The Revolutionary Government of Zanzibar

Integrated Conservation and Development Sections
Department of Commercial Crops, Fruits and Forestry.
Maruhubi

Ader's Duiker (*Cephalophus adersi*)

Species Recovery Plan
(Revised)

Forestry Technical Paper No. 124

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EXECUTIVE SUMMARY

This revised version of Ader's Duiker Species Recovery Plan (SRP) constitutes a framework to help ensure the continued and enhanced conservation of the species in Zanzibar. It is intended to be a working document that should be further revised on a regular basis.

Ader's duiker occurs on the main island of Unguja, Zanzibar as a near endemic. The population in 1999 was thought to be in the region of 600 individuals, compared with approximately 5000 in 1983. To date, two main threats have been identified as the major cause of Ader's duiker decline, namely hunting and habitat destruction.

A total of ten complimentary programmes have been devised in an attempt to stop the extinction of this species. These ten programmes are:

- ***Protection under international law.***
  Ader's duiker has been protected under Zanzibar law since 1919. The appropriate laws must be publicised and enforced.
- ***Development of an Effective Protected Areas System***
  A new, larger conservation area has been identified that will secure part of the Ader's duiker range, in which a strict anti-hunting policy will be enforced.
- ***Community Wildlife Management Programme***
  A community wildlife management programme commenced in 1995 in an effort to reduce antelope hunting to a more sustainable level. This will be continued and expanded.
- ***Community Forest Management Programme***
  Community Forest Management Agreements will be in place for the eight villages surrounding Jozani Forest, and the programme has been extended to cover most of southern Unguja.
- ***Conservation Education***
  In rural areas, people's awareness of conservation education is relatively high. However, in urban areas, a lot of work is still required.
- ***Translocation***
  In February 2000, five Ader's duikers were translocated to Chumbe Island where a female was already in place. The success of this translocation needs to be monitored before future translocation programmes can be investigated.
- ***Captive Breeding***
  An investigation into the feasibility and efficacy of a captive breeding programme was undertaken in December 2001.
- ***Trophy Hunting***
  Trophy hunting has been suggested as a conservation tool. However, for such a rare species the likely success of this programme must be investigated thoroughly.
- ***Monitoring***
  The status of Ader's duiker needs to be monitored closely so the efficacy of the SRP can be judged and, if necessary, altered.
- ***Further Research***
  A simple research programme to understand more about the behavioural and population ecology of Ader's duiker is necessary.

ACKNOWLEDGEMENTS

The following document is a revised edition of *A Conservation and Recovery Plan for the Ader's Duiker (*Cephalophus adersi*). Forestry Technical Paper No. 114* written by Andrew Williams in 1998. Much of the content in this report on the status, ecology and threats is taken from that presented by Williams. The author greatly acknowledges Williams for permission to use his material. As not to distract from the content of the document, the specific areas used have not been highlighted in the text. The reader is also referred to the numerous people acknowledged in Williams' report, as their continued input into the conservation of Ader's duiker is still valid.

Ali Ali Mwinyi must be singled out for his efforts in the implementation of the village hunting bylaws and for his enthusiasm during the translocation programme of duikers to Chumbe Island. Adrian Ely and Eleanor Carter must also be thanked for their efforts in organising and implementing the translocation project. The staff of Chumbe Island have also taken it upon themselves to monitor the translocated duikers.

The participants of the International Workshop held in Zanzibar during December 1999 should also be thanked for their time and input into Ader's Duiker conservation. Many of the following ideas are a result of their devotion to this particular species.

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INTRODUCTION

Objectives and Structure

The revised Ader's duiker Species Recovery Plan (SRP) constitutes a framework to help ensure the continued and enhanced conservation of the species in Zanzibar. The plan forms part of the Government of Zanzibar's commitment to the conservation of biodiversity as a signatory[1] of the Convention on Biodiversity signed in Rio in 1992, which was ratified by Tanzania in 1996. The further development of this plan is especially relevant given that the Zanzibar population of Ader's duiker is believed to be the last remaining viable population.

The Ader's duiker SRP is intended to be a working document which should be further revised on a regular basis. The following revision stems from an International Workshop held on the Ader's duiker in Zanzibar during December 1999. The SRP consists of:

- A brief summary of the distribution and status of the Ader's duiker together with a basic description of the appearance of the species;
- An outline of the threats and causes of decline of the species as far at they are understood;
- Frameworks of complementing and parallel strategies that will help secure the future of the species;
- An outline timetable for implementing the management strategies;
- Preliminary budgets for each component;
- A list of roles and responsibilities.

Plate 1. Ader's duiker taken by remote camera on Chumbe Island.

[1] As part of the Union Government of Tanzania

ADER'S DUIKER

Distribution and Status

World-wide

The status of Ader's duiker has been classified as both critical[2] and vulnerable[3]. Ader's occurs on the main island of Unguja, Zanzibar as a near endemic since, although the species has been described by Kingdon (1982) as widespread in the forests, woodland and thickets north of Mombasa (Kenya) – almost up to the Somali border, in the light of rapidly shrinking suitable habitat, it would appear the population has succumbed to a severe decline in numbers. In the Arabuku – Sokoke Forest north west of Kilifi (Kenya), this species, which was once common, has had few recent substantiated sightings.

Rodgers and Swai (1990) suggest that Ader's duiker may occur in the coastal thickets north and south of Tanga (Tanzania mainland) – possibly in the Sadani Game Reserve. 'Odd' skins of a red duiker have turned up in Zaraninge-Kiono on the Bagamoyo-Pangani boundary (Rodgers *pers comm.* to Butynski and Williams). This possibility remains to be investigated.

In Zanzibar

The Ader's duiker was first described by Thomas in 1917 from Zanzibar. The Ader's duiker population has been increasingly adversely affected by human activity, especially over the last 30 years, throughout its range. Associated with a large expansion in the human population (over 100% rise since 1967), there has, and continues to be, substantial older growth vegetation cutting and an escalating intensity and efficiency of hunting activities to meet the buoyant market demand. The other two antelope species occurring in Zanzibar – the blue duiker (*Cephalopus monticola sundevallii*) and the suni (*Neotragus moschatus moschatus*) have also been varyingly affected by habitat changes and hunting.

To date, three surveys have been carried out within Zanzibar. The first in 1982 (Swai 1983) estimated the Ader's duiker population to be in the region of 5000 individuals.

A second, more detailed survey undertaken in 1995 (Williams *et al.* 1996) placed the population at below 2000. The populations were shown to be located in five main sub-population with varying degrees of interconnectedness: Kiwengwa Forest in the north, localities in the central Jozani-Chwaka Bay area and Mtende in the south (see map 1).

[2] Gnusletter, 12(1)
[3] IUCN/WCMC

A third survey carried out in 1999 (Kanga 1999) placed the population at 614±46 within the same study area as Williams *et al.* (1996). This represents an 87.7±0.7% decrease in the calculated population size in 17 years. However, as each survey method used different methodologies, the results are not directly comparable. But, nevertheless, it is evident that there has been a significant decline in the population in recent decades. In light of this decline, and the fact that no other viable population is known, the Duiker Symposium held in Zimbabwe in February 2001 declared Ader's duiker the flagship species for Africa.

