5 million for eligible projects of up to three years' duration.

Diagnostic comment:

Commercial Ready is very similar to South Africa's Innovation Fund - see below.

COMET — Commercialising Emerging Technologies

COMET supports companies in their early growth stages, spin-off companies from private or public institutions and individuals to commercialise their innovations. The total financial assistance available under COMET is capped at \$120,000 (exclusive of GST) for each customer. Financial assistance to individuals is limited to a maximum of \$5,000 (exclusive of GST) for management skills development. There is no minimum COMET grant size.

COMET financial assistance is available through a two-tier funding structure:

Tier 1: Grant value of up to \$64,000 (exclusive of GST). The rate of assistance is available at 80 per cent of the eligible expenditure.

Tier 2: Grant value of up to an additional \$56,000 (exclusive of GST). The rate of assistance is available at 50 per cent of the eligible expenditure.

Diagnostic comment:

A similar scheme would be useful for South African aquaculture.

Industry Cooperative Innovation Program (ICIP)

ICIP encourages business-to-business cooperation on innovation projects that enhance the productivity, growth and international competitiveness of Australian industries. It has a particular focus on meeting strategic industry needs identified through Action Agendas. The program is available to all sectors, including cross/multi-sector cooperation. Consortia may include any appropriate combination of SMEs, large or foreign businesses, public sector entities, industry representatives or other entities.

The program's two streams cover different activities:

- Stream A supports project scoping or innovation mapping activities. Maximum funding of \$150,000 is available and projects must be completed within 18 months.
- Stream B supports research and development, proof of concept, innovation demonstration, and adaptation and/or innovation implementation activities. Funding of up to \$3 million is available and projects must be completed within three years.

New Industries Development Program — Pilot Commercialisation Projects

The New Industries Development Program (NIDP) — Pilot commercialisation Projects provide competitive-based funding assistance for 'pilot commercialisation' of new, innovative agribusiness products, technologies and services. The project aims to develop approaches that may be adopted more widely to 'incubate and hatch' new niche agribusiness ventures. Funding on an applicant matched dollar-for-dollar basis to a maximum NIDP contribution of \$120,000.

Science and Innovation Awards for Young People

The Australian Government's Science and Innovation Awards (up to Aus\$10,000 – ca. R60,000) for Young People in Agriculture, Fisheries and Forestry aims to encourage people between the ages of 18 and 35 years to use

science, technology and innovation to advance the future of agriculture, fisheries and forestry, food and natural resource management industries.

Diagnostic comment: Such an award could be particularly helpful to young graduates entering the aquaculture industry. Often they cannot find a suitable job in an aquaculture company. Such a grant would allow them to associate with a company and undertake an innovative project which could benefit the industry.

Cooperative Research Centres Program

This program provides funding for Cooperative Research Centres (CRCs). The CRC Program was established to bring together researchers and research users. It emphasises the importance of collaborative arrangements to maximise the benefits of research through enhanced use, commercialisation and technology-transfer processes. The program also has a strong education component, with a focus on producing graduates with skills relevant to industry needs. There is no set upper or lower limit of funding available for each applicant under the CRC Program, however, applications for funding of less than \$2 million (R12 million) per year are unlikely to be competitive. Applications may be for any period up to seven years. The amount of funding provided to new CRCs in the 2004 round ranged between \$20 million and \$40.25 million over seven years. Industry has also committed to provide CRCs with about 25 cents for every dollar received from participants.

Aquaculture CRC's have been established in Australia for tuna culture and "striped trumpeter" an indigenous fish species with funding worth Aus16 million over seven years. A Seafood Products "CRC" has recently been established which is expected to make a big impact in the competitiveness of Australian seafood products.

Diagnostic comment: The Australian CRC model provides a good R&D model for what is required to promote the development of high potential aquaculture technologies in South Africa. Current South African funding facilities either focus on company level priorities (e.g. THRIP, Innovation Fund) or on those of the individual researcher (NRF Core Grants). While this produces beneficial outcomes, the research needs of the sector as whole are not addressed and opportunities are often lost. A CRC type aquaculture programme(s) would prioritise research on a sectoral level and ensure that all aspects of a potential commercial technology are addressed in thorough manner.

International Science Linkages (ISL)

International Science Linkages (ISL) was established under the Australian Government's Innovation Statement — Backing Australia's Ability. It will provide \$92.7 million over nine years to assist Australian researchers and firms to build networks to gain access to international science and technology. The ISL programme seeks to help Australian researchers increase their participation in

international, leading edge, scientific research, leverage access to international research funds, raise the profile of Australian research, and support the development of strategic alliances between Australian researchers and international researchers and industry.

