



Ministry of Environment and Tourism
Republic of Namibia

SPECIES MANAGEMENT PLAN

Nile Crocodile

Crocodylus niloticus

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Foreword

The Ministry of Environment and Tourism has the constitutional mandate to conserve biological diversity of Namibia for the benefit of current and future generations. It is the responsibility of our Ministry therefore to promote conservation and long term survival of Nile crocodiles.

Nile crocodiles in Namibia are restricted to the permanently flowing rivers in the northern and north-eastern parts of the country. Conservation and sound management of crocodiles is required as the species is a human-wildlife conflict species, plays important ecological role in the aquatic ecosystem and has the potential to contribute significantly to the local and national economy.

The species is currently being managed under the general provisions of the Nature Conservation Ordinance of 1975 in the absence of an approved species management plan using. The Nile Crocodile Management Plan was drafted to coordinate and direct crocodile conservations efforts. It further provides for the vision, and outlines how the vision is to be achieved through four interlinked objectives, namely ecology, economics, social and regional objectives.

The plan was developed at the right time where human wildlife conflict is now regarded as a most important threat to biodiversity conservation and at the time where the full economic and social values of the species needs to be realised to offset the negative perceptions about the species.

The conservation of Nile crocodile is not the function and responsibility of the state alone. Majority of the Nile crocodile in Namibia are found outside of the formally protected areas. All of these areas are located in areas occupied by local communities and there exists the need to collaborate with interested and affected stakeholders to ensure the conservation and sustainable use of the species. The plan was drafted with the inputs of the stakeholders including the local communities, line ministries and civil society organisations. The Nile Crocodile Management Plan is thus not only meant for

implementation by Government officials but needs to be adopted and aggressively implemented by all stakeholders involved in the conservation of crocodiles.

Lastly, I would like to thank all staff members, partners and stakeholders who participated in the development of the Policy.

Simeon N Negumbo
PERMANENT SECRETARY

INTRODUCTION & EXECUTIVE SUMMARY

The Nile crocodile is an integral component of the aquatic ecosystems of Northern Namibia. Namibia's crocodiles have considerable aesthetic and economic potential but are currently underutilised. Conversely they are considered a serious problem animal where they occur resulting in significant social and economic costs.

Nile crocodile populations have recovered since protective measures were implemented towards the end of the last century. Namibia's population is currently listed on CITES Appendix II and in the IUCN Red List as a species of 'least concern'.

There are two principle sub populations in Namibia – one in the North East and one in the North West. Preliminary indications suggest a total population of less than 15,000 individuals of all age groups split between these two subpopulations. About a quarter of the total population occurs within Protected Areas. Little is known about the status of crocodiles in the Kunene and upper Okavango Rivers.

Crocodiles are difficult to manage because of the dynamic environment they inhabit, the economic costs they incur as problem animals and the economic value they possess. Tangible threats to crocodiles include habitat loss, direct and indirect persecution. Non-tangible threats include negative stakeholder perceptions and lack of compensatory benefits. Threats can be negated by directly reducing conflict and implementing an effective sustainable utilisation program.

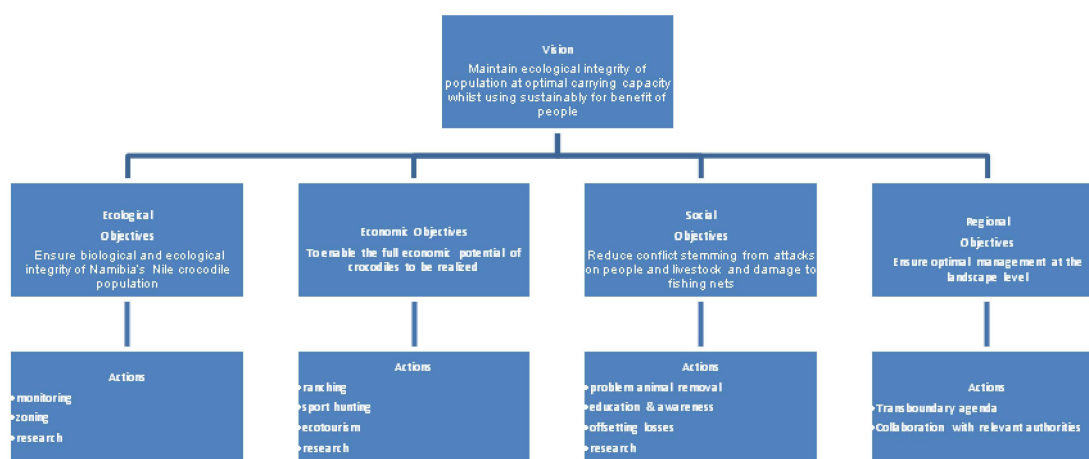
Conflict arises mainly from crocodile attacks on humans and livestock, and destruction of fishing nets. The total socio-economic cost of human crocodile conflict is difficult to estimate but direct losses and associated consequences have a significant impact on regional development.