There is a possibility that Ader's duiker may have once occurred in Pemba on Funzi Island (*pers. comm.* Sheha, Fundo in Williams (1998)) and is reported to have been introduced on to Funzi Island (Kingdon 1996), but has since become extinct on both these islands. Archer and Mwinyi (1995) mention, "*unconfirmed…*(but) *reliable reports* (which) *indicate a thriving population on Tumbatu Island"*. Further confirmation of this is yet to be forthcoming.

During February 2000, five Ader's were translocated to Chumbe Island off the coast of Unguja. This, in conjunction with the female that was already present, brings the total to three males and three females on the island. It is hoped that these individuals can be used as the start of a breeding nucleus for future re-introductions.

A single female has recently (December 2001) been discovered amongst a private collection in Paje, Unguja. It is believed this animal has been kept in captivity, apparently healthy, for over four years. As far as known at the time of writing, this is the only Ader's duiker in captivity.

It is certain that unless there is a marked reverse in the population trend through appropriate management and conservation methods that this species is in threat of extinction in the next 10 years.

Description and basic ecological details

Ader's duiker is a medium sized Cephalophine standing about 400-450 mm at the shoulder when fully grown. The antelope is a red/rufus brown with a white belly and a prominent rufus-brown tuft on the top of the head at the horns. It can be distinguished from other red duikers by its white and black dappled lower fore limbs and a broad white, lateral band stretching across from its forward lower midriff to, and across, its upper hind-quarters (below the rump – not above the tail) (Plate 2). Total average live weight of an adult appears to be 8-10 kg with no observed (as yet) substantial sexual dimorphism in this regard. Ader's duiker is the smallest of the red duikers and recent genetic analysis shows the Ader's duiker to lie in the centre of the phylogenetic red duiker group (*pers. comm.* B. Van Vurren, 1997[4] to Williams 1998).

[4] University of Pretoria, South Africa

Plate 2. Adult Ader's duiker displaying white band on rump and white dappled forelimbs.

In Unguja, Ader's duiker inhabits tall, undisturbed coral rag thicket known locally as *msitu mkubwa* (Archer 1994) of the Zanzibar-Inhambane regional mosaic (XIII). Ader's duiker appears to be loosely diurnal (Williams *et al* 1996), with a very acute sense of hearing and possibly smell (Archer 1994, Williams 1998). Ader's is a browser selecting for dicotyledenous leaves, seeds, sprouts, buds and fruits (Swai 1983). It is usually found singly, sometimes in pairs or trios and often, when encountered, may be following a troop of Sykes (*Cercopithecus mitis albogularis*) or red colobus (*Piliocolobus kirkii*) monkeys feeding on discards and dislodged edibles from the canopy above (Swai 1983, Imani *pers. comm.* to Williams 1998). Territories are maintained by facial gland secretions on prominent twigs and faecal heaps (Swai 1983).

Williams *et al.* (1996) found that Ader's duiker has very specific habitat requirements. Ader's duiker was only found in older growth thicket areas and the highest population densities (11.4±5.18 km^{-2}) were recorded in undisturbed high thicket. In contrast, Kanga (1999) did encounter the occasional Ader's in secondary thicket.

No formal study of behavioural or ecological allopatric separation of Ader's duiker with either the blue duiker or suni has yet been attempted. Moreover, little is known about the population dynamics of this species or of its reproductive biology.

Threats

Ader's duiker is threatened by hunting and habitat destruction. It is likely that habitat destruction will constitute the most difficult threat to address in terms of Ader's duikers' future security.

Hunting

There has been a long tradition of hunting in Zanzibar. Before the revolution of 1964, hunting appears to have been controlled (to a greater or lesser extent) by villager leaders who would give permission for a person(s) to hunt in their village area. Overall it is likely that the off take rate of mini antelope is likely to have been relatively sustainable – as a result of some degree of village based control, the relatively low impact of the hunters operating, a relatively large mini-antelope population and some measure of enforcement of the wildlife laws. Technically the hunting of Ader's duiker has been illegal since 1919. However, it was likely that Ader's duiker was hunted illicitly before the revolution.

After the revolution, village based hunting controls largely lapsed and hunting appears to have become unregulated, as enforcement of the wildlife laws became non-existent. Thus it would appear that, partly as a result of hunting, the mini-antelope populations of Zanzibar and, especially Ader's duiker, have undergone long term declines.

The Department of Commercial Crops, Fruits and Forestry, (DCCFF) (formerly the Commission for Natural Resources) – the institution which is responsible for the management of all forests, thickets and wildlife – begun to address the hunting situation in 1994. Initial wildlife extension work began with the placing of hunting registers in villages for the purposes of identifying the peak breeding season of the antelope population and was accompanied by research into the hunting situation (Archer 1994). Work was carried out at the village level to agree on the control of hunting and the implementation of a closed season in 1995. After the 1995 antelope population survey (Williams *et al.* 1996), recommendations were made for the establishment of Village Hunter's Associations which would be responsible for the management of wildlife – especially the antelope in their respective villages. Wildlife bylaws now exist for 12 villages within Zanzibar, though their efficiency has not been examined yet.

While hunting has been of a major detriment to the Ader's duiker population in Zanzibar, hunting has come under an increasing level of control – both at the village and governmental level. Given the continuation of the DCCFF's community wildlife programme and the support of the village based wildlife management, the hunting situation is likely to be further improved. However, at present, hunting is likely to remain a threat to the future of Ader's duiker.

Habitat destruction

The eastern coral karst of Unguja is, in its semi-natural state, covered by a mosaic of thicket forest and grassland patches. In the last 30 years there has been a substantial amount of deforestation and forest degradation which is becoming increasingly acute as the human population grows. This has also lead to severe habitat fragmentation within the Ader's duiker range (Map 1). The reasons behind this uncontrolled habitat destruction are much more complex and difficult to address than those for unsustainable hunting. It would appear that the poorest people living in the coral karst areas tend to rely most on harvesting forest produce – mainly firewood – for securing their daily subsistence requirements. A wood consumption survey undertaken in Ukongoroni and Charawe villages found that wood cutting was the primary source of income for almost half the male residents (Ely *et al.* 2000). Such harvesting is carried out on a widespread basis and constitutes a guaranteed subsistence cash income for people with few alternative means of income generation. Thus traditional law enforcement techniques have become less appropriate as they have generated conflict between the DCCFF and the local communities facing deteriorating overall standards of living.

In 1995 the Jozani – Chwaka Bay Conservation Project (a partnership between DCCFF, Zanzibar and CARE Tanzania) was initiated. This project aims to implement community based natural resource management in 8 villages immediately around Jozani Forest Reserve (Map 1), whilst at the same time offering alternative income generation projects. Although this project has taken some time to realise its objectives, it is hoped that by later part of 2002 Community Forest Management Agreements will be in place in all 8 villages within the project area. In June 2000, the project area was extended to cover a much larger area of Southern Unguja. It is hoped that through the efforts of the Jozani – Chwaka Bay Conservation Project and community based conservation initiatives such as the community based NGO Jozani Environmental Conservation Association (JECA), the rate of habitat destruction will be dramatically reduced and eventually reversed in much of the Ader's duiker range.

