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DRAFT MARINE AQUACULTURE SECTOR DEVELOPMENT PLAN

Department of Environmental Affairs and Tourism

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environment & tourism

Department:
Environmental Affairs and Tourism
REPUBLIC OF SOUTH AFRICA

MARINE AQUACULTURE SECTOR PLAN FOR SOUTH AFRICA

Vision

An internationally competitive, technology-based industry, supplying the demand for high value fishery products

Purpose:
To outline proposed strategies that will give practical developmental effect to the marine aquaculture policy objectives, which are –

- To create an enabling environment that will promote increased contribution from marine aquaculture to economic growth within the Accelerated and Shared Growth Initiative for South Africa (ASGISA) framework In a way that
    - supports local economic development;
    - ensures that marine aquaculture adheres to internationally accepted environmental and fisheries standards; and
    - grows South Afica's contribution to global aquaculture production and increases South Africa's competitiveness
- To encourage transformation and broader participation in the aquaculture sector.
- To develop regulatory and management mechanisms aimed at minimising adverse environmental impacts associated with aquaculture practices (e.g. sea ranching, sea-based cage farming etc.)
- To encourage research aimed at increasing the resource base of marine aquaculture from the few species currently being farmed to a more diverse suite of species and fish farming technology.

The intention is that the sector development plan must be a dynamic document, reviewed and revised on a regular basis in the light of experience and ongoing consultative processes with stakeholders.

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EXECUTIVE SUMMARY

The marine aquaculture sector development plan is based on a series of stocktaking and diagnostic reports on the current status and potential of the marine aquaculture industry.

The stocktaking and diagnostic exercise were based on consultations with public and private sector role-players, and a review of the global aquaculture industry. In addition, a GIS database of the marine aquaculture potential of the South African coast was developed, as well as an up-to-date contact list of persons involved in the industry. On this basis, constraints to industry development and strategies to overcome them were identified and specific actions and interventions are recommended to promote the development of the marine aquaculture sector.

Commercial South African marine aquaculture production is currently relatively small and growth has been slow compared to countries with similar situations. Reasons for this include competition from the sea fishery, a high-energy coastline that limits sea-based aquaculture, competition for land from other coastal land users restricting land-based operations, a lack of appropriate technology and an uncoordinated institutional environment.

In 2004, there were 48 active rights holders in the industry and production was 1,996 tons valued at 152.8 million Rands. In terms of volume of production, mussels represent the largest sub-sector, and accounted for 48.8 % of production, followed by abalone (27.9%), oysters (13.6%), prawns (7.0%) and *Gracillaria* (2.6%). In terms of value, abalone represents the largest sub-sector, and accounted for 87.7% of production, followed by prawns (7.7%), mussels (3.3%), oysters (1%) and *Gracillaria* (0.1%).

The stocktaking and diagnostic exercise revealed that the economic outlook for marine aquaculture over the next twenty years is exceptionally positive, and that real prices for high value fish will rise in response to increased demand. This is in response to a projected decline in the supply of high value fish from the harvest fisheries. South Africa should therefore actively harness its potential to increase marine aquaculture production and maintain market share in the high value fishery sector.

Marine aquaculture is based on intensive production technologies with high input costs. Therefore the marine aquaculture sector will be based on the production of high-value products. Marine aquaculture is not regarded as a source of cheap protein for food security, but its development can result in substantial welfare gains in poor coastal communities. Although very difficult to reliably project, since estimates have to be made on the basis of assumptions fraught with uncertainty, indicatively the South African marine aquaculture industry could grow at a sustained annual rate of between 9% (the global average growth rate of aquaculture) and 20% per annum depending on the level of public sector support provided. Estimates suggest that over the next 20 years, total production might increase from the current 2,000 tons per annum, to a conservative 10,000 tons (low range projection) or an optimistic 60,000 tons (high range projection). In terms of employment, a marine aquaculture industry producing 60,000 tons of product per year would create a considerable number of skilled jobs. The indicative magnitude is probably in excess of ten thousand jobs directly on-farm. This number can probably be doubled if the services sector employment and a multiplier effect are factored in. The indicative growth estimates are well within the environmental capacity for aquaculture, but zoned access to both sea and land based sites is required.

Key marine aquaculture sector development strategies

Based on the stocktaking and diagnostic exercise, the Department proposes the following strategies to promote the development of the sector.

1. Policy and Legislation

The sector plan stocktaking and diagnostic exercise revealed that the development of the marine aquaculture industry had been fundamentally constrained by the absence of national marine aquaculture policy and legislation which provide direction to the relevant government departments, industry and other stakeholders. A new aquaculture policy is therefore currently being drafted and circulated for comment. In preparation for the implementation of the aquaculture policy and this sector development plan, a legal review process is being undertaken to analyse all legislation that impacts on aquaculture in order to address gaps and overlaps. The outcome of the process would determine

whether it is necessary to develop new legislation to deal with aquaculture or whether existing legislation should be amended.

2. Coordinated public sector support for marine aquaculture development

At least four National Government Departments (Environmental Affairs and Tourism (DEAT), Trade and Industry (DTI), Agriculture (DoA), and Science and Technology(DST)) and four provincial governments (Northern Cape, Western Cape, Eastern Cape and KwaZulu Natal) bear the primary responsibility for marine aquaculture sector development. Many are lacking in human capacity with a good understanding of the marine aquaculture sector and of the processes required to promote sector development. It is therefore proposed that a designated body or other appropriate arrangement be established between these departments and provinces, in order to ensure coordination of public sector initiatives. In its capacity of lead agent, the DEAT will chair this proposed coordination body and provide secretariat functions. With regards to "client" interaction such as the processing of marine aquaculture applications and the allocation of rights or permits, the DEAT will assume the coordinator role to the effect of becoming a so-called "one-stop-shop" in respect of marine aquaculture investors, entrepreneurs or other interested parties.

3. Marine aquaculture Research and Technology Development

Marine aquaculture is a technology-driven industry based on mostly the domestication of wild species. South African marine aquaculture is currently based on a narrow range of species and, in order for it to grow a greater diversity of commercial species is required. Linked to this is the need to make South African producers more internationally competitive by reducing costs through improved technologies. To create a comparative market advantage, and comply with biodiversity legislation the development of technology, focusing on indigenous species should be supported by government. The sector plan outlines a marine aquaculture technology development programme which includes the following programmes:

- Marine aquaculture/environment interaction
- Abalone culture support programme
- Finfish technology platform programme
- Finfish cage culture development programme
- Commercial species diversification programme
- Marine biotechnology and seaweed culture programme
- Market potential of South African marine aquaculture products
- Pilot projects at Aquaculture Development Nodes

4. Marine aquaculture education, training and skills development

The marine aquaculture sector is a skills-based industry at all levels, and, if it is to grow, human skills capacity needs to be developed in collaboration with the key stakeholders in the private sector, educational institutions and relevant government departments. At present, formal training in aquaculture is only provided at tertiary level. There is a significant gap between the qualifications of workers (who have secondary level education) and management (who are generally university trained). A need was identified to develop technical training and skills for workers. This would enable the industry to meet efficiency and transformation goals.

5. Marine aquaculture Development Nodes.

A key sector plan strategy is the creation of "marine aquaculture development nodes" at localities with a high potential for aquaculture. Marine aquaculture development nodes are analogous to industrial parks where the public sector provides zoned land and water and a package of services to attract industry to invest in specific localities. An initial eight potential aquaculture development nodes were identified.

6. Small Medium, and Micro Enterprises

Programmes to involve SMMEs and rural communities from areas with suitable water resources in sustainable forms of aquaculture shall be part of the implementation strategy. These programmes will include integrated systems (training, technical and financial skills development), advisory and support services and other means of support and would require inputs from all relevant stakeholders and role players.

1. THE NEED FOR A PLANNED APPROACH

The South African marine aquaculture sub-sector is relatively small, but the prospects for growth over the next two decades are very promising, due to the levelling off of global fishery production and a projected increase in demand and price for high value fishery products. Therefore, from a macro-economic market perspective, South Africa should consider to harness its potential for increased marine aquaculture production capacity.

There are several significant constraints to marine aquaculture development, and public sector-driven interventions are required to create an "enabling environment" for investment into the sector. The experience of the local marine aquaculture industry to date reveals that growth has fallen far short of expectation, mainly due to an uncoordinated institutional environment, a lack of appropriate technology, difficulties in obtaining suitable culture sites, and inadequate public sector support measures to pioneer farmers. These constraints are typical of developing aquaculture industries around the world, and successful aquaculture industries have adopted a planned approach designed to achieve certain sectoral growth targets.

The need for a marine aquaculture sector plan was first identified by the Department of Environment Affairs and Tourism in the late 1990's and a consultative sector planning workshop was held to obtain stakeholder inputs.[1] The South African Marine aquaculture Sector Plan is based on research and a comprehensive series of consultations with stakeholders between May and December 2004. It outlines the production potential of the sector, identifies strategies to overcome constraints to development, sets goals and objectives, and defines a series of institutional interventions and projects designed to achieve the goals.

2. THE CURRENT STATUS OF SOUTH AFRICAN MARINE AQUACULTURE

Commercial marine aquaculture in South Africa began in the 1980's with the establishment of oyster, mussel and prawn farming. Abalone farming developed in the 1990's and is now the most valuable marine aquaculture industry. In 2004, the South African marine aquaculture industry produced 1,996 tons of products, valued at 152.8 million Rands. In terms of volume of production, mussels represent the largest sub-sector, and accounted for 48.8 % of production, followed by abalone (27.9%), oysters (13.6%), prawns (7.0%) and *Gracillaria* (2.6%). In terms of value, abalone represents the largest sub-sector, and accounted for 87.7% of production, followed by prawns (7.7%), mussels (3.3%), oysters (1%) and *Gracillaria* (0.1%).

During 2004, there were a total of 48 active rights holders in the industry. The location of the existing and proposed operations of marine aquaculture rights holders in South Africa in 2004 is presented in Figure 1. Of those rights holders, 33 were either operational (at partial capacity) or at full production, 14 rights holders were at the developmental stages of operations, and one operator (the sole prawn producer) had terminated operations[2]. In 2004, the industry provided direct on-farm employment for 740 people, and a total of 173 ha were under cultivation. The abalone industry represents the largest sub-sector in terms of both permits allocated (19 for farming and one for ranching) and employment (620 personnel, or 84% of the marine aquaculture sector). The oyster sub-sector represents the second largest industry with nine farms that are at full production, two farms at partial production, and one farm that is in the development phase. With respect to employment, the oyster sub-sector accounts for 75 jobs. The mussel sub-sector employs 23 people. At present, there is one farm that is operating at full capacity, and four farms that are in the developmental stage. In addition, there are three operational seaweed farms in operation, and two under development. Marine fish farming is set to take off following research initiatives and pilot commercial operations to develop technologies for the farming of indigenous species including dusky and silver kob (*Argyrosomus japonicus and A. inodorus*), white stumpnose (*Rhabdosargus globiceps*), geelbek (*Atractoscion aequidens*), yellowtail (*Seriola lalandii*), and white margined sole (*Synaptura marginata*).