Crocodile ranching can be a lucrative industry with considerable benefits for rural development and conservation. Crocodiles are also a valuable species in the sport hunting and ecotourism industries and have considerable tourism value.

For the purpose of this management plan, we estimate a total of 1000 female and 800 male adult wild crocodiles in Namibia. This population has the potential to generate an estimated NAD\$ 1,200,000 per annum with an estimated annual management cost of NAD\$ 500,000.

Although several key assumptions have been made in the management plan, there is little risk of the proposed management interventions having a significant long term negative effect. In the case of Namibia, long term success and profitability will depend heavily on an effective transboundary approach.

Summary of main points



Management Plan

1. Vision

To conserve and manage the national crocodile population at biologically viable levels consistent with the demands imposed and opportunities offered by the larger socio-economic setting in which crocodiles occur in Namibia

The following fundamental principles guides the attainment of the vision for crocodile conservation in Namibia:

- Wildlife management is promoted as an economically viable land use type in Namibia
- Crocodiles make significant ecological, financial as well as economic contribution to wildlife based landuses in Namibia;
- Namibia has a secure and viable population of crocodiles in the Caprivi, Kavango, Kunene and Omusati regions
- The State is willing and will continue to commit public funds to the protection and management of the species;
- The costs entailed in conserving the species which include the damage which crocodiles inflict on human livelihoods is noted and acknowledged;
- Crocodiles has unique biological characteristics and habitat requirements;
- CO-OPERATING with neighboring countries to achieve the security of crocodiles and improve their biological status is required and will be pursued at all times;
- The policy of sustainable use, as enshrined in the Namibian constitution, will result in the long term conservation and enhancement of crocodile populations;

2. Ecological Objective

To maintain the biological and ecological integrity of the national population of Nile crocodiles in Namibia

For the purposes of this management plan, “ecological integrity” with regard to crocodile management is encompassed by the following:

- To maintain genetic diversity in the Kunene, Okavango, Kwando, Chobe-Linyatti and Zambezi Rivers and associated wetlands (see map)
- Ensuring a healthy crocodile population through the maintenance of diversity and productivity of the environment.

Actions

- a) **Ongoing monitoring of the population**
- b) **Zone all crocodile habitat for management purposes**
- c) **Ecological research to refine management systems**

a) Population monitoring

Develop a practical, cost effective, scientifically robust and biologically meaningful crocodile monitoring program should as a priority. Monitoring will indicate the overall status of the population and will thus directly influence all other management actions including socio-economic outputs.

Monitoring should include a series of standardized survey methods tailored for each major habitat type, region and management zone. In addition, it should include those actions associated with ranching, wild harvests and sport hunting.

- Multi-species aerial surveys of all perennial river and wetland habitat (to determine total count of adult crocodiles, prey base and index of human activity and associated trends). Ideally, given the broader value of these wetland surveys

they should be carried out by helicopter once every two years. However, these surveys can be tailored according to available resources down to a minimum of a fixed-wing aerial survey once every 5 years. Spotlight boat surveys, ideally once every two years (can be tailored to a minimum of once every five years). Survey sample lengths should be between 15km and 30km long and should cover all major ecosystems (perennial rivers) and management zones (at least 10% of each category) (sample counts to assess population demographics)

- Include crocodile monitoring as an important management activity for conservancies. The following information should be recorded in Event Books:
 - Attacks on humans and livestock
 - Numbers harvested (trophy hunting, Problem animals, egg collection)
 - Numbers and sizes of adults seen during routine game counts
 - Nesting and other breeding activity (nests, egg shells, hatchlings)
 - Damage to fishing equipment
- MET to include crocodile and crocodile breeding activity observations in existing wildlife monitoring procedures (boat/foot/vehicle patrols and game counts in State Protected Areas).
- MET to maintain records of all reported attacks on humans and livestock
- MET to maintain records of Trophy Hunting and Problem Animal Control.
- MET to maintain records of exports (CITES tags)

At present information pertaining to carrying capacity, sex ratios, size and age structure, reproductive rates, mortality rates and movement patterns is insufficient to construct a meaningful model for decision making purposes. Crocodiles display highly variable population demographics compared to terrestrial mammals and this further complicates the predictive power of crude modeling. Until accurate population models can be developed, basic population demographics should be monitored for significant deviations and these events should direct management actions. In the long term the above mentioned management data will necessarily provide the information necessary to parameterize useful population models with time and area specific management applications.