ACTIONS FOR CONSERVATION AND RECOVERY

Protection under international and national law

The Ader's duiker has been fully protected from hunting under national Zanzibar law (CAP 128) since 22nd June 1919. CAP 128 has been partially superseded by the new Forest Resources Management and Conservation Act No.10 of 1996 that has a new protected species list annexed to the legislation, divided into four appendices. The Ader's duiker has been listed on Appendix 1 – which designates this species totally protected and prioritised for conservation action. In October 1997 the new legislation was assented to by the President and implemented.

The Environmental Management for Sustainable Development Act, 1996 also provides provision for the protection of the Ader's duiker and other species of conservation importance under sections 90 and 97. Under Section 97 of this Act "A person who –

(a) Trades;
(b) Possesses; or
(c) Disturbs the habitat of

A component of biological diversity in violation of guidelines and measures prescribed under section 90 and other provisions in this Act commits an offence…"

Despite the degree of protection afforded to the Ader's duiker under national law, the law has not been effectively enforced, such that the species has been hunted heavily in recent years. With the new conservation initiatives at the community level and greater advocacy of the law, the extent and severity of the hunting pressure appears to have declined, especially with the re-imposition of the annual six-month closed hunting season for the Suni and Blue duiker.

<u>Management Actions:</u>

- ensure the implementers of the law are sufficiently aware of the law and the laws are enforced
- take appropriate action to ensure that such desirable parts of CAP 128 as may be required are included and added to, as appropriate, through the creation of regulations in the implementation of the new legislation
- co-operate with the Department of the Environment in implementing the biodiversity protection sections of the Environmental Management for Sustainable Development Act

- ensure that the Ader's duiker is appropriately listed and included in all relevant international biodiversity agreements.

Development of an Effective Protected Areas System

A new, larger conservation area has been identified and will be designated as the Jozani-Chwaka Bay National Park (JCBNP) (see Map 1). The JCBNP will secure part of the Ader's range in which a strict anti-hunting policy that will be enforced through patrolling and stiff penalties for law-breakers.

Areas within the Jozani-Chwaka Bay Conservation Area will soon have areas identified as *High Protection Zones* through the implementation of Community Forest Management Agreements. These areas will afford much protection to duiker habitat. However, the network of such protected areas needs to be expanded to cover all potential duiker habitat.

Management Actions:

- A national conservation education campaign to advocate the boundaries and the main regulations of the new JCBNP should be carried out through the media. The protection of all wildlife in JCBNP should be made very clear and the strict nature of law enforcement activities and the potential penalties for offenders should be clearly explained.
- Regular patrols – especially at night – to control illegal hunting in and around the National Park should be carried out.
- Areas protected under Community Forest Management Agreements should be extended to cover a wider area, thus incorporating all potential duiker habitat.
- Identify and clearly mark wildlife corridors and designate particular conservation status to those areas.

Community Wildlife Management Programme

A programme of community wildlife management commenced in 1995 in an effort to reduce antelope hunting to a more sustainable level. The original closed hunting season declared in CAP 128 has been revived across the entire island, whilst workshops and co-ordinating meetings have been held with hunting groups, stakeholders, administrative authorities and the police. Village Wildlife bylaws are now in force in 12 villages.

Management Actions:

- Continue to support the implementation of Shehia by-laws at the Shehia level, including the undertaking of hunting patrols and the issuing of hunting permits. The collection of permit and fine revenue should be used to support community based wildlife management in each Shehia.
- Encourage each Shehia to identify an area of coral rag forest to be set aside as a reserve and totally protect such areas from hunting and deforestation.
- Provide sufficient support and extension services in order to enable the success of the community wildlife management initiative.
- Continue to liase with Village Conservation Committees, hunter associations, Shehas, district and regional administrative authorities, the police and other stakeholders in order to effectively implement the closed hunting season on an annual basis.
- Solicit and engender the support and co-operation of NGOs working in the environment and conservation sector.

Community Forest Management Programme

The Community Forest Management Agreements for the 8 villages immediately surrounding Jozani Forest Reserve are near completion, with the first being launched in Cheju village early in 2001, with the remainder hopefully in place by mid 2002. A parallel saving and loan scheme has also been running in the 8 project villages. Within each village, areas have been set-aside as *High Protection Zones* that allow extremely limited use of forest products. These areas should allow regeneration of duiker habitat.

In June 2000, the Community Forest Management Agreements programme was extended to cover a much wider area around Jozani. Thus, some form of community protection will soon cover four out of the five major sub-populations of Ader's duiker[5].

Management Actions:

- Monitor the success of the Community Forest Management Agreements in terms of duiker habitat.

Conservation Education

People's awareness of wildlife and forest conservation has been raised considerably in the villages in and around the Jozani – Chwaka Bay Conservation Area. In urban areas, however, it would appear that people's awareness is much lower, which is an important factor as has been estimated that urban based hunters make up 52% of the total Ader's hunters. A concentrated effort to educate people about the increasing decline of

[5] Work has begun at the time of writing to afford some protection to the fifth area, namely Kiwengwa Forest.

natural resources should be made. Indeed, in this context the likely extinction of the Zanzibar leopard (*Panthera pardus adersi*) and the decline of the Ader's duiker can be used as examples.

Management Actions:

- A programme of video shows and discussions in villages should be made about conservation issues – especially focusing on the linkages between the declines in natural resources and people's socio-economic status.
- A series of radio and television programmes on conservation issues should be broadcast, especially targeting the urban population of Zanzibar.
- A documentary following the translocation of Ader's duiker to Chumbe Island was made. This should be broadcast on national TV and, possibly, at the Zanzibar International Film Festival.
- Interpretative material for school curricula should be prepared and schools encouraged to bring their pupils to Jozani.
- Establishment of urban based hunter's association.
- Monitor the National Hunting group to encourage hunters to adopt responsible hunting practices.

Translocation

Ader's duiker will continue to be threatened by hunting and habitat destruction to a lesser or greater extent on the main island of Unguja for the foreseeable future. However, there are several outlying islets, which could potentially support a small population in the medium term in the absence of these threats. It is for this reason that a small-scale translocation project was undertaken in 2000. A total of five animals were translocted to Chumbe Island off the west coast of Unguja (Mwinyi 2000). A female had been previously moved to the island in 1997, thus the total population on the island comprises 3 males and 3 females. A monitoring programme, using hidden cameras, has been initiated by Chumbe Island staff in conjunction with the Mammal Ecology Research Group (MERG), University of London, in an attempt to monitor the success of this project. An analysis of the data recovered to date is expected in early 2002. As this is the only on-going research on Ader's duiker, it is felt that increasing the number of cameras from 3 to 6 would be advantageous.

Unfortunately, due to the high mortality rate experienced throughout the translocation project (four out of the nine animals trapped died), there are no plans at present to translocate further animals. However, if breeding can successfully be proven on Chumbe, the translocation of further animals could be advisable to reduce the risk of genetic inbreeding, subject to the identification and confirmation of safe (improved) capture techniques. Prior to any further translocation, thought must be given to the carrying capacity of such small islands and therefore the viability of any translocation schemes.

Management Actions:

- Continue to monitor the translocated individuals on Chumbe Island
- Increases the number of cameras on Chumbe Island
- If breeding is successful on Chumbe, investigate more efficient methods of moving animals, with the possibility of translocating a limited number of individuals to Chumbe to reduce inbreeding.
- Investigate the presence of Ader's duiker at Tumbatu Island.