Chile:

Chile which traditionally had a weak R&D base places emphasis on technology transfer through various incentives administered by CORFO.

Visiting Experts

Grants are available to contract experts or international level consultants in technologies and highly specialised productive process, with the purpose of satisfying specific technological requirements with direct benefit and immediate application for those who propose the project. The maximum contribution is of \$ 30.000.000 Chilean pesos (ca. R420,000) and 50-70 % of the total cost depending on company turnover.

Technological Internships

With this fund, companies, its professionals and technical personnel can acquire training and advanced technical competence. The grant consists of a contribution that co-finances the expenses associated with the internship of a professional or national technician at an international technology centre, or in foreign Company linked to the main activity of the Chilean company, for a maximum period of three months. The finance includes grant of 50-70 % of the total cost, or \$16.000.000 pesos (R223,000).

Technological Missions

This Technology Transfer grant facility supports activities that include research, technology diffusion, and transfer or adaptation of management and/or production technologies, with the purpose of contributing to the modernization of a companies production. It takes the form of a “Technology Mission” abroad, and has to be presented by an associated groups of companies. These missions can include visits to companies, universities or research and technology development centers, which are of interest to the associated companies. A Technological Missions grant consists of a subsidy of up to 50-70 % of the corresponding cost.

Individual Venture Innovation

This line of finance available from *Innova Chile* supports innovation projects of companies involved;- in the development of technologies for new products, goods or services; or in the incorporation of new processes to its production, including models, prototypes and pilot plants. It consists of co-financing that covers up to 50 % of the cost of the innovation project with a maximum ceiling to fund of \$ 400 million Chilean pesos (R5.6 million), the company having to contribute the remaining amount.

Diagnostic comment: Chile's "Individual Venture Innovation" fund is similar to South Africa's "Innovation Fund" and Australia's "Commercial Ready Programme"

Venture Capital

This finance facility seeks to promote the emergence of new entrepreneurs by means of assistance in the formulation and execution of innovative business projects, including the start up, operational and growth stages. It consists of a non-refundable contribution that co-finances the definition and formulation of innovative business projects, on the basis of proposed business profile. Once business formulation stage is completed, the proposing company may apply for co-financing for the execution of the project. Finance for both stages is disbursed through sponsor institutions registered with *Innova Chile*.

Technology Consortium

Co-finance for the costs of rights to technology is available from *Innova Chile* which may be used to pay royalties, patents and other rights, and activities of support to the economic and financial management of a transferring and/ or a commercializing a technology. The *Innova Chile* contribution consists of a non-refundable subsidy of up to 50 % of amount needed for the execution of the project. In this consortium, research activities, development, and innovation projects are included. A "technology consortium" consists of an agreement between two national companies; or one national company and a national or foreign Institution or technological center; and other similar combinations. It grants a maximum amount of \$ 600 million pesos (R8.3 million).

Technology Diffusion Programs

Technology Diffusion Programs are available to national technology institutions and universities for the purpose of technological exploration abroad; and the later diffusion of the results obtained, to level centers, technological entities and universities. The maximum co-financing amount from *Innova Chile* is 80 % of the total cost of the project, with a ceiling of \$ 80 million pesos (R1.1 million). National technology Institutes, public or private, Universities, technological entities with experiences and specialization in the project development, linked to technological alternatives and productive applications may participate in this program.

Technology Diffusion Centres

Support is available for the the creation and strengthening of the Technology Diffusion Centers (CDT) in the following stages:

- Technological diagnosis and feasibility of establishing a CDT.
- Constitution of the CDT.
- Strengthening of existing CDTs

Technology Diffusion Centre grants in the form of a 2 year subsidy may be applied for, which covers 40 % of the total cost approved by the Committee, with a maximum grant contribution 10.000 UF's (R2.6 million). Technology

Diffusion Centers may be established by consortia of productive companies of goods and / or services in the same sector or value chain with common interest in technological problems.

South Africa:

THRIP

South Africa's Technology and Human Resources for Industry Programme (THRIP) funded by the DTI through the National Research Foundation is a highly successful matching funding scheme for industry – tertiary research institution research partnerships. Various aquaculture projects have been funded through the THRIP.

Innovation Fund - MiTech

The Innovation Fund invests in projects that have potential social and economic benefit for South Africa and that promote the economic competitiveness of South Africa internationally. The goal of the Department of Science and Technology's Innovation Fund Technology Missions (MiTech) is to fund high risk, early stage, technology development research with a potential for broad economic benefits. Funding is for the support of accelerating the development of critical pre-competitive technologies to the point at which product Project funding is limited to a maximum of R3 million per year and the funding period is usually limited to 5 years. The consortium cost share, primarily coming from industry partners, must be at least 50% of the total project costs.