Monitoring and research outputs should be assessed periodically in terms of maintaining precision and accuracy to adequately monitor demographic trends. Where modification of scientific protocol is required, this should be discussed and ratified by a panel of scientists, including a representative from the IUCN Crocodile Specialist Group.

b) Zoning

Zoning provides an effective means of managing a species with multiple values in a human wildlife landscape. Zoning involves varying levels of management intensity loosely based on the spatial patterns of conservation and socio-economic objectives. These criteria parameterize a function which determines management actions.

Zones will be based on:

- Protected area category or comparative conservation status. This will include both banks of a river, irrespective of political boundaries
- Estimated crocodile population densities
- Expected levels of human encroachment on the crocodile habitat and the resulting conflicts between humans and crocodile
- Synergy with other forms of natural resource management. In particular fisheries and associated conservation measures for freshwater fish stocks.

Important: Zoning as a management activity will not supersede existing wildlife legislature. For example, Protected Areas falling within utilization zones will not be downgraded to allow hunting or egg collection.

In the case of Namibia three zones have been identified (Map 1). Map 1 should be further refined to include finer scale zoning based on site visits, stakeholder involvement and any other practical implications. This is particularly so on the Kunene where the river ecology is largely pristine and human impacts are at present very low.

1. Crocodile Conservation Zones

Fully protected areas where both banks of the river or the greater landscape lie within the boundaries of the Protected Area. The purpose shall be to maintain the natural biological and ecological integrity of crocodile populations. This will include maintaining and where possible increasing the current population size. No consumptive utilization will be allowed except for scientific research. All use will be limited to non- consumptive tourism.

Proposed areas:

- Nkasa Rupara (Mamili) National Park (opposite bank in Botswana is non-consumptive tourism)
- Buffalo/Mahango section of Okavango River in Bwabwata National Park
- Skeleton Coast Park section of Kunene River (opposite bank in Angola is Iona National Park IUCN category II)
- Mudumu National Park (opposite bank in Botswana is non-consumptive tourism)
- Extraordinary cases. These will include important breeding sites, buffer zones around tourist lodges and game viewing hotspots (e.g. Kasane waterfront). Also included here will be protected fish reserves designated by, or in collaboration with, inland fisheries authorities and local communities. Extraordinary zoning should be considered on a case by case basis.

2. Crocodile Utilization Zones

Areas generally close to or on the periphery of protected areas where wildlife is a recognized form of land use. The objective here would be to maintain the natural structure and function of crocodile populations in accordance with levels acceptable under local conditions. Sustainable harvest of eggs, problem animal control and sport hunting will be permitted. Management capacity would ideally be provided by conservancies and private sector partnerships with support from MET.

Proposed areas:

- Conservancies bordering rivers/wetlands.
- Non-conservancy areas bordering rivers/wetlands and Protected Areas of special interest/importance to crocodiles or with longer term potential as viable crocodile habitat.

3. Intensive management zones

Areas situated away from the influence of Protected Areas where wildlife is not considered a major land use type. These areas will have minimal long term potential for crocodile conservation because the potential returns from sustainable utilization are insignificant compared to the potential costs of human crocodile conflict. The object here will be to intensively manage the population for smaller size classes of crocodile (ie <2m). Egg collection and sport hunting may also be permitted along with routine problem animal control activities. It is important to note that these areas should not be considered 'crocodile-free' or 'safe-for-swimming' and standard conflict avoidance measures should be maintained at all times. Management capacity should be provided by MET and possibly private sector partnerships.

