Schedule 2

GUIDELINES AND POTENTIAL AREAS FOR MARINE RANCHING AND STOCK ENHANCEMENT OF ABALONE *HALIOTIS MIDAE* IN SOUTH AFRICA

Department of Agriculture, Forestry and Fisheries

April 2010

agriculture,
forestry & fisheries

Department:
Agriculture, forestry & fisheries
REPUBLIC OF SOUTH AFRICA

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1. INTRODUCTION

The abalone *Haliotis midae* occurs naturally between Cape Columbine on the west coast and Port St Johns on the east coast of South Africa (Fig. 1). A commercial fishery for abalone has been in existence since 1949 and is centred in the south-western Cape region from Cape Columbine to Quoin Point along the south coast (Fig. 1). In the past abalone were harvested by subsistence fishers also in parts of the Eastern Cape Province. Intertidal stocks in most areas are now depleted, and there is currently no regulated fishery in that area. A large recreational sector targeted abalone along its entire natural distribution range (excluding closed areas) for approximately 20 years, but was suspended in 2003 because of a decline in the resource. Poaching and ecological changes led to the closure of the commercial abalone fishery in February 2008.

Since the 1980s, farming of abalone has developed rapidly and production levels are now in the order of 1000 tons (in 2009). With the increase in the availability of abalone seed/juvenile larvae, various ranching (reseeding) experiments have been initiated, mainly in the vicinity of Port Nolloth along the west coast, and on a smaller scale, at Cape Reciefe along the east coast. The precautionary approach was followed and the number and extent of these operations were restricted. However, interest in abalone ranching has grown and the Department of Agriculture, Forestry and Fisheries (the Department) has developed Guidelines for Marine Ranching and Stock Enhancement in South Africa.

The purpose of this document is to provide information to assist applicants wishing to undertake ranching or stock enhancement of abalone, *Haliotis midae* specifically and should be read together with the Guidelines for Marine Ranching and Stock Enhancement in South Africa and the Policy for the Development of a Sustainable Marine Aquaculture Sector in South Africa.

At this stage, the enhancement of abalone in areas where recruitment has not collapsed will not be considered. In instances where information is readily available, the enhancement of abalone in areas where stocks have not depleted below 20% of pre-exploitation levels will not be considered.

The Guidelines for Marine Ranching and Stock Enhancement in South Africa uses the following definitions and these should be applied to abalone:

- Marine Ranching

Bannister (1991)[1] defines marine ranching (reseeding) as "Identifiable stock released with the intention of being harvested by the releasing agency."

- Stock Enhancement

Bannister (1991) defines enhancement as "The releasing of stock for the public good without the intention of directly benefiting an exclusive user group." Generally this would imply some form of government assistance.

2. KEY ISSUES FOR ABALONE RANCHING

Parties who are interested in undertaking abalone ranching and stock enhancement should address, in particular, the broad concerns (potential risks) listed and discussed briefly below. These concerns should be addressed (discussed) in the application and should as far as possible be included in the scope of the Risk Assessment (RA) as per the National Environmental Management Biodiversity Act (2004) in the case of translocated animals or an Environmental Assessment (EA) as per the National Environmental Management Act (1998). The level or extent of biological risk needs to be determined and if it is considered to be at an acceptable level in accordance with the Guidelines for Marine Ranching and Stock Enhancement in South Africa, then the potential benefits need to be carefully considered and weighed against the potential risks. Note that only a few of the more important factors are discussed below, but proposals must still include all the information that is required in accordance with the Guidelines for Marine Ranching and Stock Enhancement in South Africa.

2.1 Environmental Interactions

2.1.1 Trophic/Ecological

The impact of an introduced species on the ecosystem and species biodiversity needs to be assessed. Competition with other grazers and predation (e.g. by rock lobsters) should be considered. For example the recent large-scale migration of west coast rock lobster into

[1] Cited in Borg 2004

the area between Cape Hangklip and Hermanus has led to the demise of the sea urchin population and has affected the survival of juvenile abalone. Juvenile abalone derive shelter and protection from predators such as lobsters by settling beneath the sea urchins.

The impact on biodiversity is of particular concern when introducing abalone into areas outside of its natural range e.g. along the Northern Cape coast. In this instance, it will also be important to investigate possible reasons why abalone do not occur naturally within an area, so that this may be addressed during the pilot project stage.