Innovation Fund – Technology Advancement Programme

The Innovation Fund – Technology Action Programme (TAP) provides funding for proof of concept research and development that will lead to prototype stage or equivalent. The Innovation Fund invests in end-stage research where research knowledge can be translated into new and improved products, processes or services that are introduced into economic or social markets. The Innovation Fund has as its focus projects which:

- involve technological innovation with a large component being R&D that provides new knowledge
- build on existing research that will enable progress to the prototype stage or equivalent are in areas that will deliver a significant benefit to South Africa either through expanding existing commodity sectors that create new opportunities or other benefits for historically disadvantaged groups
- enabling the migration of existing industries to new added value areas, or create new leveraged industries from existing industries
- enabling the establishment or significant expansion of new or emerging high R&D intensive industries
- involve within a consortium arrangement the appropriate combination of research, business, or NGO partners to achieve the benefit.

National Research Foundation Focus Areas

Grants for marine aquaculture are available to NRF rated researchers at tertiary institutions under the "Sea and the Coast Programme" which forms part of the Ecosystems and Biodiversity focus area. Several researchers have made valuable contributions to aquaculture technology development (particularly

abalone and marine finfish) and the training of graduate students through this facility.

SEDA Technology Programme (stp)

The **SEDA stp** was created to provide technology and business development support services to small enterprises as an integral part of its mandate to drive the national technology and business incubation agenda. **stp** contributes to South Africa's economic development through the creation and support of technology business centers, including incubators and technology demonstration centres. These centres provide a variety of business support services and office infrastructure to small enterprises. **stp** also provides a range of services that enable industry and in particular small enterprises in the second economy to access and transfer technology. SEDA incorporated the Community Public Private Partnership Programme (CPPP) from the Development Bank of South Africa, along with its aquaculture project portfolio. However, an exodus of key staff saw the collapse of aquaculture project support within SEDA.

4.4.8 Business and Taxation Assistance

Australia:

R&D Tax Concession

The R&D Tax Concession is the principal government initiative to enhance and increase the amount of R&D conducted in Australia. It provides a tax deduction for eligible expenditure on R&D. The concession is available to all industries.

The concession enables Australian incorporated companies to deduct up to 125 per cent of eligible expenditure on R&D from assessable income when lodging their tax returns. A 175 per cent Premium (Incremental) Tax Concession and R&D Tax Offset for small companies are also available in certain circumstances. To obtain the concession, R&D activities must be:

- systematic, investigative and experimental, involve innovation or high levels of technical risk, and are carried out to acquire new knowledge or produce new materials, products, devices, processes or services, or
- other activities directly related to undertaking the above.

Tradex (Exemption from Duties and Tax on Goods for Re-export)

Tradex provides persons or organisations with an up-front exemption from Customs duty and GST on imported goods intended for export or to be used as inputs to exports. The scheme removes the need to 'drawback' the charges after export.

Pooled Development Fund (PDF)

The Pooled Development Fund program increases the supply of equity capital for growing Australian small- and medium-sized enterprises (SMEs). PDFs are private sector investment companies established under legislation.

They raise capital from investors and use it to invest (take equity) in Australian SMEs. In return, PDFs and their shareholders are taxed at a lower rate on income generated through PDF activities.

Diagnostic comment: A key South African strategy for the development of aquaculture SME's for people from disadvantaged backgrounds is to integrate them with established aquaculture businesses by means of equity in the SME's. An incentive for established South African aquaculture companies to mentor BEE SME's could be a lower tax rate on the income generated from the SME's partnerships.

Chile:

No R&D tax concession appears to be available in Chile. Tax concessions are available for specified investments in certain of Chile's remote regions. Chile provides a subsidy ranging between three and nine percent on certain non-traditional export items.

South Africa:

A 150% R&D tax deduction was introduced in 2006 for *bona fide* research conducted at tertiary institutions.

4.4.9. Environmental Management

Australia:

Environmental Management Systems Incentive Program

An Environmental Management System (EMS) is a business management tool that is helping Australia's rural industries and individual primary producers better manage their impact on the environment and improve sustainability and production efficiencies through property management planning. EMS can help primary producers meet emerging personal, social, market and consumer demands for product quality and environmental assurance. The EMS process is based on a continuous improvement cycle of 'plan-do-check-act/review'. Through the EMS Incentives Program (EMSIP), the Australian Government is offering a taxable reimbursement to individual primary producers who want to implement an EMS for their business. Funding is provided for 50 per cent of costs associated with implementing an EMS. The maximum reimbursement of \$3,000 is available to applicants whose taxable income is \$40,000 or less. For applicants whose taxable income is between \$40,000 and \$45,000, the maximum entitlement of \$3,000 will reduce by \$3 for every \$5 of taxable income over \$40,000.