It is important to note that not all of the rights holders presented in Figure 1 have activated their permits. Some of the projects are still at the developmental or pilot phase of operations, and some of

[1] Stenton-Dozey, J. 1999. Proceedings of a National Workshop on Planning for Sustainable Development of Marine Aquaculture in South Africa. DEAT, Marine aquaculture Section. 152 p.

[2] The prawn farms were sold as two separate units and recapitalised for expansion in 2005

the established operations are expanding. For example, the Amatikulu prawn farm in Kwa-Zulu Natal is in the process of being re-developed and capitalised for super-intensive production. The current state of the industry is summarized in Table 1. The estimates in this table are based on information available at Marine and Coastal Management, and telephonic surveys.

Figure 1. Marine aquaculture rights holders in South Africa, and the current or proposed locations of their operations

Table 1. A summary of the South African mariculture industry in 2004.

Mariculture activity	Number of rights holders	Status of operations in 2004				Estimated production (tonnes)	Est. area under cultivation (ha)	Estimated Employment (individuals)
		Development	Operational	Full production	Terminated 2004			
Abalone pump ashore	19	2	12	5	-	600	35	600
Abalone ranching	1	-	1	-	-	0	2	20
Finfish cages	1	1	-	-	-	0	0	0
Finfish pump ashore	1	1	-	-	-	10	0.03	2
Mussels	5	4	-	1	-	900	55	23
Oysters	12	1	2	9	-	376	45	75
Prawns	1	-	-	-	1	130	30	40
Seaweed	5	2	3	-	-	200	0.20	10
Total	**48**	**14**	**18**	**15**	**1**	**1,996**	**173**	**740**

Despite the present relatively slow growth and small size of the South African marine aquaculture sector, the industry is well served by the country's established infrastructure and support services, including equipment manufacturers and suppliers, feed manufacturers, internationally accepted product certification protocols, consultants, producer organisations, tertiary research and training facilities and trade publications. Most of the infrastructure and service prerequisites for developing the marine aquaculture sector are thus in place, and the marine aquaculture sector plan can therefore focus on developing strategies to eliminate constraints to growth.

3. PRODUCTION POTENTIAL OF THE SOUTH AFRICA MARINE AQUACULTURE SECTOR

The prioritizing of scarce public resources in support of marine aquaculture sector development requires a realistic forecast of the production potential of the sector in terms of product volume, product value and jobs. Furthermore, a planned sector development needs to be designed around certain goals or targets, which determine the resources and interventions that will be required to achieve them. A series of analyses were conducted to estimate the potential market opportunities for South African marine aquaculture products, and the production potential of the South African coastal environment and infrastructure. Based on this and the nature of the intervention by government to promote the sector, a series of possible growth scenarios were modelled. It should be noted, however, that this modelling exercise had to be made on the basis of a series of assumptions, most of which are fraught with uncertainty. The scenarios, therefore, only serve as illustrations or examples of what *might* be achieved *if* certain key preconditions were fulfilled.

3.1 Market and Consumptions trends

3.1.1 Globally rising demand for aquaculture products

The aquaculture sector is booming worldwide to meet the shortfall in demand for fishery products - resulting from the levelling off of fishery production. The global aquaculture sector has grown at an annual compounded rate of 9.2% per annum since 1973, and is projected to grow at 3.8% per annum until 2020. Increased demand is expected to cause the price of high value fish to increase by 15% in real terms by 2020.

South Africa has a well established fishery sector, and is currently a net exporter of fishery products. However, most South African fisheries are considered to be maximally utilised, and high value product fisheries such as abalone, prawns and linefish are over-exploited. The projected increase in demand for high end fish products provides opportunity for substantial increase in marine aquaculture production. Domestic demand can also be met by imports, therefore the projected increase in demand simply and only provides an opportunity for the marine aquaculture sub-sector, if it is competitive.

3.1.2 Cost competitiveness of aquaculture products

Aquaculture is a form of intensive farming with relatively high unit production costs -compared to our industrial fisheries. The challenge is therefore to identify market opportunities for high value products that can be farmed profitably. Production costs tend to be higher during the set-up phase of a new aquaculture sector, because production techniques have not been optimised, and economies of scale have not yet been achieved. Therefore, in many countries where aquaculture industries have been successful, governments have provided financial and technological support measures to their pioneer farmers until the sector had become established and competitive.

3.1.3 Local and export markets

The capacity of the South African market for high value fishery products is relatively small, which imposes certain production and economy of scale constraints on aquaculture producers. Small and medium size oyster, mussel and trout producers run profitable businesses by marketing their products locally. The strategy of many producers aspiring to enter the export market is to market their products locally until they achieve the required export volumes. The strong Rand and growing local seafood consumption has underscored the growing importance of the local market for aquaculture producers. Sea foods such as tuna, prawns and white fillets have become global commodities, and thus producers intending to export aquaculture products have to be competitive on a global scale. A sobering example of the global market at work was the recent closure of a prawn farm in KwaZulu Natal, resulting from a drop in price due to cheaper production of prawns in China, and the strengthening of the Rand. Prawns could therefore be imported at a price lower than the local cost of production and the farm was forced to cease production.

3.1.4 Creating a competitive advantage

If South Africa is to become a successful exporter of aquaculture products, it will have to be based on a competitive advantage that is sustainable. Clearly, the previous reliance of South African exporters on a weak Rand was not a sustainable comparative cost advantage. South Africa could build comparative market advantages through various strategies including the use of indigenous species for niche markets, exploitation of local environmental advantages, the development of cost efficient technology suited to local conditions, the branding of locally produced species, and a “clean, green” image. Such strategies will however require cooperation amongst producers, and more importantly

government support, which is potentially available as part of South Africa's micro-economic reform strategy. A key element of the marine aquaculture sector plan is to mobilise this support and channel it to the marine aquaculture sector through appropriate institutions.

3.2 Marine aquaculture Production Potential of the South African Coastline

The high-energy nature of the South African coastline limits opportunities for sea-based aquaculture to a small number of sheltered bays and estuaries. Shore-based, pump ashore operations have been successfully developed for abalone and seaweed farming. Although South Africa possesses favourable environmental conditions for aquaculture, access to suitable sites, both sea-and land-based, has been identified as a fundamental constraint to the growth of the sector. A key sector plan strategy is therefore the identification and zoning of suitable areas for marine aquaculture. A marine aquaculture GIS (geographical information system) database was compiled and was used to analyse the attributes and potential of the South African coastline for aquaculture on a provincial basis. This was followed by the selection of sites or "development nodes", which possess a high potential for aquaculture.

3.3 Growth Projections for South African Marine aquaculture

The growth of the South African marine aquaculture sector will primarily be determined by the characteristics of the natural environment, market demand, the competitiveness of producers, site availability, the availability and access to appropriate farming technologies, and the basket of services and incentives available to industry. Therefore to a large extent, the growth rate of the marine aquaculture sector will be determined by the nature of the interventions by government to promote its growth.

Three possible growth scenarios are outlined below, based on the level of sectoral support provided.

Scenario 1: Business as Usual

At present, the marine aquaculture industry in South Africa comprises 48 rights holders producing 1,996 tons of abalone, oysters, mussels and prawns per annum (Table 1). A total of 173ha is under cultivation, and the sector provides employment for 740 people. Assuming that no interventions are made to promote industry development, and that growth is limited to the expansion of current operations, the industry could grow to a ceiling of about 8,000 tons production per annum, employing about 2,500 people. It is estimated that it would take about 10-15 years to reach this ceiling.

Scenario 2: Establish Marine aquaculture "Development Nodes"

If the recommended strategy of establishing eight "aquaculture development nodes" is implemented, and public sector institutional support for marine aquaculture is improved, it is anticipated that production could increase to 15,000 tons per annum over the next 10-15 years. This level of production would provide direct on-farm employment for approximately 4,000 people.

Scenario 3: A Technology Push and Full Package of Sector Support

With government support and the full complement of interventions proposed in the Marine aquaculture Sector Plan, the growth in South Africa should match the global growth rate of 9% per annum over the next 20 years. More optimistically, growth of 20% per annum could be attained if government actively supports and promotes marine aquaculture -as in Chile and Canada. Support measures to the sector would include the establishment of development nodes, technology development, and financial incentives to new aquaculture businesses, institutional coordination and services to facilitate market access.

It is not beyond realism to suggest that over the next 20 years, total production might increase from the current 2,000 tons per annum, to a conservative 10,000 tons (low range projection) or an optimistic 60,000 tons (high range projection). In terms of employment, a marine aquaculture industry producing 60,000 tons of product per year would employ at least 14,250 people directly on-farm. This number can probably be doubled if the services sector employment and a multiplier effect are factored in.

4. STRATEGIES FOR SECTOR DEVELOPMENT

4.1 POLICY AND LEGISLATION

The sector plan stocktaking and diagnostic exercise revealed that the development of the marine aquaculture industry had been fundamentally constrained by the absence of national marine aquaculture policy and legislation which provide direction to the relevant government departments, industry and other stakeholders. A new marine aquaculture policy is therefore currently being drafted and circulated for comment. Policy objectives are:

- To create an enabling environment that will promote increased contribution from marine aquaculture to economic growth within the Accelerated and Shared Growth Initiative for SA (ASGISA) framework In a way that
    - supports local economic development;
    - ensures that marine aquaculture adheres to internationally accepted environmental and fisheries standards; and
    - grows SA's contribution to global aquaculture production and increases SA's competitiveness
- To encourage transformation and broader participation in the aquaculture sector.
- To develop regulatory and management mechanisms aimed at minimising adverse environmental impacts associated with aquaculture practices (e.g. sea ranching, sea-based cage farming etc.)
- To encourage research aimed at increasing the resource base of marine aquaculture from the few species currently being farmed to a more diverse suite of species and fish farming technology.

This sector development plan serves as a supporting instrument for the implementation of the marine aquaculture policy. It will be further supplemented by guidelines for certain forms of marine aquaculture, for example fin-fish cage farming and marine ranching.

The intention is that the sector development plan must be a dynamic document, reviewed and revised on a regular basis in the light of experience and ongoing consultative processes with stakeholders.