The objectives of any future abalone ranching or stock enhancement initiatives need to be clearly identified upfront by the applicant in accordance with the definitions listed above. Ranching or stock enhancement will only be considered if the resource has declined to a level where reproduction (successful fertilisation) is compromised to an extent that recruitment is severely impaired. In areas where information is readily available, ranching or stock enhancement initiatives will only be considered if the resource has declined to below 20% of pre-exploitation levels. This applies in particular to areas that support or once supported viable populations of abalone.

These issues will need to be thoroughly addressed in the RA or EA that is required before commencing with ranching or stock enhancement initiatives (i.e. resource surveys will need to be undertaken if adequate information does not already exist and enforcement plans/arrangements need to be developed).

2.1.2 Carrying Capacity

Stocking densities should not exceed the environmental carrying capacity of the area. While the carrying capacity of an area is unlikely to be reached during pilot ranching operations, an estimate of projected carrying capacity is required to determine seeding numbers. In the case of *H. midae* an indicator that may be of use is the average density of 3 abalone per m^2 for emergent abalone recorded in Betty's Bay (a protected area) in 1995, when the population was still considered to be at pristine levels (i.e. just prior to the escalation of poaching and the movement of west coast rock lobster into the area). Note, however, that densities were highly variable within the area, ranging from $0.08/m^2$ to $11.45/m^2$ along some transects. The monitoring of abalone density must form a key component of the independent research and monitoring that accompanies the stock

enhancement or ranching operation. The Department's abalone research division could provide advice and feedback on managing abalone density and habitat carrying capacity as ranching and stock enhancement projects develop.

2.1.3 Genetic

In areas where abalone occurs naturally, the potential loss of (genetic) biodiversity through breeding between hatchery and wild stocks needs to be considered and appropriate steps need to be taken to mitigate this potential risk, e.g. detailed broodstock and genetic verification protocols. The objective of breeding for ranching or stock enhancement is to retain as many wild alleles in the hatchery breeding population as possible, and not mix the genetic profiles of different stocks.

Proposals should therefore take the following guidelines into consideration:

(i) All hatchery stock to be released into the marine environment should originate from broodstock obtained from the same genetic zone.

(ii) Large numbers (in excess of 100) of randomly collected animals for broodstock should be used to produce juveniles for release purposes. This will help prevent loss of genetic diversity through inbreeding and genetic drift. A rotational breeding protocol should be adopted.

(iii) No selection process to improve the broodstock must occur in the case of transfers of species within their natural range.

(iv) Animals from the wild, broodstock and seed should be routinely profiled to compare genetic similarity and dissimilarity.

2.1.4 Disease

The potential for the accidental introduction of pathogens and parasites needs to be considered and mitigated against and disease monitoring and certification protocols need to be included. Stock to be released must be examined for diseases and pests before hand. Testing and certification of disease- or pest-free status must be performed by government veterinarians or other competent persons/ institutes whose tests will be certified in accordance with government requirements. Prescribed "Guidelines for Translocating Abalone" must be followed. These requirements must be formalised into a hatchery specific "biosecurity" protocol which must be approved by the Department.

2.2 Resource sharing and user conflict

Apart from all the other resource user issues that need to be considered (see Guidelines for Marine Ranching and Stock Enhancement in South Africa), the following are of particular importance:

Ownership of the stock and harvesting rights will differ depending on whether the resource is within or outside of the natural range of *H. midae*. In areas outside of the natural range, ownership and rights of access can be more easily determined.

In areas where a commercial abalone fishery is/was in existence preference will be given to commercial abalone right holders. In these areas, exclusive harvesting rights will be allocated and the harvesting will be managed and regulated in accordance with the wild fishery, and no distinction will be made between seeded and wild abalone. Regulations will include catch and size limits (to be determined per area) and closed seasons, if applicable. The initial harvesting date will be determined based on the growth rates and size at maturity and may differ on a regional basis.

The sea bed area in which sedentary stock, such as abalone, are seeded will not be owned by the right holder, and the rights of other users of the area (e.g. swimmers, vessels, fishing right holders) will still be valid, unless they are restricted by the Minister in terms of the Marine Living Resources Act.

The applicant should identify potential social/user conflicts arising from the project and make recommendations on how to mitigate/ manage them. The applicant should advertise and hold at least one public meeting regarding the proposed project in the local area. The advertisement should run for at least 1 month in the local news papers and public areas such as municipality offices. The issues raised in the public participation process should be addressed in the proposal to be submitted. All comments should be attached to the proposal.

