



# Research needs in the Transkei and Ciskei coastal zone

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SANCOR

Report on a workshop held at Mpekweni, Ciskei on 3 March 1988

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Cover illustration: Local people harvesting in the intertidal zone on  
Transkei coast  
Photograph by Dr C L Griffiths

## ABSTRACT

**KEYWORDS:** Transkei coast, Ciskei coast, coastal reserves, development pressures.

This report contains papers presented at a workshop on research needs in the Transkei and Ciskei coastal zones held at Mpekweni, Ciskei on 3 March 1988. The discussion which followed is summarized, and legislative, management and research priorities are identified.

## UITTREKSEL

Hierdie verslag bevat referate wat aangebied is tydens 'n werksessie oor navorsingsbehoefte in die kussone van die Transkei en Ciskei wat op 3 Maart 1988 in Mpekweni, Ciskei gehou is. Die bespreking wat gevolg het word opgesom en wetgewende, bestuurs- en navorsingsprioriteite word geïdentifiseer.

## ACKNOWLEDGEMENTS

This workshop resulted from discussions of the Task Team on Coastal Zone Management of the Secretariat for Multilateral Cooperation in Southern Africa (SECOSAF). It was initiated by André van der Westhuysen, and we take this opportunity to thank him not only for this but also for his contribution to marine science in southern Africa.

Funding and logistical support were provided by the South African National Committee for Oceanographic Research (SANCOR) of the Foundation for Research Development (FRD) and the Ciskei and Transkei Governments. We would especially like to thank Mr M Coleman and the Ciskei Department of Agriculture, Forestry and Research Development for arranging and hosting the meeting at the superbly developed resort at Mpekweni.

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## **ABSTRACT AND SUMMARY**

This report contains papers presented at a workshop on Research Needs in the Transkei and Ciskei Coastal Zone held at Mpekweni, Ciskei on 3 March 1988. The discussion following the presentation of these papers is summarized, and legislative, management and research priorities are identified.

### **LEGISLATIVE NEEDS**

The need for integrated legislation encompassing the whole coastal zone is identified as an ideal. Existing legislation should be implemented. For this adequate policing capability is required. Control should be centralized and unified.

### **MANAGEMENT NEEDS**

There is a vital need for a Coastal Zone Plan to be drawn up and implemented. This requires coordination and communication between scientists, managers and users. Education to develop the conservation ethic is essential, and conversely scientists and managers should be acutely aware of local aspirations and cultures. The lack of adequately qualified manpower is stressed as a major problem.

### **RESEARCH PRIORITIES**

1. More information is needed on the biology of intensively exploited intertidal invertebrates (e.g. brown mussels, rock oysters, limpets).
2. An analysis of alternative sources of food and income for people presently exploiting living coastal resources is required.
3. Research is needed on interactions between intertidal and shallow water species, particularly those which may affect recolonization after exploitation.
4. Patterns of recruitment and dispersal of key invertebrate species need to be determined and monitored.
5. A system of monitoring linefish catches should be developed (or adapted from the South African system).
6. Research on the potential impacts of any major developments proposed for the coastal zone should be undertaken in advance of any approval being granted for such developments.

7. A general survey of Transkei and Ciskei estuaries is needed to determine their status and to identify estuaries worthy of special attention or conservation. Continuous low-level observations on estuaries should be instituted.
8. Studies on the effects of bait-digging in estuaries, particularly for mud and swimming prawns should be undertaken.

It is strongly suggested that research results form not only the basis for protective legislation, but that they be used in scenario-planning to highlight the complex interactions between both the people and resources of this beautiful coastal region.

## INTRODUCTION

PROFESSOR G M BRANCH, ZOOLOGY DEPARTMENT, UNIVERSITY OF CAPE TOWN,  
CONVENER AND CHAIRMAN OF THE WORKSHOP

Both Ciskei and Transkei have magnificent, relatively undeveloped coastlines which are a major attraction to tourists. As population numbers build up, so the pressures and demands placed on the coastline increase. At present it is the untouched and unspoilt nature of the coast which attracts its many visitors and tourists, but it is precisely this natural beauty which is most threatened by development. The coast is also a source of food for local people and of delicacies such as oysters and rock lobsters which grace the tables of tourist hotels. These living resources are also threatened by increasing exploitation. These - and other - increasing threats demand knowledge on which adequate management plans can be based, to maintain the coast and its flora and fauna while permitting its wise utilization.

The workshop which is reported here grew out of a meeting of the SECOSAF\* Task Team on Coastal Zone Management, at which requests were made by representatives of the Ciskei and Transkei governments to identify the research needs which are of greatest importance to this section of the southern African coastline. The intentions of the workshop were:

- a) To identify management problems which exist along the coasts of Transkei and Ciskei.
- b) To relate these problems to research that has already been undertaken or is underway.
- c) To discuss management problems in relation to existing and proposed legislation and its implementation.
- d) To identify and stimulate research that is still needed to provide further information, and to assign priorities to this research in a pragmatic manner that is in keeping with realistic expectations of manpower and funding.

To achieve these objectives the programme was divided into four sections. The first consisted of two papers outlining the perceived pressures on the coastline and a third paper on the Nature Conservation Act (1987) recently completed by the Ciskei Government - particularly its relevance to the coastal zone. From the outset it must be recognized that this Act is an important step, it achieves several things that other southern African states may do well to emulate. It

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\*SECOSAF: Secretariat for Multilateral Cooperation in Southern Africa



streamlines and clarifies legislation. More importantly it brings the control of nature conservation under a single body - the Department of Agriculture, Forestry and Rural Development - doing away with many of the problems of divided control which plague other parts of the southern African coastline. It also compels other government departments to conform to the terms of the Act - a bold and important aspect that is seldom emulated in other countries.

At the same time as congratulating the Ciskei Government on this Act, it must be recognized that the Transkei Government was at the forefront when it came to recognizing the need for coastal reserves, and created reserves at Dwesa and Hluleka at a very early stage. While these reserves are not yet fully protected (because their intertidal and subtidal zones are not yet legislatively protected) they have set an admirable example.

The second section of the workshop comprised six papers which briefly outlined past research that has been undertaken and is of relevance to the problems of coastal management in the Ciskei and Transkei. The papers focused on the exploitation of intertidal invertebrates; harvesting of seaweeds; estuaries; coastal and dune vegetation; and marine fish. No attempt was made to cover all the research that has been undertaken, but rather to concentrate on important aspects and to illustrate the type of research that has been done.

The papers served as a springboard for the third section of the workshop, namely an open discussion of the needs for future research. This culminated in the final section of the workshop, devoted to drawing up priorities and recommendations for future research needs.

We were privileged to have the Ciskei Minister of Agriculture, Forestry and Rural Development to open the workshop. Minister Ngomo explained that, growing up as he had in the country, he had been a conservationist all his life and that he was accordingly honoured to be invited to open this workshop. He took a very serious view of the preservation of the natural resources of Ciskei for the enjoyment of future generations. He strongly encouraged the sharing of ideas and knowledge as a basis of learning and education, and felt that the existing feudal system could be used wisely to ensure the future of all the people in the area. The tension between the need to encourage more development and tourism, and the increased pressure this would put on the coastline was a constant problem, but he hoped that, in future, disasters such as those that have occurred in the past would be avoided. Conservation should not be a *post facto* attempt to smooth over mistakes, but a process of active forward planning. The Minister stressed the importance of interstate collaboration, saying that species did not recognize political boundaries. He called on Transkei, Ciskei and South Africa to work together to manage this beautiful coastline so that it could be enjoyed by all in the future.

## ENVIRONMENTAL CONCERNS IN THE TRANSKEI WILD COAST ZONE

MR M A KERR, TRANSKEI DEVELOPMENT CORPORATION

Whilst the primary aim of the Transkei National Tourism Board is to publicize and promote tourism in and to Transkei, the Transkei Development Corporation aims at encouraging the aesthetic development of a range of tourism facilities along the Wild Coast in harmony with nature. Developments are restricted by the Coastal Development Control Plan to identified 1st, 2nd and 3rd order nodes along the coast. This zonation has been adhered to, but detailed aesthetic planning and control has, unfortunately, often been by-passed by business and political considerations. For example, the Wild Coast Holiday Inn and Casino required considerable additions and R2 million worth of landscaping and planting of indigenous flora to restore the aesthetics of the magnificent landscape.

