

**A STRATEGIC ASSESSMENT OF RECREATIONAL USE AREAS FOR OFF-ROAD VEHICLES IN THE COASTAL ZONE OF KWAZULU-NATAL, SOUTH AFRICA.**

L. Celliers<sup>a,\*</sup>, T. Moffett<sup>b</sup>, N.C. James<sup>a</sup>, B.Q. Mann<sup>a</sup>

<sup>a</sup> Oceanographic Research Institute, P.O. Box 10712, Marine Parade, 4056, South Africa

<sup>b</sup> Coastal Management Unit, Department of Agriculture and Environmental Affairs, Private Bag X9059, Pietermaritzburg, 3200, South Africa

\* Corresponding author

Tel.: +2731-3373536

Facsimile: +2731-3372132

Email: [l.celliers@ori.org.za](mailto:l.celliers@ori.org.za)

## **Abstract**

In January 2002, the Minister of the Department of Environmental Affairs and Tourism of the South African government promulgated new regulations controlling the use of off-road vehicles in the coastal zone of South Africa. The new regulations provided for a general prohibition on the recreational use of off-road vehicles (ORVs) in the coastal zone as well as providing procedure for approving the use of vehicles in the coastal zone under specific circumstances. The regulations now specify that recreational use of ORVs can only take place in designated recreational use areas (RUAs). This paper described the process of developing a cohesive strategy for the siting of RUAs in the coastal zone of KwaZulu-Natal. This strategy was developed to avoid *ad hoc* application for areas that might be unsuitable (environmentally or socially) for ORV use. Potential RUAs was identified using seven principles that disqualified areas that were not suitable and subjecting the potential RUAs to a number of other considerations. The seven principles are sufficiently generic to be applied to the other three coastal provinces of South Africa and probably further afield. This strategy identified a network of ecologically and socially justifiable RUAs along the coast of KwaZulu-Natal. These areas will not be designated automatically but each area will need to be further scrutinised by an environmental impact assessment.

## **1. Introduction**

Permit applications for recreational use areas (RUAs) for off-road vehicles (ORVs) on the coast of KwaZulu-Natal (KZN), South Africa should be evaluated within a regulatory framework that must balance human use and habitat protection. People have an inalienable right to the opportunity to escape from the artificial impositions of others, and certain areas must be guaranteed to be free from motor vehicles [1]. Beaches are important open-air recreation sources for most coastal town-dwellers and are regarded as healthy, open places [2]. Consequently, designating RUAs, where ORVs may be used, affects a number of users and user groups and a careful, inclusive approach is needed to accommodate all users when designating these areas. This follows the principles of integrated coastal zone management that dictates that coastal use be defined according to a spectrum of variables.

Scientific studies elucidating the effects of ORVs in the diverse environments of the coastal zone have been scant [3-6]. However, existing studies show that off-road vehicles influence the fauna and flora of beaches negatively, while also contributing to the destabilisation of coastal dunes (see review by [7]). A survey of the perceptions and needs of beach managers with regards to sandy beach conservation concluded that ORVs, together with litter, were the most common problem experienced by beach managers [8]. In addition, 52% of the KZN beach managers that responded to this survey reported negative human impacts on adjoining dunes, mostly caused by ORVs. Physical effects of ORVs on beaches include changes in the density of soil bulk and erosion. Erosion can be substantial on slopes, as sand is forced downhill by vehicles, which can lead to lowering of the sand dunes. Above the high-water mark, vehicles

can also break the salty crust on the surface leading to a loss of sand to the sea [9]. ORVs disturb the flora and fauna on beaches by inhibiting the growth of new plants, disturb nesting and resting birds in the ‘berm’ area above the spring high-water mark and crush ghost crabs along the foreshore. Ghost crabs have been shown to be particularly susceptible to crushing at night as they become disorientated by vehicle headlights, often freezing or running towards the source of light [9].

### *1.1 The 1994 policy controlling recreational driving*

A national General Policy was introduced in 1994 to control recreational driving on South Africa’s beaches and dunes. Under this policy, vehicular access and use has generally been allowed in less sensitive areas but disallowed in more sensitive areas. Although vehicular access has been controlled by permit systems, administered by regional and/or local authorities in some areas, many municipal authorities simply do not have the capacity to implement the 1994 policy. This resulted in a number of sensitive coastal environments not being adequately protected from the effects of the recreational use of ORVs. Implementation of the 1994 policy in marine protected areas (MPA) was the responsibility of the MPA managers. In the province of KZN, that responsibility has historically been vested in the parastatal conservation body, Ezemvelo KwaZulu-Natal Wildlife (EKZNW), which regulated vehicles on the beaches by the issue of annual permits in KZN, and closed sensitive areas to beach driving. However, the lack of implementation of the General Policy in areas not under the control of EKZNW highlighted the need for national legislation, which has uniform application along the entire coastline of South Africa.

## *1.2 The new regulations*

The Minister of Environmental Affairs and Tourism, acting in compliance with his mandate, drafted, debated and passed new regulations to protect the interest of civil society and the environment of the coastal zone. The control of vehicles in the coastal zone of South Africa (Regulation No. 1399 of 2001) became effective on 20 January 2002 in terms of section 44 of the National Environmental Management Act (NEMA; No. 1-7 of 1998). The new regulations make provision for the declaration, by the Director-General of Marine and Coastal Management (MCM), of RUAs in the coastal zone within which vehicles may be used for recreational purposes. Local authorities or the managers of protected coastal areas may apply to the Director-General to designate an area under their jurisdiction as a RUA, if they have fulfilled certain requirements. These requirements (section 27(7) of NEMA) include the investigation, assessment and communication of the potential impacts of the activities associated with recreational vehicle use in the proposed RUAs (i.e. in a comprehensive environmental impact assessment). The Director-General may not designate RUAs unless there has been consultation with the provincial authorities, local authorities, and managers of the protected area and other organs of state that have jurisdiction over any part of the proposed RUA. The Director-General also has the power to revoke a RUA if necessary (for example if driving is causing significant harm to the environment in this area). Once a RUA has been designated, members of the public have to apply to the governing local authority for a permit to drive in this area. Furthermore, the 2002 regulations will prevail if there is a conflict between any of the provisions stated in them, and either the General Policy, or any other regulations, by-laws or other subordinate legislation relating to the use of vehicles in the coastal zone made under any Act, prior to the 2002 regulations.