Proposed areas

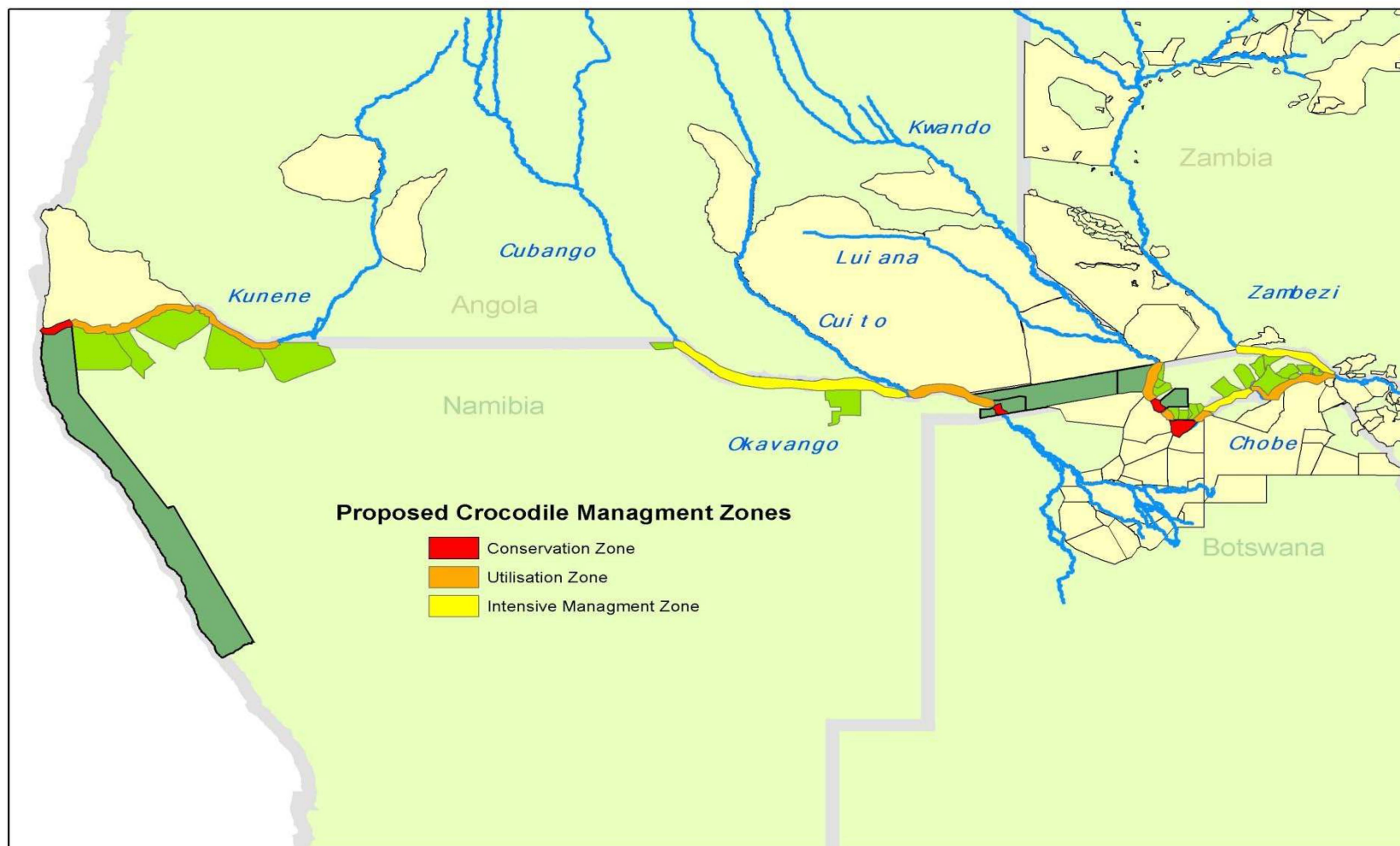
- All remaining areas not mentioned above

b) Ecological research

Research should focus on answering questions relating to management. Kunene is a priority in terms of baseline ecological and biological data. Some important research questions include:

- Genetic portfolios of major subpopulations
- Recruitment
- Breeding habitat suitability
- Regional and temporal movement patterns
- Locality or ecosystem specific diets
- Population abundance including the development and/or refinement of boat, food, nest and aerial survey methodologies

- Status and trends in wildlife and fish biomass, biodiversity and distribution



Map 1. Crocodile management zones for Namibia.

3. Economic Objectives

To enable the full economic potential of crocodiles to be realized according to the provisions for sustainable use in Namibia's Constitution

Actions

- a) The development of crocodile ranching based on wild egg harvests as per CITES guidelines and regulations
- b) Restrict sport hunting to 25 specimens and modify these according to trends
- c) Encourage non-consumptive tourism
- d) Encourage research & development

Special considerations

The global economic downturn in recent years has had a considerable impact on the crocodile skin industry and wildlife tourism. At the time of writing the situation remains in a state of flux and the long term implications for crocodile economics remain unknown. It is therefore recommended that detailed economic feasibility studies are carried out for those management actions requiring substantial investments.

a) Ranching and egg collection

In Namibia crocodiles occur in remote and/or relatively cool regions. These areas are suboptimal for large scale crocodile production because of lack of large volumes of feed and the need for supplementary heating. It is thus suggested that the crocodile production program in Namibia is developed cautiously and organically in accordance with local resources, abilities and stakeholders. This approach will allow the relative significance of the primary economic drivers (feed and heat) to be dampened by secondary benefits like tourism. It will also allow exposure and experimentation with minimal inherent risk.