In preparation for the implementation of the aquaculture policy by this sector development plan, a legal review process is being undertaken to analyse all legislation that impacts on aquaculture in order to address gaps and overlaps. The outcome of the process would determine whether it is necessary to develop new separate legislation to deal with aquaculture or whether existing legislation should be amended.

4.2. COORDINATED PUBLIC SECTOR SUPPORT FOR MARINE AQUACULTURE DEVELOPMENT

Successful aquaculture involves a wide range of activities such as engineering, environmental management, planning, transport, education, food production and processing, marketing, and scientific and technology research. For these activities to be developed, government structures need to be developed at both National, Provincial and Local level. A number of different Government portfolios are relevant for the orderly management and successful development of the aquaculture sector. Most governmental structures do not at present have adequate capacity for effective management, planning, and promotion of the aquaculture sector in South Africa. This sector document aims at addressing those needs by proposing the following:

Co-ordination and co-operation between various government departments responsible for Aquaculture is encouraged. The following arrangements will be maintained:

a) Department of Agriculture (DoA) continues to take responsibility for the regulation, management and development of freshwater aquaculture, while DEAT takes responsibility for all aquaculture taking place in the marine and estuarine environments.
b) DST will be encouraged to support the development of appropriate technologies for sea-based aquaculture.

c) DTI will provide support in the form of capital investment and business skills to new entrants in the form of SMMEs. The DTI (SABS) will ensure that import and export products adhere to required standards.
d) DWAF will provide support on issues involving water resource planning and water use authorization.
e) Provincial Departments responsible for Economic and Environmental Affairs will develop local Aquaculture economic opportunities and continue issuing of EIA authorizations for land-based operations respectively.
f) For Sea based sites, DEAT will grant approval
g) Public-Private-Partnerships are encouraged to enhance growth and development of the sector. A working together arrangement and assuming responsibility in areas that would optimize maximum sustainable development of the sector is emphasized.

In section 1 reference was made to the inadequate coordination by government departments. This situation can be remedied via the model below.

Model: Management and sector development to be undertaken by a specifically mandated unit within DEAT and DoA respectively, where each Department will be responsible for development, management, administration, and research within the sector. This will include the development, adoption and implementation of a legislative and regulatory framework for the industry. It is proposed that this capacity be supported and guided by an Advisory Forum that will be convened by DEAT Branch Marine and Coastal Management (MCM).

Composition of Forum

a) The Forum shall consist of representatives of the national departments (DEAT, DoA, DoH, DTI, DST and DWAF). The representatives will be nominated by the relevant Director General.
b) DEAT will be represented by Marine and Coastal Management (MCM), Biodiversity and Conservation (B&C); and Environmental Quality and Protection (EQP).
c) The Forum shall also include the four Provincial Coastal Departments that have a role play in aquaculture development.
d) Further, the Forum shall include representatives nominated by relevant industrial bodies.
e) Independent experts in marine aquaculture.

Functions of Forum

The forum shall advise the Department on any matter-

a) Referred to it by the Department, and in particular-
   i. The management and development of aquaculture, including issues relating to environmental protection;
   ii. Aquaculture legislation;
   iii. Establishment and amendment of operational management procedures and sector development plans;
   iv. Recommendations and directives on areas of research.

4.2.1 INSTITUTIONAL ROLES

In this section the current roles and responsibilities of the various government departments towards marine aquaculture are outlined. It will be complemented by policies and plans in respect of marine aquaculture by other government departments and provinces. For most of these other government departments, involvement in aquaculture is a new undertaking, and their roles are often not clearly defined. This plan seeks to promote interaction between all relevant spheres of government and the aquaculture industry, intended to result in a clear definition of roles and delimitation of responsibilities and improved coordination of institutional arrangements in respect of marine aquaculture sector development.

As already mentioned, a key finding of the stocktaking and diagnostic exercise was that many support measures for marine aquaculture sector development are potentially available from various government agencies. However, they need to be mobilised and made accessible to marine aquaculture entrepreneurs in a coordinated way. The need for a clearly mandated public sector institution to coordinate and promote marine aquaculture development was therefore identified. In terms of this sector development plan the DEAT will be undertaking this responsibility.

4.2.2 Department of Environmental and Affairs and Tourism

DEAT Branch MCM is designated as the lead agent for marine aquaculture, and is the primary government department responsible for marine aquaculture policy development, permitting and compliance with environmental laws. It possesses a marine aquaculture research and management capacity which:

- Conducts research and funds a limited amount of research at other institutions via the Marine Living Resources Fund and the Department of Science and Technology funded "Marine Aquaculture Frontier Programme".
- Processes and make decisions in terms of marine aquaculture rights and permit applications
- Operates a molluscan shellfish monitoring and control programme.
- Develops marine aquaculture regulations and operational guidelines.
- Interacts with the marine aquaculture industry on policy and technical issues.
- Meets regularly with industry through the Marine aquaculture Liaison Group.
- DEAT will liaise with other relevant government departments, provinces, industry and other stakeholders. It will coordinate the mobilisation of institutional support and resources. It is envisaged that DEAT will provide a "one-stop-shop" for facilitating investment in new marine aquaculture projects.
- Legislate for the zoning of land and sea space for aquaculture.

Proposed changes and improvements to enhance DEAT's role in marine aquaculture sector development:

Research and Technology Development.

- A research plan and research leadership is required to optimise the benefits of the Sea Point Aquarium for marine aquaculture sector development.
- The appointment of at least one experienced scientist/ research leader with a specialisation in aquaculture technology development is required.
- The focus of the facility should be on public good research aimed at stimulating sector development. Private good research could be accommodated on a "cost recovery" basis provided space allows.
- The results of public good research must be disseminated by means of scientific publications, manuals, seminars and courses at the aquarium.
- Research conducted at the Sea Point Aquarium should be integrated into a coordinated marine aquaculture technology development programme aimed at achieving sector development goals.

Marine aquaculture management and administration

The DEAT should be a "one stop shop" facilitating

- Development and reviewing of policy, sector development strategy and legislation;
- The processing of marine aquaculture applications; Any applicant will then submit his/her application at the DEAT contact point, and DEAT will ensure that necessary assessment/approval by other relevant authorities is obtained as part of its own processing (see Appendix 2).
- Dealing with other issues related to marine aquaculture, such as *e.g*
    - Decisions regarding environmental management;
    - Promotion and development initiatives including public financial support;
- Communication and coordination of activities between other government departments other institutions and the industry;
- Provide secretariat for the proposed interdepartmental coordination forum.

Rights application assessment, authorization and licensing/permitting

In order for the Department to fulfil the management and regulation of the sector efficiently, all marine aquaculture operations shall apply for a right to engage in marine aquaculture operation in accordance with Section 18 of MLRA 18 of 1998 or relevant section new legislation if promulgated. The current application process is time-consuming, complicated and expensive. Given the number of regulatory departments involved and the complexity of issues,

the allocation of rights is an involved and costly process for both government and industry. A user- friendly, timely and streamlined approval system is required, since improving the efficiency and effectiveness of the process of rights allocation will lead to lower costs and less uncertainty. Assistance should be provided to potential operators in the application process. It is envisaged that applications may be submitted on a continuous basis, and that the processing thereof will either happen on a similar continuous basis or in batches, for instance quarterly. Streamlining of the application process is a key objective under the "one stop shop" model outlined above. All rights granted shall be valid for a period of 15 years or a period to be determined by the Minister, according to the provisions of the proposed new legislation. A key objective of the rights allocations will be to ensure that the marine aquaculture industry develops in accordance with BEE principles in order to address historical imbalances and to achieve equity within the industry.

Marine aquaculture Services

The molluscan shellfish monitoring and control programme conducted by DEAT in partnership with industry is strategically important for marine aquaculture sector development. This programme should be strengthened by securing long term public sector funding (including capital equipment and laboratories), expanding the number of monitoring sites to benefit small and emerging shellfish producers, and reviewing the public sector-industry contract in terms of costs to industry.

In order to carry out marine aquaculture risk assessment, health management, phyto-sanitary and sanitary services, facilities (laboratories) will be established within DEAT to provide microbiology, histology, biotoxins and phytoplankton studies and tests.

The issue of public sector responsibility for marine aquaculture risk assessment and health management needs to be resolved. Practically, a laboratory and manpower for marine aquaculture health management would best be situated at the Sea Point Aquarium along with the above services. However, responsibility for agricultural veterinary services resides with the Department of Agriculture, but this Department currently does not possess capacity to provide a service to the marine aquaculture sector. Therefore such capacity will be developed by DEAT in collaboration with the DoA.

Environmental impacts monitoring programme

Environmental compatibility will be ensured through development and implementation of regulatory monitoring programmes e.g. shellfish monitoring programme for chemical pollutants. Rights holders will be encouraged to implement a self- monitoring programme, while the Department will perform random monitoring of all aquaculture activities. To ensure compliance, all lease areas/sites will be subject to physical inspections annually, and the lease agreement will remain in place for as long all performance requirements and obligations are met by the aquaculture farmers. A regulatory framework that is aligned to relevant legislation such as the National Environmental Management: Biodiversity Act will be applied in order to reduce negative impacts on biodiversity. Guidance will be provided to industry on listed species under the Biodiversity Regulations which be released soon.

Food quality, safety and public health

As consumer awareness increases, producers, suppliers and processors need to improve the quality of products and enhance product safety. A seafood quality management programme is required and should adopt international food safety standards, protocols and quality systems. The DEAT will, together with the Department of Health (DoH) and South African Bureau of Standards (SABS) be responsible for monitoring of aquaculture products and ensure that quality standards are adhered to by industry.

Industry liaison and consultation

The growth potential and profitability of Aquaculture is also limited by a lack of co-operation and information-sharing between individual producers. A high degree of industry participation in all strategic and developmental activities will be encouraged through formal liaison with representative industry associations as well as with relevant working groups.

Operational guidelines and permit conditions
There is a need to develop and implement clear permit conditions and performance criteria. Accurate and easily available statistics form a key component of effective strategic planning and management, and there is a need to establish and maintain a National Aquaculture database for that purpose. Farm administration and compliance require strengthening, including the development of mechanisms and protocols for the timely collection and reporting of statistics.

Best management practice for aquaculture
The development and implementation of auditable "best management practices" will enhance the competitiveness of the aquaculture industry, open new international markets, and reduce threats such as disease and sanctions by regulatory authorities and consumers. A traceability system which could be used for marketing, breeding purposes, as well as for tracing and diagnostic of infections, and for vaccines will also be developed for aquaculture products.