In my opinion the most serious threat to the Wild Coast and its estuaries is the insidious degrading of the catchments by poor land use. In the case of the Transkei, nearly all these catchments are within Transkei territory, a fact which should make for easier control. The major exceptions are the Mtamvuna, Mzimvubu basin, and Great Kei, catchments which Heydorn would include in his definition of the *ecological coastal zone*. It is imperative that both catchments and estuaries are monitored in a scientific manner to assess their status, condition and any changes. In the case of estuaries, the emphasis should be on siltation, bank erosion, pollution and the movement of sediments by longshore currents and wave action. A geomorphological approach is paramount, supported by ecological investigation. Prioritization of both estuaries and catchments is also essential.

Tourism is the only major "industry" along the Wild Coast and is therefore the most important formal provider of jobs and incomes. Although they provide only a small revenue to Transkei, seaweed and shellfish collecting and ski-boat catches are very important to the local subsistence populations in the coastal zone, and a major concern is the utilization or over-exploitation of crayfish, mussels, red steenbras, black steenbras, 'seventy-four', oysters and seaweed. It is a matter of urgency that these populations or stocks be scientifically assessed.

The tourism "industry", already a multi-million rand business, is totally dependent on the exceptional natural resources that occur on this truly magnificent and largely pristine Wild Coast. Unfortunately, however, although tourism worldwide is listed as the biggest foreign capital earner, in the SATBVC context it is given no incentives as it is not a manufacturing industry. Sufficient casinos have been developed, but these are not the only facilities desired by tourists, many of whom seek the coast for its natural resources.

I have highlighted above some of the more important research needs in the Transkei. In addition, however, I see the implementation of the knowledge acquired through research as a major stumbling block. It is time that the problem areas in Transkei are attended to effectively and not just paid lipservice by politicians and some civil servants. The *real question* is how are Transkei's priceless natural resources being administered and managed? This responsibility is vested in the Department of Forestry and its Divisions of Nature Conservation and Fisheries. As presently structured and staffed, it is beyond the limited means of these small Divisions to administer and manage these natural resources effectively.

- \* the organizational structure is totally inadequate and some posts are vacant - establishment c. 100
- \* there are too few members of staff that are suitably trained as administrators, wildlife/marine managers and researchers
- \* the allocation of materials and equipment is inadequate
- \* legislation is clumsy - several Acts are administered by many different Departments and is generally inadequate
- \* the budget of R757 000 is totally unrealistic for Transkei (for comparison, note that the Natal Parks Board budget is R45 million)

This budget reflects the very low national priority past Governments have given to nature conservation. There is a most urgent need to bring to the notice of the highest levels of Government this totally unworkable situation. Both the Transkei's natural resources and the future of its people are at stake - the land and the sea are all they have.

I propose that this workshop formulate a strong and urgent recommendation to the Chairman of the Transkei Military Council at the end of today's deliberations. This motivation should include *inter alia* -

- \* that nature conservation (terrestrial and fresh water) be run by an independent Board, appropriately qualified and experienced, with a competent executive and staff
- \* similarly that an independently operating Marine Resources Board be formed
- \* that a clearly defined policy with objectives be laid down

- \* that a prioritized research programme and a schedule of management plans be formulated
- \* and that adequate funds be provided.

In conclusion, the problem is primarily one of administration and management shortcomings largely beyond the control of the incumbent staff and NOT of insufficient research findings. The data are there - let us apply them, adapt them where necessary, but above all get on with the job.

## PRESSURES ON THE CISKEI COAST

MR V L MGADLE, CISKEI DEPARTMENT OF AGRICULTURE, FORESTRY AND RURAL DEVELOPMENT

### INTRODUCTION

Before I address the question of Pressures on the Ciskei Coast I would like to introduce some of our coastal resorts.

The Chalumna River forms the eastern boundary between RSA and Ciskei, and flows into the sea throughout year. The adjacent shore is rocky, harvestable, and supplies the domestic needs of Chief Pato's people. It was here, on 22 of December 1938, that the first coelacanth (*Latimeria chalumnae*) was caught by the I & J trawler, "Nerine". This remarkable fish was believed to have become extinct 70-80 million years ago and its discovery off Ciskei coast some 50 years ago was, and remains, one of the major zoological events of this century. The area around Chalumna is also rich in Archaeology.

Kiwane is a closed river and has a conservation station. There are holiday cottages there and it is popular amongst Ciskeians, many of whom visit it during the festive season.

The Keiskamma is Ciskei's major estuary, and popular for its beauty and good fishing. There are also harvestable rocks in the area. The western side is built up with cottages, hotels, shops, village, etc. It is Chief Pato's tribal resource area, and the flood plain is used for grazing and subsistence farming. The Keiskamma River is threatened by soil erosion.

Mtana and Gqutywa are both unspoilt, closed rivers.

Saddle Military Base is used for training Ciskei soldiers.

Begha: The eastern side has a high density township development. A nature conservation station exists on the western side. An eel project is based here.

Mgwalana is the site of a township development and a potential launching site. The river mouth is closed.

Mtati has a caravan site.

Mpekweni has recently been developed as a modern holiday resort. The area between here and Begha has been proposed as a coastal nature reserve.

## SEAWEED HARVESTING

Ciskei has a coastline of approximately sixty five kilometres. There is only a limited area of rocky shore where seaweed harvesting may take place. This rocky shoreline is also the habitat of a wide variety of shellfish and crustaceans. There appears to be a direct relationship between many of these species which are exploited for tourist use, and seaweed, yet there is little scientific knowledge on how the harvesting of seaweed will effect the long-term viability of the life cycles of these species. Some people believe that in the long term seaweed harvesting will reduce population numbers, especially of the grazing species which depend on seaweed for survival. (Editor's note: this question has recently been researched by the Sea Fisheries Research Institute in Cape Town).

Tourist development along the unspoilt Ciskei coast is dynamic and many millions have been spent on hotels and resorts. Tourists rely heavily on the coastline to produce fresh shellfish for their tables and it is envisaged that there could be direct conflict between harvesting teams, sun bathers, rock seafishermen and tourists. An attempt is being made to control commercial harvesting, e.g. a one-year permit to harvest seaweed has been issued by Ciskei to Taurus Chemicals on the understanding that the period of harvesting is self-limited by spring-tide lows, and that there will be little chance of over-harvesting. (Editor's note: Again, the desirability and viability of this has been studied, and is dealt with below.)

## ESTUARIES

Nature Conservation in Ciskei has expressed concern with regard to the heavy siltation in rivers and estuaries resulting from soil erosion caused by human activities (poor land husbandry and management), coupled with droughts and sporadic rains. Estuaries contain many valuable species such as prawns and worms and also act as nurseries for many fish. The natural process of soil erosion, accelerated by the activities of man, is resulting in heavily silted waters and endangering entire estuarine ecosystems. The heavy influx of anglers and disregard for conservation regulations give cause for concern and contribute much to the depletion of popular forms of bait. Because of their role in the estuarine food chain, it is important that these species are conserved and we feel that research into the sustainable yield of bait organisms in Ciskei's estuaries is urgently needed.

## ROCK STRIPPING

The new Ciskei Nature Conservation Act makes provision for the control of over-exploitation of shellfish, by means of daily bag limits and minimum size restrictions. The major problem is people stripping not

for their own domestic use, but to sell to hotels and holiday makers. Individuals have been found with over 700 shellfish of all sizes, highlighting the damage that may be inflicted if insufficient power is provided to police the regulations.

#### SKIBOATS/TRAWLERS/OFF-ROAD VEHICLES

The same Act makes provision for the licencing and registration of skiboats to control their use in our water systems. It is, however, difficult to control skiboats that launch outside Ciskei waters to come and fish in Ciskei's economic zone. Among the problems we face are: not knowing the sustainable yields of our fish, the lack of the required patrol boats and manpower to police our waters, and uncertainty as to how many boats can actually be accommodated in the Ciskei's economic zone. Close liaison between our Department and RSA officials is a need as many of those who buy the fish come from outside Ciskei. This cooperation is also needed to control the activities of trawlers and the use of off road vehicles, most of which come from RSA. Although the new Act does provide for the control of off-road vehicles along the coast, we would very much like to have more research into their effects.

#### COASTAL DEVELOPMENT

Scientific knowledge with respect to township development along the coast is sorely needed. It gives cause for concern that there is no on-going involvement between planners and environmentalists. Planners should recognize the interaction between human activity and natural process, and take cognizance of environmental factors when deciding upon developments. The new Ciskei Nature Conservation Act makes provision for a coastal conservation area whereby no-one may develop within the area without prior approval from Nature Conservation (Sec. 42(2)).