Captive Breeding

Captive breeding has, for several decades, been seen as one possible answer that can be employed as a conservation tool to help small populations. Williams (1998) proposed a captive breeding programme for Ader's duiker, with a detailed proposal being complied (Williams 1997). The captive breeding programme was further agreed at the International Workshop in December 1999. However, as funding has yet to be forthcoming for this part of Ader's duiker conservation, and due to mounting criticism of captive programmes (see for example Oates 1999), the DCCFF is at present reviewing the validity of a captive breeding programme. A discussion paper has been produced (Finnie 2001) to be circulated to all interested parties, with the hope that a consensus can be reached.

An international Duiker Symposium held in Zimbabwe in February 2001 suggested captive breeding was a viable option and should be explored further. A feasibility study was conducted in December 2001 by Zimbabwe Marwell Trust, which recommended that a captive breeding and research station should be constructed at Jozani, although Kiwengwa is a suitable alternative, initially catering for five pairs of duikers. A copy of the recommendations proposed by the Marwell Zimbabwe Trust is presented in Appendix 1.

Management Actions:

- Review recommendations concerning captive breeding.
- If captive breeding is deemed an acceptable option, seek funding as per budgets presented in Appendix 1.

Trophy Hunting

In many circumstances, well managed and controlled trophy hunting can yield a substantial revenue for wildlife management whilst being ecologically sustainable. Trophy hunting for a limited number of Ader's duiker, perhaps in the region of five each year, within a few participating communities could be used as

innovative strategy for conserving Ader's duiker in Zanzibar. However, there are many conflicting moral issues that also must be considered when evaluating trophy hunting (see Finnie and Ely 2001, for more details).

Early in 1998, the Commission for Natural Resources was approached by a reputable Safari Hunting company, seeking to secure a contract to hunt five Ader's for a fee of US$ 5 000 per animal. This has caused much debate between all parties involved with Ader's duiker conservation. During the International Workshop on Ader's Conservation held on Zanzibar in December 1999, a decision could not be reached. The European Association of Zoos and Aquaria (EAZA) offered a significant amount of money to off set loses from hunting if the decision was delayed by a year. This was agreed, with the money being used for Ader's duiker conservation. A discussion paper (Finnie and Ely 2001) was circulated within the DCCFF to allow a more informed decision to be made.

At the present time, the Ministry of Agriculture, Natural Resources, Environment and Co-operatives (the Ministry the DCCFF is responsible to) has given permission for the Trophy Hunting to be undertaken within Unguja. However, CARE Tanzania, who are a partner in the project and are responsible for the majority of the funding for the JCBCP, have reservations about Trophy Hunting. It is therefore, proposed to carry out a more detailed feasibility study of the hunting of Ader's duiker, using an external independent consultant, so that all major partners involved in the project can make an objective, informed decision.

Management Actions:

- Conduct independent feasibility study on Trophy Hunting of Ader's duiker.
- Should the feasibility study prove positive, carry out trophy hunting as per recommendations.

Monitoring

The status of Ader's duiker needs to be monitored so that the performance of management actions can be effectively reviewed. Monitoring is often forgotten or relegated to a last priority especially when resources are in short supply. Thus a monitoring programme for the Ader's duiker, while needing to be sufficiently comprehensive, should also be sustainable in terms of its demands in resources and time.

The surveys undertaken in 1995 (Williams *et al.* 1996) and 1999 (Kanga 1999) used similar methodology, so could be used as baseline data sets. However, both surveys were costly in terms of demands on resources. There is also the possibility, after the results of the translocation project in February 1999, that they resulted

in a relatively high accidental mortality rate of captured animals (both surveys and the translocation project used the traditional net drive method of capture (see Williams *et al.* 1996 for a detailed description)). Therefore, a non-intrusive method of monitoring would be ideal, with the possibility of using proxy indicators.

Management Actions

- Develop and implement a non-intrusive monitoring programme to monitor the Ader's duiker population which can be carried out every 2 – 3 years
- The village hunting management data base should be further developed. Information should be collected on a quarterly basis at the village level by the Wildlife Officer at the DCCFF which details the number of antelope hunted with a measure of hunting effort, the number of patrols carried out and the number of illegal incidents. This will enable an overall view of the following indicators to be developed:
  - The activity of community wildlife management in different villages
  - The level of hunting during different times of the year
  - The generation of an index of the overall mini-antelope population from harvest and hunting effort data
  - An indication of peak breeding seasons and other population ecology data from data on the animals harvested
  - The number of illegal incidents – indicating the effectiveness and respect for law enforcement by the wider community.
- The number of Shehia forest reserves and other cultural groves created specially for wildlife conservation should be marked and recorded on a central data base.
- The Ader's duikers on Chumbe Island should be monitored on a regular basis.

Further Research

Well directed research is often essential for the conservation of biodiversity. A simple research programme to understand more about the behavioural and population ecology of Ader's duiker should be embarked upon. It has been suggested that in the absence of significant funding, that University students be encouraged to undertake research work, particularly from East African universities. It is also proposed that researchers from outside East Africa should pay a research fee which could be used to fund African students.

Research Carried Out Thus Far:

1983 Swai – Population survey of the mini antelopes of Zanzibar

1994/5 Archer & Mwinyi – Hunting practices and some ecology

1995 Williams *et al.* – Population survey and some ecology

1996 Strand – Study on activity patterns of the Ader's duiker

1997 Van Vurren – Genetic phenology of the red duikers

1998 Kanga – Population survey.

1999 Masoud – Trophy Hunting feasibility study

Management Actions:

- Liase with east African and international institutions about the need and potential for further research on the Ader's duiker.
- Facilitate all research carried out on the Ader's duiker
- Develop a co-ordinated research programme.
- Develop a list of priority research requiring external funding.

Management Options Plan

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Protection under international and national law					
Ensure the implementers of the law are sufficiently aware of the law	✔	✔	✔	✔	✔
Take appropriate action to ensure that such desirable parts of CAP 128 as may be required are included and added to, as appropriate, through the creation of regulations in the implementation of the new legislation	✔				
Co-operate with the Department of the Environment in implementing the biodiversity protection sections of the Environmental Management for Sustainable Development Act	✔	✔	✔	✔	✔
Ensure that the Ader's duiker is appropriately listed and included in all relevant international biodiversity agreements	✔				
Development of an Effective Protected Areas System					
A national conservation education campaign to advocate the boundaries and the main regulations of the new JCBNP should be carried out through the media.	✔	✔			
Regular patrols – especially at night – to control illegal hunting in and around the National Park should be carried out.	✔	✔	✔	✔	✔
Areas protected under Community Forest Management Agreements should be extended to cover a wider area, thus incorporating all potential duiker habitat.	✔	✔			
Identify and clearly mark wildlife corridors and designate particular conservation status to those areas	✔	✔			
Community Wildlife Management Programme					
Continue to support the implementation of Shehia by-laws at the Shehia level	✔	✔	✔	✔	✔
To encourage each Shehia to identify an area of coral rag forest to be set aside as a reserve and totally protect such areas from hunting and deforestation	✔	✔	✔	✔	✔
Continue to liase with Village Conservation Committees, hunter associations, Shehas, district and regional administrative authorities, the police and other stakeholders in order to effectively implement the closed hunting season on an annual basis.	✔	✔	✔	✔	✔
Solicit and engender the support and co-operation of NGOs working in the environment and conservation sector.	✔	✔	✔	✔	✔
Community Forest Management Programme					