### 1.3 *ORVs in KZN*

Dealing with such matters in KwaZulu-Natal (KZN), a coastal province of South Africa, is the Department of Agricultural and Environmental Affairs (DAEA), and more specifically the Coastal Management Unit (CMU), the provincial government authority. Although DAEA would issue a record of decision following an environmental impact assessment, this department can only comment on the proposed RUA as an interested and affected party. The final decision remains that of the Director-General of the Department of Environmental Affairs and Tourism, the national counterpart of DAEA. Herein lies the weakness of the regulations. The 2002 regulations do not require applications for RUAs to be motivated in terms of a cohesive provincial or national strategy of coastal use. Such a strategy for coastal use would have to be devised under the auspices of the relevant and existing provincial authority, i.e. the DAEA and more specifically the Coastal Management Unit. The coastal use strategy would need to be compiled using appropriate scientific and conservation expertise and would need to include relevant socio-economic considerations. Such a cohesive strategy for coastal use would exclude the possibility of the *ad hoc* designation of RUAs and would improve the capacity of conservation agencies to monitor and regulate extractive use of coastal resources such as rock and surf fishing and spear fishing.

For this reason, the CMU in KZN approached the Oceanographic Research Institute, a Durban-based non-governmental organisation with good capacity in applied marine and coastal research, to develop an appropriate strategy for coastal use in KZN. The objectives of this study were to collate and map information relevant to the designation of ORV recreational use areas in the coastal zone of KZN as specified by the new regulation and to justify, both scientifically and socially, the siting of ORV

recreational use areas. These RUAs were to be defined in terms of size, location and usage and formed part of a provincial strategy for the management of ORVs in the coastal zone of KZN.

## **2. Methods**

### *2.1 Study area*

This study was executed within the province of KwaZulu-Natal (KZN), one of four coastal provinces of South Africa (Fig. 1).

#### **FIGURE 1.**

The province of KZN consists of the Hibiscus, Durban, Dolphin, Zululand and Maputaland coastal regions as defined by the Coastal Policy Green Paper [10]:

- Maputaland is the longest coastal region in KwaZulu-Natal, covering 179 km from the border between Mozambique and South Africa to the St Lucia Estuary. The coast is characterised by interconnected freshwater and estuarine lake systems, forested dunes and wide sandy beaches [10]. Although the region only has three estuaries, more than 80 % of the KZN estuarine area in KZN is made up by the St Lucia and Kosi lake systems [11]. The majority of this coastal region falls within the Greater St Lucia Wetland Park (GSLWP) which was recently declared a World Heritage Site (November 2000). Most of the coastal area in the GSLWP have been proclaimed Marine Protected Areas and the park extends from the border with Mozambique to Cape Vidal in the south. This area was previously zoned for different levels of human use (i.e. sanctuary, restricted and controlled zones) by EKZNW. ORV use in sanctuary and restricted zones has generally been restricted to management and scientific use, while controlled zones were subjected to considerable ORV use before the implementation of the 2002 regulations.

- Zululand is the second longest coastal region in KZN, covering 134 km from the the St Lucia Estuary to the Tugela River [10]. Despite the length of the coastline, only seven estuaries enter the sea along this stretch of coast, which consists primarily of long, uninterrupted sandy beaches, backed by high, forested dunes and broad coastal plains [10]. The area to the north of the Tugela River extending to the Mlalazi River consists of the only major prograding dune system along the KZN coast [12].
- The Dolphin Coast, 70 km from the Tugela River Mouth to the Tongaat River, is characterised by coarse sandy beaches enclosed between rocky outcrops [10].
- Durban Metro is the smallest coastal region, that stretches for 52 km from the Tongaat River in the north to the Umkomaas River in the south [10]. Nine estuaries are found in this region and the coastline consists of fairly long, coarse sandy beaches, which are interrupted by occasional rocky outcrops and backed by low dunes [10].
- Finally, the Hibiscus Coast, 127 km from the Ilovo River to the Umtamvuna River, contains forty-six estuaries, the highest number and density in KZN [13]. The beaches are predominantly coarse and sandy and are interrupted by estuaries, occasional rocky headlands and wave-cut platforms [10].

Historical use of ORVs in the coastal zone of KZN has mostly been limited to the extensive sandy beaches north of Durban Metro and more specifically to the Zululand and Maputaland coastal regions (Table 1). Ironically, many of the beaches in the latter areas are located within the boundaries of the Greater St Lucia Wetland Park. ORV use on the Hibiscus Coast has historically been low, mainly because of the unsuitable

physical attributes of the coastline in that region (i.e. numerous estuaries and rocky headlands).

**TABLE 1.**

*2.2 Decision support system*

A panel of experts comprising scientists and coastal zone managers was convened as a RUA Task Team. This panel identified seven coastal attributes or characteristics with spatial dimensions that immediately disqualified an area from being considered for a RUA (Table 2). Spatial data relating to the seven exclusions were either extracted from existing data sources or were created as new overlays for the GIS project depicting the KZN coast (Table 3).

**TABLE 2.**

A model of potential RUAs in KwaZulu-Natal was created with a GIS, using a 100 m grid cell along the coast and the data relating to the seven exclusions (Table 2). Each 100 m cell was assigned a value of 0 or greater in the GIS project depending on whether it intercepted with, or was within 100 m of an exclusion zone (e.g. an estuary mouth). A zero value was designated if there were no underlying exclusions. The cumulative effect of multiple exclusions in one coastal block was not considered and once a cell was designated a value greater than zero it was considered to be exempt from being considered for a RUA (see Fig. 2).

**TABLE 3.**

**FIGURE 2.**

Once areas exempt from RUAs had been identified, the remainder of the coast was divided into coastal segments ( $\geq 2$  km) which were considered potential RUAs. The percentage of total coastline protected from ORVs was then calculated. The coast was analysed according to biogeographic regions (see discussion) and the five coastal

regions outlined in the Coastal Policy Green Paper [10]. The size and number of segments in each region was determined.

### *2.3 Further evaluation of potential RUAs*

Coastal areas (> 2 km) not disqualified by the seven exclusions may be considered for RUAs. However, a number of other considerations were identified to ensure the maintenance of conservation and user logic. Thus, in addition to the seven immediate exclusions, there might be other considerations precluding an area from being declared a RUA. The other considerations are not part of the “up-front” exclusion assessment but are all issues that need to be addressed by the environmental impact assessment that follows the application for a RUA.

#### *2.3.1 Proposed and desired Marine Protected Areas (MPAs)*

Coastal areas that have been identified as possible future MPAs should not be considered for RUAs until the conservation status of the area has been declared by the relevant government body and an integrated management plan has been developed. Some areas along the KZN coast have previously been identified as potential MPAs (Table 4; [14-16]).

#### **TABLE 4.**

#### *2.3.2 Subsistence fishing*

Designation of RUAs should be avoided in areas where inshore resources are being accessed by subsistence fishers. Proposed subsistence areas, as well as proposed “mussel sanctuaries” which are part of the subsistence-use implementation process and the mussel management plan respectively, could potentially lead to user conflict in a proposed RUA [17].

### 2.3.3 *Biodiversity targets*

Furthermore, it is essential that protection is afforded to an acceptable proportion of each representative shoreline habitat, and that conservation targets are achieved using a biogeographic approach. Areas in which biodiversity are perceived to be diminishing or threatened should not be considered for RUAs.