National Landcare Program (NLP) — Natural Resource Innovation Grants

The Natural Resource Innovation Grants are one-off grants to encourage people engaged in farming, food, aquaculture and forest industries to contribute to sustainable production by developing and/or adopting and promoting innovative practices, production techniques, technologies and products. New and innovative water-related activities are also encouraged. By encouraging

innovation, the Grants facilitate continuous improvement and adoption of best practice, thus, supporting the principal goal of the NLP.

Chile

No information obtained.

South Africa

Most information and assistance is related to compliance and best management practise.

BMP, Authorisation Protocol and Booklet for the Western Cape

Outlines “Best Management Practises” (BMP) and procedures to be followed in obtaining the necessary authorisations to conduct aquaculture.

Guidelines for Sustainable Finfish Culture

Outlines MCM’s requirements for compliance with environment legislation.

Eastern Cape Finfish Culture Strategic Environmental Assessment

The East Cape Development Corporation has initiated a Strategic Environmental Assessment to identify and zone suitable waters for sea cage aquaculture of finfish.

4.4.10. Information

Australia:

The Australian Seafood Industry Council

The Australian Seafood Industry Council is the peak body representing the commercial wild harvest, aquaculture and post-harvest seafood industries in Australia. The industry’s gross value of production is \$2.1 billion, including \$1.6 billion in exports. ASIC’s mission is: *Through industry leadership and representation, provide a single united voice for all sectors of the Australian seafood industry on national issues of importance to the industry.* ASIC is located in Canberra, close to the seat of the Australian Government and the decision makers. However, it remains responsive to the interests of state, territory and and Commonwealth waters’ fishing operators and aquaculturists, as well as the post-harvest sector.

Seafood Services Australia (SSA)

SSA is a not-for-profit company established as a catalyst for sustainable development of the seafood industry. SSA’s founding members are the Fisheries Research and Development Corporation and the Australian Seafood Industry Council. SSA’s constitution focuses the company on helping the industry overcome impediments to its development that exist because of ‘market’ or ‘institutional’ failure. To ensure wide industry input, the SSA Network is designed to link people, expertise and resources from Australia and around the world with the seafood industry. SSA helps seafood businesses by working with them to:

- obtain (or generate) and commercialise new knowledge and technologies
- exchange information and advice

- develop and implement systems and standards to manage seafood safety, quality and environment
- identify and capitalise on opportunities.

Other

The “Australian FishBook II” lists extensive sources of other aquaculture fishery related statistics, advisory services and online and actual Government entry points.

Diagnostic comment: In general, Australian access to information related to aquaculture is excellent and a great help to small and medium enterprises. The “FishBook II” resource is in itself a huge source of information, the equivalent of which South Africa does not possess. A big constraint to new entrants into the South African aquaculture industry is access to information. South Africa would do well to emulate some of the Australian examples.

Chile:

No information was obtained on Chilean information sources.

South Africa:

Aquaculture Institute of South Africa (AISA) and the Aquaculture Association of Southern Africa (AASA)

AASA and AISA are the primary sources of information on the South African aquaculture industry. Both maintains a websites (www.aqua-aasa.co.za; www.ai-sa.org.za), a newsletter, and host a bi-annual aquaculture conference. AASA maintains linkages to associated producer associations and government.

Government Websites

General information on aquaculture and detailed information on permitting and regulatory requirements is available on the MCM-DEAT and Department Agriculture websites. Significantly, no guidance on investment in aquaculture is available through the DTI.

4.4.11 Credit Guarantees

Australia:

Export Finance and Insurance Corporation (EFIC)

The Export Finance and Insurance Corporation is Australia’s export credit agency. EFIC provides international competitive finance and insurance services to Australian exporters and companies investing in new projects overseas. EFIC operates primarily in the part of the market that the private sector does not serve. At the same time, EFIC is a self-funding organisation that operates according to commercial principles. EFIC provides medium- to long-term finance facilities (generally over two years) to buyers of Australian exports, or

their financiers, to help them buy exports. Exports financed this way are usually capital goods and/or services, rather than commodities or other consumables. The group also offers political risk insurance to protect investors and lenders against financial losses arising mainly from political events. The export finance products EFIC offers include:

- direct loan
- export finance guarantee
- documentary credit finance and guarantee
- political risk insurance
- medium-term payment insurance
- bonds and guarantees

Chile:

Credit guarantees

To help investors raise finance, CORFO provides loan guarantees under a scheme described in the Countrywide Investment Incentives section.