#### CONCLUSION

I believe that research on the following is required:

1. Seaweed harvesting - relationships between shellfish and the seaweed.
2. Ecological evaluation of the Keiskamma Estuary and the effect of township development along the coast.
3. A definite population policy to determine and control the number of people living along the coast.

## CISKEI NATURE CONSERVATION ACT 1987 – RELEVANCE TO THE COASTAL ZONE

MR M COLEMAN, DIRECTOR OF ENVIRONMENTAL AFFAIRS, CISKEI

### INTRODUCTION

The Ciskei Nature Conservation Act of 1987 arose out of the need to replace the Act of 1976 which had become outdated. Conservation thinking had advanced, and Ciskei had developed its own emphasis which required legislative support. In particular, there was a desire to pull together the diverse residual legislation affecting the coastal zone, and to consolidate its administration as far as possible under one authority, the Division of Nature Conservation in the Department of Agriculture, Forestry and Rural Development. The new Act therefore repeals, amongst others, the Seashore Act, Sea Fisheries Act, Sea Birds and Seals Protection Act.

### RESERVES AND CONSERVATION AREAS

The 1987 Act provides for a range of reserves and land-use controls for different objectives and management situations. Of most direct impact on the coastal zone is the creation of a Coastal Conservation Area 1 000 metres wide "to protect, in particular, the seashore, dunebelt and estuaries". This should facilitate a wholistic approach to the management of what is, in effect, a single dynamic system. Within the Coastal Conservation Area there is control by permit of access, physical development (even by state departments) and of any activity "which disturbs or may disturb the natural state of the vegetation, the land or any waters" (Section 42).

The new Act enables the creation of a wider range of nature reserves not only for different objectives but for management by different agencies. National nature reserves have as their objectives:

- a) the protection, preservation, reproduction or propagation in their natural state of wild animals and indigenous plants, including, where appropriate, marine and other aquatic life and plants;
- b) the protection and preservation of any objects of geological, archaeological, historical, oceanographic, educational or other scientific interest;
- c) the creation of opportunities for study and research in any of the aforementioned fields;
- d) the provision of facilities for recreation in a rural and natural environment; and



- e) the preservation and enhancement of the natural beauty of the area concerned.

All of these objectives may be applied to the coastal area.

The Department of Agriculture, Forestry and Rural Development has the legal ability to delegate the management of these national reserves to local authorities. In addition, local authorities may now establish reserves which include tribal authority resource areas. (These are areas where grazing of large stock and payment of fees is to the tribal authority instead of to the central government revenue fund). In effect this is legal recognition of successful Ciskei policies which are already in operation. Landowners may also now establish private reserves and "natural areas".

The creation of marine reserves is specifically covered in Section 49 where "any waters or any State land and adjoining waters" may be declared a reserve. Combining the Coastal Conservation Area provisions with those of the Territorial Waters Act provides the opportunity for sound coastal conservation without the frustrating gaps and anomalies of the past. The Water Catchment Areas section of the Act is closely related to the possible creation of estuarine reserves. This Act widens the provisions from mountain catchments to include some land-use control in the catchment, a step which is of great importance to estuarine conservation. Hiking trail legislation has also been incorporated into this Act (rather than the Forestry Act) and applies along the coast where there is the existing shipwreck Trail.

#### MEASURES FOR CONTROL

Even researchers from eminent academic institutions require control on occasions! The Act makes full provision for genuine research, including exemptions by permit from most normal controls, for scientific purposes. However, no general permits will be issued, for example for unspecified "collection of samples".

Two new control permits have been created: one for marine angling and the other for use of vehicles on beaches. The marine angling permit has been discussed with angling organizations and has their strong support. It will be used as the basis for random sampling of catch statistics to replace the previous unsuccessful catch information requested (but never received!) from every angler. The permit will form a source of information for conservation policy as well as being a means of law enforcement. Off-road vehicle permits will be issued with the cooperation of angling clubs and also to visitors and individuals. At present, there is no problem with beach vehicles in terms of numbers on the Ciskei coast, but pressures are increasing and again it is better to have a control system in existence *before* a crisis. Certain stretches

of beach may be closed (as part of marine reserves, for example, or at peak periods) but we do not believe that a blanket ban is either justified scientifically or is wise management of tourism and recreation at this stage.

Controls of fishing by bag limits, method, closed seasons, and minimum sizes have been updated to accord with the best information we can find on stocks, breeding seasons, maturity size, movement and migration, especially into estuarine nursery areas. Other than crab and cast-nets under permit, all nets are now prohibited in Ciskei. Special provisions are made for whales, seals and lobsters.

Commercial fishing and processing have now also been incorporated in this Act. However, unlike Transkei, in Ciskei no commercial fishing permits have been issued: we have neither proof of adequate fish stocks, nor the means to police commercial activities at present, and thus prefer to take a conservative approach. One perlemoen (or abalone) permit has been issued which, under strict conditions, allows a small quota to be taken. Likewise, one seaweed harvesting permit is being issued on conditions more conservative than those recommended by either the University of Port Elizabeth or Sea Fisheries Research Institute. Hopefully, both will prove to be examples of "wise use" of Ciskei's resources. Hotels are issued with permits which allow them to hold stocks of shellfish purely for use by bona fide guests.

#### IMPLEMENTATION OF THE ACT

Without the support and understanding of the people of Ciskei we are wasting our time. For this reason one of our three sections in the Nature Conservation Division is that of Environmental Education. Their main target group is upper primary school teachers of science and geography who receive in-service courses from our staff at the Department of Education's Hlaziya training centre. Follow-up is then given in the schools. This helps to reinforce especially the practical group methods they are taught.

In the field Nature Conservation Officers are trained to educate and inform the public. Written warnings are only issued as a second step, and, only as a last-resort, are the full powers given by the Act brought into use. More formally, Cabinet approval has been obtained for the creation of a Ciskei Coastal Liaison Committee. This follows the successful Ciskei Trout Liaison Committee. It will include relevant government agencies, university representatives, angling organizations, and representatives from tourist, coastal tribal and local authorities. At the national level we receive much help through SECOSAF and the multi-lateral technical committees, as indeed the organization of this workshop by the Foundation for Research Development demonstrates. Local collaboration with Cape Nature Conservation and Sea Fisheries inspectors is very cordial.

**CONCLUSION**

We have tried in our new Act to make direct use of recent research, to base our management policies on sound research results, and, as the Honourable Minister has already emphasized, to make wise use of Ciskei's coastal resources. At present I see Ciskei's priorities in the use of marine resources as firstly, local subsistence consumption, and secondly, support of tourism and recreation, with commercial use under strict conditions as a lesser priority.

Amendments are possible, even to a new Act, so we would welcome your comments and suggestions for further improvements.

## EXPLOITATION OF INTERTIDAL INVERTEBRATES IN TRANSKEI AND CISKEI

DR P A R HOCKEY, PERCY FITZPATRICK INSTITUTE OF AFRICAN ORNITHOLOGY,  
UNIVERSITY OF CAPE TOWN

The rocky intertidal regions of Transkei and Ciskei are among the most heavily exploited in southern Africa. In Transkei, between the Kei River and Port St Johns, an estimated 5,5 tonnes of invertebrates are removed annually per km of rocky shore: in the 20 km south of Hole-in-the-Wall, this figure increases to more than 14 t km<sup>-1</sup> (Hockey et al. in press). North of Port St Johns exploitation pressure is lower, due to a less dense coastal population and domination of the substrata by quartzitic sandstones and limestones. In southern and central Transkei, collectors favour tillite, shale and dolerite substrata, and the total annual 'harvest' is c. 553 t (Hockey et al. in press).

Such exploitation has been ongoing for many thousands of years, but has become more intense in recent times as the population of Transkei more than doubled between 1960 and 1984 (Bembridge 1987). Collectors are selective both in the species and sizes which they take, and specialize particularly in mussels and limpets, with mussels being the traditionally favoured prey (Bigalke 1973, Siegfried et al. 1985). Exploitation has altered intertidal community structure and reduced the populations and mean sizes (hence reproductive potential) of certain species (Branch 1975, Hockey and Bosman 1986). The brown mussel *Perna perna* resource appears to be seriously depleted. At Human's Rocks, mussel size and availability declined markedly between 1978 and 1984. Whereas mussels accounted for 92% of all prey items in 1978, they made up only 57% of the catch in 1984, the shortfall being substituted by increased collecting pressure on limpets (Siegfried et al. 1985, Hockey and Bosman 1986).