The effective conservation of biodiversity of KwaZulu-Natal is dependent on adequate protection within each biogeographic province along our coast (see Sink 2001 for review). Furthermore, protection should not only be extended to biogeographic regions but should also be extended to cover the physical heterogeneity and the variety of biological communities. An international standard to ensure that adequate biodiversity protection is achieved suggests the need to give at least 20% of each biogeographic province protection status [18]. The contiguous St Lucia and Maputaland Marine Reserves fall within the sub-tropical East coast province which extends down the east coast of Southern Africa from North of Maputo to East London [19]. Three biogeographic sub-provinces have been identified as contributing towards the biodiversity of KZN. These are from north of the Mozambican border to Cape Vidal, Cape Vidal to Durban and from Durban to south of the Transkei border [20] (see Fig. 1).

### 2.3.4 *Other considerations*

Other factors that should be considered before an area can be declared a RUA include:

- Only areas that were subjected to significant historical ORV usage at the time of the implementation of the 2002 regulations should be considered for RUAs. Data-

sources for ORV use in KZN include the NMLS and EKZWN beach permit sales (where applicable). The historical use information should be considered the “ceiling” value for ORVs in any area sufficiently covered by the NMLS data. However, the carrying capacity of each proposed RUA needs to be independently assessed.

- RUAs and beach access points should in no way interfere with, negatively affect or detract from the conservation value of existing Admiralty Reserves and Coastal Green Wedges as identified in the relevant reports [21, 22]. Areas of indigenous coastal vegetation have to be noted and alternative sites must be considered.
- Where sensitive areas or sites exist within a designated RUA, a buffer protection zone should be declared. This buffer zone must be between the normal high water mark and the edge of the sea or 20 m from the nearest dune vegetation, and 100 m from the nearest bank of an estuary.
- Beach areas with hazardous conditions for ORV use should not be considered for RUAs. Environmental impact assessments should comment on beach slope, grain size, beach width and length, and beach access points.
- Small beaches that are limited in space for both pedestrian and vehicular use (<1 km from nearest car park) should not be considered for RUAs.
- Specific areas of archaeological interest and cultural significance should not be considered for RUAs.
- Cognisance must be taken of the impact of the beach vehicle ban on past beach users. Where possible, user groups with a history of ORV beach use should be consulted and accommodated within the premise of the 2002 regulations.
- Equitable access to all user groups must be considered when proposing a RUA and its management.

### 2.3.5 *Beach access considerations.*

- No new ORV access points to the beach should be considered.
- Areas where erosion or other soil or resource damage will occur as a result of ORV accessing the beach should not be considered for RUAs.
- The availability, convenience, conservation logic and safety of existing vehicle parking and pedestrian access and facilities must be taken into consideration when determining the need for ORV parking and recreational travel on the beach itself.
- Only existing, appropriate beach access ramps should be considered for vehicular traffic.

### 2.3.6 *Beach management considerations*

- RUAs should not be established where enforcement and monitoring of ORV use on beaches are inadequate.
- The public services involved in the management of beaches must be considered but service access onto the beach should not necessarily be opened for public vehicle access.
- Adequate vehicular access for shore patrols, law enforcement, search and rescue, property protection and control of litter and sanitation will be required at beaches.

## 3. **Results**

The coastline of KwaZulu-Natal is approximately 562 km long [10], of which 239 km (43 %) was not immediately disqualified by the seven exclusions (Fig. 3). The majority of segments were 4-6 km long, with a mean length of 7.3 km (Table 5). A few larger segments (>20 km) were found north of the Tugela River. This 239 km

represents the “first cut” in identifying coastal areas suitable for RUAs (Fig. 3). Other considerations, such as the existence and location of vehicle access ramps, and areas with no or low historical ORV use, will also disqualify many of the potential RUAs.

**FIGURE 3.**

**TABLE 5.**

Analysis of segment length in each biogeographic sub-province has shown that 69 % of the coastline between Mozambique and Cape Vidal has been disqualified from RUAs using the initial seven exclusions. Thirty eight percent of the coastline between Cape Vidal and Durban was disqualified while 78 % of the coastline south of Durban was disqualified.

The coast was further divided into the regions outlined in the Coastal Policy Green Paper [10] and the results from the disqualification of areas are depicted in Table 6.

**TABLE 6.**

Both sanctuary and restricted zones of the Greater St Lucia Wetland Park, in the Maputaland coastal region, were excluded from being considered for RUAs by virtue of their existing zonation for use within an integrated management plan. Eight RUA segments were identified in the controlled zones, and these were 70 km long in total and accounted for 39 % of the coastline in this region. The Zululand coastal region has a history of ORV use and because of its uninterrupted beaches, eight segments were identified for potential RUAs. These segments covered 86 % of the Zululand coastline and comprised the largest percentage of the total potential RUAs in KZN at 48 %. The Dolphin Coast was generally regarded as being unsuitable for ORV use by virtue of the coarse sandy beaches enclosed between rocky outcrops. Only two potential RUAs were identified in this region. These cover 9 % of the coastline in this

region and comprise only 3 % of the potential RUAs in KZN. The five segments identified in the Durban Metro coastal region accounted for only 9 % of the potential RUAs in KZN, and comprised 40 % of the coastline within this region. Historical use of ORVs was low on the Hibiscus Coast mainly because of the physical nature of the coastline. Although 10 segments suitable for RUAs were identified, the total length of these segments was only 26 km. These segments comprised 20 % of the total coastline in this region and accounted for only 11 % of the total area identified for potential RUAs along the KZN coast.

#### **4. Discussion**

The establishment of RUAs along the KZN coastline relies primarily on the disqualification of areas according to seven measurable exclusion parameters. Thus the initial phase, or “first cut”, disqualifies areas along the coast that would be unsuitable or unjustifiable for ORV use. More than 50 % of the coastline was disqualified from being considered for RUAs following the first step in the decision support model. This already provides a number of important guidelines for managers and decision-makers to follow when considering applications for RUAs. The seven exclusions were simple and logical, and could easily be visualised on a map. Although the seven exclusions might not, in all cases, be the deciding factor in the disqualification of RUAs, this model certainly presents a user-friendly approach with strong conservation logic. This system of identifying “no-go” areas, followed by careful consideration of potential RUAs according to a number of other important factors, provided an easy-to-use decision support tool. The users of this system need not necessarily be experts in any particular field relating to ORV use, but are guided by a number of simple principles (Fig. 4).

#### **FIGURE 4.**

The promulgation of the new legislation was well received by a large section of the population in South Africa, although there has been strong criticism from ORV users, particularly the recreational and competitive fishing community. The expeditious promulgation of these regulations caught most of the provincial governments unprepared and has placed a considerable amount of social and political pressure on these government departments to establish RUAs as specified by the regulations. However, the 2002 regulations present unique opportunities for coastal governments, conservation managers and local authorities to contribute towards a strategy of integrated coastal management with a strong grounding in conservation logic.