Marine Protected Areas (MPAs)
In order to ensure conservation of marine and coastal habitats and their biodiversity the Minister of the DEAT may declare MPAs in terms of the Marine Living Resources Act, and a number of such MPAs have been declared. This principle is based on the assumption that aquaculture is an activity that may, at least potentially, compromise the purpose of an MPA and that it generally will not be allowed to be initiated within the boundaries thereof. Planned or ongoing aquaculture activities that constitute a problem in relation to an MPA must be rigorously assessed on a case-by-case scenario based on the principle of precautionary approach.

4.2.3 The Department of Trade and Industry

In terms of South Africa's micro-economic policy, the Department of Trade and Industry (DTI) is tasked with leading sector development, which includes providing the necessary strategic leadership and industrial support measures. In recent years, the DTI has recognised marine aquaculture as an emerging industry and launched initiatives to provide for sector development. These have included:

- The inclusion of aquaculture as a sector which qualifies for government's small and medium size enterprise development (SMEDP) incentives.
- The drafting of a "customised sector plan", which outlines specific interventions by the DTI to stimulate marine aquaculture sector growth. At the time of writing, the customised sector plan had not been published.

Several DTI sectoral incentives are potentially available to the marine aquaculture industry but have not yet been utilised due to a lack of awareness, red tape and a lack of personnel within DTI specifically tasked with promoting marine aquaculture sector development. A challenge is therefore to mobilise the potential institutional support that is available to serve the needs of marine aquaculture entrepreneurs.

It is therefore proposed that:

- The DTI nominate dedicated personnel to promote marine aquaculture sector development in terms of DTI's mandate as well as in terms of this plan.
- The DTI in particular take the lead in mobilising available public sector incentive schemes, financial facilities and other services for marine aquaculture producers.
- The DTI provide support to the Provincial Departments of Economic Affairs and other agencies in establishing the "Aquaculture Development Nodes".

4.2.4 The Department of Science and Technology

The Department of Science and Technology (DST) is responsible for supporting the development of technology to promote economic and social development. Following discussions with DEAT, the DST undertook to support marine aquaculture sector development by means of providing funding for technology development. In 2005, a "Marine Aquaculture Frontier Programme" was launched and R5 million transferred to DEAT who undertook to administer the programme. It has been suggested that a

marine aquaculture "Centre of Excellence" could be developed which may attract more substantial DST support.

It is proposed that DST supports the further development and conversion of the Frontier Programme into a Marine Aquaculture Centre of Excellence.

4.2.5 The Department of Agriculture

The Department of Agriculture's, Directorate of Veterinary Services is responsible for the disease-free certification of live aquaculture products moving in and out of the country.

Proposals to enhance the Department of Agriculture's role in marine aquaculture sector development are:

- The Department of Agriculture should be encouraged to assume its responsibility for monitoring and control of animal health and veterinary services in terms of aquaculture organisms, and in consultation with DEAT consider how best to give effect to this responsibility in practical terms.
- The Department of Agriculture in the coastal provinces should review their role in marine aquaculture research in consultation with DEAT. Given the traditional strength of research at for example the Elsenburg Institute and its involvement in aquaculture research, its strategic involvement in sector development should be considered.

4.2.6 The Department of Water Affairs and Forestry

The Department of Water Affairs and Forestry has jurisdiction over the onshore use of water, effluent discharges and estuarine aquaculture activities. The DWAF has recently developed a policy which defines its responsibility towards aquaculture in terms of the Water Act. The policy is mainly focussed on aspects of access to freshwater resources and the management of water quality.

It is proposed, however, that clarity with regard to the delimitation of roles and responsibility in terms of aquaculture activities in estuaries be obtained.

4.2.7 Provincial Government Departments

The provincial government departments responsible for economic development in the Western Cape, Northern Cape, Eastern Cape and KwaZulu Natal Provinces and local authorities have included aquaculture in their economic development strategies. A key strategy of this sector plan is to –

- Support the provincial departments to promote sector development at a local level as part of their provincial economic development strategies.
- By establishing "aquaculture development nodes" in the provinces and providing support packages of expertise, technology and financial incentives, investment into the marine aquaculture sector will be boosted.
- Liaise with the coastal provinces regarding their responsibility for the timely issuing of a record of decisions in respect of EIAs. This is a crucial issue for the future successful marine aquaculture sector development.
- Encourage provincial departments to liaise and assist municipal authorities to include marine aquaculture in their integrated development plans.
- Dedicated, high level personnel will be required to work with the provinces in conceptualising, planning, appraising and implementing development node and other projects, with primary funding by the Department of Trade and Industry.
- Provincial initiatives to promote marine aquaculture need to be linked to the national initiative to promote the development of "Marine aquaculture Development Nodes".
- The national initiative will be driven by DEAT, which will assist in conceptualising and planning development nodes, and facilitate the provision of public sector support packages including aquaculture business planning and appraisal, DTI sector incentives, finance through public sector finance institutions, technology advice, and environmental assessments.

4.2.8 Local Government

Municipalities should include aquaculture development nodes in the Integrated Development Plans (IDPs), should also undertake spatial planning and make provisions in their budgets for supporting aquaculture infrastructure and local demonstration projects.

4.3. MARINE AQUACULTURE RESEARCH AND TECHNOLOGY DEVELOPMENT

4.3.1 Coordinated R&D programmes

The DEAT Frontier Programme Marine Aquaculture Research and Development is presently the lead research and development programme for marine aquaculture. This programme was initiated in 2005 and was designed to fast-track the establishment of a Center of Excellence for Marine Aquaculture to be formed within Marine and Coastal Management of the Department of Environmental Affairs and Tourism. The Frontier Programme is funded primarily by the Department of Science and Technology and represents a consensus of priority projects as determined by key stakeholders including the Branch Marine and Coastal Management, universities and industry.

The establishment of an emerging Center of Excellence will secure future funding from the Department of Science and Technology. The Center will serve to stimulate and fund collaborative research opportunities and the creation of partnerships between existing institutions with aquaculture research capacity. It will thereby encourage the growth of a critical research and skills base capable of responding to the research and technology requirements of the marine aquaculture industry.

Marine and Coastal Management will assume responsibility for the management of the Center and will convene a Scientific Steering Committee, representing all stakeholders, to oversee project coordination and integration. The functions of this committee will include sourcing additional funds, identifying research and development priorities, allocating project funds, and monitoring project progress.

4.3.2 Marine aquaculture Technology Development

The development of marine aquaculture technology, particularly for indigenous species, was identified as a key strategy for growing the marine aquaculture sector. Linked to this is the need to make South African producers more internationally competitive by reducing costs through improved technology. Although research and development for a range of species is being conducted, much of this is poorly funded and conducted in a piecemeal fashion. In order to ensure that the necessary technology is developed, it is essential that well funded, centrally coordinated research programmes be initiated. The research capacities of our institutions also need to be improved. Although government is starting to address these needs, significantly more resources need to be made available if established industries are to remain competitive and new industries developed. It is therefore proposed that a coordinated marine aquaculture technology development programme for marine aquaculture be established.

The public sector (DST, DTI and DEAT) will invest in technology development in partnership with industry to promote sector development. Suggested research and technology development programmes include:

- Marine aquaculture/environment interaction
- Abalone culture support programme
- Integrated aquaculture
- Finfish technology platform programme
- Finfish cage culture development programme
- Biotechnology programme
- Seaweed research
- Commercial species diversification programme
- Nutrition
- Animal Health programme
- Hatcheries

Marine aquaculture/environment interaction

Aquaculture has often been associated with environmental degradation, with the key issues being biological, organic and chemical pollution, eutrophication and habitat modification. Without proper evaluation and mitigation of impacts and implementation of responsible environmental management plans, aquaculture activities may degrade the ecosystems upon which they rely. Therefore, an increased understanding and monitoring of the interactions between aquaculture and the environment

are required. There is a need to administer a compliance, fish health and environmental framework that provides confidence to industry, investors and the broader community.

A harmful algae monitoring and research programme is required in order to assess the risks and to mitigate the impacts on aquaculture as this is common on the South African coastline and freshwater systems and pose a major threat to the development of aquaculture

Abalone technology support programme

Abalone farming is the mainstay of the aquaculture industry and requires research and development support to reduce risk and make the production technology more cost efficient and competitive internationally. The sector is well organised through the Abalone Farmers Association of South Africa which has the capacity to organise collaborative research. AFASA has supported collaborative R&D at research institutions at around R500,000 per annum for the last few years. During the sector planning process abalone culture research priorities were identified.

Integrated Aquaculture

Increased emphasis needs to be placed on integrated water use to improve environmental performance. Polyculture incorporating the increased use of plants and animals for reducing waste loads should be encouraged. Research programme should include investigating the development of integrated aquaculture systems.

Finfish technology platform

If the marine aquaculture industry in South Africa is to develop and produce significant volumes of product, it is strategically important to develop appropriate technologies for the farming of indigenous marine finfish. To this end, a research and technology development to support industry to commercialise marine fish culture is required.

At a National Research Foundation (NRF) workshop in 2002, the concept of a “Marine Finfish Technology Platform” was proposed whereby capacity would be developed both within research institutions and industry to develop the respective elements of commercial culture technologies. It was proposed that capacity around core-disciplines within the research institutions be built to enable the research community to work on a range of candidate species. It was suggested that three to five species need to be identified as prime national candidates. Candidate species would be chosen for their ease of culture (preferably species for which there are established technology abroad and must preferably be species which have (or are similar to species which have) an established high market value.

A research program to bring these candidates to commercial production would include:

- A broodstock domestication programme including the maturation of juvenile fish.
- A market analysis for our indigenous finfish species needs to be undertaken
- Larval rearing and juvenile production programme.
- Establishment of grow-out technology including feed and nutritional requirements.

A simultaneous programme for screening potential new species is recommended wherein:
A thorough desktop study is undertaken.

- Broodstock are kept in captivity and eggs hatched and reared on an experimental basis.
- Wild-caught juveniles are used to determine growth rates, food conversion efficiency and responses to captivity.

The possibility of producing white fillets on an industrial scale for species with an international volume market requires investigation. In order for this to come to fruition, and indeed for finfish marine aquaculture to become a commercial reality at a large enough scale to compete internationally, offshore cage culture technology must be established. The viability of onshore recirculating technology for finfish culture requires investigation.

The DST/DEAT Marine Aquaculture Frontier Programme is a good start which provides funding to achieve some of the above objectives. Further dedicated funding is required to research the market for cultured finfish, and to develop cost-effective systems for shore based and offshore culture.

Finfish cage culture technology programme

In order to grow out finfish cost-effectively, environmentally acceptable cage systems suited to the local environment are required. Furthermore, the siting of cage culture presents a major challenge in terms of environmental impacts and conflicts with other users of the marine environment. In the light of the regulatory, environmental and technical challenges that confront the development of finfish cage culture it is essential that government support the establishment of cage culture.