Elsewhere in the world, intense shellfish exploitation has led to local extinction with little or no evidence of recolonization (Hockey 1987). At present we have little or no knowledge of dispersal capabilities of these exploited species, nor of minimum viable population sizes. However, the external and random fertilization of gametes in the water column imply that minimum populations for self-perpetuation may be large. Persistent removal of the largest and most fecund invertebrates by collectors exacerbates the problem.

Despite the large amounts of shellfish removed from the shore, the per capita nutritional benefits derived from this source do not exceed 8% of the annual protein requirement (Hockey et al. in press). This is far less than the potential protein production derived from livestock (meat and milk) in the coastal region (op. cit.). However, comparing the real and potential use of shellfish and livestock is problematic, as shellfish are a common resource whereas livestock are privately owned.

In addition to providing a source of nutrition, the shellfish communities of this section of southern Africa's coast are particularly interesting biologically as the region includes a transition zone between two marine biogeographical provinces, one temperate and one subtropical.

In view of the degraded nature of much of the shore and its value as a source of food for local people, a major re-think about its conservation status is overdue. In terms of immediate action there are two high priorities.

1. Establishment of a marine reserve network. This requires a research programme to investigate aspects of the population dynamics of exploited species (particularly their reproduction and dispersal) relevant to optimizing the sizes, spacing and positioning of such reserves.
2. Investigating avenues for substituting nutritional benefits derived from wild-caught shellfish. This includes improved efficiency of utilization of livestock-derived protein, and investigating the feasibility of mariculture projects along the coast, particularly for mussels.

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## MANAGEMENT OF *GELIDIUM PRISTOIDES* RESOURCES

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### BACKGROUND

*Gelidium pristoides* is an intertidal red alga which constitutes one of the most important floral components of the mid-littoral zone along the southeast coast of southern Africa. Besides its ecological importance, it is the most exploited agarophyte in Southern Africa. The possible effects and repercussions of the constant harvesting of this resource have been cause for concern to management bodies, ecologists and the commercial company responsible for the harvesting and agar production. In order to develop a management policy for the exploitation of *Gelidium*, a study of three key aspects, namely eco-reproduction, regrowth and agar variability was undertaken.

### RESULTS

#### Reproductive ecology

The study showed that the relative proportions of the population contributed by tetrasporic, female and male plants remain fairly constant throughout the year viz. 64%, 21% and 15% respectively. However, the reproductive potential of each of these phases does not remain constant and fertility of both the tetrasporophytes and the carposporophytes increases to a maximum in the September–November period. In the case of tetrasporophytes, sori reach a maximum of about 6500 g<sup>-1</sup> dry mass while the number of cystocarps peaks at 4800 g<sup>-1</sup> dry mass. It would appear thus that fertility reaches a peak just prior to the summer solstice period, when physical factors are generally optimal for the establishment of juveniles. Maximum recruitment occurs during this period.

#### Standing Crop, Harvesting and Regrowth

##### a) Standing Crop

The standing crop of *Gelidium pristoides* exhibits distinct seasonal variations with the highest biomass, about 115 g m<sup>-2</sup> (dry mass), occurring during the late summer months (December to April), whereafter it declines during winter to a minimum of 50 to 60 g m<sup>-2</sup> in September. Data on relative cover of *Gelidium* show virtually the same temporal pattern.

b) Post-harvest Regrowth

A summary of the most important findings are presented in Table I. No differences were found between the recovery rates of hand-picked and cut or clipped plants.

Table 1.

Time required after harvesting of *Gelidium pristoides* for biomass levels to recover to control (unharvested) levels.

Harvest Month	Recovery Time (months)
February	5 - 8
April	4 - 5
August	5 - 6
October	5
December	3

c) Agar Assays

Monthly variations in yield and gel quality of agar were determined. Maximum agar yields (up to 38%) were obtained during late summer (December to March). Overall gel quality was also found to be highest during this period with gel strength (of 1% samples) peaking at 800 g cm<sup>-2</sup> and 3,6-anhydrogalactose content (40%), gel rigidity and cohesion also all at their maximum levels, while sulphate content (1,3%) and gel flexibility were at a minimum. The agar of this alga is of exceptionally high quality and even at its minimum, gel strength (400 g cm<sup>-2</sup>) exceeds that of the majority of other agars.

CONCLUSIONS AND RECOMMENDATIONS

Based purely on economic terms, the questions which an exploiter of an agarophyte would ask himself concerning the resource he plans to harvest are:

- a) when will the yield of agar be maximal,
- b) when is the quality of the agar highest, and
- c) how often can an area be harvested?

What the marine manager must ask himself is: when, how often and to what extent, should harvesting be permitted so as to ensure that the exploitation would have minimal negative ecological impact?



While certain limits may have to be placed on the commercial exploiter it is important that the marine manager does not stifle all exploitation, but rather that he manages it in such a way as to ensure satisfaction to both the exploiter and the ecologist.

Peak harvestable biomass occurs during late summer (December to March). Coinciding with this is the peak in agar production, and the overall quality of agar is also highest at this time. It would seem that two harvests of the same area per year would be both commercially profitable and ecologically sound, namely one in December - yielding approximately 108 g of dried seaweed  $m^{-2}$  of substratum and a second harvest during February/March, realizing a further 115 g  $m^{-2}$ . The three-month recovery period between the two harvests would result in the full recovery and replenishment of the resource. Maximum agar yield and quality both occur at this time and overall commercial gains would thus be optimal. This would also be ecologically sound in terms of reproduction, as fertility, and therefore reproduction, peaks during September to November. Harvesting after this reproductive peak would thus have the smallest negative impact on recruitment.

The impacts of exploitation of *G. pristoides* on intertidal animals were not investigated in this study, but it is felt that clipping, rather than hand plucking, would minimize the number of limpets which are removed during harvesting. No differences were found with respect to either the yield of seaweed or the rate of regrowth, between hand-picked and cut plots. (Editor's note: Research on the impact of seaweed harvesting on associated fauna has been carried out by the Sea Fisheries Research Institute and indicated that negative effects are minimal.)

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## ESTUARIES IN THE TRANSKEI: THEIR PAST, PRESENT AND FUTURE

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### INTRODUCTION

The Transkei receives a high mean annual precipitation (1050 mm) as it lies on the Eastern Escarpment of the Drakensberg. This water drains to the sea via some 62 estuaries and river mouths which punctuate its 250 km long coastline, yielding an average of one river mouth every 4 km (Natal, 1 per 2,4 km, Begg 1978; Cape, 1 per 13 km, Heydorn & Tinley 1980). These Wild Coast estuaries may be broadly divided into two types, the large silted estuaries such as the Kei, Mzimvubu and Bashee which drain from the Drakensberg escarpment and midland plateau above the coastal monocline (catchment area >2000 sq km) and the smaller clear estuaries like Mngazana, Mntafufu and Mtakatye (catchment area <2000 sq km) which drain from the wetter, wooded slopes of the coastal monocline. The latter estuaries tend to have small catchment areas relative to the mean annual runoff because the coastal strip receives relatively more rain per unit area of catchment (Table 1).

### CONSERVATION

Recommendations for the conservation and management of Transkei's estuaries have been made in the past (Wallace and Van der Elst 1974; Glyphis 1976; Branch 1976; Cooper 1977; Emmerson 1987) but to date very little has been achieved. Cooper's (1977) Wildlife Society document, which identified nature conservation priorities along the Transkei coast and included many estuaries, was accepted by the Transkei Government in the Coastal Development Control Plan of 1979. It took another eight years before it was tabled in Parliament, but was delayed when the Minister concerned died. At this stage members of the International Union for the Conservation of Nature and Natural Resources (IUCN) in Geneva expressed interest in placing sections of the Transkei coast on their protection list due to its unique flora and fauna. Since then the plan appears to have been shelved.

The Control Plan proposals classified the following estuaries within National Parks or Nature Reserves:

1. The Pondoland Wild Coast National Park - Mtamvuna, Mtentu, Msikaba, Mzintlava, Mzamba, Mnyameni, Mbotyi and Mntafufu.
2. Dwesa-Cwebe National Park - Bashee, Nqabara-Nqabarana and Mendu.
3. Nature Reserves - Mngazana, Manubi-Qora, Kobonqaba-Nxaxo, Ngqusi, Xora, Mnenu, Mtakatye and Mtata.

With the exception of the Bashee and Mtata all these proposed estuaries are small type 2 estuaries which could be managed easily. This is consistent with Wallace and Van der Elst's (1974) suggestion that conservation be concentrated on the smaller unspoilt estuaries as the larger ones were already too badly degraded. Human and animal populations in these type 1 catchments are increasing rapidly placing an even further load on these systems.