Monitor the success of the Community Forest Management Agreements in terms of duiker habitat	✔		✔		✔
Conservation Education					
A programme of video shows and discussions in villages should be conducted about conservation issues	✔	✔	✔	✔	✔
A series of radio and television programmes on conservation issues should be broadcast, especially targeting the urban population of Zanzibar.		✔			
A documentary following the translocation of Ader's duiker to Chumbe Island was made. This should be broadcast on national TV and, possibly, at the Zanzibar International Film Festival.	✔				
Interpretative material for school curricula should be prepared and schools encouraged to bring their pupils to Jozani.	✔				
Establishment of urban based hunting association	✔				
Monitor the National hunting group to encourage hunters to adopt responsible hunting practices	✔	✔	✔	✔	✔
Translocation					
Continue to monitor the translocated individuals on Chumbe Island	✔	✔	✔	✔	✔
If breeding is successful on Chumbe, investigate more efficient methods of moving animals, with the possibility of translocating a limited number of individuals to Chumbe to reduce inbreeding.			✔		
Investigate the presence of Ader's duiker on Tumbatu Island	✔				
Captive Breeding					
Review recommendations on captive breeding	✔				
Seek funding if captive breeding is deemed acceptable	✔				
Trophy Hunting					
Conduct independent feasibility study on Trophy Hunting of Ader's duiker.	✔				
Should the feasibility study prove positive, carry out trophy hunting as per recommendations		✔	✔	✔	
Monitoring					
Development and implement a non-intrusive monitoring programme to monitor the Ader's duiker population which can be carried out every 2 – 3 years	✔		✔		✔
The village hunting management data base should be further developed		✔			

The number of Shehia forest reserves and other cultural groves created specially for wildlife conservation should be marked and recorded on a central data base.	✔				
The Ader's duikers on Chumbe Island should be monitored on a regular basis.	✔	✔	✔	✔	✔
Further Research					
To liase with east African and international institutions about the need and potential for further research on the Ader's duiker.		✔			
To facilitate all research carried out on the Ader's duiker		✔	✔	✔	✔
To develop a co-ordinated research programme.		✔			
Develop a priority list of research requiring external funding	✔				

Budgets

Due to the limited amount of funding available for Ader's duiker conservation, it is hoped that the Government of Zanzibar, through the DCCFF, will be able to implement the majority of the management options during its normal activities [these are annotated by GoZ in the following plan]. Where these activities are currently implemented by JCBCP, the financial responsibility will lie with JCBCP. All figures are US$.

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Protection under international and national law					
To ensure the implementers of the law are sufficiently aware of the law	GoZ	GoZ	GoZ	GoZ	GoZ
To take appropriate action to ensure that such desirable parts of CAP 128 as may be required are included and added to, as appropriate, through the creation of regulations in the implementation of the new legislation	GoZ				
To co-operate with the Department of the Environment in implementing the biodiversity protection sections of the Environmental Management for Sustainable Development Act	GoZ	GoZ	GoZ	GoZ	GoZ
To ensure that the Ader's duiker is appropriately listed and included in all relevant international biodiversity agreements	GoZ				
Development of an Effective Protected Areas System					
A national conservation education campaign to advocate the boundaries and the main regulations of the new JCBNP should be carried out through the media.	JCBCP	JCBCP			
Regular patrols – especially at night – to control illegal hunting in and around the National Park should be carried out.	6 250	4 800	GoZ	GoZ	GoZ
Areas protected under Community Forest Management Agreements should be extended to cover a wider area, thus incorporating all potential duiker habitat.	JCBCP	JCBCP			
Identify and clearly mark wildlife corridors and designate particular conservation status to those areas	1 000	500			
Community Wildlife Management Programme					
To continue to support the implementation of Shehia by-laws at the Shehia level	GoZ	GoZ	GoZ	GoZ	GoZ
To encourage each Shehia to identify an area of coral rag forest to be set aside as a reserve and totally protect such areas from hunting and deforestation	GoZ	GoZ	GoZ	GoZ	GoZ
To continue to liase with Village Conservation Committees, hunter associations,	GoZ	GoZ	GoZ	GoZ	GoZ

Shehas, district and regional administrative authorities, the police and other stakeholders in order to effectively implement the closed hunting season on an annual basis.					
To solicit and engender the support and co-operation of NGOs working in the environment and conservation sector.	GoZ	GoZ	GoZ	GoZ	GoZ
Community Forest Management Programme					
Monitor the success of the Community Forest Management Agreements in terms of duiker habitat	GoZ		GoZ		GoZ
Conservation Education					
A programme of video shows and discussions in villages should be made about conservation issues	2 000	GoZ	GoZ	GoZ	GoZ
A series of radio and television programmes on conservation issues should be broadcast, especially targeting the urban population of Zanzibar.		GoZ			
A documentary following the translocation of Ader's duiker to Chumbe Island was made. This should be broadcast on national TV and, possibly, at the Zanzibar International Film Festival.	GoZ				
Interpretative material for school curricula should be prepared and schools encouraged to bring their pupils to Jozani.	1 000				
Establishment of urban based hunting association	GoZ				
Monitor the National hunting group to encourage hunters to adopt responsible hunting practices	GoZ	GoZ	GoZ	GoZ	GoZ
Translocation					
Continue to monitor the translocated individuals on Chumbe Island	CHICOP	CHICOP	CHICOP	CHICOP	CHICOP
Increase number of remote cameras on Chumbe Island					
If breeding is successful on Chumbe, investigate more efficient methods of moving animals, with the possibility of translocating a limited number of individuals to Chumbe to reduce inbreeding.			GoZ/ CHICOP		
Investigate the presence of Ader's duiker on Tumbatu Island	GoZ				
Captive Breeding					
Review captive breeding recommendations	GoZ				
Seek funding if captive breeding deemed acceptable	GoZ				

Trophy Hunting					
Conduct independent feasibility study on Trophy Hunting of Ader's duiker.	GoZ				
Should the feasibility study prove positive, carry out trophy hunting as per recommendations		GoZ	GoZ	GoZ	GoZ
Monitoring					
Development and implement a non-intrusive monitoring programme to monitor the Ader's duiker population which can be carried out every 2 – 3 years	5 000		5 000		5 000
The village hunting management data base should be further developed		GoZ			
The number of Shehia forest reserves and other cultural groves created specially for wildlife conservation should be marked and recorded on a central data base.	GoZ				
The Ader's duikers on Chumbe Island should be monitored on a regular basis.	GoZ	GoZ	GoZ	GoZ	GoZ
Further Research					
To liase with east African and international institutions about the need and potential for further research on the Ader's duiker.		GoZ			
To facilitate all research carried out on the Ader's duiker		GoZ	GoZ	GoZ	GoZ
To develop a co-ordinated research programme.		GoZ			
Develop a priority list of research requiring external funding	GoZ				

ROLES AND RESPONSIBILITIES

Department of Commercial Crops, Fruits and Forestry

This is the department within The Government of Zanzibar that is responsible for conservation issues. The DCCFF will play a central role in the implementation of the Ader's Duiker Species Recovery Plan. The DCCFF should also be the co-ordinating body for all programmes relating to Ader's duiker conservation.