The establishment of a provincial strategy for the siting of RUAs, assisted by the decision support model described in this paper, allows for effective coastal zone management with relation to ORVs. The guidelines for the designation of RUAs in the coastal zone of KZN are governed by the following rationale:

- The new regulations on control of vehicles in the coastal zone impose a general prohibition on the recreational use of vehicles in the coastal zone (Regulation No. 1399 of 2001).
- Off-road vehicle (ORV) use in the coastal zone is not compatible with the natural processes and adaptations of organisms to this environment [23].
- However, under certain conditions, recreational vehicles will again be allowed onto the beach but their use will be restricted to remain within the premise of the new legislation.
- Furthermore, in most cases, it is preferable to establish fewer, well-managed “heavy use” RUAs, rather than many “low-use” RUAs [23].

One of the major concerns when proposing RUAs along the coast is that due to a lack of scientific and social research it is nearly impossible to motivate why certain areas should or should not be considered for RUAs. Very few studies elaborate on the complexities of ORV impacts in the coastal zone. Primarily, the decision support model attempts to identify portions of the coastline where RUAs would be inappropriate with regards to conservation principles and other obvious conflicts. In addition to a “no-go” decision, it also provides decision-makers with a checklist of other considerations that need to be addressed by the EIA that accompanies the RUA application. A negative response to individual considerations does not necessarily imply immediate disqualification, however, a number of negative responses will probably exclude an area as a RUA.

Although this decision support system can still be manipulated, it provides a logical decision support system that will prevent *ad hoc* applications from being considered. An important aspect of the model is the need for good quality spatial data and sufficient human capacity to manipulate data in the GIS. This model, by virtue of the seven exclusions, can be criticised for being inflexible and in some cases being unreasonably stringent. However, it does not allow for subjectivity or biases, and provides a socially and scientifically justifiable motivation for not considering certain coastal areas suitable for ORV use. Although the guidelines were developed to site RUAs in KZN, the principles are sufficiently generic to be applied to the rest of the coastal provinces of South Africa and could potentially serve as a national model for the siting of RUAs and other similar areas.

Integrated coastal zone management dictates that coastal use be defined according to a spectrum of variables. Similarly, RUAs influence a diverse number of users and

user groups and a careful inclusive approach in their designation is needed to address all the concerns.

## **5. Acknowledgements**

The Recreational Use Areas Task Team and the organisations they represent are gratefully acknowledged for the time spent discussing and reviewing the many drafts of this document. The Task Team, in addition to the authors included, Michael Schleyer (Oceanographic Research Institute), Ian Patrick (Ezemvelo KwaZulu-Natal Wildlife), Rob Broker (Ezemvelo KwaZulu-Natal Wildlife), Ken Breetzke (Urban Strategy, Durban Metro Council), Rudy van der Elst (Oceanographic Research Institute). Additional comments relating to the Greater St Lucia Wetland Park were provided by Jean Harris and Ken Morty (Ezemvelo KwaZulu-Natal Wildlife), Andrew Zaloumis (Greater St Lucia Wetland Park Authority), Mike Bouwer (Greater St Lucia Wetland Park Authority) and Ashleigh McKenzie (Acer Africa). Our gratitude also goes to Wendy Robertson and Judy Mann for review of earlier drafts of this document.

## 6. References

- [1] National Parks Association of New South Wales Inc. Motor vehicles in natural areas. <http://speednet.com.au/~abarca/NPApol01VEHICLES.htm> . 2002.
- [2] Bird ECF. Beach management. Chichester: John Wiley & Sons Ltd., 1996 (281 pp.).
- [3] Brodhead JMB, Godfrey PJ. Effects of off-road vehicles on plants of a northern marsh. Report UM/NPSCRU No. 33. 1979.
- [4] Leatherman SP, Godfrey PJ. The impact of off-road vehicles on coastal ecosystems in Cape Cod National Seashore: an overview. Report UM/NPSCRU No. 34. 1979.
- [5] Van Der Merwe D, Van Der Merwe D. Effects of off-road vehicles on the macrofauna of a sandy beach. *South African Journal of Science* 1991;87:210-3.
- [6] Els S, McLachlan A. A survey of off-road vehicle use in the Eastern Cape. Report 21, SAB Institute for Coastal Research, Port Elizabeth, South Africa, 1990. 38pp.
- [7] Van Der Merwe D. The effects of off-road vehicles (ORV's) on coastal ecosystems - a review. Report 17, SAB Institute for Coastal Research, Port Elizabeth, 1988. 64pp.
- [8] De Ruyck A, McLachlan A. Sandy beach conservation-perceptions and needs of beach managers. Report 34, Institute for Coastal Research, Port Elizabeth, South Africa, 1993. 34pp.
- [9] Boon R, Mann BQ, Robertson WD. Environmental Assessment: Off-Road Vehicles at Tongaat Long Beach. Report 1., Wildlife and Environment Society of South Africa, 1999. 20pp.
- [10] Department of Environmental Affairs and Tourism, South Africa. Coastal Policy Green Paper: Towards a sustainable coastal development in South Africa. Cape Town, 1998. 155pp.
- [11] Whitfield AK. Biology and ecology of fishes in Southern African Estuaries. Grahamstown: J.L.B. Smith Institute of Ichthyology, Grahams Town, South Africa, 1998. 223pp.
- [12] Flemming BW, Hay ER. Sediment distribution and dynamics of the Natal continental shelf. In: Schumann EH, editor. Coastal Ocean Studies off Natal, South Africa. New York: Springer-Verlag, 1988. p. 47-80.