## RESEARCH

Probably the earliest scientific records from Transkeian estuaries go back to the early botanists such as Harvey et al. (1861-1862; *Flora Capensis*), Sim (1907), Thistleton-Dyer (1912), Muir (1937) and West (1945) who did preliminary work on mangrove distribution. This was subsequently updated by MacNae (1963), Steinke (1972) and Ward and Steinke (1982). The earliest zoological/ecological work on Transkeian estuaries appears to have been done in 1950 by the Zoology department of the University of Cape Town (Day 1981) who briefly investigated the benthic macrofauna and fish of the Mtamvuna, Mzimvubu, Bulalo, Bashee and Mbanyana estuaries. Since then other research has been carried out in a number of Transkeian estuaries to include meiofauna, plankton, benthic macrofauna, ichthyology and conservation/management. This research is summarized in Table 2. From this synopsis of estuarine research, a number of points have emerged:

1. Apart from Professor Day's early work (summarized in Day 1981), no published work came out of the Transkei during the fifties and sixties.
2. Almost all research has been carried out during the seventies and eighties, usually from "once off" surveys by outside bodies. Results from regular sampling have only emerged during the last nine years, mainly since the establishment of the University of Transkei.
3. A good gauge of the status of Transkeian estuaries can be derived from the number of fish species recorded per estuary. Turbid, degraded systems such as the Mzimvubu, Kei and Bashee have a low fish species diversity compared to clear systems such as the Mngazana and Mntafufu. Both Day (1967; 1981) and Whitfield (1983) have observed that silt reduces light penetration and smothers reefs and submerged vegetation such as *Zostera* which normally support a high species diversity so that rich niches along with their associated species are destroyed (i.e. niche breadth or diversity is narrowed). Estuaries can be reclaimed, like the Thames, but in a third world context such as the Transkei where there is spiralling population, livestock and agricultural pressure in the catchments, it is better to concentrate on conserving the smaller unspoilt systems as has been suggested (Wallace and Van der Elst 1974) as it

is "less expensive to protect rather than restore the environment and some types of environmental damage are irreparable" (Cooper 1977).

4. A "systems approach" to research in the better known estuaries such as the Mngazana has been initiated where energy flow, the relationship between the estuary and nearshore, and import/export are, or will be, examined.

#### CONCLUSIONS

1. With Mozambique no longer a tourist spot, Natal overcrowded and the low value of the Rand, there is ever increasing pressure on Transkeian estuaries for recreation. Development according to the Control Plan, with minor amendments, needs to be invoked as soon as possible.
2. Smaller unspoilt estuaries need to be concentrated on by means of more comprehensive ecological surveys.
3. Whole catchments and not just the immediate estuary areas, need to be managed and conserved, like the Siyayi Project in Natal.
4. A priority list should be made with valuable and potentially degradable estuaries such as Mngazana and Mntafufu given a high priority.
5. Local people affected by the creation of coastal reserves should be aided by support programmes such as woodlot establishment. If open-type reserves are envisaged where local people can still utilize the estuaries resources (e.g. fishing, pole and reed collection), then accurate scientific monitoring will be needed to evaluate the impact on the environment. The collection of *Cymbopogon* in Mkambati is a pertinent example.
6. With estuaries like the Mtentu and Msikaba, baseline data are required before the systems are degraded (by sugar milling activities for example). Such research is already planned by the University of Transkei and the Transkei Development Corporation.
7. Transkei's estuaries can be regarded as nothing less than a national heritage, which, like any asset, should be preserved for posterity.

**Table 1.**  
**Catchment area, Mean Annual Runoff (MAR) and ratios of Area: Runoff**  
**for some Transkeian estuaries. Data from Eksteen et al. (1979).**

Estuary	Catchment Area, sq. km.	MAR	Area: Runoff Ratio
Kei	20607	1006	20,5
Mzimvubu	19853	3417	5,8
Bashee	6030	942	6,4
Mtata	2585	357	7,2
Mtamvuna	2184	349	6,3
Msikaba	1010	131	7,7
Mtentu	964	121	8,0
Qora	700	76	9,2
Nqabara	578	61	9,5
Mngazi	561	65	8,6
Mzamba	505	73	6,9
Mtakatye	493	56	8,8
Xora	438	49	8,9
Shixini	331	41	8,1
Kobonqaba	321	42	7,6
Mngazana	285	48	5,9
Mzintlava	280	65	4,3
Mdumbe	234	37	6,3
Mnyameni	180	40	4,5
Mntafufu	178	48	3,7
Mncwasa	164	31	5,3
Mnenu	97	21	4,6
Nxaxo	81	17	4,8
Qolora	77	11	7,0
Mpako	76	17	4,5
Ntlonyane	74	18	4,1
Nqabarana	70	17	4,1
Ngqusi	53	11	4,8
Bulungula	46	11	4,2

Table 2.  
Synopsis of estuarine research in the Transkei

Category	Reference	Estuary
Meiofauna	Oliff (1978), Dye (1979) Dye (1983a,b,c,d) Dye (present)	Mngazana Mngazana Mntafufu
Plankton	Tattersall (1950)  Connell & Grindley (1974) Connell (1974) Wooldridge (1974) Bradford (1976) Wooldridge (1976) Wooldridge (1977a, 1977b) Wooldridge (unpublished) Oliff (1978) Pereyra-Lago (in press)	Mngazi, Mzimvubu, Bashee Mbanyana Mtentu Mtentu Msikaba, Mbotyi Mngazana Msikaba Mngazana, Mbotyi Mbotyi, Sinangwana Mzimvubu, Mngazana Mntafufu
Benthic Macrofauna	UCT (1950)  MacNae (1963) Blaber <i>et al.</i> (1974) Oliff (1976) Oliff (1978) Begg (1978, 1984) Branch & Grindley (1979) Day (1981) Emmerson (submitted) UNITRA (present)	Mtamvuna, Mzimvubu, Bulolo, Bashee, Mbanyana Mngazana, Mtata Msikaba Mtamvuna Mzimvubu Mtamvuna Mngazana Msikaba, Mngazi Mngazana Mntafufu, Mngazana
Ichthyofauna	UCT (1950)  Wallace & Van der Elst (1974) Blaber (1977) Oliff (1978) Branch & Grindley (1979) Marais & Prinsloo (1980)  Day (1981) Whitfield (1983)  Begg (1984) Plumstead (1984)  Plumstead <i>et al.</i> (1985)	Mtamvuna, Mzimvubu, Bulolo, Bashee, Mbanyana Xora, Kobola Msikaba, Mtentu Mzimvubu Mngazana Mngazana, Mtata, Mqabara, Kei Mngazi Mzimvubu, Mngazana, Bashee, Kei Mtamvuna Mzamba, Mntafufu, Mtata, Bashee, Kei Kei
Conservation/ Management	Anon (1969) Wallace & Van der Elst (1974)  Branch (1976) Glyphis (1976) Cooper (1977) Day (1981) Emmerson (1987)	Mntafufu, Mbotyi Transkeian estuaries in general Mngazana Mngazana see text Numerous estuaries Mngazana Mngazana

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## COASTAL AND DUNE VEGETATION

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Over the past 12 years studies have been undertaken on the vegetation of the coastal region, principally between the Kei Mouth and the Tsitsikamma River but with occasional expeditions into Transkei. These studies have included general surveys and more detailed case studies of specific regions, the accent having been mainly on management. On a number of occasions the Department of Plant Science at Rhodes University has been approached to tackle specific problems of coastal zone management within the dune zone and coastal vegetation.

Dependent on geology and geomorphology along the coastline, there is wide variability with respect to the different coastal zones - namely the surf zone, the beach, the dune system and the climax vegetation. Thus we see a change of landform from the rocky cliffs and headlands predominating in Transkei to more extensive dunefields with occasional rocky headlands as one moves southwestwards. There is a corresponding change in flora and vegetation coupled with this variation in landform, and studies have been made of the terrestrial vegetation within the dune systems and climax vegetation. A transition of floristic types has been noted: the Tongoland-Pondoland or subtropical flora migrates south down the coast and is predominant in the river valleys; occasional representatives of the inland Afromontane flora, such as yellowwoods, are found in forested areas of the coast: and the Cape flora, with fynbos elements, extends up the coast. These species complexes are reflected in the different climax vegetation types which are found along the coast, namely, coastal grassland, forest, scrub or thicket, and fynbos. Consequently, in general terms, there is a change from coastal grassland and forest to thicket and fynbos as one moves down the coast. These changes are primarily due to rainfall and temperature with local differences dependent upon landform, geology, etc.