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Phone: ++ 255 (0)24 223 8628
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Email **careznz@redcolobus.org**
Contacts: Dr Bakari. S. Asseid , Director **b.s.asseid@redcolobus.org**
Thabit Masoud, Head of ICD Section. **thabitmasoud@redcolobus.org**
Ali Ali Mwinyi, Wildlife Officer

CARE Tanzania

CARE Tanzania, through the implementation of Jozani Chwaka Bay Conservation Project, plays a key role in providing technical support and funding to DCCFF.

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Derek Finnie, Conservation Advisor. **derekfinnie@redcolobus.org**

Chumbe Island Coral Park (CHICOP)

CHICOP took the responsibility for initialising the transloaction project to Chumbe Island and have continued to take the responsibility for monitoring the success of this programme.

Address: PO Box 3203
Zanzibar
Tanzania
Phone: ++ 255 (0)24 223 1040
Email: chumbe@zitec.org

Zoos Help Foundation (Stichting Dierentuinen Helpen)

The Zoos Help Foundation has been providing technical help and advice, as well as raising funds specifically for Ader's duiker conservation

Address:	Apenheul Primate Park
	PO Box 97
	7300 AB Apeldoorn
	The Netherlands
Phone:	++31 (0)55 357 5700
Fax:	++31 (0)55 357 5701
Email:	office@apenheul.nl
Contact:	Frank Rietkerk, General Curator. f.rietkerk@apenheul.nl

Marwell Zimbabwe Trust

To date the Marwell Zimbabwe Trust has provide invaluable advice on captive breeding, and has pledged further help if captive breeding is to be undertaken.

Address:	PO Box 3863
	Bulawayo
	Zimbabwe
Contacts:	Verity Bowman vbowman@mweb.co.zw
	Dr Amy Plowman aplowman@paigntonzoo.org.uk

Mammal Ecology Research Group (MERG)

MERG have provide, and continue to provide, valuable assistance in the monitoring of Ader's duiker on Chumbe Island and with analysis of the data that has been collected.

Address;	Mammal Ecology Research Group (MERG), Royal Holloway, University of London, Egham, Surrey, TW20 0EX
Contact:	Don MacPherson (Wildlife Biologist), donmacph11@aol.com Jenny MacPherson (Conservation Biologist), Jenny.Macpherson@rhul.ac.uk

The following individuals have also been involved with Ader's duiker conservation

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Kevin Dunham	faykevin@ecoweb.co.zw

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APPENDIX 1

Recommendations regarding the proposal for a captive breeding centre for Aders' duiker

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Devon

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December 2001

1. Background

The Aders' duiker species recovery plan (Finnie, 2001) includes a management action to review the proposal for a captive breeding centre. It is hoped that these recommendations can facilitate that review process. They arise from site visits and discussions with DCCFF and CARE staff in Zanzibar during 24th Nov-10th Dec 2001.

2. Rationale for a captive breeding and research centre

Aders' duiker numbers have been declining for several years and the best estimate of total numbers on Unguja at present is approximately 700-800 animals. Many efforts have been made to date to reduce the decline in Aders' duiker numbers. Despite these efforts the only population that can be regarded as safe at present is in Jozani Forest. This is likely to be only a small number, perhaps 20-50 animals.

Community forest management agreements will soon be active in Charawe and Ukongoroni and are being developed at this time for Michamvi. It is hoped these agreements will reduce forest degradation due to woodcutting, reduce hunting and allow forest regeneration. Further agreements are planned for Jambiani/Mtule and Mtende, but it will be several months at the very least before being implemented in these areas. Kiwengwa at present remains unprotected with no plans for management agreements. Currently in all these areas Aders' duiker are still being hunted (in Mtende apparently at a rate of approximately 1 per week) and woodcutting, with and without permits, continues at an alarming rate.

Enforcement of the existing laws and proposed management agreements will rely largely on properly trained and managed forest guards. The Dutch Zoo Federation has offered to fund these for Ukongori, Charawe and Mtende. However, given the delays in receiving this funding, this enforcement may not be in place for several months and its effectiveness cannot be evaluated for at least another year. Even with these guards in place several Aders' duiker areas will still be unprotected.

It is generally agreed that it will take up to five years to stop and begin to reverse the degradation of duiker habitat. Thus, it seems likely that duiker numbers outside of the Jozani Forest Reserve will continue to decline at the same rate as in recent years in the near future. This will result in a critically low population size within the next year or two.

A 'safety net' population was established on Chumbe Island last year, consisting of six individuals. Due to monitoring difficulties it is not possible to say how well these animals are doing but it seems likely they have all survived. However Chumbe is only a small island and will likely hold a maximum population of maybe nine pairs of animals. More details of how the current animals are doing and how many more animals may be able to be accommodated may be forthcoming in the next six months to a year depending on the results of remote camera trapping.

Primary Recommendations: given the uncertainties regarding the success of other conservation initiatives and the possible time delays involved, our primary recommendations are:

a) To continue with plans for a captive breeding centre as soon as possible
b) In particular it will take some time to secure adequate funding and this should be sought as a matter of urgency
c) It will also take time to train appropriate staff, prompt consideration should be given to recruiting staff and initiating their training
d) Detailed plans for a centre should be developed so that as soon as funding is secured it can be built. Construction time at least for animal pens should be relatively short so if immediate action is taken now to attract funding and consider staff training requirements a centre could be ready to receive duiker by the cool season (best capture time) in 2003.

3. Benefits of a captive breeding and research centre

1. Establishment of a 'safety net' population should conservation *in situ* prove unsuccessful or unpredictable events result in a sudden decline in wild numbers.
2. Opportunity to conduct research and learn more about this little known species.
3. Education of local children to explain the importance of Aders' duiker, forests in general and other environmental issues.
4. Motivation of local people and encouragement for them to view the species as internationally important and a source of local pride rather than just another type of bushmeat.
5. Benefits to community including employment and assistance with the existing community forest management programme.
6. Development of expertise in managing animals for possible translocations between sites in the wild (may be needed for metapopulation management or restocking other forests, possibly even on the mainland)
7. If successful would raise the profile of Zanzibar's conservation efforts and expertise in the international community and enhance opportunities for funding other projects.
8. Possibly some income generation by entrance fees for tourists distributed along the same lines as the Jozani project. If breeding goes exceptionally well also possibly income from exporting animals to other institutions. However, it is unlikely the centre could be completely self-financing.

4. Possible sites for a captive breeding and research centre

1. Outside of Zanzibar

Sending animals to a foreign zoo or breeding establishment would have the advantage of greatly reducing the costs involved within Zanzibar (possibly the receiving establishment would cover them all) and could be done quickly in an emergency situation. The disadvantages are: the high risk of mortality during transportation, that none of the community or educational benefits listed above would apply and there is a risk in the long term of not having animals returned for reintroduction. It is always more difficult to successfully breed animals in distant locations away from natural food sources, climate etc so breeding may be slower in a foreign establishment. It is recommended that this option is only considered as a fall back in an emergency situation if funding is not forthcoming for a centre on Zanzibar.