It is recommended that Government fund a finfish cage culture technology programme which includes:

- Pilot projects in partnership with industry to develop and evaluate the cage technology, and the environmental effects.
- Environmental Impact Assessments at proposed sites or development nodes.
- Cage culture technology acquisition and transfer.
- Assistance with the cost of importing prototype cages and the monitoring their performance.
- Once cage technology programmes are underway, local capacity in cage technology should be nurtured through involving marine engineering expertise in South Africa.

Biotechnology programme

Marine biotechnology is a rapidly expanding moving field full of opportunities which South Africa can enter, as it possesses the required basic research expertise and infrastructure. The biotechnology required by the marine aquaculture sector can equally serve other resource users such as the fisheries and pharmaceutical industries. By the same token, marine biotechnology products may require the use of marine aquaculture to produce sufficient raw material which can be processed for active compounds (e.g. genetically engineered and naturally occurring seaweeds or sponges). As such, a marine biotechnology platform needs to be established in collaboration with these users as well as the established biotechnology companies in the country. Biotechnology companies should be provided with incentives to cooperate with the marine aquaculture industry.

The establishment of a centre dedicated to marine biotechnology should be investigated. This can take the form of a BRIC (Biotechnology Regional Innovation Centre)[3] or Centre of Excellence.[4] South Africa should consider establishing a marine biotechnology institute, aligned to similar institutes overseas.

Seaweed research

The culture of South African seaweeds has the potential to yield unique and useful products, but such development will be entirely dependent on a directed research effort similar to the proposed biotechnology programme. It is recommended that:

- Interest in conducting research into products from seaweeds be promoted amongst interested research institutions.
- A programme for screening local species with aquaculture potential be initiated.
- A programme for evaluating the potential of indigenous seaweeds containing bioactive compounds must be initiated.
- The initiative of growing seaweeds in combination with abalone be supported and expanded.

Commercial Species Diversification Programme

South African marine aquaculture is currently based on a narrow range of species which are mainly exotic. If the marine aquaculture sector is to grow, culture technology for a greater range of economically valuable indigenous species is required. In view of environmental legislation which increasingly restricts the use of exotic species, investment should be made in the development of culture technology for indigenous species. Furthermore, protocols and management guidelines for the culture exotic species which do not potentially pose a threat to the environment are required.

It is recommended that a marine aquaculture species diversification programme be supported which:

[3] BRICs (Biotechnology Regional Innovation Centres are a key component of South Africa's National Biotechnology Strategy which seeks to establish a globally competitive biotechnology industry.

[4] South Africa's National Research and Development Strategy identifies the need to create "centres and networks of excellence" in science and technology, including in the social sciences, as a key component of the human capital and transformation dimensions of government policy. It is envisaged that such centres will stimulate sustained distinction in research while simultaneously generating highly qualified human resource capacity in order to impact meaningfully on key national and global areas of knowledge. Centres of excellence are promoted by the National Research Foundation and the Department of Science and Technology.

- Screens indigenous marine species for their aquaculture potential.
- Evaluates the use of potentially benign exotic species for aquaculture in South Africa, and where appropriate, provides guidelines on the use of species which do not pose a threat to the environment.

The screening of new species for marine aquaculture is currently supported through the DST/DEAT Marine Aquaculture Frontier Programme.

Nutrition
Feed development must be undertaken by understanding the dietary requirements of cultured species, including their application to practical culture conditions. Developing species-specific broodstock and larval diets will be a priority.

Animal Health
Prevention should be encouraged as a mitigation process for disease transmission since no cures exist for several diseases in cultured species. Improving monitoring programs for known and emerging diseases and pathogens will be encouraged, as well as the use of biomolecular tools for diagnostics. Technologies such as underwater cameras and telemetry control will ensure animal health monitoring is accomplished, and early identification of fish health issues will be ensured to reduce potential stock loss and spread of pathogens. Thus, a holistic ecosystems approach to aquatic animal health management, emphasizing preventative measures and maintenance of a healthy culture environment will be promoted.

Hatcheries
An essential prerequisite for any aquaculture venture is a reliable source of mass quantities of seed stock. Almost invariably, aquaculture projects require hatchery-produced seed stock for grow-out. Consequently, there is a need to develop sustainable technologies for hatchery seed production. Hatcheries can be expensive to establish, and require a high level of technology. The establishment of hatcheries will provide support, while they can be used as training centres. A multi-species hatchery, which is a single hatchery with the ability to produce mass quantities of seed stock for several target species, would service the needs of several aquaculture projects in a province. A timely investment in hatchery technology will provide a major stimulus to the growth of the sector, especially for emerging, small-scale farmers, by guaranteeing the supply of seed.

4.3.3 International Collaboration
Wherever possible, appropriate technology must be sourced overseas. International collaboration must be pursued in order to import the technology through joint ventures or international grant funding. Where necessary, international consultants or experts should be employed to help establish the technology locally.

It is therefore recommended that:

- At each Marine aquaculture Development Nodes a research and technology support programme be developed to support commercial marine aquaculture operations establish themselves.
- Consideration should be given to “demonstration” projects whereby research is conducted to evaluate commercial prototypes and attract industry to invest in the development node.
- At each development node a dedicated Research and Development/pilot commercial facility be created as part of the site infrastructure.
- There is an active process to transfer technology developed in the programmes suggested above to the pilot project phase at the development nodes.
- Wherever possible, appropriate technology must be sourced overseas. International collaboration must be pursued in order to import the technology through joint ventures or international grant funding. Where necessary, international consultants or experts should be employed to help establish the technology locally.

4.4. MARINE AQUACULTURE EDUCATION, TRAINING AND SKILLS DEVELOPMENT PROGRAMME

In order to ensure sustained growth of marine aquaculture sector, skilled human capacity needs to be developed and heightened at all levels of industry. At present, formal training in aquaculture is only provided at tertiary level. There is a need to develop accredited technical training courses for the workforce. The training programme should be in line with the National Qualifications Framework (NQF) and encompass the Recognition of Prior Learning (RPL) programme of accreditation. The establishment of a National Aquaculture Skills Development Academy would enable South Africa to produce skilled manpower to man the expanded aquaculture programmes and also to service the aquaculture skills needs of Nepad countries.

ASGISA has earmarked R21.9 billion for establishment of a National Skills Development Strategy (NSDS) to accommodate funding of various initiatives that could include marine aquaculture skills development programmes. Training alone is not sufficient therefore technical support would be required particularly in rural aquaculture projects. Support could be provided through the establishment of government extension officer programme or through Community-Public-Private Partnerships (CPPP's) to provide projects sustainability.

The Sector for Education and Training Authority for I.C.T. is funding learnership to increase skills in the sector. In order to ensure success of SMME's in the aquaculture industry it is necessary that a comprehensive skills development programme be undertaken embracing all the various levels of the enterprise from workforce level to top management. The comprehensive short courses should be conducted on the premises and timed to coincide with the various operational periods such as Hatchery, Grow-out, Harvesting as well for technicians and scientists and senior management study courses in financial management, marketing management and human resource development.

Training programmes as outlined below should be adopted by aquaculture organizations to empower employees with on-the-job practical knowledge that would ensure sustainable development of the business. Curricula may include *i.a.*

Introduction of the species

- Natural distribution area
- Natural breeding area
- Natural feeding area
- Natural feeding strategy
- Growth
- Biology
- Anatomy
- Physiology
- Age and size of maturation

The environment of the species

- Estuary, lagoon, seashore, open sea
- Current
- Dissolved and saturated gasses
- Temperature
- Salt content
- Ph

Farming of the specie

- Methods and techniques
- Planning; growth rate, mortality, biomass, need for tanks, water, food, slaughtering etc
- Managing and production
- Tanks, enhancement suited the stage of life
- Type of food, size, nutrients, energy content, digestively, feeding regime suited the stage of life
- Stocking density

- Sorting
- Transport of alive fish

Water – Quality

- Inlet: pipes, pumps, valves
- Disinfection
- Treatment: oxygenation, aeration, temperature control, Ph
- Recirculation
- Filters

Different farming methods

- Spawning, stripping
- Production and feeding of “alive food” like zooplankton, rotifers, artemia
- artificial food
- feeding regime
- light regime

Slaughtering

Processing

Equipments

- Tanks; PVC, PE, glass fibber
- Sea-cages; inshore, offshore, plastic, steel
- Boats
- Automatic feeders
- Fish pumps
- Transport equipments
- Filters
- Oxygen control and distribution
- Air compressors, air blowers
- Sorting equipments

Diseases/animal health

- Bacterial
- Virus
- Fungi
- Parasites
- Environmental
- Treatment

Basic ropes, knots, net, net repair

Hygiene

- Personal
- Cleaning and disinfection regime
- Cleaning equipment
- Cleaning methods
- Infection ways
- Quarantine

Basic chemistry

- The use of chemicals
- Precautions

Basic plumbing

- Pipes, valves, pumps

Basic mechanics

- Steel qualities
- Mixed metals
- Welding

Basic electricity

After school, 2 years trainee practice is needed. The training period ends with a practical exam. To get started there could be courses, classes, exams and certificates on each component of the topics suggested above.

There could be a difference between freshwater, seawater, and offshore certificates and/or difference between fish, shellfish, and mussels.

The Aquaculture Skills Development Academy could be established in conjunction with local universities and other research organizations. The academy should provide in-service training on aquaculture farms during hatchery, grow-out and harvesting period and be responsible for ongoing mentorship to various projects.

4.5. MARINE AQUACULTURE DEVELOPMENT NODES

Access to sites, both on land and water, was identified as a major constraint to marine aquaculture sector development. It is therefore proposed that a programme be launched by government to secure suitable sites for aquaculture, and develop them as “Aquaculture Development Nodes”. Aquaculture Development Nodes can incorporate both land and water areas.

An aquaculture development node is analogous to an industrial park where sites and infrastructure are provided for investors in marine aquaculture. Eight development nodes which could rapidly be developed for marine aquaculture were identified in the sector planning process and are profiled in Appendix 1. In addition to the provision of basic “site and service” it is envisaged that a more comprehensive package of support would be provided at marine aquaculture development nodes including:

- Environmental assessments and approved culture species.
- Business planning and appraisal services.
- Access to the DTI sectoral financial incentives.
- Assistance in obtaining finance through the Industrial Development Corporation, Land Bank and Development Bank of Southern Africa.
- Small producer support projects aimed at empowering historically disadvantaged individuals.
- Services – permitting, research, expert advice, phytosanitary, veterinary, market access etc.