- [13]Harrison TD, Cooper JAG, Ramm AEL. State of the South African Estuaries: geomorphology, ichtyofauna, water quality and aesthetics. Report 2, Department of Environmental Affairs and Tourism, Cape Town, South Africa, 2002. 126pp.
- [14]Grindley JR, Cooper KH, Hall AV. Proposals for marine nature reserves for South Africa. The Wildlife Society of South Africa, 1976. 16pp.
- [15]Mann BQ, Taylor RH, Densham D. A synthesis of the current status of marine and estuarine protected areas along the KwaZulu-Natal coast. *Lammergeyer* 1998;45:48-64.
- [16]Markewicz T, Nichols J, Mander M. Towards a coastal assets management policy for the KwaZulu-Natal North Coast. Town and Regional Planning Commission, 2000. 28pp.
- [17]Harris JM, Branch GM, Clark BM, Cockroft AC, Coetzee C, Dye AH, Hauck M, Johnson A, Kati-Kati L, Maseka Z, Salo K, Sauer WHH. Recommendations for the management of subsistence fisheries in South Africa. *South African Journal of Marine Science* 2002;24:503-23.
- [18]Ezemvelo KwaZulu-Natal Wildlife. Proposed principles for assessing applications for recreational vehicle use areas in the coastal zone of KwaZulu-Natal. Unpublished Document 2002.
- [19]Stephenson TA, Stephenson A. Life between tidemarks on rocky shores. San Francisco: W.H. Freeman, 1972.
- [20]Sink KJ. A hierarchical analysis of abiotic determinants and harvesting impacts in the rocky intertidal communities of KwaZulu-Natal. Ph.D. Thesis, University of Cape Town, Cape Town, 2001. 277pp.
- [21]Margeot H, Forbes A, Forse W. The Admiralty Reserve in KwaZulu-Natal., The Town and Regional Planning Commission, Province of KwaZulu-Natal., 1997.
- [22]Metroplan. Green Wedges policy for the South Coast., The Town and Regional Planning Commission, Province of KwaZulu-Natal, 1998.
- [23]Brown AC, McLachlan A. Ecology of sandy shores. Amsterdam: Elsevier, 1990. 328pp.
- [24]McGwynne LE, McLachlan A. Ecology and management of sandy coasts. Report 30, Institute for Coastal Research, Port Elizabeth, South Africa, 1992. 83pp.
- [25]Schneier SM. Guidelines for coastal land use (seventh draft)., Council for the Environment Committee for Coastal and Marine Systems, Cape Town, 1988. 121pp.

- [26]Clark JR. Coastal zone management handbook. Boca Rotan: Lewis Publishers, 1996. 694pp.
- [27]Allanson BR, Baird D. Estuaries of South Africa. Cambridge: Cambridge University Press, 1999. 340 pp.
- [28]Day JC. Zoning-lessons from the Great Barrier Reef Marine Park. Ocean and Coastal Management 2002;45:139-56.
- [29]Hosier PE, Kochhar M, Thayer V. Off-road vehicle and pedestrian track effects on the sea-approach of hatchling Loggerhead turtles. Environmental Conservation 1981;8:158-61.
- [30]Department of Fisheries. Memorandum of understanding on the conservation and management of marine turtles of the Indian Ocean and south-east Asia. Report, Kuantan, Malaysia, 2000. 4pp.
- [31]Jackson L, Lipschitz S. Coastal sensitivity atlas of Southern Africa 1984. Pretoria: South African Department of Transport, 1984. 34pp.
- [32]Steinke TD. Mangroves in South African estuaries. In: Allanson BR, Baird D, editors. Estuaries of South Africa. Cambridge: Cambridge University Press, 1999. p119-40.

## **7. Figure captions**

Figure 1. Location of KZN in South Africa and the boundaries of the five coastal regions and the three biogeographic sub-provinces within KZN.

Figure 2. Example of the decision support model for the designation of RUAs. The areas depicted are on the KZN south coast (Hibberdene). The squares represent the coastal blocks (100m x 100m) with intercepting exclusions.

Figure 3. Potential RUAs along the coast of KZN identified using a decision support model based on seven exclusion parameters.

Figure 4. Flowchart of decision support system following a RUA application.

## 8. Tables

Table 1.

Historical use of ORV (1995-2001) in the five coastal regions of KwaZulu-Natal captured from daily Ezemvelo KwaZulu-Natal Wildlife patrols for the National Marine Linefish System (Pradervand and Mann unpublished data).

<b>Coastal region</b>	<b>Total ORV count (1995-2001)</b>	<b>Average annual ORV count</b>
Maputaland Coast	247 317.4	35 331.1
Zululand Coast	129 516.0	18 502.3
Dolphin Coast	10 924.4	1 560.6
Durban Metro Coast	4 932.0	704.6
Hibiscus Coast	19 646.6	2 806.7

Table 2.

Seven attributes or characteristics of the coastal zone of KwaZulu-Natal that would immediately disqualify such an area from being considered as a potential RUA.

<b>Exclusion</b>	<b>Description /Motivation</b>
<b>1. Any area outside the hard sand of the intertidal zone.</b>	The intertidal zone of beaches is washed twice a day by tides. Neap tides reach above midway on the shore and spring tides reach up to the driftline bordering the frontal dunes. Vigorous swash and wave action mobilises large volumes of sand that regularly reshape the beach face. Beaches are malleable and resilient and can readily withstand moderate levels of human and vehicular activity [24]. However, human activity that removes or damages the frontal dune system and its vegetation cover is potentially the most destructive as these dunes represent the natural protective buffer of the coast [24-26]. Furthermore, the drift lines are the precursors of new sand dunes and accreting beaches and can also moderate the rate of erosion when new vegetation is established at the base of the dune scarp (for complete reference and discussion see Van der Merwe, 1988). Driving should therefore not be allowed in the upper backshore area, particularly in the areas of drift and only during daylight hours [5, 7].
<b>2. Fragile, rare, relict or vanishing vegetation</b>	Fragile, rare, relict or vanishing vegetation such as mangrove forests, wetlands, saltmarshes and other ecologically sensitive areas such as estuaries and river mouths [3, 4, 11, 13, 27]. This sensitivity is measured in relation to the geomorphology and sedimentology, hydrodynamics, chemistry, zooplankton, macroinvertebrates, ichthyofauna and estuarine birds [27]. However, these are all integral parts of the estuarine ecosystem and hence overall sensitivity must be measured as a combination of all the separate sensitivities. Boon et al. (1999) concluded that vehicles should be completely banned from the estuarine environment by virtue of its extreme biological importance. Estuaries were graded as exclusion zones regardless of their current health status as determined by [13]. Exclusion of estuaries and river mouths also safeguards the maintenance of key ecological processes associated with such environments.
<b>3. Wildlife sanctuaries and reserves</b>	Wildlife sanctuaries and reserves managed by an existing integrated management plan (IMP) were excluded based on specific zonation and conservation status within such a management plan (e.g. the sanctuary and restricted zones in the GSLWP). As far as practicable, the pattern of zones within a multiple-use marine protected area should avoid sudden transition from highly protected areas to areas of relatively little protection. "Buffer" zones should be considered wherever possible [28].
<b>4. Unsuitable physical attributes of beaches or natural barriers</b>	Unsuitable physical attributes of beaches or natural barriers such as rocky headlands, ledges and wavecut rocky platforms were considered exclusion zones as these require ORVs to pass between the rocky areas and the dunes. Although vehicles can sometimes cross these structures under favourable conditions during low tide, it remains a function of the waves, currents, tide and wind that cannot be predicted and these areas were therefore not considered. ORVs may not venture out of the intertidal zone of a beach, and crossing or bypassing a rocky headland or wave cut platform will necessitate driving on the backshore (see exclusion 1). Vehicles attempting to cross these structures increase the likelihood of erosion along the dune line while also damaging dune vegetation.