Namibia presents an excellent location to trial a small scale production model. The development of a crocodile ranch and research on local breeding biology are prerequisites to the development of an egg collection model. Appendix 1 lays out the detailed actions required to establish crocodile ranching in Namibia.

b) Sport hunting

Hunting clients seek crocodile trophies with long body length and large head size and thus hunting is focused on older males. NE Namibia experiences relatively cool seasonal temperatures and growth rates are greatly reduced during the winter months. Given these conditions, it would be reasonable to assume that it takes at least 20 years for a male crocodile to reach trophy size. From current estimates, and assuming roughly half the surveyed animals over 2m in length are actually over 3m in length, we can assume approximately 417 trophy males in NE Namibia. If the current annual quota of 25 (6%) is harvested solely in NE Namibia (the only population monitored and therefore the only population technically valid for CITES permits), harvest would outstrip recruitment and trophy hunting would become unsustainable. The model becomes even less sustainable if hunting is restricted to unprotected areas, reducing the turnover time from 16 years to 4 years.

However, the case for a reduction in current quota is somewhat negated by a number of factors. These include: a) the recent history of human crocodile conflict suggesting a ‘one off’ elevated harvest would improve public perceptions towards crocodile conservation b) existing management structures allow for rapid remedial action c) crocodiles show strong density dependent population growth e) trophy hunting targets males larger than minimum reproductive size.

Ecologically it will be important to retain a portion of the population with a natural size and age structure, which should include 50+ year old animals with lengths exceeding 5m.

Quota setting should consider a number of monitoring criteria. In particular:

- All surveys should include a distinction between animals >2m and ‘large’ (~>3) crocodiles. Trophy hunting should be restricted to animals greater than 3.2 m and hunting returns forwarded to all relevant crocodile management authorities (details to include place of hunt, name of hunter, total length, snout vent length, skull length, sex and where possible CITES tag number).
- The spatial and numerical data obtained from aerial surveys together with the hunting feedback can be used as primary information in setting quotas. This can be augmented with information on recruitment from sample counts (size ratios) and conservancy monitoring efforts (HCC records).
- In the absence of information suggesting otherwise, a quota of 4% of large animals may be set.

This method would provide a means of setting precautionary quotas on a five year cycle. In time a more mathematically robust system can be developed with the aid of locality specific population models (see research section below).

It is recommended that the current trophy hunting quota of 25 animals be retained for the time being. The bulk of this quota should be allocated as trophy animals to Caprivi conservancies. The remainder should be allocated as problem animals on a case by case basis.

c) Non consumptive tourism

Exploring innovative ways and means of showcasing the aesthetically valuable components of crocodile behavior could add a key asset to regional tourism development. Crocodile cage diving, underwater viewing facilities and crocodile night safaris are prime examples. In other parts of the world crocodiles have been successfully marketed as flagship tourism draw-cards with people visiting remote destinations specifically to see these animals in their natural habitat. If portrayed and marketed in this manner, crocodiles may provide an excellent avenue to promote tourism in the less visited regions of Northern Namibia whilst providing river-side conservancies with a means to expand their holistic sustainable use portfolios.

Important actions may include:

- Local stakeholders and particularly those involved in the tourism industry should be made aware of the fact crocodiles are a major draw card on par with elephants.
- Tourist operators should be encouraged to develop crocodile specific activities and where necessary technical and legislative support should be provided (e.g. permits for night boat trips).
- Humanitarian and conservation NGOs should be encouraged to use crocodiles as a versatile development tool. For example, crocodile cage diving represents a relatively small, attractive and easily fundable package for donor organizations yet the potential benefits for crocodiles and local communities are multifarious.

d) Research

Encourage research on Nile crocodiles with an emphasis on applied research relating to Namibia's sustainable use and market based conservation strategy. Economic and market research should be carried out to better exploit the exceptional manner in which Namibia produces socially and environmentally conscious wildlife products. Research should be encouraged and coordinated by MET with active participation from regional NGOs and conservancies. Examples of key economic research include:

- Market research on the role of Namibia's economic capacity and brand name vis a vis crocodiles and regional development. For example, developing a small scale tannery and leatherworks in conjunction with a farm may provide a valuable addition to local curio markets and may represent an ideal starting point with low risk and intrinsic value.
- Developing a mechanism and platform to showcase ideas which link crocodile conservation with regional development and business entrepreneurs
- Exploring new products and markets. For example:- Is it viable to have size dependent values for trophy animals (similar to tusk weight for elephant trophies) and is there potential for harvesting non-trophy size classes through ranching operations or hunting?