South Africa:

Khula Finance

Loan guarantees of up R1 million are available through the Khula Finance Corporation for SME's and BEE companies. The facility does not appear to have been used by any aquaculture ventures because medium sized aquaculture venture generally require emore capital and SME's are usually financed as part of a scheme (such as the DST's Technology for Sustainable Livelihoods Programme), and not as stand alone entrepreneur driven enterprises.

Section 5. Human resource requirements

Aquaculture is a new sector and thus one of the major constraints to its orderly development is a shortage of skilled and experienced human resources, both in the private and public sectors.

Symptoms of the shortage of skills in the private sector include:

- A high occurrence of poorly conceived ventures which either fail or have to re-financed to achieve viability.
- Missed opportunities for commercial projects.
- Poorly conceived project proposals that do not pass due diligence appraisals by finance institutions.
- Operational inefficiencies and increased incident risk, due to poorly skilled technical/ middle management personnel.

Symptoms of a shortage of skills in the public sector include:

- An inability to effectively fulfil the mandate of various departments in respect of aquaculture.
- A lack of leadership and vision to conceive projects (particularly BEE and public- private partnerships) to develop the aquaculture sector to its potential by means of public sector interventions.
- A reactive, rather than a pro-active approach to aquaculture sector development.
- Inadequate responses to enquiries from the private sector which could result in significant investment.
- Slow and inefficient administrative processes as a result of bureaucratic application of regulations.

Despite the above skills constraints a small but experienced cadre of skilled manpower does exist both in the private and public sectors which is driving the development of the aquaculture sector. Although aquaculture production of relatively small, the established commercial operations possess highly skilled and experienced managements, the number of which is growing organically with the sector. A shortage of aquaculture training and experience is however a major constraint to prospective new entrants into the sector.

In terms of formally trained human resources, there is large skills divide between the middle and senior management, who typically have a university or tertiary qualification, and the workers and their supervisors - who almost universally possess no training beyond a school leaver's certificate. This introduces inefficiencies into the business operation, and a low productivity per worker compared to other countries such as Australia or Chile.

In the public sector, officials responsible for managing aquaculture typically have a tertiary qualification, but few have any formal aquaculture training. Due to the generic skills learned at tertiary level by public sector employees, they quickly acquire the necessary aquaculture management skills by experience on the job. However, informal contact with public sector officials reveals a hunger for further in-service and formal tertiary education specific to aquaculture.

University level aquaculture courses are well established at the Universities of Limpopo, Rhodes and Stellenbosch and graduates from these institutions supply the high level human resource requirements of the public and private sectors. Interestingly, graduates from Limpopo (who are mainly black) tend to be appointed to the public sector positions, and those from Rhodes and Stellenbosch (who are mainly white) to the private sector posts. A shortage of bursaries is seen as the main constraint to attracting more black students into aquaculture, particularly at Stellenbosch and Rhodes Universities. Actively recruiting and funding black students at all institutions is seen as a critical intervention to achieve racial representivity as the sector grows.

There are no tertiary aquaculture technical courses offered by any of the South African Technikons which is a major gap in terms of the supply of skills for the growing aquaculture sector. There is no local equivalent to the Australian TAFE, or the Chilean “Aquaculture engineer” courses which train aquaculture technicians. The Tompi Seleka Agricultural College used to offer aquaculture training, from which many current agriculture officials benefited, however the course has not been offered for several years due to a perceived lack of opportunity in aquaculture.

Similarly, there are no SETA unit standards and accredited courses for in-service training which address aquaculture production skills. ABET and similar general skills courses are however available through the AgriSETA (Botes, 2007). The transport-SETA (TETA) has taken on a role to support marine aquaculture and is funding the training of members of the Port Nolloth community in abalone culture through the Fishing and Mariculture Development Association (FAMDA), to prepare them for employment at the Namaqualand Aquaculture Park. Stellenbosch University regularly comes to Port Nolloth to offer the theoretical and practical training. A limited offering of *ad hoc* aquaculture short courses is available through Rhodes, Stellenbosch and a few private service providers, the skills training needs of the aquaculture sector need to be comprehensively addressed.

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Appendix 1 Stakeholder consultation report

In order to inform the industry about the DTI project, an initial explanatory press release (Box 1) outlining the purpose of the project, was sent to all industry stakeholders via the Aquaculture Association of Southern Africa's mailing list. Nine respondents indicated that they would like to be consulted during the process, and these individuals were duly asked for their input into the stakeholder review process. In addition, representatives of the grower / producer associations were solicited for their views as were a number of key informants from the major production sub-sectors (Tables 1 and 2 at the end of the report lists the producer associations and key informants that were interviewed). The majority of the interviews were conducted telephonically, however, a small number were undertaken in person.