2. Within Zanzibar

This would be the preferred option given that it reduces the need for long distance travel and has the advantages of availability of natural forage, climate etc and will provide the positive benefits to the community as listed above. The disadvantage is the large cost involved in establishing a completely new station.

Two possible sites have been identified within Zanzibar, Jozani Forest or Kiwengwa. The advantages and disadvantages of each have been discussed in detail (Appendix B). The main advantages of Jozani are that assuming facilities such as the education centre and researcher accommodation can be shared the initial costs will be lower. Also less marketing resources would be required each year since many tourists and locals already visit. We feel the probability of obtaining adequate funding and making the centre successful in the early years, particularly with regard to education and public awareness aspects,

is greater if it was sited at Jozani and therefore we recommend this location. However, whatever decision is made as to the site of the centre the support of the Marwell Zimbabwe Trust and Paignton Zoo Environmental Park will remain the same.

5. Feasibility issues

1. Capturing and maintaining animals in captivity

There is much concern over the vulnerability of this species to human disturbance, capture and transport, mainly resulting from the high mortality rates experienced during the Chumbe Island translocation project. We believe mortality during capture and translocation can be significantly reduced with appropriate expertise and veterinary management using new sedatives. During his survey in 1995 Andrew Williams caught and handled eight duikers for 15 minutes, while taking morphometric measurements and blood samples, without any losses. In addition, at least two animals to our knowledge (females at Jozani and Paje) have survived significant periods in captivity without any expert knowledge or assistance. The female currently held at Paje seems healthy and not at all disturbed by the very close presence of human observers. Therefore, with better technical advice and support it seems entirely likely that Aders' duiker can be captured and successfully managed in captivity.

It is recommended that initially a founder population of five pairs of duiker are caught. If survival and breeding are satisfactory five additional pairs should be caught in year three. Ideally breeding will increase the captive population to 20 pairs and that number maintained for the duration of the programme. If breeding is very successful and exceeds this capacity and there are no suitable release sites available consideration will need to be given to exporting animals to foreign institutions. Legal issues would need close attention to ensure these animals and any offspring would be returned to Zanzibar in the future. It is not recommended that any animals should be exported unless the capacity of the centre is exceeded and reintroduction is not possible immediately.

2. Long term sustainability, staffing and management

Captive breeding is a long term commitment and requires skilled and dedicated staff. It is reasonable to assume that the station would be required for at least 20 years ie. the estimated time required to reverse habitat degradation and regenerate and protect enough natural habitat to reintroduce captive bred animals.

Success of the project is totally dependant on the skills and determination of a competent manager working with the guidance of an effective advisory committee. The advisory committee should be assembled and function much as described in the original proposal with minor revisions. The project manager needs to be full time and without other duties in the DCCFF, he/she needs to be educated to a level capable of undertaking scientific research in order to learn as much as possible about the animals while they are in captivity. He/she will also need to capable of managing other staff and finances. We recommend that initially a foreign manager is appointed with a view to recruiting a local trainee manager in year three and handing over full management to that person in year four.

3. Veterinary support

Good veterinary support is essential and consideration needs to be given to the availability of this on the island. At present there is very little wildlife veterinary expertise in Zanzibar. It may be necessary to train the breeding centre manager in basic veterinary techniques

4. Funding

Funding is a major issue, there is a large cost involved over a long period of time. It is extremely unlikely that any external funding organisation will agree to commit to the project for longer than 3-5 years at a time. We have therefore attempted to estimate a budget for the first five years (Appendix A). However, even if initial funds are found it must be borne in mind that further funds will still need to be sought in future. Whilst some income may be generated from visitors the centre will never be totally self-sustaining.

It is also possible that funding for captive breeding might detract from that for *in situ* conservation and this needs to be considered.

6. Reintroduction of animals

It is unlikely that suitable, safe reintroduction sites will be available within five years so we have not included the cost of this in the estimated budget. It is assumed that existing programmes of the DCCFF to protect and regenerate suitable habitat will continue and expand for the foreseeable future, therefore, there should be no additional costs involved in site preparation and protection. However, significant costs will be involved in a release event including construction of staged release pens, veterinary testing to ensure released animals are disease free, transport, equipment and personnel to conduct the release and monitor animals for at least one year after.

Reintroductions should begin as soon as the DCCFF consider that there are suitable, safe sites available and there are adequate numbers of animals in captivity. Ideally all captive animals should be released within 20 years of commencing the breeding programme and the programme brought to an end, providing the DCCFF are confident that it is no longer required.

7. Design and construction of the breeding centre

A rough sketch of a simple centre layout is included in Appendix C. This is not prescriptive and meant only for guidance as to how large an area will be required. It includes six duiker pens, enough for the initial five pairs and one spare for isolation in emergency. By extrapolation it can be seen that once the final captive population size of 20 pairs is reached (20 pens + 2-4 spare) a total area (including buildings) of approximately 6ha will be required. However most natural vegetation will remain intact. Cleared spaces around each pen are recommended for disease control and the ability to visualise animals in all parts of the pen when necessary for routine checks and research projects. A cleared area around the whole complex is recommended as a firebreak. We also recommend a security fence is erected around the entire site to protect duiker from poachers and other risks such as stray dogs. It should also be considered that natural forage will need to be collected for the duikers and a large area of good forest is needed for this, it is likely that space will also be required for a tree nursery to help provide this forage in the long term.

Buildings required would be an office, housing for the Project Manager and occasional visiting researchers and a storage facility. This could be one large or two or three smaller buildings. Unless the centre is sited close to Jozani an education building would also be required.

We estimate six duiker pens as indicated will take 2-3 months to construct. Without knowing more about the local construction industry we cannot estimate the time required to erect the buildings.

We are very happy to assist in more detailed plans for a centre, particularly the design of animal enclosures, in the near future.

8. Possible assistance from Marwell Zimbabwe Trust (MZT) and/or Paignton Zoo Environmental Park (PZEP)

1. Identifying and helping to apply to possible funding sources.
2. Training staff. It is suggested that the Project Manager is trained in duiker husbandry at MZT for 6 months prior to capturing animals in Zanzibar. This may also include some time spent at other duiker holding institutions in South Africa, with whom we have good contacts. In the first year the proposed budget includes this training, plus an assessment visit to MZT by the HOC (DCCFF) and a follow up visit for a member of MZT to visit Zanzibar to assess progress and offer further technical advice. In subsequent years it includes a visit to MZT by the trainee manager in year 3 and another advisory visit to Zanzibar by MZT staff following that.
3. Technical advice. MZT and PZEP staff can advise on all aspects of breeding duiker the initial detailed design of the breeding centre (particularly animal enclosures), capturing animals, introduction of animals to enclosures, preventative health programme, husbandry protocols, nutrition etc. The proposed budget includes funds for one exchange visit per year, either for an

expert to visit Zanzibar or the Project Manager to visit overseas experts, institutions or technical meetings.

4. Advice and support for educational activities, marketing and publicity.
5. Management of funds in the preparatory period of the project.