<p><b>5. Areas of fragile natural features or scientific interest</b></p>	<p>Areas of fragile natural features or scientific interest such as turtle nesting sites during nesting season (October-February) and threatened bird roosting and nesting sites were excluded [29]. South Africa is a signatory to the Memorandum of understanding on the conservation and management of marine turtles and their habitats of the Indian Ocean and South-East Asia and is committed to a number of principles regarding turtle conservation [30]. In this memorandum it was noted that marine turtles have a priority for conservation action through their listing in the respective texts or appendices of a number of international protocols [30]. Signatories also acknowledged that human activity such as tourism, destruction or modification of habitats and coastal development might threaten marine turtle populations directly or indirectly.</p>
<p><b>6. Areas of potential beach user conflict</b></p>	<p>Areas where vehicular activity would adversely affect other users of natural areas such as established swimming beaches (e.g. shark netted beaches) to avoid possible beach user conflict. Studies have shown that a large proportion of beach users, both local and international, enjoys the sun and beach as well as the experience of nature and landscape. Vehicle use on beaches adjoining areas of outstanding public interest or scenic areas may also be restricted. The public’s recreational interests and priorities at each beach and region of the coast should be considered before an ORV RUA is considered. A survey of ORV use in the Eastern Cape reported that beach users found ORVs disturbing because they jeopardised their safety, ORVs are noisy, churn up sand, make the beach look untidy and destroy its pristine atmosphere [6]. The protection of public safety is the primary concern although well-managed beach access points that can accommodate both pedestrian and ORV traffic need to be examined independently. Where there is conflict between passive beach users and ORV users, passive areas should have priority of consideration as they cause the lesser environmental and social impacts.</p>
<p><b>7. Unidentified or unexplored key ecological processes</b></p>	<p>Cognisance must be taken of possible ecosystem-wide changes caused by ORVs in RUAs. The protection of biodiversity in the three biogeographic zones of KZN has absolute priority and any activities that could potentially induce negative ecosystem effects should not be considered. The lack of information on such systems prevented the effective application of this exclusion and thus it played no role in the identification of RUAs. However, ecosystem changes due to ORV use cannot be discounted and these may be included following additional studies. Long-term monitoring needs to be an integral part of an integrated management plan for a declared RUA.</p>

Table 3.  
Spatial data used as overlays on a GIS map of the KZN coast.

<b>Dataset name</b>	<b>Description</b>	<b>Source</b>
KZN boundary	Boundary of KwaZulu-Natal	Department of Traditional and Local Government Affairs
KZN beaches	Attributes and amenities of the beaches of KZN	KwaZulu-Natal Tourism Authority
Existing provincial wildlife reserves	Network of existing wildlife reserves, including the two existing MPAs in KZN	Ezemvelo KwaZulu-Natal Wildlife
Coastal sensitivity atlas	Coastal sensitivity	[31]
Mangrove distribution	Mangrove locations, species and area as attributes	[32]
Estuary location and attributes	Attributes such as estuary class, mouth status, size, water quality etc. are included	[13]
Biogeographic zones	Biogeographic zones based on intertidal ecosystems	[20]

Table 4.  
Proposed MPAs along the coast of KZN[14, 15, 16].

<b>Name</b>	<b>Southern Border</b>	<b>Northern Border</b>
<b>KZN South Coast</b>		
Southern Park	Isipingo Estuary	Brighton Beach
Aliwal Shoal MPA	Mzimayi River	Ngane River
Umdoni Park Reserve	Mkumbane River	Umdoni Point
<b>KZN North Coast</b>		
Amatikulu & Umlalazi Nature Reserve	1 km north of Tugela River Mouth	Umlalazi Estuary
Dolphin Coast MPA	Mhlali River	Mvoti River
Umhlanga Nature Reserve	Breakers Hotel	Umhlanga Estuary

Table 5.

Summary of a possible RUA network using the current KwaZulu-Natal provincial model for the designation of RUAs

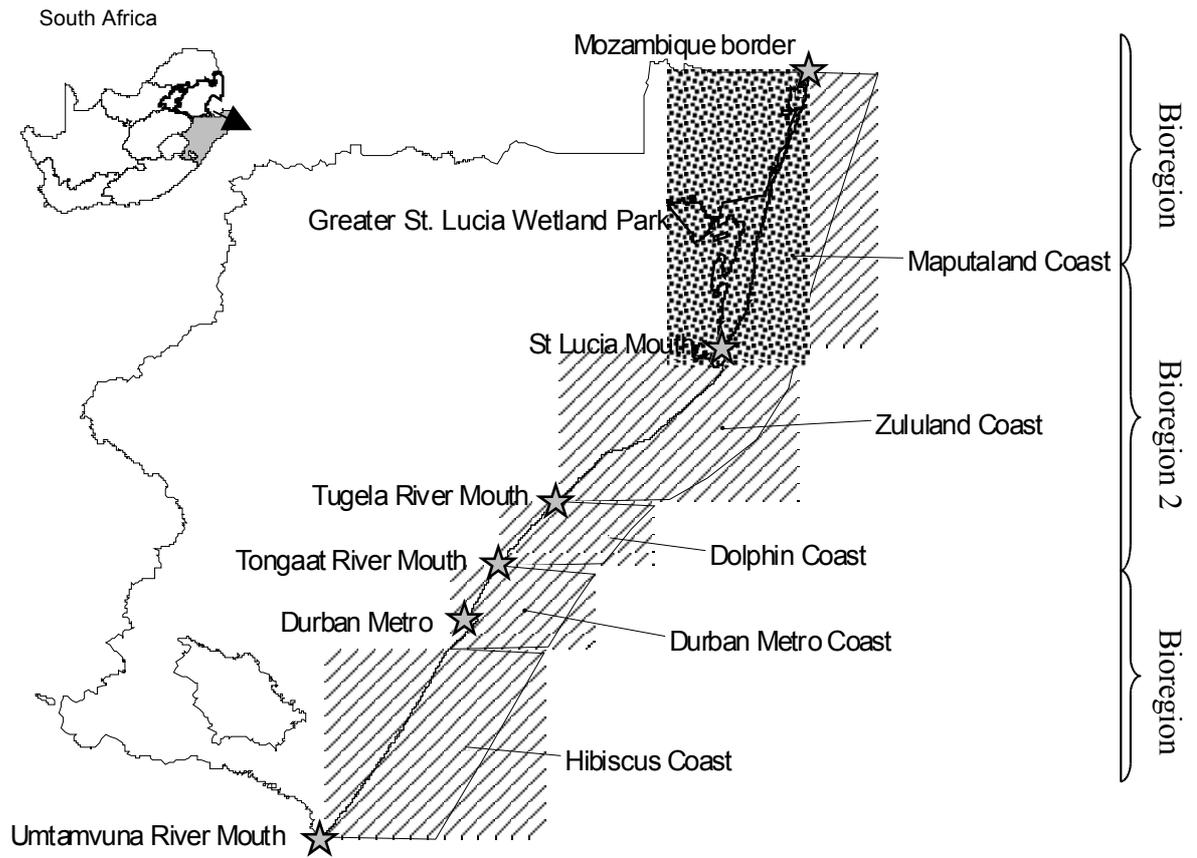
Total distance covered by RUAs (km)	239.1
Mean length of proposed RUAs (km)	7.3
Maximum length of RUAs (km)	28.4
Minimum length of RUAs (km)	2.0
Total length of KwaZulu-Natal coast (km)	562
Percent of KwaZulu-Natal covered by RUAs	42.6

Table 6.