There is a natural change as plants invade the mobile sands deposited on beaches. A number of species of pioneer plants invade the foredunes and a different complement of species are found in the protected dune slacks. Over a period of time there is a gradual change or succession from pioneer to climax plant communities. Our surveys of the coastal vegetation have concentrated in this dune region in an attempt to explain changes in species composition and abundance due to phytochorological or floristic affinities, and changes due to succession from pioneer to climax communities. We have coupled our studies to those of the controlling environmental factors, the macroclimatic effects along the coastline and, also, at a specific study site where we are attempting to explain the successional process in more detail, to microclimatic and soil factors. An understanding of these basic ecological processes is fundamental to implementing a successful management programme within the coastal zone.

The fragile and transitory nature of the dune system necessitates studies on dune stabilization. In many instances inappropriate development in the coastal zone has led to problems of invading drift sands or beach erosion. The easiest solution is to control development in such a way that it will have minimal disturbance on unstable or changing systems. Unfortunately, in many cases this is not possible, and stabilization has often been attempted using indigenous species. In the past, the use of alien species has resulted in the invasion of indigenous vegetation, incidentally posing an unnecessary fire threat to coastal townships. Experimental work on the germination of indigenous species and field trials under different conditions have shown the potential of these species as dune stabilizers. Standard techniques of dune stabilization have been developed by the Directorate of Forestry and these have been documented in an information pamphlet. Areas which have been artificially stabilized by the Directorate of Forestry have been monitored to determine the success of this stabilization programme. These areas range from the Kei Mouth to the Sundays River and include a variety of methods of dune stabilization and the use of both exotic and indigenous species.

One of the most contentious issues in coastal regions is the use of off-road vehicles (ORV's) on beaches. A controlled experiment to determine the effects of ORV's on the coastal vegetation has been established near the Fish River Mouth. The monitoring of three types of pioneer and dune scrub communities subjected to different treatments in the form of vehicle passages and human trampling was initiated about a year ago. Recovery in height and cover of the plants is monitored at monthly intervals.

The most appropriate method of eliminating man-made environmental problems is to avoid them by carrying out a carefully planned environmental impact assessment prior to any development. The Department of Plant Sciences has recently been involved in a number of such studies. An example is the Great Fish River Project where Sun International propose to develop a coastal resort in the form of a hotel and casino with an 18 hole golf course and water sport facilities, between the Great Fish and Old Womans Rivers. Our input was to analyze the state of the natural vegetation, the susceptibility of the coastal dunes to erosion and to advise on the siting of the various facilities. In general, one can say that developers are now more conscious of the need for this type of study to protect both their development and the natural environment. Too often, however, there is a tendency to push the environmental constraints too far for the sake of short term monetary gain. It is on these issues that we can and must advise, as correct long-term planning will always be the most successful method of coastal zone management.

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## TRANSKEI COASTAL REGION - VEGETATION RESEARCH - PAST AND CURRENT

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This paper summarizes the past and current research that has been, or is being, undertaken on the coastal vegetation of the Transkei region. The research is divided into phytogeography and plant ecology. Detail of the research is not given here, but the reader is referred to the relevant papers and reports.

### PHYTOGEOGRAPHY

Endemism is very high on the Natal Group Sandstone soils of northeastern Pondoland. There are one monotypic endemic tree family and six monotypic endemic tree genera (all on the brink of natural extinction), as well as a total of about 70 species of flowering plants that are strictly or largely confined to these soils. Very little is known about the phytogeographical affinities of the coastal flora apart from the recent studies of van Wyk (1982, 1983, 1984, and 1985), Van der Merwe *et al.* (1988), Van Wyk and Archer (1987), Van Wyk and Mostert (1987), Van Wyk and Prins (1987), Van Wyk and Schrire (1986), Moffet (1988), Johnson (1985), Shackleton *et al.* (in press) and Cawe (in press).

### PLANT ECOLOGY

#### Grasslands

In his MSc study entitled "An Ecological Survey of the Mkambati Game Reserve in North-Eastern Pondoland", C Shackleton has collected data on 8 000 ha of Pondoland Coastal Plateau Sourveld. This includes a general vegetation survey, vegetation and soil maps, biomass production and changes in nutrient qualities of major grassland types, utilization by introduced wild ungulates, and ungulate condition indices. To date the fieldwork is complete, and the thesis draft is due by January 1989.

S E Shackleton's MSc study focuses on the Autecology of *Cymbopogon validus* in Mkambati Game Reserve with particular emphasis on its role as a local thatching grass. The response of adult plants and regeneration relative to different forms of defoliation have been monitored and surveys have established yields and demand by local people for *C validus* as thatch. The fieldwork is due to end in April 1988, with a draft thesis by July 1989.

Cawe, Granger and McKenzie have undertaken a vegetation survey of the Northern Pondoland Coast. This unpublished report: "A Vegetation Survey of the Northern Pondoland Coast and Guidelines for the Establishment of a Coastal National Park" was submitted to the Transkei Division of Nature Conservation. It includes a general reconnaissance survey of 250

km<sup>2</sup> of Coast Forest and Thornveld and Pondoland Coastal Plateau Sourveld between Msikaba and Umzimvubu rivers. However, it has never been formally accepted by the Department of Agriculture and Forestry, and the proposals have never been implemented, although they are fairly frequently mentioned - sometimes even with enthusiasm!

Other studies include the Wildlife Society of South Africa reports (1969 and 1977); AOC Technical Services (1966) Soil survey; Mkambati Game Reserve, hunting and vegetation (Bigalcke 1973); Mkambati Game Reserve, vegetation and game (Chapman 1980); Soil Survey (Drennan *et al.* 1978); Dwesa Nature Reserve, vegetation and management (McKenzie and Cowling 1979); Transkei coastal vegetation (Moll and White 1978); Mkambati Game Reserve, vegetation (Tinley, Farrel and Van Riet 1978).

### Forests

Cawe's PhD study concentrates on the indigenous coastal forests of Transkei. Its principal objective is to obtain an overview of stocks of potentially exploitable indigenous timbers, with a secondary objective of investigating the ecological characteristics of these forests and their biogeographical affinities. Other studies are: Von Breitenbach's general reconnaissance 1976 and Ward and Steinke's work on mangroves (1982).

### CONCLUSIONS

In conclusion, the ecology of the Mkambati Game Reserve ecology is well documented and highlights its great value as a conservation area for the endemic flora of Pondoland. However, the vegetation occurring along the remaining 90% of the coast has either not been studied at all or has been the subject of very cursory reconnaissance surveys. With the exception of Mkambati Game Reserve and Dwesa Nature Reserve the vegetation in none of the other 6 nature reserves along the coast of Transkei has been formally studied. In fact, in the Transkei only the Mkambati Game Reserve has a scientifically based management plan, and even this is poorly implemented.

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## MARINE LINEFISH RESEARCH

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### GENERAL

The east coast of southern Africa has a very diverse marine ichthyofauna comprising fish of Indo-Pacific, Atlantic, Southern Ocean, circumglobal and endemic origin. In addition to large conventional commercial fisheries, there are at least 245 species which may be caught by hook and line. Many of these fish adhere to distinct patterns of seasonality and life history. The most important of these are a spring spawning migration from the Cape to Natal, passing through Ciskei and Transkei, and a return migration, as well as dispersal of eggs and larvae by the westward-flowing Agulhas Current. Ciskei and Transkei are, therefore, strategically situated with respect to much of southern Africa's linefish resources. It follows that research and management should, to a very large extent, be shared - especially so as to avoid duplication.

Since 1974 there has been a coordinated approach to marine linefish research in RSA and most projects (irrespective of their funding) are reported to the South African National Committee for Oceanographic Research (SANCOR) Linefish Programme Committee. The progress on this coordinated research is described below.

### RESEARCH PROGRESS

#### Basic life history of species

Most earlier projects focussed on this aspect, which includes taxonomy, reproduction, seasonality, feeding, etc. To a great extent this work has been completed and about 80% of species in the RSA linefish catch have been studied.

#### Stock Assessment

This quantitative approach was a natural progression from earlier studies and involves such parameters as growth rates, mortalities, yield per recruit, stock size, sustained yield, etc. Good progress has been made in this field and about ten species have been assessed.