4. Social Objectives

To promote multi-stakeholder management of crocodiles in those places where they interact with people in order to reduce conflict

Actions

- a) **Develop a problem animal control protocol to facilitate rapid response in accordance with the National Policy on Human Wildlife Conflict Management**
- b) **Encourage wider Education and Awareness on crocodiles and human crocodile conflict**
- c) **Continue to pursue loss off-setting schemes**
- d) **Carry research and monitoring activities related to human crocodile conflict and mitigation**

a) Problem-causing animal removal

A problem causing animal is defined as a crocodile confirmed as being responsible for an attack on a human or livestock animal or both. The authenticity of the report needs verification by MET or community game guards. Confirmation is sometimes possible during the hours or even days after the attack when the animal responsible is often seen resting or feeding on the victim close to the attack site. In cases where individual identity cannot be established with certainty; the situation should be monitored over several days and, depending on the situation, an educated guess may be justified. Similarly, in cases where multiple large animals are seen feeding on the victim, the verifying authority should make every effort to remain in the area to monitor the resident crocodile population and identify a likely suspect. That said the indiscriminate targeting of

proximate crocodiles is to be discouraged. In cases where confirmed problem animals are large males, every effort should be made to ensure these animals are harvested by sport hunters as part of the sport hunting quota. Problem causing animals may be captured and transferred to a captive facility. Unwanted problem animals and those that have killed and eaten humans should be destroyed. Live trapping in a box trap is the most cost effective, safe and selective means of capturing and/or killing problem causing crocodiles, but other methods may be used such as shooting with high powered rifle. Relocation is a viable management option only if there is a substantial physical barrier between capture site and relocation site and there is no resident crocodile population at the release site. Incidents of attacks on humans inside Protected Areas deserve special consideration and should be dealt with by MET on a case by case basis.

Response effort should be graduated according to available resources, species attacked, outcome of attack and attack frequency. Multiple attacks on humans including a fatality demand the highest level of response possible.

The destruction of fishing equipment is too common to warrant problem animal status or action. Where large crocodiles and fishing activities are sympatric according to recommended management zones (see above), crocodile friendly fishing methods should be encouraged (i.e. no gill nets) and fishermen should be considered prime candidates for benefits derived from sustainable use programs.

Problem causing animal control should remain the preserve of the MET, at least in the short term. However, MET should have the wherewithal to authorize sport hunting or capture of animals by crocodile ranches where feasible. Fee structures would have to be arranged but ultimately there is no reason why problem animal control should not have a commercial component.

Problem causing animal control is an emotive and sometimes controversial subject with important ramifications for management. A robust policy and protocol should be

implemented as soon as possible and this should be reviewed on a regular basis to ensure compliance with other management objectives.

b) Education and Awareness

Education and awareness should be considered an important overall objective of crocodile management in Namibia. There is much folk law, fear and superstition surrounding crocodiles, yet basic understanding of crocodile behavior and biology is often lacking. This creates a cocktail of misinformation which can fundamentally undermine management efforts. Furthermore, the behavioral patterns of cold blooded, primitive vertebrates like crocodiles can often be accurately predicted and thus education and awareness can reduce HCC in a very direct fashion.

The following actions should be taken:

- Government and NGOs should conduct extension services to sensitize communities to crocodile biology, behavior, ecology, conservation and management.
- Those responsible for other spheres of crocodile management (e.g. croc farms or tourist operators) should be provided with the necessary tools and techniques (eg posters and pamphlets).
- Easy-to-interpret signs warning of the dangers of crocodiles should be advertised around riverside towns and in community centers.
- The large volume and technical nature of crocodile management ideally warrants a series of workshops and training exercises. The necessary skills and resource people are readily available in Southern Africa and collaboration with relevant neighboring wildlife authorities and crocodile industry specialists should be encouraged.

c) Off-setting losses

As with problem animal removal, off-setting losses is made difficult because of the verification problems associated with the aquatic realm. This can be further complicated when attack frequency increases exponentially in the absence of more direct remedial action. In areas where the Human Wildlife Self Reliance Scheme (HWSRS) is not operational, off-setting losses should only be considered once the core crocodile management framework is functioning and stakeholders are aware and informed of the necessary considerations.

Off-setting should work in conjunction with zoning and ensure proportionate response and a value linked to sustainable utilisation. In the longer term the financials should be directly balanced with the overall benefits associated with crocodiles akin to ecosystem service payments. HWSRS provides an ideal framework on which to build.

d) Research and Monitoring of Human Crocodile Conflict

Human crocodile conflict is a contentious and understudied phenomenon in Namibia. The impact is significant yet little is known about the quantitative or qualitative nature and how it manifests in rural communities.

The following research should be carried out:

- Socio-economic review of HCC in Namibia to determine total cost and identify worst affected areas. This should include semi-structured interviews at the local level.
- Identify measures suitable for immediate deployment in the worst affected areas
- Ecology and behavior of crocodiles in human dominated landscapes (e.g. upper Okavango River)

e) Other Human Crocodile Conflict Mitigation actions

Crocodile proof harbors are an effective means of reducing attacks. Traditionally built and easily maintained thorn-fence harbors should be encouraged wherever possible. Harbors constructed from expensive materials such as steel fencing may prove useful in

high value situations where their construction and maintenance cost can be justified. An example would be tourist swimming areas.