The interviews were conducted in an unstructured and informal manner in which respondents were asked to describe their previous experience in accessing DTI financial incentives and services. Respondents were encouraged to describe the major constraints that they experienced in developing farms, and provide an indication of the types of financial incentives / products that they felt would stimulate the sector. During the interviews, the role of the DTI in developing an enabling environment for aquaculture sector development was a major theme.

Box 1. Press release informing industry stakeholders of the DTI project

Press Release

The Department of Trade and Industry (DTI) has contracted Enviro-Fish Africa (Pty) Ltd. to review the current status of aquaculture production in South Africa, and to recommend strategies that the DTI could implement to promote sector development.

The DTI is a key government player responsible for promoting trade and sector development, and aquaculture, being a very young industry, has special development needs which fall within the DTI mandate. The DTI initiated its SMEDP Aquaculture Policy in 2003, has co-funded the establishment of a shellfish sanitation programme to enable shellfish producers to export to the EU, and provided support for SEDA to promote aquaculture projects. While these interventions have been welcomed by industry, their impact on sector development has perhaps not always met expectations, and it is clear that much more can be done by the DTI to support aquaculture sector development. The DTI now wishes to develop customized, sector specific interventions to promote the development of the aquaculture sector. The project thus presents an important opportunity for stakeholders to make inputs and suggestions which will shape the DTI's response to the sectors needs.

Over the coming months, our team will be contacting key stakeholders to obtain information and elicit views that will be used to assist in the development of the Department's sector strategy. If you would like your views to be included in the study, or would like to discuss the study, please contact either myself at p.britz@ru.ac.za or Dr Tom Shipton at t.shipton@envirofishafrica.co.za

It was apparent that very few individuals had applied for DTI financial assistance products. Indeed, the majority of the respondents were unaware of the role that the DTI could play in sector development, or of the products that have in the past been available to emergent farmers. As general comments, the industry found that the application processes were onerous, and it was difficult to navigate the "DTI structures" – to the extent that many farmers simply gave up trying to access the funding structures. Many respondents indicated that the DTI had no capacity with which to deal with either established or emergent fish farmers, as there was no-one available at the DTI who had aquaculture training. With respect to specific programmes, the respondents provided the following insight:

Small to Medium Enterprise Development Programme

Approximately 30% of respondents were aware of the SMEDP, and while it was operational, and only three respondents indicated that they had successfully applied for a grant. The major problems that were reported with the SMEDP was that the process to get funds was too onerous in terms of providing business plans, financial audits, proof of ownership etc. and that many individuals who had applied simply gave up. Indeed, one respondent who was a chartered accountant indicated that even with his professional business planning skills, he failed to navigate the application criteria, and withdrew his application. Another perceived a failure with the programme was that the payment terms were retrospective, i.e. the grant monies were provided after the investment had been made. Thus, even if the monies were forthcoming, the investor still had to “foot” the initial bills and raise the full risk capital. Taking into consideration the time that applicants were taking to navigate the system and get grants authorised, and the fact that payments were retrospective, it was effectively impossible to incorporate the grant into an existing business plan, as often there was no way of knowing whether applications would be successful. Therefore, a number of respondents indicated that the final approval of the grant, rather being viewed as something that could be seen as an integral part of the business planning process, was more of a “bonus”, that if one was lucky may be forthcoming at the end of the project. While the problems with the existing system were noted, the idea of grant funding was generally perceived as a good idea, and one that the industry supported, and assuming that the application processes could be streamlined, one that the industry was keen to support.

Khula Credit Indemnity Scheme

While the majority of respondents indicated that access to start-up capital was a major constraint to development, there was no knowledge of the Khula Credit Indemnity Scheme, and no-one reported that they had attempted to use the facility. Discussions with the stakeholders suggested that while they approved in principle with the scheme, the terms were not necessarily suited to aquaculture. Of particular import was the fact that the loan guarantee was limited to R1 million, and that many aquaculture developments were well in excess of this figure. This while it could be used for smaller ventures and start-up capital, it would not prove attractive to the larger developers – the point here being that the larger developers should go to the development finance Institutions such as the IDC, DBSA, Ithala Bank which are geared to provide larger loans. Notwithstanding the limitations in the loan guarantee, the loan itself was deemed to be too expensive to be attractive – at 3% above prime, the cost of the loan was viewed to be very high, and it was repeatedly stated that what the industry requires is access to cheaper finance, not expensive finance. Finally, the loan terms, and in particular the need to provide collateral for the loan was also viewed as unattractive. Access to Khula finance requires that the applicant make available as security any assets or investments that he /she owns, and Khula would provide a guarantee in respect of the shortfall after taking in account the collateral offered by the applicant. Aquaculture is often viewed as a high risk industry – particularly with those individuals who are pioneering new species or new production technologies – and many respondents indicated that they were unwilling to enter into financial arrangements in which they could lose not only their farms, but in addition, other non-farm assets. Thus, the notion of limited liability was raised in which loan guarantees could be provided for infrastructure, that in the event of failure, could be sold to recover costs, or alternatively, equity share holdings. The issue of equity shareholdings was one that was also discussed with respect to the Development Finance Institutions.