#### Fishery Statistics

It was recognized at a very early stage that large-scale catch and effort statistics were fundamental to proper stock assessment and ultimate management. Such a nationwide system now exists and during 1986 saw the documentation and analyses of 180 000 fishermen outings from Kosi Bay to the Orange River. The system comprises catch cards and

licence returns for all sectors of linefishing and provides (a) detailed analyses for scientific and management use, and (b) comprehensive reports as feedback to the fishermen themselves. In addition to this, there is also a large nationwide tagging programme that provides detailed data on linefish migration, mortality rates and growth.

#### **Eggs, larvae and juveniles**

This aspect of fishery research was recognized as fundamental but, unfortunately, has not yet been adequately covered. With one or two noteworthy exceptions, there remains a need to study the early life history of our fishes.

#### **LINEFISH RESEARCH OPTIONS FOR TRANSKEI AND CISKEI**

If we recognize that Transkei, Ciskei and RSA share common linefish stocks, then research and management should be coordinated - to the obvious benefit of all. Much of the research that has already been undertaken is of direct relevance to the Transkei and Ciskei, including the biology, stock assessment and fishery statistics. Quite a number of researchers have collected data and published results from their studies in Transkei waters. Furthermore, the possibility already exists for special data analyses to be undertaken on behalf of Transkei and Ciskei.

Research requirements for the regions should be primarily of an applied nature and can be divided into the following two broad categories.

#### **Overall needs**

- a) Evaluation and collation of data presently available, e.g. published papers, unpublished reports, SANCOR Report 70 (Visboekie).
- b) Investigation of relevant data sets, such as the National Marine Linefish Database and the Tagging Project. An attempt should be made to locate hitherto unknown records, e.g. private logbooks.
- c) Instigation of data collecting techniques, which should preferably be integrated with RSA systems.

#### **Specific needs**

- a) Evaluation and study of the nature of the local linefishery especially with respect to socio-economic aspects. Recommendations are needed that will optimize the use of this valuable but limited resource.

- b) Study of the critical aspects of the life histories of target species that transit through Ciskei and Transkei. Hence the reproduction of red steenbras, seventy four, poenskop, musselcracker, garrick, elf, geelbek, bronze bream and galjoen needs to be investigated.
  
- c) Early life history of target species within Transkei and Ciskei waters needs study - including the status of estuarine nursery areas, the importance of intertidal pools to juveniles and, ultimately, egg and larval surveys at sea.

The overall objective of all the above research proposals should be to derive an effective linefish management plan for the Ciskei and Transkei, not unlike that in the RSA, but suitably tailored to meet the social and economic requirements of the region.

## COASTAL ZONE MANAGEMENT IN TRANSKEI

PROFESSOR A H DYE, ZOOLOGY DEPARTMENT, UNIVERSITY OF TRANSKEI

### HUMAN EXPLOITATION

Increased human activities have led to an increase in the utilization and disturbance of the natural resources of Transkei's coastal zone, particularly in terms of the exploitation of food items such as linefish, crayfish, mussels and oysters which are utilized by the indigenous people, hotels, commercial licence holders and casual tourists. Local people also consume other species such as whelks and limpets and in some areas seaweed is harvested.

This exploitation continues largely uncontrolled and in many areas the abundance of these organisms has been reduced to low levels. Ongoing research has shown that recovery is poor and there is clearly a need for effective control of this exploitation. This is particularly important in view of the fact that Transkei is not an isolated area but forms part of the southern African coastal system. The introduction of restrictions such as bag limits, closed seasons and quotas should be coordinated with adjacent areas.

### PROBLEMS IN THE IMPLEMENTATION OF MANAGEMENT MEASURES

1. Despite numerous meetings and discussions on the topic of management, Transkei still has no national policy for conservation and management of its natural resources. Little will be achieved until this fundamental issue is resolved.
2. The Division of Nature Conservation lacks sufficient adequately trained and motivated staff to undertake the task of integrating the biological and ethnological data needed to formulate a workable management strategy for the coastal zone.
3. Existing legislation is rarely enforced. This is due partly to the lack of manpower and/or inadequate motivation, and partly to the confusion which exists about applicability of the Sea Fisheries Act. No quotas are enforced and data on amounts collected by hotels and commercial operators are almost impossible to obtain and difficult to verify.
4. Little use is made of the results of past and ongoing research. Commercial exploitation of species such as crayfish continues despite scientific opinion that this is not a sustainable resource.

5. There is no systematic programme of education in which coastal people are informed of the need for conservation despite the fact that educational slide-shows have been produced for this purpose.
6. There is no integration of effort between the Departments of Education, Commerce and Industry, Local Government and Nature Conservation on ways of improving the socio-economic conditions of coastal people.

#### **RESEARCH REQUIREMENTS**

Sufficient ecological information is already at hand to provide some basis for management. Further research is, however, needed to provide a better understanding of the coastal system and to make adjustments to management strategies from time to time.

The following is a list of research priorities:

1. Studies of the biology of exploited species (stock assessment, recruitment).
2. Research into alternative sources of food and income for coastal people.
3. Studies of the long-term effects of exploitation and changes in the environment.
4. Primary production studies and species interactions.
5. Quantification and monitoring of exploitation (linefish, commercial fisheries, angling, hotels and local people).
6. Investigations into ways of increasing the productivity of organisms such as mussels with a view to supplementing natural stocks.
7. Studies of harvesting strategies which do not affect the integrity of stocks.

Of the above, items 1, 3 and 4 have been receiving attention for some time.

#### **RECOMMENDATIONS**

1. The Transkei Government must be made aware of the seriousness of the situation and the fact that Transkei lags far behind its neighbours in formulating and implementing management policy. Such a policy should be formulated as a matter of urgency.

2. Every avenue should be explored to train and recruit additional qualified staff into Nature Conservation so that all aspects of the problem, planning, implementation and law enforcement, can be tackled.
3. Closer cooperation and openness must be fostered between various government departments to facilitate the implementation of education and management schemes.
4. Greater efforts should be made to find ways of reducing the dependence (financial and otherwise) of the coastal people on intertidal resources. This could reduce exploitation and pave the way for effective control.
5. Consideration should be given to the introduction of angling and shellfish collecting licences for visitors and local people. This should be accompanied by a revision of bag limits and commercial catch quotas.

## DISCUSSION ON RESEARCH NEEDS

SUMMARIZED BY L Y SHACKLETON, FOUNDATION FOR RESEARCH DEVELOPMENT

Effective coastal zone management is dependent on appropriate legislation based on adequate scientific information, together with communication. During the presentations and discussions two different sources of problems with respect to managing the Transkei and Ciskei coastal areas became evident:

1. Legislative problems
2. Research needs

Whilst noting the importance of the former, the discussion at this particular workshop centered on the research priorities.

### Legislative problems

It was recognized that the new Ciskei Nature Conservation Act of 1987 is a major advance in coastal zone management in the area. However, problems of implementation and policing of the Act remain. In Transkei integrated legislation is needed, and these problems are exacerbated by the lack of any major government policy with respect to conservation. Centrally coordinated coastal planning with clearly defined coastal zones drawn up for different types of coastal utilization was felt to be imperative. Divided control over coastal management remains a problem.

The critical shortage of manpower has to be addressed. This was reflected both in the numbers of jobs available, the qualifications of personnel and in the shortage of training centres and facilities. In addition, poor coordination and communication often hinders the effectiveness of the few people that are involved in conservation efforts. Attention was drawn to the fact that this coordination must extend inland from the coast to the catchment areas, both with respect to catchment control and land utilization. Increasing population density in the coastal zone and catchments is a dominant factor that must influence planning. The point was made that it was very difficult to control numbers of people living at the coast, but that development can be controlled.

Poor communication between managers, researchers and users was also identified as contributing towards the coordination problems. Research results must be communicated to managers, and similarly management decisions should be discussed with researchers, establishing a constructive feedback situation. This will enable the best use to be made of the limited manpower available.



**SUMMARY OF MANAGERIAL AND  
LEGISLATIVE PROBLEMS AND NEEDS:**

- Need for integrated legislation.
- Need for implementation of existing legislation and for adequate policing to ensure it is applied.
- Need for centralised and unified control.
- Limitations of adequately qualified manpower stressed as a major problem.
- Coordination and communication between scientists, managers and users essential, so that needs are fed to scientists and results to managers. Similarly, the importance of decisions needs to be communicated to the general public and the users of the coastline.
- Education is required to share the aims and benefits of conservation with users and local people. Communication of the conservation ethic is important if future and long-term conservation is to be attained. Conversely, scientists need to be acutely aware of local aspirations and cultures.
- Vital need for a Coastal Zone Plan and its implementation.