Appendix A – Estimated budget for first five years

Notes:
All figures are based on the budget in the original proposal, we have not researched the cost of various items in any detail.

Estimated costs of staff salaries, training, travel and technical advice are as described in appropriate places in the text.

Costs if the centre is based at Kiwengwa are higher as it assumed that at Jozani more facilities are already installed and can be made use of by the centre. Extra expense is needed at Kiwengwa in the following areas:
Construction – installation of electricity and water supplies, additional researcher accommodation
Admin resources – installation of communication systems
Education centre – it is assumed the centre already at Jozani could be used but a new building would be needed at Kiwengwa
Marketing – more resources would be needed to attract visitors to a new centre

Budget Estimate (US$) for Aders' Duiker Captive Breeding Centre												
	Year 1	Year 1	Year 2	Year 2	Year 3	Year 3	Year 4	Year 4	Year 5	Year 5	Total	Total
Item	**Jozani**	**Kiwengwa**	**Jozani**	**Kiwengwa**	**Jozani**	**Kiwengwa**	**Jozani**	**Kiwengwa**	**Jozani**	**Kiwengwa**	**Jozani**	**Kiwengwa**
Captive breeding facility	**41000**	**45500**	**3500**	**3500**	**8750**	**8750**	**4000**	**4000**	**4250**	**4250**	**61500**	**66000**
Construction: Office/house/pens	25000	28000	0	0	5000	5000	0	0	0	0	**30000**	**33000**
Maintenance	250	250	250	250	250	250	250	250	250	250	**1250**	**1250**
Security fence?	750	750	0	0	0	0	0	0	0	0	**750**	**750**
Office/Admin resources	3000	4500	1000	1000	1000	1000	1000	1000	1000	1000	**7000**	**8500**
Vehicles purchase	10000	10000	0	0	0	0	0	0	0	0	**10000**	**10000**
Vehicles fuel & maintenance	2000	2000	2250	2250	2500	2500	2750	2750	3000	3000	**12500**	**12500**
Duiker acquisistion & Maintenance	**7000**	**7000**	**3500**	**3500**	**9000**	**9000**	**4750**	**4750**	**4750**	**4750**	**29000**	**29000**
Capture founder population	4000	4000	0	0	4000	4000	0	0	0	0	**8000**	**8000**
Provision of food	1000	1000	1000	1000	2000	2000	2000	2000	2000	2000	**8000**	**8000**
Vet attention & drugs	1000	1000	1000	1000	2000	2000	2000	2000	2000	2000	**8000**	**8000**
Cleaning materials/misc equip	1000	1000	500	500	1000	1000	750	750	750	750	**4000**	**4000**
Staff	**16000**	**16000**	**16000**	**16000**	**21000**	**21000**	**11000**	**11000**	**11000**	**11000**	**75000**	**75000**
Project Manager	12000	12000	12000	12000	12000	12000	5000	5000	5000	5000	**46000**	**46000**
Project Manager Trainee	0	0	0	0	3000	3000	post closed	0	0	0	**3000**	**3000**
Duiker Attendants	2000	2000	2000	2000	4000	4000	4000	4000	4000	4000	**16000**	**16000**
Security staff	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	**10000**	**10000**
Staff Training	**1000**	**1000**	**0**	**0**	**300**	**300**	**0**	**0**	**0**	**0**	**1300**	**1300**
Captive animal management	1000	1000	0	0	200	200	0	0	0	0	**1200**	**1200**
Project admin management	0	0	0	0	100	100	0	0	0	0	**100**	**100**
Travel & Subsistence	**5000**	**5000**	**600**	**600**	**1600**	**1600**	**1600**	**1600**	**600**	**600**	**9400**	**9400**
Proj Manager Training	2800	2800	0	0	1000	1000	0	0	0	0	**3800**	**3800**
HOC to external institution	700	700	0	0	0	0	0	0	0	0	**700**	**700**
HOD external inst to ZNZ	900	900	0	0	0	0	1000	1000	0	0	**1900**	**1900**

ADCBMC meetings local	600	600	600	600	600	600	600	600	600	600	**3000**	**3000**
Technical Support (in situ)	**0**	**0**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**	**4000**	**4000**
Exchange visits	0	0	1000	1000	1000	1000	1000	1000	1000	1000	**4000**	**4000**
Education	**3100**	**7250**	**3100**	**4250**	**3100**	**4250**	**3100**	**4250**	**3100**	**4250**	**15500**	**24250**
Construction of centre	0	3000	0	0	0	0	0	0	0	0	**0**	**3000**
Maintenance	100	250	100	250	100	250	100	250	100	250	**500**	**1250**
Teaching resources	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	**10000**	**10000**
Media/ PR/ Brochures etc	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000	**5000**	**10000**
Evaluation of project	**0**	**0**	**0**	**0**	**1000**	**1000**	**0**	**0**	**1000**	**1000**	**2000**	**2000**
Annual Total	**73100**	**81750**	**27700**	**28850**	**45750**	**46900**	**25450**	**26600**	**25700**	**26850**	**197700**	**210950**

Appendix B Summary of Advantages and Disadvantages of Jozani and Kiwengwa as sites for a captive breeding station		
Requirement/objective	**Jozani Forest**	**Kiwengwa Forest**
Space – estimated 4.5ha required in long term	Yes Concerns: Majority of area is unsuitable groundwater forest which would be too wet to keep duikers on. The centre would take up a fairly significant amount of thicket within the National Park , is this legal and/or ethical	Yes
Forage plants – ample local supply and/or space for tree nursery	Yes Concerns: Ethics of chopping browse in National Park? Space for tree nursery?	Yes - wider range of species is available which is healthier for the animals. There is much seriously degraded land that could be used for tree nursery
Veterinary support – closer the better	Vet service from town But potentially a veterinary centre may be built in Pete	Vet service from town
Contact and support from DCCFF – vital to maintain moral and ensure good management	Daily contact easy, potentially support in the vicinity if required for unpredictable events Concerns: conflict over different requirements of managing the centre and the National Park, support from Jozani Park staff may not be forthcoming	Much less contact from DCCFF staff since they rarely visit this area. Difficulties in sharing facilities such as vehicles due to being outside the CARE project area
Research facilities	In the short term could possibly share with those currently being built until the centre can establish its own	Need to build from scratch
Community support/conflict – much greater success if local community is co-operative	Yes? But how will the community feel about "building a zoo in the forest"	Yes?
Security – animals must be safe	Existing staff presence would mean less security required	No existing staff presence so extra security costs involved
Education - tourists Zanzibari schools Other local people	Yes, they already visit. Entry fee could be increased slightly Yes, they already visit Local people have already been targeted for conservation education	?? Severe doubt that many can be persuaded to visit and if they do this will likely reduce the number that go to Jozani (few will visit both). Higher marketing budget required to achieve significant numbers of visits ?? Schools unlikely to visit Jozani and Kiwengwa so would be splitting resources into two sites to reach the same target audience May reach wider range of local communities in north of island where conservation education has been much less
Wider community benefits – employment, motivation, etc.	Unlikely to significantly increase the benefits already achieved by the Jozani area communities	Kiwengwa extremely neglected to date and would benefit greatly

Appendix C – Rough sketch of a simple centre layout

Note: Not prescriptive but only to give an idea of size of area required.