Development Finance Institutions

The role of the development finance institutions such as the IDC, DBSA, Ithala Bank were recognised by all the respondents. As a general comment, few individuals had an in-depth knowledge of the products and services that were available. A number of respondents indicated that the collateral requirements for accessing loans from the development banks were too high, and that this precluded many individuals from accessing loans – one respondent suggested that instead of requiring collateral, the banks could take equity stakes in the business. Lending rates were also perceived to be similar to the commercial banks, and were therefore not stimulating the industry as would be the case were lending rates lower.

In support of the DFI's, they have a large number of financial products available to the sector, and as their mandates include taking on higher risk "development" investments than the commercial banks, they therefore provide tailor-made lending services which would probably not be available from the commercial banks. While all the DFI's require some form of collateral as loan guarantees, some programmes enable the banks to take equity stakes in investments (e.g IDC). Furthermore, development programmes such as the DBSA's Development Fund, are available and designed to assist entrants to develop programmes to enter new sectors. Indeed, the DBSA's development fund has recently been used to provide technical assistance to a Tilapia start-up in Malawi.

Export Marketing and Investment Assistance Scheme (EMIA)

Only one respondent indicated that they had used the DTI export promotion services. The respondent indicated that the service had been excellent, and assisted in the development of international markets for the ornamental fish trade. Those respondents that could potentially access international markets indicated that while they were unaware of these services, they would be interested in using the services in the future.

Small to Medium Size Enterprise Development Agency (SEDA)

None of the respondents indicated that they were aware that SEDA could provide assistance. In the past SEDA had aquaculture desk with a dedicated aquaculture specialist (Mr N. Bacela), however he moved to Marine and Coastal Management in 2006, and to the consultants' knowledge his position has not been filled. Many of the respondents indicated that there was no-one at the DTI with aquaculture knowledge who could assist and advise them with their funding applications – this was viewed as a major impediment to using the DTI's programmes, and one that could potentially be resolved by capacitating SEDA.

Diagnostic

In general, individual farmers have a poor knowledge of the financial support tools that are available. This was not restricted to the DTI's programmes (e.g SMEDP, Khula Credit indemnity Scheme, IDC), but was evident across the wider spectrum of support tools that are available from other Government Departments and the Development Finance Institutions (DFIs). Of those farmers that had tried to access the DTI's programmes, the consensus was that the processes to access services were time consuming and onerous. It was noted that there was no-one at the DTI who was responsible for aquaculture and conversant with the issues to help navigate the

system, and that the financial products on offer were generic, and while they had the potential to develop the sub-sector, needed to be more sector specific.

Aquaculture is viewed as a high risk venture, and access to finance is a perennial problem. The industry would like the authorities to provide an environment in which finance was easier to access, cheaper, and required less personal indemnity.

Other issues of concern

In addition to the accessing the DTI services, and the various financial tools that are available to the industry, a number of other issues that currently hinder sector development were also raised by the respondents. These include:

1. Onerous Environmental Legislation

Complying with environmental legislation is seen as a significant cost to entry into the sector. The principle legislation that the industry has to comply with is:

1. National Environmental Management Act (Act 107 of 1998) - Aquaculture is a listed activity, and all developments require an Environmental Impact Assessment (EIA).
2. National Environmental Management: Biodiversity Act (Act 10 of 1994) – In order to receive a permit to import and farm an exotic species, a risk assessment that outlines the possible effects that the species' release into the environment would have on species biodiversity has to be undertaken.

While both these Acts are designed to protect the environment, the respondents indicated that they have serious cost implications to the development of a farm. Typically, complex EIAs can cost in the region of R200-700,000, which to an emergent farmer will be a major cost consideration, and is likely to significantly affect their balance sheets.