Education was identified as a major area requiring attention. Education was required both to train conservation and management staff and to develop a conservation ethic in the local people. Training facilities are needed in Transkei, Ciskei and the Republic of South Africa. Problems in communicating conservation awareness to tribal people need to be overcome. It was seen as essential that, through grassroots communication, the local people be made aware of the relevance of conservation legislation to their way of life. Conversely, scientists and managers need to be acutely aware of the cultural heritage of the inhabitants of the coastal region.

### Research needs

The following areas of research were put forward for discussion by those participating in the workshop.

- Utilized or exploited stocks
- Mariculture
- Development - Hotels and tourism
  - Business
  - Harbours
- Off-road vehicles
- Estuaries
- Dunes
- Population monitoring
- Mining
- Catchment studies
- Indigenous forests
- Medicinal plants
- Coastal ungulates and avifauna
- Pollution
- Reserves

Certain of these research areas were discussed in more detail.

### Utilized or Exploited Stocks

This category comprised renewable living resources which are utilized by the local population, those that are exploited in support of the tourism industry, and stocks that are being commercially exploited. These included the shellfish (mussels, oysters, limpets), fish (linefish and demersal), rock lobster, seaweed and bait organisms. The types of questions that need to be answered about these resources are: What is the size of each stock? What are the allowable yields? What is the present utilization of each stock? What role does stock utilization play in the local economy and culture? What are the interactions between the exploited species and other organisms? What are the ecological effects of utilization or over-utilization? Long-term

patterns of recruitment need to be determined. Basic to all these questions is the need for an ongoing monitoring programme which should be both scientifically rigorous and yet designed so as to be easily carried out by local field officers.

In discussion it was felt the priorities for research on intertidal and shallow-water invertebrates were mussels, limpets and the sub-tidal oyster. In Transkei, less detailed work on the rock lobster is required, particularly in relation to assessing stocks and the extent of exploitation. Red bait (*Pyura*) and subtidal oysters were identified as lower priorities requiring future attention. Research into seaweed exploitation had successfully answered most of the management queries, and what remains to be done is long-term monitoring of the stocks. Amongst the bait organisms, mud and swimming prawns were identified as a high priority for research. The need for licences and a return system to monitor catches of fish was emphasized. With respect to fish, much data was available on the species that pass through the Transkei and Ciskei waters. An attempt should, however, be made to evaluate the local fishery, what is being caught where, by whom and what value it has to the local community. Integral to this is a need to attempt to assess the degree of illegal fishing of species in these waters during the South African closed seasons. Species in particular need of attention are the red steenbras, seventy-four, poenskop, musselcracker and black steenbras. While research is needed to assess the stocks of demersal fish, this was considered a low priority. The role of the estuaries along this coastline in the life history of the fish also needed investigation. Research into the cetaceans passing along this coast was also mentioned, both to gain fuller information on the total southern African cetacean populations and their distributions, and because of their role as a potential competitor with man for marine resources. The increasing utilization of squid will also require further scientific information for its management.

### Mariculture

The possibility of establishing a mariculture along this coast was discussed. It was felt that the major problems to be overcome in doing this were of an engineering, rather than a biological, nature. Doubts were expressed as to whether the cost of such a venture would not preclude it from contributing to the daily diet of the local people. Nevertheless the suggestion was made that a preliminary survey of the local estuaries be carried out to look at the feasibility of mariculture in estuaries.

### Development

Two types of research were highlighted here. Firstly the need to get statistics pertaining to tourism, and secondly those relating to

utilization by indigenous people of the coastal areas of Ciskei and Transkei. This is essentially socio-economic research. Further, it was felt that scientific research into the availability of potable water would be of value. In most cases it is not possible to predict future developments along the coast, but once developments at specific sites have been proposed it is imperative that adequate assessments are made of the proposals and their potential impact. Again, the overriding need for a coordinated coastal plan with defined coastal zones was stressed.

#### Off-road vehicles

It was agreed that, considering the ongoing projects at Rhodes University, University of Cape Town and University of Port Elizabeth, sufficient research was already being undertaken to determine the deleterious effects of off-road vehicles and that, once this research is complete, there will be adequate information to draft appropriate legislation.

#### Estuaries

There was general agreement amongst all present that the estuaries of the Transkei and Ciskei needed to be surveyed to gain insight into the types of estuaries present, the physical processes controlling them and their biological species composition. Initially, surveys of the type completed by Begg in Natal should be a priority. As part of this survey, estuaries needing specific attention should be identified. The Continuous Low-level Estuarine Observation (CLEO) system developed by the SANCOR Estuaries Programme was recommended as it could make use of local people using simple equipment to monitor estuarine conditions. Considerable concern centred on the use of estuaries as nursery grounds for fish, and there was a recommendation that the work already being done on this be extended. Socio-economic research on the utilization of estuaries, both by tourists and for local subsistence, was also needed. Concern was expressed about the use of mangroves for timber and research is required on the intensity of their utilization. The effects of cattle grazing and trampling in salt marshes and mangroves, the need for assessment of *Scylla* (mud crab) stocks and take, and the effects of ski boats on estuary banks were also identified as aspects requiring research, but of lower priority.

#### Dunes

Sufficient scientific information was available or is currently being obtained for the management of dunes and this was not seen as a research priority.

### **Population modelling**

A census was carried out in 1986, but sequential data should also be collected. This was recognized to be a government function, but the data are needed by both scientists and managers. Aerial Surveys coupled with detailed subsampling of areas abutting the coast were suggested to give some idea of the rate of increase of the population.

### **Mining**

Three large deposits of black sands with the potential for about 15 years exploitation are known on beaches and coastal dunes of the Transkei. However, at present, no specific research was required into the effects of coastal mining. The botanical information for the necessary rehabilitation after mining is essentially available.

### **Catchment studies**

The relevance of these to the coastal zone was emphasized, both with respect to agricultural practices and stock activities. These affect both the quality and quantity of water in estuaries. They also supply food to the local populations, thereby relieving pressure on the coastal resources.

### **Indigenous Forests**

Research on indigenous forests is ongoing, and sufficient scientific information is available (Dr B MacKenzie, University Western Cape) for their management.

### **Medicinal plants**

Research has been carried out on these, and further work was not seen to be a priority.

### **Coastal ungulates and avifauna**

More information is needed on the species and numbers of fauna present in the coastal areas of Ciskei and Transkei. The degradative role of domestic ungulates on coastal vegetation also needed to be assessed.

### **Pollution**

As yet marine pollution does not appear to be a problem along the Transkei and Ciskei coast.

## **Reserves**

It was felt necessary to develop criteria for the establishment of coastal reserves. These criteria should take cognizance of terrestrial (coastal and catchment), as well as marine planning requirements, and consideration needs to be given to their number, size, shape and position.

## **General**

During the discussions the importance of baseline studies, followed up by well-designed monitoring programmes was repeatedly stressed. This applied not only to the resources, beaches and estuaries, but also to the people, tourist and local, interacting with these. It was strongly suggested that the research results form not only the basis for protective legislation, but that they also be used for scenario planning studies. Finally, in an attempt to highlight the value of a conservation-orientated ethic to the local authorities, a not-so-frivolous suggestion was made: research should be undertaken into the effect on both the people and resources of this beautiful coastal region of no conservation measures being taken - a worst-case scenario.

## **Overall priorities**

In drawing up priorities, the meeting took into account the limited manpower and funding available for research and attempted to identify priorities which can realistically be attempted in the next five to ten years.

### **SUMMARY OF RESEARCH PRIORITIES:**

- More information on the biology of exploited invertebrates, notably brown mussels, rock oysters and limpets, which are already intensively exploited and in urgent need of attention.
- Analysis of alternative sources of food and income for people presently exploiting living coastal resources.
- Research on interactions between intertidal and shallow-water species, particularly those which may affect recolonisation after exploitation.
- Determination and monitoring of patterns of recruitment and dispersal of key invertebrate species.
- Development of a system to allow monitoring of linefish catches. Such a system exists in South Africa and could be modified for local circumstances.
- Ad hoc independent research on the potential impacts of any major developments proposed for the coastal zone. To be undertaken in advance of any approval being granted for such developments.
- A general survey of estuaries in Ciskei and Transkei to determine their status and to identify estuaries worthy of special attention or conservation.
- Institution of a system of continuous low-level observations on estuaries.
- Studies on the effects of bait-digging in estuaries, particularly for mud prawns and swimming prawns.

APPENDIX

PARTICIPANTS

COASTAL ZONE RESEARCH : CISKEI AND TRANSKEI COASTS

Name	Organization
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