2.3. Seeding and Harvest Rights

Ranching and stock enhancement within the near shore will be undertaken based on the principles of designated and preferential user rights. In terms of ranching, the Department will consider applications for seeding and the successful applicant will be authorised to

seed and harvest within the designated sea area. Seeding will be undertaken with a valid permit that will be issued with specific conditions. The harvesting of the resources will be done with a harvesting permit that will be issued once the stock assessment has been undertaken in areas where the abalone released occurs naturally. The Department will determine the minimum harvesting size, quantities and time in consultation with the right holder. Harvesting will only be undertaken once the seeded abalone reaches the legal size limit. In areas where abalone does not occur naturally (e.g. Northern Cape), there will be no size limits for harvesting but harvesting will only be undertaken with a harvesting permit. If the stock moves out of their designated ranching area the right holder has no right to retrieve it.

In terms of stock enhancement, once a fish is released from a hatchery into the sea, it is no longer the property of the releasing agent, it becomes a public good. It becomes part of a wild stock, subject to use rights allocated by Government. The exclusive use right is now the asset of the designated right holder(s).

2.4 Economic viability

Proposals should provide information on the economic feasibility of the proposed activity, such as a cost benefit analysis. Positive economic (productivity, revenue, profitability, jobs etc.) benefits need to be balanced against negative ecological effects. Details of facilities, infrastructure and employment opportunities that will be created in the process, should be provided. The economic viability of abalone ranching in South Africa has not yet been determined, although models suggest that it has the potential to be a lucrative business. However, this will need to be thoroughly assessed.

2.5 Monitoring

The applicant should submit a proposed monitoring programme to be undertaken by an appropriately qualified person/organisation. The monitoring programme should be developed to evaluate success and determine the cost and benefits of the project. Monitoring serves to verify that the project is meeting its performance targets. The Department will review progress reports and results submitted by the applicant and may undertake additional investigations or sampling where necessary. The effectiveness of any enhancement operations will need to be closely monitored – hence methods need to be established to distinguish "wild" from seeded abalone where natural populations exist.

These techniques have not yet been developed in South Africa, and any future initiative will need to address this aspect. The environmental impacts need to be monitored by an independent party, to be contracted by the applicant if successful. This should be undertaken in consultation with the Department.

2.6 Enforcement

The applicant should develop an enforcement plan since illegal harvesting (poaching) will no doubt be a problem. The plan should involve the Department, the right holder, the local community and other key law enforcement agencies. The primary responsibility for protection of seeded stock lies with the right holder. The allocation of exclusive harvesting rights should aid in enforcement of compliance and this management approach will be favourably considered.

Traceability protocols (i.e. tracking system for the animals from source to retail) will be determined prior to harvesting.

The right holder will be required to comply with the terms of the right and permit conditions and failure to comply may result in legal proceedings.

3. POTENTIAL AREAS FOR ABALONE RANCHING OR STOCK ENHANCEMENT

The broad areas that might be suitable for abalone ranching have been identified and are illustrated in Fig 1 (broken bold lines on the map). Within the broad areas, specific sites still need to be identified. Site suitability will depend upon, amongst other things, habitat suitability, accessibility, degree of wave exposure and other coastal activities (resource user conflict issues) including protected (closed) areas. Therefore some of the areas that are included in Fig. 1 may prove to be unsuitable upon closer inspection or following a Strategic Environmental Assessment (SEA).

The size of the area to be allocated will be based on kelp bed area (which is the main source of food for abalone), survival estimates and on available economic model projections. Where different rights (concession areas) are allocated adjacent to one another, buffer zones (approximately 1 - 10 km) will separate adjacent ventures. Buffer

zones will also be used to separate ranching areas and areas that are set aside to protect viable populations, including closed areas and Marine Protected Areas (MPAs).

3.1 Northern Cape

This area of coastline falls beyond the northern-most limit of the distribution of *H. midae* along the west coast. It is characterised by the occurrence of large areas of west coast kelp (mainly *Laminaria pallida*) beds. Ranching experiments have been undertaken in this region since 1995 and have shown that abalone can survive and grow in the kelp beds along this coastline. A large number of abalone has been seeded at various sites with variable survival rates. At least one site has been identified where high survival rates were obtained and where there are high densities of emergent abalone. Modelling exercises suggest that the potential returns from ranching could be considerable. However the abalone still needs to be harvested in order to assess the economic viability of ranching operations.

A number of key aspects have been addressed during the course of the pilot projects undertaken in this area. These include survival rates (although these were limited to the early stages), growth rates (again, limited to the short term), factors affecting survival and growth, and estimates of the total biomass, potential yield, economic viability and the minimum viable length of coastline required for a future commercial venture. However many questions remain unanswered, namely:

- the impact of abalone introductions to the Northern Cape coast, on the natural biota of the area (effect on the ecosystem);
- why abalone do not occur naturally along this coastline;
- studies into new diseases and pathogens need to be undertaken for effective disease control;
- long-term survival and growth rates and additional information on factors affecting these two parameters; and
- economic viability.