The ornamental fish farmers reported that they import approximately 85% of their product - the industry is a multi-species industry and as such many different exotic species are currently imported. The farmers that were approached for comment indicated that the costs of complying with the Biodiversity Act and undertaking risk analyses for each species that is imported would seriously jeopardize the future of the industry. This is an issue that needs to be resolved as it is currently causing serious uncertainty within the industry. A slightly different problem is facing the tilapia industry, where in order to be competitive, the industry would like to grow the fast growing Nile tilapia (*Oreochromis niloticus*) – as opposed to the slower growing indigenous Mosambique tilapia (*Oreochromis mossambicus*). While the arguments for and against the introduction of Nile tilapia are complex and beyond the scope of this report, prior to major investments into the sector, the industry needs resolution on the issue. The cost of complying with the Biodiversity Act and undertaking the necessary impact assessments will be beyond the scope of any one producer, and therefore the problem is almost viewed as an institutional issue that is limiting the development of the sub-sector as a whole, and needs to be resolved by government.

Of great concern was the summary closure and heavy fining by MCM of an established oyster farm in Saldanha bay whose permit had expired. The producer had been unable to provide a tax clearance certificate in time to renew his permit due to internal issues

with a business partner. His business was closed without warning by MCM compliance officials.

2. High entry costs

Respondents indicated that the high entry costs into the sector are a major impediment to new entrants into the sector. In particular, the high costs associated with coastal land / sea access required for mariculture is viewed as a major constraint to the development of the sector. High infrastructure development costs were also reported as a major constraints to development – this problem is particularly acute for the smaller operators where the high costs of installing basic infrastructure (e.g pumping and reticulation systems) mean that operations have to be large to the gain the economies of scale that can justify the initial investment costs.

3. High research and Development costs

Respondents indicated that in order for the sector to grow, South Africa needs to develop more species that can be farmed, and to stay competitive, improve on the technologies that are currently being used to culture existing species. Technology development is an expensive process and one which even the larger companies such as I&J are struggle to fund, for the smaller companies, technology is something that they require, but are unable to fund. It was therefore reported that there is a need to develop funding programmes.

While THRIP and other generic research facilities are useful to industry for funding aquaculture R&D, if the sector as a whole is to be promoted, dedicated and coordinated aquaculture research programmes will be required. The Australian Cooperative Research Centre Model is a good one which could be applied to aquaculture R&D in South Africa

4. Health and sanitary issues

Telephonic interviews were conducted with Mr Piet Truter, subject specialist for fishery products at the SABS, and Dr Grant Pitcher, Principal Scientist at Marine and Coastal Management responsible for managing the South African Molluscan Shellfish Sanitation Programme

Table 1. Grower / Producer association that were consulted during the research.

Grower / Producer Associations

Abalone Farmers Association of South Africa
Marine Finfish Farmers Association of South Africa
Tilapia Association of South Africa (TILSA)
Western Cape Tilapia Growers Association
Western Cape Trout growers Association
Mpumalanga Trout Growers Forum
South African Koi Traders Association (SAKTA)
Abalone Farmers Association of South Africa

Table 2. Key industry informants that were consulted during the stakeholder consultation process.

Key industry contacts	Company	e-mail
Mr Daniel Wolmersley	Fizantekraal Trout farm	fizantakraal@iafrica.com
Mr Gerrie Van der Merwe	Lunsklip Fisheries	lunsklip@intekom.co.za
Mr Krijn Resoort	Dewdale Trout Farm	krijn@dewdale.com
Mr Buddy Dy Prieë	Millbank Trout - processing	Buddy@millbanktrout.com
Mr Ken Heur	Millbank trout - Production	ken@millbanktrout.com
Mr Daniel Wolmersley	three steams	trout@three-streams.co.za
Mr Ralph Damonse	Molapong Aquaculture	damo@iafrica.com
Mr Kriek Bekker	Aquastel	kriek@bekkercorp.com
Mr Sven Kreher	Aurelian aquaculture	svk@iafrica.com
Mr Colin Nel	South African Koi Traders Association	-
Mr Neil Stallard	Willow Hill Farm	stallard@iafrica.com
Mr Adrian Piers	African Fish (Pty) Ltd	africanfish@zamtel.zm
Mr Grant Brooker	Global Ocean (Pty) Ltd	grantb@globalocean.co.za
Mr Terry Erasmus	Olgear	info@olgear.com
Mr Rob Landman	Irvin and Johnson (Pty) Ltd	robla@ij.co.za
Mr Nic Loubser	Irvin and Johnson (Pty) Ltd	nic@ij.co.za
Mr Andre Du Plessis	Aquafarm (Pty) Ltd	andre@aquafarm.co.za
Mr Rory Hashick	East Cape Development Corporation	rory@ecdc.co.za
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Mr Willie De Wet	Marine Growers Pty Ltd	perly@iafrica.com
Mr Richard Clark	Wild Coast Abalone	wcabs@mweb.co.za
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