The primary responsibility for establishing “aquaculture development nodes” resides with the provincial governments and their economic development agencies. However, it is envisaged that the DEAT will play a lead role in conceptualising and planning the development nodes in partnership with the provinces, and facilitate the establishment of a package of services that will accompany each node. The eight profiled Marine aquaculture Development Nodes are sites at which scoping and planning exercises for marine aquaculture have been carried out by various parties. The potential for establishing further development nodes, particularly sea-based areas for cage culture, should be investigated (see the Finfish Cage Culture Technology Development project above).

4.5.1 Identification of Aquaculture Development Nodes

Although certain areas of land and water may be potentially suitable for marine aquaculture, the actual establishment of an aquaculture site is an onerous and time consuming process. Typically, the development process may require an environmental impact assessment, land rezoning, public comment and meetings, and applications for various permits. Obtaining access to areas of water (outside of National Ports Authority controlled waters) for sea-based aquaculture is particularly difficult, as there is no legal instrument for the granting of a use right for this purpose. Therefore, a

decision of parliament is required to grant a use right to an area of sea for aquaculture. In order to attract investors into the aquaculture sector, easier access to land and sea-based sites is required.

A key sector plan strategy is, therefore, the identification of potential "marine aquaculture development nodes" where suitable environmental and infrastructural conditions are present for the development of aquaculture, and where there is an interest by stakeholders to develop the specific site into a cluster of aquaculture businesses. If the identified development nodes could be earmarked for aquaculture and infrastructure and services provided, in a manner analogous to a town's industrial sites, it would be much easier for entrepreneurs to establish aquaculture ventures. More comprehensive packages of support could be levered to support the development nodes including technology and R&D support, marketing of the investment and more complete infrastructure packages including sea water supply. Coastal industrial development zones (IDZ's), such as Coega and the East London IDZ, are ideal locations for aquaculture development nodes and in which a full package of infrastructure, services and incentives could be offered to investors.

The clustering of aquaculture businesses also makes environmental and economic sense as:

- Aquaculture is concentrated into a few prime areas, and dispersed *ad hoc* development, which conflicts with other coastal uses, is avoided.
- Environmental assessment and permitting processes can largely be carried out before investors move in.
- Economies of scale are achieved which makes joint product marketing, and the provision of services more viable.

An initial eight potential "development node" sites were identified at Port Nolloth and Kleinsee in the Northern Cape Province, Toothrock, Saldanha Bay and Mossel Bay in the Western Cape, Coega (Port Elizabeth), the East London IDZ in the Eastern Cape, and Amatikulu/Mtunzini in KwaZulu Natal. Initial discussions were held with stakeholders, and the marine aquaculture potential of each site conceptualised. The process of establishing Development Nodes will be taken forward by the Marine aquaculture Institute of South Africa with support from the Department of Trade and Industry.

4.5.2 The Western Cape Province

The Western Cape Province has the greatest length of developed coastline in the country due to its economic strength that is rooted in coastal activities such as ports, fishing, residential areas and tourism. Favourable environmental conditions and an established infrastructure have been fundamental to the development of the Western Cape's marine aquaculture industry, resulting in it the being the leading producer. The GIS analysis revealed that the Western Cape has the longest coastline (592km) potentially suitable for marine aquaculture development in the country. This potential is mostly located the West Coast, Cape Metropolitan, and Agulhas Coast regions, due to the developed road network, proximity to airports and urban settlements which offer required services. Abalone farms are located on both the West and South coasts (Figure 1).

In terms of sea based aquaculture, Saldanha Bay offers a substantial area (400 Ha, ± 260 ha still available) of sheltered water which is leased by National Ports Authority for aquaculture. With the development of improved technology for sea cages, other semi-sheltered bays could be considered for aquaculture, for example, a project to farm salmon in cages in Walker Bay has been approved.

4.5.3 The Northern Cape Province

The Northern Cape Province's coastal environment is unique in that mining is virtually the sole economic activity. The downscaling of mining has created opportunities for the development of other sectors, and marine aquaculture has been identified as a priority for development by the Provincial Government. Although it has the shortest provincial coastline in the country (340km or 10% of the national coastline), a high proportion of the coastline (47%) was found to have moderate to high potential for marine aquaculture development. Large areas of mined coastal land are potentially suitable for shore based aquaculture, and the presence of an excellent infrastructure (roads, electricity, communications and airports) reduce the opportunity costs of initiating marine aquaculture operations. The absence of other competing activities, and the opportunity to plan aquaculture development as an alternative to mining, make the Northern Cape Province a very attractive area for

future development. Two sites, at Kleinsee and Port Nolloth, have been earmarked as potential marine aquaculture development nodes.

Large areas of kelp bed exist off the Northern Cape Province coastline, and an experimental abalone ranching project as highlighted the production potential of this habitat. It is estimated that the kelp bed habitat could support 1000t of abalone production. The Northern Cape Province has a very exposed coastline, and the only site that could be considered for sea-based aquaculture is Boegoeberg Bay, a semi-sheltered deep water bay just south of Alexander Bay.

4.5.4 The Eastern Cape Province

The Eastern Cape Province has the second longest accessible coastline, about 38% of which was deemed to have potential for marine aquaculture development. The major areas that are suitable for development are around East London and Port Elizabeth and two "aquaculture development nodes" are proposed for the Coega and East London IDZ's (Industrial Development Zones). The lee of the Port Elizabeth and Coega harbours offer opportunities for expanded sea based production. The relative inaccessibility to the Wild Coast was found to be a major constraint to marine aquaculture development along the northern part of the Eastern Cape coastline.
KwaZulu Natal

4.5.5 The KwaZulu Natal Province

The KwaZulu Natal coast is highly developed, and only 100 km of coastline was identified as having potential for marine aquaculture development. The extensive urban, conservation, and recreational use of coastal space indicates a high potential for competition and conflict with any new marine aquaculture proposals. Potential areas for marine aquaculture development are mostly located along the Dolphin Coast region. It was concluded that the marine aquaculture development potential of the KwaZulu Natal coast was low, and that efforts should go into enhancing the competitiveness of the existing prawn farms.

4.6. Pilot Projects at Marine aquaculture Development Nodes

Integral to the package of public sector support for marine aquaculture development nodes is technical assistance to establish commercial technologies on site. Experience has shown that marine aquaculture technologies need to be adapted to specific sites and that "pilot projects" are pivotal in creating viable commercial operations. The jump from laboratory to pilot scale production is a substantial one and many operations ultimately fail because the pilot project stage is either by-passed or under resourced. Pilot projects are expensive and it is appropriate that pioneer aquaculturists at new development nodes are assisted to establish their commercial technologies.

4.7. Small Medium, and Micro Enterprises (SMMEs)

Few individuals or communities have access to the capital needed to start up aquaculture projects, lack technical skills nor do they have links with the main players in the industry. Public-Private-Partnerships (PPPs) will be established to involve SMMEs in sustainable forms of aquaculture. Provincial governments and municipalities could act as brokers in identifying BEE partners, and by contributing to a commercial venture by providing land and water resources, which are significant assets. The Community-Public-Private-Partnerships (CPPPs) model could be adopted for the development of commercial aquaculture in rural areas. This would be catalysed by the involvement of rural community structure, governmental and the private sector. The objective contributions for registration and obligations of CPPPs would be similar to those applicable to the PPPs. The community could be organised in co-operatives which would be a business undertaking whereby a group of individuals strive on a voluntary basis to meet their mutual economic and social needs. This would be done is such a way that the economic advantage there from are greater than that which individual achieve on his/her own.

Demonstration farms may be established with the support of government to demonstrate the viability of selected aquaculture SMME initiatives. The farms could be utilised as learning centres for potential farmers from neighbouring communities. An example would be a strategic partnership between government and industry for a joint establishment of a commercial project, and, once the project reaches a stage when it can survive and sustain itself without further assistance, one of the partners relinquishes its interests according to a pre-defined exit strategy, into the hands of emerging farmers.

An SMME mentorship programmes will be established whereby new or potential entrepreneurs are exposed to the benefit of practical knowledge and experience of professional aquaculture practitioners or farmers who they would not normally have access to. Mentors will provide motivation, guidance and advice to new entrepreneurs in the management and technical aspects of business. They should work along side the new entrepreneurs to ensure that the business has the best possible chance of sustaining itself.

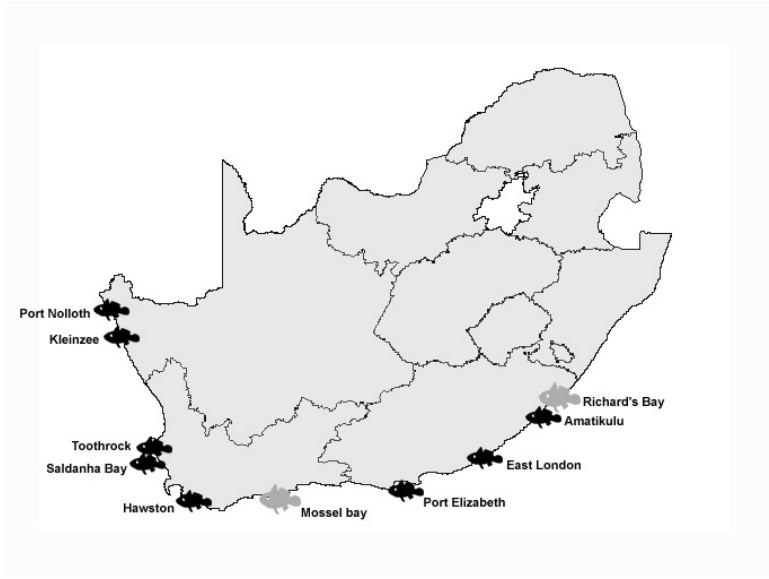
The SMME development programme could be achieved in two ways; 1. A private investor contributes financial and technical skills while the community provides resources (land/water, labour etc); and 2. Government could provide funding for the community per cent share in the venture, the private company provides technical skills and some of the funding. The community will provide resources such as labour or land/water if possible.

APPENDIX 1: PROFILES OF PROPOSED AQUACULTURE DEVELOPMENT NODES

The sector planning process identified eight potential aquaculture development nodes, the development of which would significantly increase South Africa's aquaculture production. Initial discussions were held with the prospective stakeholders regarding the potential of each site and possibilities for developing them. The participants were briefed about the Marine aquaculture Sector Planning process and the development node concept. An initial analysis of each site was undertaken to determine its suitability for various forms of aquaculture. A brief description of each site, including the climate, sea water quality and the current infrastructure in place is provided below. While the potential of each node has been outlined, it will be necessary for DEAT to take responsibility for promoting the development nodes process in collaboration with the respective stakeholders.