Summary of possible RUA segments in each of the five coastal regions along the coast of KwaZulu-Natal, South Africa.

<b>Region</b>	<b>Maputaland</b>	<b>Zululand</b>	<b>Dolphin</b>	<b>Durban Metro</b>	<b>Hibiscus</b>
Length of region (km)	179	134	70	52	127
No. of proposed RUAs	8	8	2	5	10
Total length of RUAs (km)	70.1	115.8	6.6	20.6	26.0
Mean length of RUAs (km)	8.8	14.5	3.3	4.1	2.6
Maximum length of RUAs (km)	25.4	28.4	4.6	7.2	4.4
Minimum length of RUAs (km)	2.2	4.9	2.0	2.2	2.0
% of region covered by RUAs	39.2	86.4	9.4	39.6	20.5

## 9. Figures



**FIG. 1**

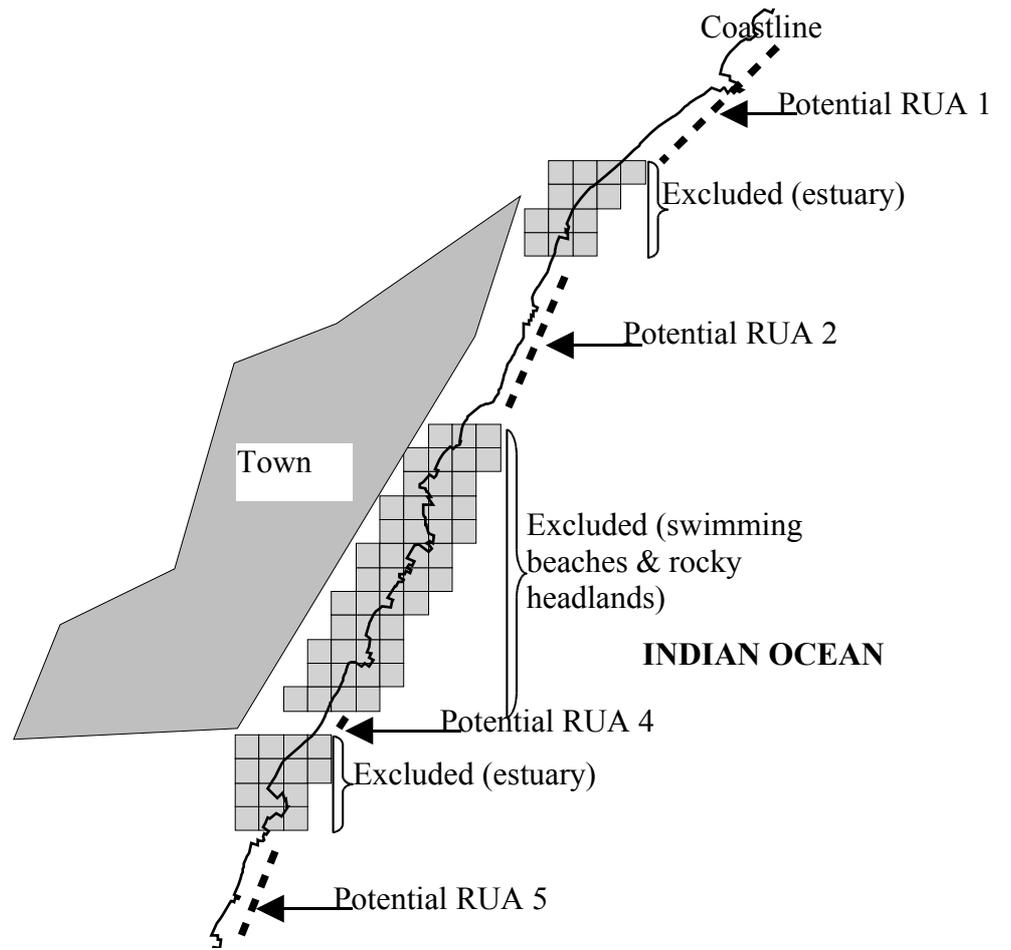
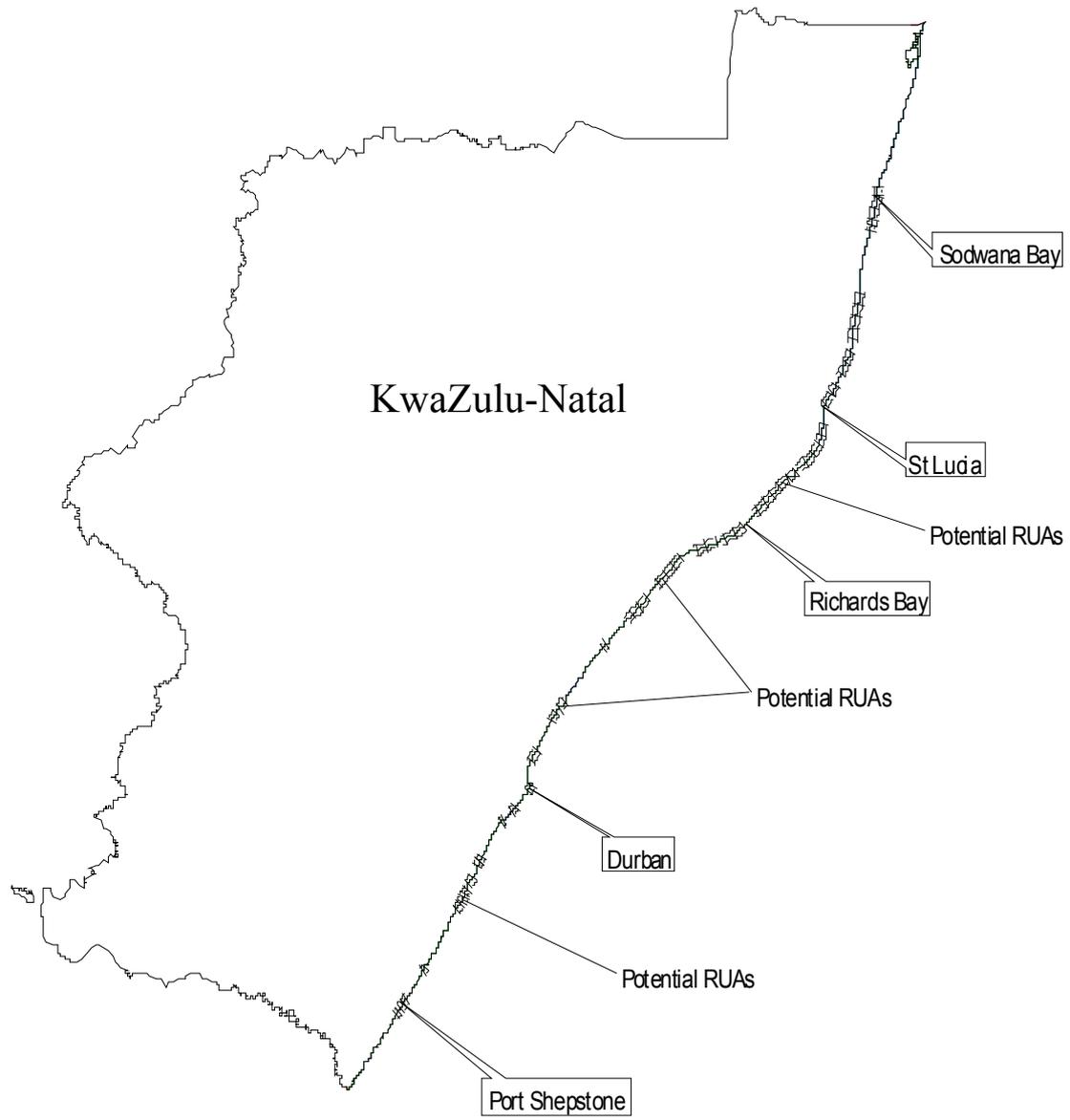
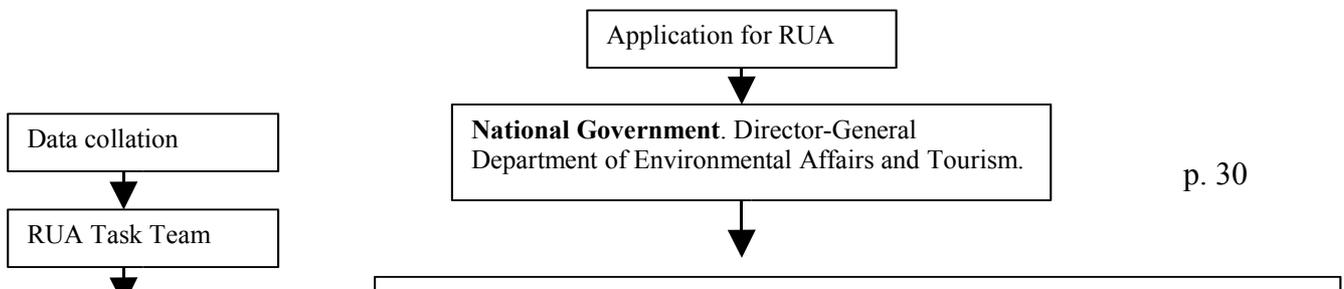