Limiting dependence of river-side water usage drastically reduces attacks. Installing water pumps and boreholes to provide an alternative supply of fresh water for humans and livestock should be encouraged.

The above actions are generally too costly and locality specific to be considered principle actions in their own right. Rather the general concepts should be included in the education and awareness campaign in the hope that others may take the initiative.

5. Regional Objectives

To ensure optimal management of Nile crocodiles at the greater landscape level

Actions

- a) Encourage a transboundary agenda**
- b) Collaboration with relevant authorities**

a) Transboundary cooperation

Crocodiles have received considerable conservation attention from Zambia, Botswana and Zimbabwe, however in most cases the resolution and outcome of these efforts have seldom included or benefited Namibia.

The borderline section of the Kwando River and the Linyanti and Chobe Rivers mostly border conservancies on the Namibian side and various Protected Areas on the Botswana side. The Botswana areas consist of the Chobe National Park and a series of mostly non-hunting game management areas. With regards to zoning (see above), both Madumu and Mamili border non-hunting, photographic safari areas thus offering excellent opportunities for transboundary Conservation Zones buffered with Utilization Zones.

Namibia needs to exercise considerable sensitivity in exploiting crocodiles along the Chobe National Park river sections, as river based photographic tourism is a regional development mainstay. There is a strong case for seeking the full participation of the Botswana Government wherever possible.

Much of the lower Kunene River borders the Iona National Park. Here again there is an excellent opportunity to create a transboundary Conservation Zone with the Skeleton Coast Park along with a buffering Utilization Zone upstream involving the Kunene conservancies.

It is worthwhile mentioning that the lower Kunene and the Caprivi region are the focus of larger Transfrontier Conservation Areas (TFCA) in the form of Iona - Skeleton Coast TFCA and Kavango Zambezi TFCA (KAZA -TFCA). These initiatives convey a strong conservation imperative for future land tenure decisions within these areas and this adds further impetus for the formal designation of cross border Conservation and Utilization Zones.

For the remainder of the borderline rivers and river sections, there is less emphasis placed on non-instrumental value and management operations need not be as sensitive. The geography and ecology of these river sections is relatively uniform and thus crocodile habitat is shared equally between both banks. Both Zambia and Zimbabwe have active crocodile ranching and management programs which include adult and/or egg harvests and trophy hunting. Human populations on the Angolan side of the Okavango River remain comparatively low and there is no crocodile management program in operation at present.

In common law, any animal which is on the Namibian side of the river is effectively owned by Namibia and, provided that animals are actually killed in Namibian waters as part of an official program, no offence will have been committed.

The following actions should be taken:

- Maintaining liaison between wildlife departments and communities managing wildlife on either side of the international border;
- Maintaining linkages between populations;
- Ensuring compatible forms of land use on either side of the international boundary;
- Co-operating on law enforcement directed at illegal persecution;
- Collaborating on air and boat surveys to improve population estimates.
- Setting hunting quotas and monitoring the sustainability of hunting.
- Problem animal control. Experience gained from problem animal control could be shared, including successful deterrents which do not involve killing crocodiles
- Sustainable harvesting of crocodile eggs and/or crocodiles

b) Collaboration with relevant authorities

The management of crocodiles is largely synonymous with the management of freshwater. Considerable resources are deployed towards the management of the greater Zambezi, Okavango and Kunene wetland basins and many of the associated actions are synergistic with crocodile management. Fisheries, hydroelectric schemes, industrial water reservoirs, golf courses and even mining operations can actually enhance crocodile management programs provided there is collaboration and due consideration. Prime examples would be synchronizing crocodile zonation with protected fish breeding areas or constructing ‘crocodile friendly’ water reservoirs for agriculture and industry.

The following actions should be taken:

- Identify those stakeholder initiatives which have similar or relevant management actions.
- Establish a platform for collaboration and synchronize management effort where possible

6. Finance and Capacity

In order to estimate the income and costs it is necessary to estimate population size to determine opening stock. There are no data for the Kunene and upper Okavango and therefore the following value estimates will be confined to the Caprivi region. If necessary, these figures can be doubled for a very crude estimate of total wild population. This, together with cost and cost vs benefit estimates are based on extrapolations of crocodile habitat (see background report).

Stock	Females	Males	Eggs per year
Total numbers	529	417	17986
Value (NAD\$)	1058000	1251000	693600

A key decision is weather to opt for a small scale crocodile ranching program or a large scale program. The former is recommended as most suitable. The following table details comparisons and key costs and benefits of the two approaches. All values in NAD\$.