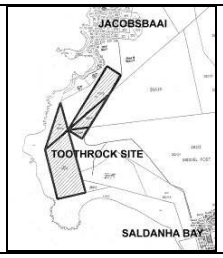
The potential mariculture nodes identified included Port Nolloth and Kleinsee in the Northern Cape Province, Toothrock, Saldanha Bay and Mossel Bay in the Western Cape, Coega (Port Elizabeth), the East London IDZ in the Eastern Cape, and Amatikulu in Kwa-Zulu Natal (Figure 2). The following provides a brief description of the eight development nodes, the stakeholder interaction that has taken pace to date, and an outline of an appropriate developmental pathway:

Figure 2. Potential mariculture development node sites



POTENTIAL MARINE AQUACULTURE NODES

Tooth rock



Location:	Approximately 7.5 km NW of Saldanha Bay; 2.5 km SE of Jacobs Bay, Western Cape Province.					
Size:	111 ha total; area available for development approx 50 ha, of which 10 will be used for the seed operation (Clear Seas Aquaculture's 100 t abalone farm).					
Site description:	Exposed, arid coastal land. Vegetation – Strand veldt. Maximum height above sea level <15 m. Rocky granite shores. No fresh ground water or run off on site. Site was an ex-SANDF Air force bombing practice area.					
Climate:	Summer mean temperature = 19.5 ˚C, winter mean = 12 ˚C, range 5 – 25 ˚C. Rainfall 200 – 250 mm per annum, from April - September. Prevailing winds from the south (SE & SW), switching to N - NW from May – August. Average wind velocity = 19.4 km/hr.					
Infrastructure:	Roads:	Yes – good quality graded, untarred	Power:	No – to be supplied from Jacobsbaai	Fresh water:	No – to be supplied from Jacobsbaai
	Sewerage:	No – septic tanks to be used	Marine Pumps:	No – to be installed	Buildings:	None
	Other	A small aircraft runway is located on the site.				
Seawater quality:	The quality of the sea water off Tooth rock is dependent on the Northward flow of the cold Benguela current creating jet currents past Cape Columbine, the Cape Columbine upwelling cell, and the prevailing winds from the south. Temperature mean = 13 ˚C, average minimum & maximum = 10 – 18 ˚C. Temperature fluctuates slightly with season but less than expected due to the prevailing summer winds inducing upwelling events of deep cold water. These events can also result in Harmful Algal Blooms (HABs), which are the single biggest threat to mariculture in this region. As many as 5 of these upwelling events can happen per year in the Cape Columbine region.					
Status of Project:	The tooth rock mariculture development has received approval from the local municipality (Saldanha Bay), has been granted an exemption to carry out mariculture on the site from Marine & Coastal Management, and a full Environment Impact Assessment has been carried out. Development is currently being held up by financial restructuring.					
Comments:	An excellent site for pump ashore mariculture. The site is close to St Helena Bay and Saldanha Bay, both fishing oriented communities, where employees, processing facilities and other related services and specialists are located. Also relatively close to Cape Town (±130 km) and Cape Town International Airport (±150 km).					

Coega IDZ


Location:	Approximately 20km East of Port Elizabeth adjacent to a new deep water port that is under construction on the Coega River.					
Size:	Onshore : ± 200 ha, Offshore : ± 50 ha					
Site description:	Exposed, arid, coastal land. Vegetation : Coastal dune vegetation and Mesic Succulent Thicket. Geology : Coastal limestone and sand dune systems. Freshwater – Coega Ridge Aquifer (average borehole yield 3 L sec^{-1}).					
Climate:	Summer mean temperature = 19.9ºC, winter mean = 14.3ºC, range 7.5 – 25.5ºC. Mean annual rainfall = 613mm. Annual prevailing winds from west and west south west (41% combined frequency). October - March easterly (15% frequency).					
Infrastructure:	Roads:	Yes - Good quality access to national road system	Power:	Yes – supplied by national grid / proposed power station.	Fresh water:	Yes - potential for borehole extraction.
	Sewerage:	Yes – a sewerage network will be installed.	Marine Pumps:	Installed capacity for a 60 ton per annum abalone farm.	Buildings:	Marine growers abalone farm.
	Other	The Marine Growers (Pty) Ltd. is currently operating a 60 ton per annum abalone farm in the IDZ. The Western breakwater of the Port of Ngqura provides a sheltered open water area for sea based mariculture operations.				
Seawater quality:	A long shore current (that moves from Port Elizabeth in the West to Cape Padrone in the East) supplies water into Algoa Bay. The NPA has installed a sand bypass system to maintain the long shore drift. In recent years, the abalone farm has reported increased silt loads in the water that is pumped ashore. It is likely that the silt is a result of the port construction work, and that the issue will resolve itself once the construction phase of the port development is completed. There have been no reports of harmful algal blooms in the bay.					
Status of Project:	The Coega IDZ is under construction. There is potential to develop synergies between the mariculture sector and other developments within the IDZ, these include the food processing, light manufacturing, customs and logistics services. The Coega Development Corporation and the National Ports Authority are joint owners of the Marine Growers (Pty) Ltd abalone farm.					
Comments:	The onshore site comprises an abalone farm. Potentially, the farm could provide the anchor tenant for the node. Expansion could include shore based abalone, seaweed culture, and tank based fin-fish. The development of a gas power station may provide possibilities for tank based warm fresh-water aquaculture and biotechnology e.g tilapia, ornamental fish, and algal beneficiation. The western breakwater of the Port of Ngqura provides shelter from the easterly swells, and provides opportunities for sea based mariculture e.g fish cage culture, oyster culture.					

East London IDZ

Location:	The IDZ is located on the West Bank of East London, adjacent to the existing port and airport.					
Size:	The IDZ comprises 1,500 ha of land. Of this land, 30.3 ha of which is located on the sea front, and is suitable for pump ashore mariculture operations (11 plots, ± 2.5 ha each).					
Site description:	Exposed, coastal land. Vegetation : Predominantly bushveld and grassland. Geology : Sandy beach and Rocky shore.					
Climate:	Summer mean temperature = 24.5ºC, winter mean = 21.4ºC, range. Mean annual rainfall = 864mm. Annual prevailing winds: west and east-north-east, significant easterly, north-easterly, south-westerly and northerly components. The area experiences little shelter from strong winds.					
Infrastructure:	Roads:	Yes - Good quality access to national road system	Power:	Yes – Area supplied by national grid	Fresh water:	Poor quality ground water (brackish). Municipal water will be required
	Sewerage:	Yes – the sites are Greenfield sites, but will be attached to the sewerage system	Marine Pumps:	Existing Buffalo City Municipality marine pipe intake has spare capacity of $2m^3$ / min.	Buildings:	None
	Other	The area is within 5 km of East London airport and the East London Harbor				
Seawater quality:	The Agulhas current provides the major influence on water movement in the area - moving water in a South Westerly direction. Waste activated sludge from the East Bank sewerage works is pumped across to the Hood Point outfall and discharged into the surf zone. There are concerns that the outfall may affect water quality in the marine environment off the IDZ. Limited monitoring has taken place, and the veracity of this statement needs to be established.					
Status of Project:	To date there has been no construction activities at the site. Sea-Tek wavelengths (Pty) Ltd. have initiated the development of a 60 ton per annum abalone farm using recirculation technology. The company has the rental rights to five out of the eleven plots that are suitable for mariculture development. The company would present an ideal anchor company for the development node.					
Comments:	The Buffalo City Municipality has installed a marine draw off point. Seawater is pumped to a $700m^3$ storage facility that is located to the west of the proposed node. The facility has a spare capacity of $2m^3$ / min. This capacity could be used for pump ashore abalone, seaweed and finfish farming.					

Amatikulu



Location:	130 kilometers north of Durban (Latitude: 29 58S Longitude: 030 57E).Two closely related sites : Amatikulu is on the 7.5km long Amatikulu river estuary. Mtunzini on the Mlalazi river 25 kilometers north of Amatikulu.					
Size:	Mtunzini – 26ha ponds (area possibly expandable to ± 400 ha); Amatikulu 9.6 ha ponds + ornamental fish farm ± 2 ha (area possibly expandable to ± 170 ha).					
Site description:	Low lying estuarine coastal zone. Vegetation: tropical. Geology : Amatikulu – predominantly sandy substrate. Mtunzini – predominantly clay substrate.					
Climate:	Summer mean temperature = 23.5ºC winter mean = 18ºC, range = 37 - 6ºC Mean annual rainfall = 1,500 mm.					
Infrastructure:	Roads:	Yes - Good quality access to national road system	Power:	Yes – Area supplied by national grid	Fresh water:	Available through borehole extraction at the Amatikulu site,
	Sewerage:	Present	Marine Pumps:	Existing capacity at both Mtunzini and Amatikulu sites (Estuarine supplies)	Buildings:	Mtunzini – existing hatchery and grow-out ponds. Amatikulu – prawn grow-out ponds + ornamental fish farm
	Other	International airport and port facilities are available 130 km from the site at Durban				
Seawater quality:	Brackish water can be an abstraction issue at Mtunzini . At Amatikulu, the marine water quality is good. There has been some concerns pertaining to salt intrusion into the aquifer – this could potentially impact freshwater ornamental fish production					
Status of Project:	Mtunizini Prawns (Pty) Ltd. have stopped trading. Vunani Aquaculture Projects (Pty) has bought the Mtunzini site, and in 2005, anticipate developing it as a super-intensive prawn farm (tunnel raceway system). The commercial feasibility of expanding the Amatikulu site to 170 ha of ponds (prawns / finfish) is under consideration by Siyaya Fisheries.					
Comments:	The existing infrastructure / expertise at the two sites represents the only significant mariculture assets in KwaZulu Natal. Both Vunani Aquaculture Projects (Pty) and Siyaya Fisheries propose to upgrade existing technology. In addition to prawn culture there are possibilities for finfish culture (Cobia, Basses, Breams). Siyaya Fisheries is also looking at the possibility of tank based finfish culture at Umgababa (30°09'20"S 30°49'48.1"E).					

Hawston Seafarms Foundation site

The Hawston Seafarms Foundation is a community based project chaired by Mr Phillip Swart of the local Hawston community. The principal funder of the development is the Development Bank of Southern Africa. Technical partners are HIK abalone in Hermanus and Global Ocean (also in Hermanus) are technical consultants.