Ranching of abalone in this region should continue on an experimental (pilot project) basis to address the gaps in information. However, any further seeding of abalone along this coastline is subject to the applicant first undertaking a RA, a requirement in terms of the National Environmental Management Biodiversity Act (2004) for the introduction of an

"alien species" (i.e. in this case a translocation of an indigenous species to an area outside of its natural distribution range). Such an assessment should also assess the reproductive potential of the seeded abalone. Note that the coastline area of the Groen-Spoeg National Park including a buffer zone of 5 km either side will not be considered.

3.2 Western Cape

This region has had abundant abalone populations and has supported a commercial fishery since 1949, but resource declines over the past decade have resulted in large reductions in the size of the populations and the Total Allowable Catch for this sector to the extent that the fishery has been closed.

The area along the west coast from *Olifantsbos to Cape Columbine* is on the northern-most fringe of the natural distribution range of *H. midae*, and contains moderate densities of abalone due to low and sporadic recruitment. This area has sustained moderate levels of commercial fishing over the years. Ranching may be considered in this area, subject to a SEA being undertaken. Note that this does not include the coastline around Robben Island which still supports a significant population of abalone.

The Cape Peninsula and False Bay areas from Olifantsbos to *Smitswinkel Bay* also supports significant abalone populations, therefore ranching or stock enhancement will not be considered for this area at present.

The area between Cape Hangklip and Hermanus has been impacted most by ecological changes, and as a result, there are very low levels (less than 5%) of abalone recruitment due to predation by west coast rock lobster into the area. The ranching of abalone along this stretch of coastline may be considered at present. However under the current condition, predation by the west coast rock lobster will need to be factored into the reseeding protocol, e.g. by reseeding animals at a size where they are less vulnerable to predation.

The area from Hermanus to Quoin Point still supports a viable abalone population. Ranching or stock enhancement will not be considered for this area at present, but may be considered in the future if stocks decline to a level where natural recruitment is affected.

The abalone population in the area *East of Quoin Point (to Natures Valley / the provincial border)* is patchily distributed as a result no commercial fishery developed in this region. Certain areas along this stretch of coastline might be suitable for ranching or stock enhancement. The specific areas will need to be carefully selected on the basis of suitable habitat, and potential factors that have limited the levels of natural populations need to be considered.

3.3 Eastern Cape

The abalone resource in this region is also patchily distributed and as a result no commercial fishery was ever established. However, experimental and subsistence fishing permits were issued for a number of years in the former Ciskei and Transkei areas. Stocks in this region have now been severely depleted due to poaching, and no further harvesting permits were issued since 2004.

The area in the vicinity of *Cape Recife* once supported a significant population of abalone, but is now severely depleted and has been identified as a potential site for ranching or stock enhancement as a means to facilitate recovery of natural stocks. A pilot project investigating the potential of stock enhancement in this area showed high survival rates (although only short term survival was monitored). However a theoretical economic analysis based on this study suggested that a future commercial ranching venture at this site would probably not be economically feasible as a stand-alone operation but could be operated effectively if it is complemented by an existing abalone farming venture.

Certain sites *West of Cape Recife* might be suitable for ranching or stock enhancement, although the specific areas will need to be carefully selected on the basis of suitable habitat. Potential factors that have limited the levels of natural populations in the first instance need to be identified upfront and addressed through the pilot project.

Certain sites along the stretch *between Cape Recife and Port St Johns* might also be suitable for ranching or stock enhancement. However, the specific areas will need to be carefully selected on the basis of suitable habitat. The potential factors that have limited the levels of natural populations in the first instance need to be determined and addressed through a pilot project. Specific areas might include areas around Hamburg, i.e. between the Great Fish and Tsholomqa rivers and in the vicinity of the Great Kei River to

Wavecrest. These areas held viable abalone populations and were the sites for experimental and subsistence harvesting in the past. The sites might still be targeted by poachers who harvest the deeper component of the stock, where there are still pockets of abalone.

Note that the area between Kleinemonde and the Great Fish River is to be assessed for suitability and potential for ranching and stock enhancement.

The area around Bird Island is a marine protected area and therefore will not be considered for ranching or stock enhancement at this stage.

3.4 Kwa-Zulu Natal

Since this area falls beyond the natural distribution range of abalone, with no known suitable habitat for abalone, ranching or stock enhancement in not being considered in this region.