FIG. 2



**FIG. 3**



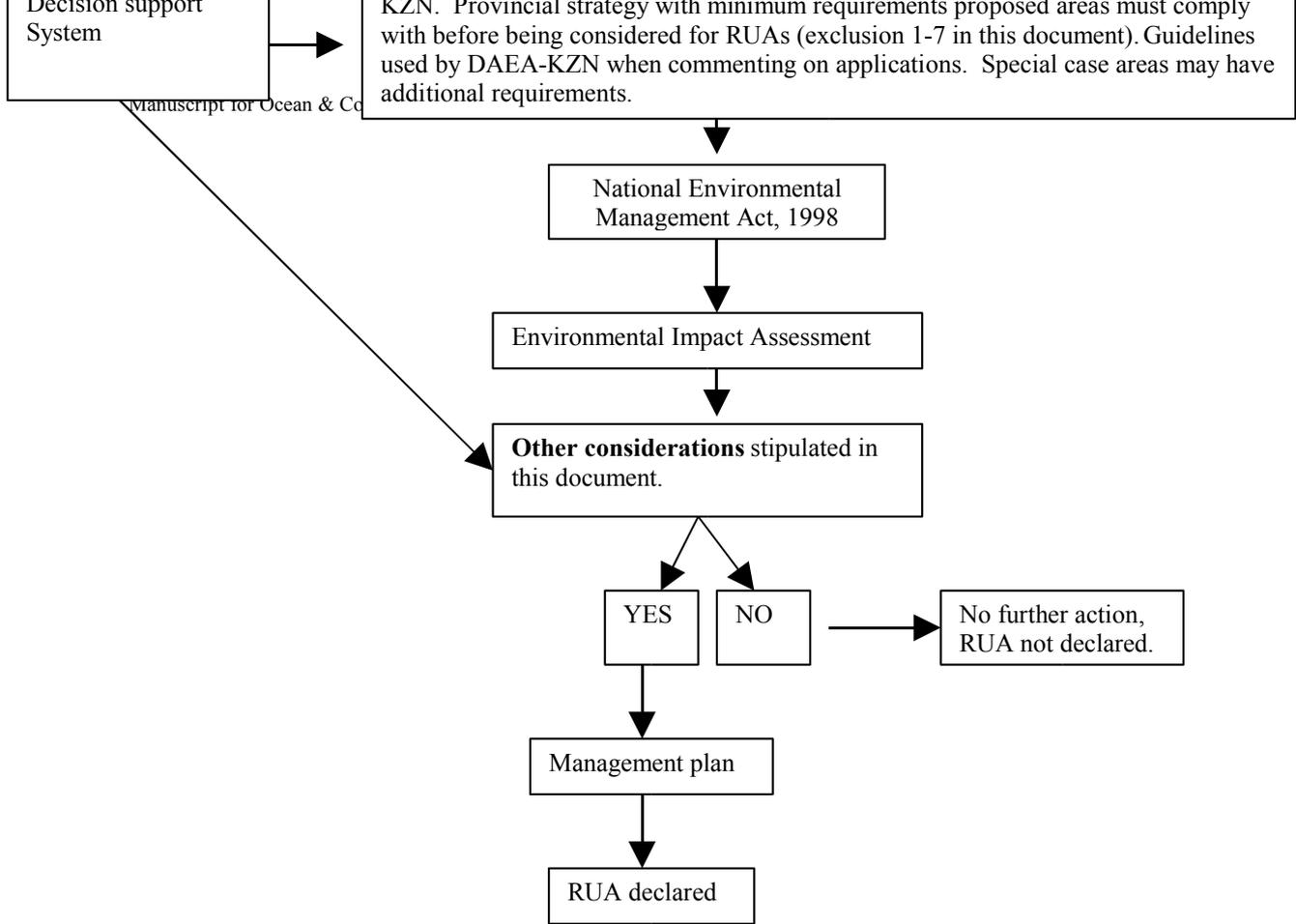


FIG. 4