<table>
<tr><td>Location:</td><td colspan="6">Approximately 15 km North of Kleinemond and 5km South of Hermanus, Western Cape Province. .</td></tr>
<tr><td>Size:</td><td colspan="6">An area of 40ha was purchased from the Department of Housing. 10-12 ha are at present suitable for mariculture, but the entire 40 ha could be used if it becomes economically viable to do so.</td></tr>
<tr><td>Site description:</td><td colspan="6">The site is bounded by the Atlantic Ocean to the west, the R43 regional road to the east, Hoek van die Berg private reserve to the north and the Overstrand Municipality housing project to the south.

The land is sloping dune with alien “rooikrans” forest. The aliens are being removed by the Job Creations Trust with funding from the Development Bank of Southern Africa. There is 20m of head between the water level and the farming area. The water table is at a depth of 5m.

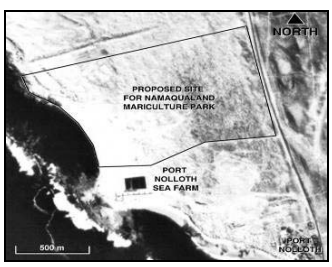
The closest mariculture site is in Hermanus, is 5 km away.

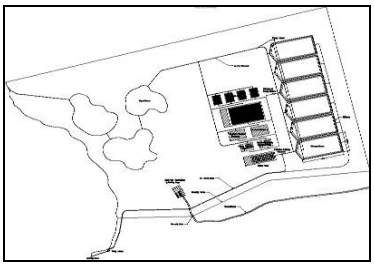
The ocean current flows from east to west at an average yearly speed of 0.5 $m.s^{-1}$. Average swell hight = 1m, average wave frequency = 5 seconds, mean tidal range = 2 m.</td></tr>
<tr><td>Climate:</td><td colspan="6">Summer mean temperature = 22 ˚C, winter mean = 13˚C, range 6 – 32 ˚C. Prevailing winds are from the north-west in winter and from the south-east in summer. Mean rainfall is 25mm/month.</td></tr>
<tr><td rowspan="3">Infrastructure:</td><td>Roads:</td><td>No – but adjacent to the R43.</td><td>Power:</td><td>No – to be supplied from the Overstrand Municipality</td><td>Fresh water:</td><td>No – to be supplied from the Overstrand Municipality</td></tr>
<tr><td>Sewerage:</td><td>No – septic tanks to be used</td><td>Marine Pumps:</td><td>No – to be installed</td><td>Buildings:</td><td>None</td></tr>
<tr><td>Other</td><td colspan="5"></td></tr>
<tr><td>Seawater quality:</td><td colspan="6">Minimum sea temperature is 11°C, the maximum is 23 and the mean is 16. There is a low frequency of toxic algal bloom events. There are no known pollution threats.</td></tr>
<tr><td>Mariculture potential</td><td colspan="6">The first phase of the project will establish a 2 ha community farm in collaboration with HIK abalone. The next phase will construct a 10-12 ha facility which will produce 600-700 tons of abalone. There are also plans for culturing finfish and gracilaria (for abalone feed) in pumped effluent water. The rest of the land area will be provided with seawater and made available for rental to other mariculture ventures.</td></tr>
<tr><td>Status of Project:</td><td colspan="6">Construction is expected to begin in September 2005. It has been delayed because there is a legal dispute with the ministry of housing over the transfer of the land. If transfer is received by September 2005, the project expects to be pumping water through the facility in March-April 2006.</td></tr>
</table>

	An EIA has been completed for an initial 2 ha recirculating abalone facility. An EIA for the next phase is underway.
Comments:	The site is close enough to the Hermanus group of abalone farms to use the same established infrastructure.

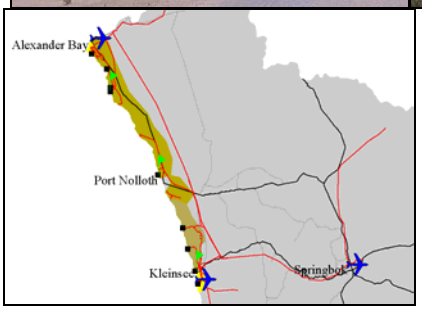
Namaqualand Mariculture Park (Port Nolloth)

Location:	Approximately 1.5 km NW of Port Nolloth, Northern Cape Province. Grid co-ordinates are approximately 16°51' E, 29 °14' S.					
Size:	134 ha total; area available for development approx 80 ha, pending outcome of EIA.					
Site description:	The site is bounded by the Atlantic Ocean to the west, the Alexkor Mining Company's security fence to the north, the R308 National Road (Port Nolloth to Alexander Bay) to the east, and an un-tarred access road to the south. The site is municipal land that has been treated as commonage, and no infrastructure is present. It rises gently from an exposed rocky/sandy coastline north-eastwards across the primary dune and up to its highest point of 19.2 m at the apex of the secondary dune. The land consists predominantly of sand covered by coastal scrub vegetation.					
Climate:	Summer mean temperature = 19.2 ˚C, winter mean = 14.7 ˚C, range 10 – 25 ˚C. Mean rainfall 46 mm per annum. Prevailing winds from the south (75%, SE & SW), switching to N - NW in June & July.					
Infrastructure:	Roads:	Yes – graded, not tarred	Power:	No – to be supplied from Port Nolloth	Fresh water:	No – to be supplied from Port Nolloth
	Sewerage:	No – septic tanks to be used	Marine Pumps:	No – to be installed	Buildings:	None
	Other					
Seawater quality:	A minimum seawater temperature of 10 °C to a maximum of just over 20 °C, with 84 % of the temperatures falling within a range of 13 °C to 17 °C. The average swell height is between 1.0 to 2.0 meters for 50 % of the time in the near shore area, and their frequency ranges from 4 to 8 waves per minute for more than 90% of the time. The mean tidal range along the Namaqualand coast is about 1.57 m, with spring tides as much as 2.24 m. The Benguela current moves offshore from south to north, at a rate of about 25 – 75 $cm.s^{-1}$. A southward moving counter-current often occurs near the surface close inshore, particularly during winter but also periodically during the rest of the year, when reversals can take place for several days. A northward moving long-shore current is generated by the prevailing southerly winds, in the absence of an overriding counter-current.					
Status of Project:	The Namaqualand Mariculture Park is supported by Provincial Government, which will finance a significant amount of the development & Capital costs of the infrastructure of the project. Municipal and regulatory approval is still needed, pending an EIA. Site development is anticipated within the year (2005).					
Comments:	Although the mariculture node is relatively far away from product take-off points (densely populated conurbations, airports, etc.), the active support of local government, easy access to the coast and good water quality makes this a site of great potential.					





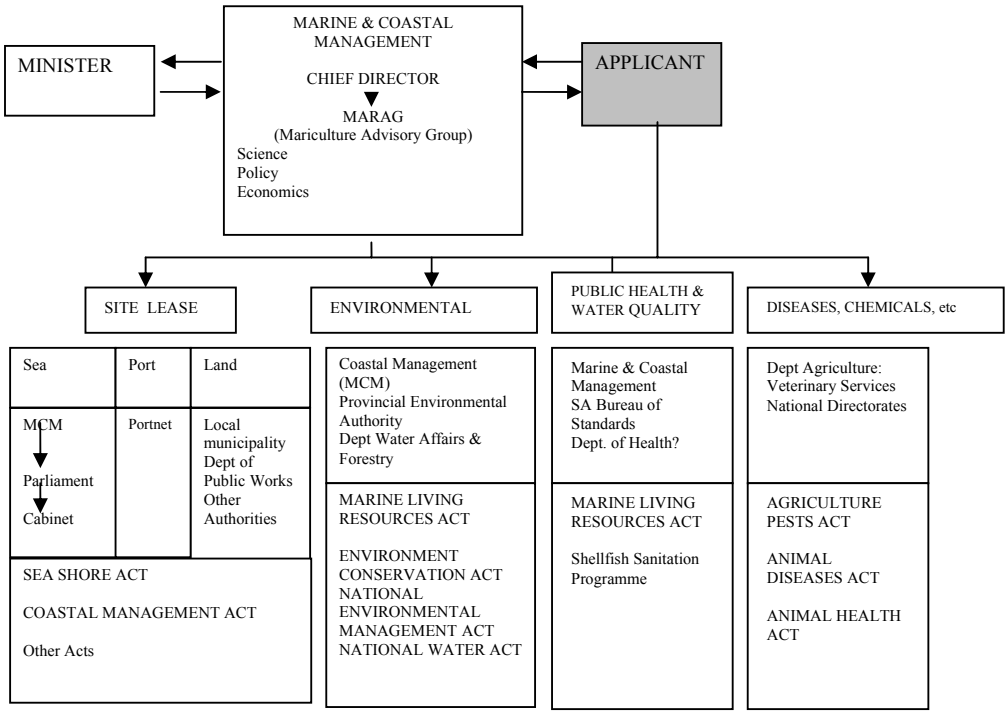
Kleinsee (De Beers Mine AK3 pump station)



Location:	A potential mariculture node has been identified near Kleinsee, Northern Cape Province, in a mined out area adjacent to the De Beers Mine AK3 pump station. The site is approximately 40 km west from the Steinkopf-Port Nolloth tar road, following the Kleinsee turn-off, along a dirt road.					
Size:	Approximately 100 ha; running 2 km along the coast, and 1 km inland.					
Site description:	The site is located in a mined-out sector within the De Beers Mine security area. It is a relatively flat area that has been mined to bed rock, with 2 km of coastal access. Various pumping and other related infrastructure is available on site.					
Climate:	Site specific data not available, but refer to Port Nolloth Mariculture Node for approximate climate information.					
Infrastructure:	Roads:	Yes – graded, not tarred	Power:	Yes	Fresh water:	Yes
	Sewerage:	No – septic tanks to be used	Marine Pumps:	Yes	Buildings:	Yes
	Other	Storage dams, Excellent tarred airport nearby.				

Seawater quality:	Site specific data not available, but refer to Port Nolloth Mariculture Node for approximate seawater quality information.
Status of Project:	Mine policy favours the development of non-mining businesses with private sector partners with specialist expertise. A pilot seaweed/ oyster project has been conducted at the site. Although the oyster operation proved to be successful, access to the area remains a problem.
Comments:	The mariculture node falls within the mine security area and if mariculture operations develop further, appropriate arrangements would have to be made around security issues. It has been suggested that the mariculture node could be fenced out of the mine security area. While the AK3 mariculture site is the obvious one to develop at Kleinsee, the coast to the south of the town offers interesting possibilities. For example, the large flat low lying (1-2m above sea level) area (ca. 100ha) just to the South of town could be suitable for earthen pond aquaculture of marine fish species.

APPENDIX 2: MARINE AQUACULTURE APPLICATION FLOW CHART



Comments to be submitted to the Department by 31 January 2007

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