4 GRANTING OF RIGHTS

Applications may be lodged with the Department and these will be assessed by the Marine Aquaculture Working Group (DAFF internal advisory body). Among the criteria that will be used when assessing the applications shall be: ability and capacity to undertake ranching/stock enhancement, environmental considerations, community involvement and beneficiaries, job creation (number of jobs per tonne), investment (Rands per year), economic feasibility and transformation including Broad-Based Black Economic Empowerment (BBBEE) objectives. Applicants will be given up to three years to exercise the right to ranch. In the event that the right has not been exercised for 3 years, the right will be revoked. Once a right is granted, a permit will be issued, subject to conditions, for a specified period not exceeding two years.

4.1 Pilot Projects

Once a proposal is assessed and deemed feasible, a pilot scale operation should be carried out during which ecological interactions and risk assessment assumptions, and social and economic responses are monitored to determine viability. A limited number of sites will

be available for pilot projects in each of the areas identified above (See paragraphs 4.2 and 6 below, for areas to be considered for pilot projects). Scientific assessment should address survival of the released stock and the main causes of mortality, growth of the released stock, impact on the gene pool, and other environmental impacts.

The pilot phase shall not exceed 10 years. This is considered to be long enough to allow assessment of the enhancement techniques employed and critical ecological processes and effects.

4.2 Proposed Areas for Abalone Ranching Pilot Projects

The areas outlined below will be considered for pilot projects.

Northern Cape:

Area NC 1
+- 60 km

		Latitude	Longitude
NC1a	Boegoeberg Noord	28°45'41,35"S	16°33'41,93"E
NC1b	Beach north of North Point	29°14' 7,65" S	16°51'14,08"E

Area NC 2
+- 32 km

		Latitude	Longitude
NC2a	Rocks outside south end of McDougall Bay	29°17'34,23"S	16°52'32,08"E
NC2b	Rob Island	29°43' 7,12"S	16°59'50,45"E

Area NC 3
+- 43 km

		Latitude	Longitude
NC3a	Beach at Kleinzee	29°40'43,9"S	17° 3' 3,5" E
NC3b	Swartduine	30° 2'52,04S	17°10'39,69E

Area NC4
+- 40 km

		Latitude	Longitude
NC4a	Skulpfontein	30° 6' 8,15S	17°11' 8,03E
NC4b	2 small rocks 200m from shore	30°25'56,26"S	17°20' 5,43E

Buffer zone	Namibian boarder	17 km →	NC1
	NC1	7 km →	NC2
	NC2	13 km →	NC3
	NC3	6 km →	NC4

Western Cape

WC 1

Maasbaai +- 8km

		Latitude	Longitude
WC1a	Sandy beach north of Cape Hangklip	34°22'52,35"S	18°49'33,91"E
WC1b	Sandy beach east of Maasbaai	34°22'49,44"S	18°51'22,82"E

WC 2

Betty's bay +-10km

		Longitude	Latitude
WC2a	Jock-se-baai	34°21'22,65"S	18°56'14,53"E
WC2b	Sandy Beach at Bettys bay	34°20'34,38"S	19° 2'16,02"E

WC 3

Hawston +- 8km

		Longitude	Latitude
WC3a	Sandy beach west of Hawston	34°23'58,68"S	19° 7'27,22"E
WC3b	Sandy beach at Onrus	34°25'12,00"S	19°10'49,17"E

Buffer zones

From	Sandy beach east of Maasbaai	34°22'49,44"S	18°51'22,82"E
To	Jock-se-baai +- 8km	34°21'22,65"S	18°56'14,53"E

From	Sandy Beach at Bettysbay	34°20'34,38"S	19° 2'16,02"E
To	Sandy beach west of Hawston+-10km	34°23'58,68"S	19° 7'27,22"E

From	Sandy beach at Onrus	34°25'12,00"S	19°10'49,17"E
To	Onwards to Next zone in the Eastern Cape		

Eastern Cape

EC 1 +- 15km

		Lattitude	Longitude
EC 1a	Skoenmakerskop MPA	34° 2' 46,05" S	25° 32' 33,39" E
EC 1b	Cape Receife	34° 2' 0,33" S	25° 42' 18,43" E

EC 2 +- 50 km

		Lattitude	Longitude
EC 2a	Hamburg	33° 17' 1,94" S	27° 29' 31,54" E
EC 2b	East London	33° 1' 28,13" S	27° 55' 50,53" E

EC 3 +- 65 km

		Latitude	Longitude