	Capital investment required	annual profit	Years to profit	risks	direct local jobs	compatibility with vision	scalable
Small scale ranch (500)	650,000	110,000	10	Low	3	High	yes (x4)
Large scale ranch (5000)	3,100,000	700,000	9	high	20	Low	no

The implementation costs of the management plan will vary greatly according to the type and level of utilisation, problem animal control strategies adopted and the extent of survey, monitoring and research undertaken. To give some indication, the development of the small scale ranch (total capital expenses included), research and monitoring on the Kunene river (aerial + boat/foot surveys), 10 workshops (covering all topics and regions) and the removal of 11 problem animals will total approximately NAD\$878,000. Ultimately the running costs and benefits may also vary considerably according to population size, quotas and regional tourism development. It is important to note the lag time necessary for return on investment. The full benefits of a formal crocodile

management program will take at least ten years to realise. The following provides a rough guideline of potential costs vs benefits:

Yearly benefits (NAD\$)		Yearly costs (NAD\$)	
Small scale ranch X 4	440000	Monitoring & research	77000
Tourism (1 x cage diving or similar)	214000	PAC	22440
Sport hunting (25)	510000	Compensation (livestock)	400000
Egg harvest (26% @ 1.70 per egg)	15028		
Total	1,179,028		499,440

6. Risks and assumptions

There is little risk that the management interventions could have an adverse effect on the status of wild crocodile populations in Namibia provided the entire exercise is based on adaptive management with sound monitoring systems in place. It is most likely that the majority of the assumptions presented below will be satisfied. However, any assumption which is not satisfied should be seen as a potential risk.

Assumptions

1. Adequate funding will be available to the MET to maintain its essential functions in Protected Areas.
2. MET will devolve crocodile management to the local stakeholders (which includes representatives of MET).
3. The devolution of rights over crocodiles will improve the overall security of crocodiles, result in sustainable use of the species and create the conditions for maintaining population levels.
4. The status quo of crocodile management programs in neighboring countries remains relatively stable.
5. The fundamental ecological determinants underpinning the population and ecological characteristics of Namibia's crocodile population remain stable. The most important consideration here will be the overall status and trends in wildlife and fish biomass, biodiversity and distribution.
6. Market forces relating to the sport hunting, tourism and crocodile skin industries remain buoyant and relatively stable. Important as a significant percentage of crocodile value is linked to relatively fickle industries (ie tourism and high end fashion)
7. Biological parameter estimates are accurate. Of particular concern is the assumption of age to maturity and trophy size.

Risks

1. Overcapitalization and poor incentive structure will undermine both management and conservation efforts from the start. Management initiatives should be well grounded within the regional context with a clear understanding of local strengths, weaknesses, costs and opportunities. At least initially, financials should be down played to avoid raising expectations and disappointment in the event of suboptimal financial flows. Ultimately the majority of costs and benefits of a crocodile management program are to be borne by regional stakeholders, and therefore it is important that this program be initiated and developed organically in concert with local abilities, resources and philosophies.
2. If the assumptions are satisfied, the risk of illegal persecution by Namibian citizens will decrease. However, successful conservation of crocodiles in Namibia may be undermined by illegal persecution along international borders – particularly from fishing and livestock communities that are not benefitting from wildlife utilization.
3. If the recommendations for determining sustainable use are not observed, there is a risk of unnatural changes in the long term breeding performance and productivity.
4. Crocodile hunting and the exotic skin trade attract considerable attention from animal rights groups. Provided local communities are seen to be benefitting and supporting management efforts, this should not be a significant threat.

8. Implementation Process & Update Procedure

Timing and Duration of Plan

This management plan is time sensitive and therefore the following issues should be addressed as a priority. Failure to act on these prerequisite actions in a timely fashion may result in parts of the management plan becoming redundant.

1. The intention to harvest should be discussed with relevant authorities from neighboring countries. A large number of target animals are those on international

boundaries and the potential for misunderstandings should be removed at the outset.

2. All stakeholders need to be fully aware of the planned management activities before any harvesting commences. Private sector stakeholders, MET staff, conservancy members and local communities outside conservancies need to understand the key parameters and constraints on crocodile management, the responsibilities expected of them in monitoring and the procedures to be followed.
3. From the outset, an adaptive management monitoring system should underpin all management activities and it is essential that this is in place at the start. Apart from the data collection system, a scientist needs to be appointed to analyze and interpret the data.
4. The above implies that considerable training should take place. Ideally this should take place at a series of workshops over a period of time and involve follow up sessions where necessary.

Drafts of this Species Management Plan will be reviewed in 2012. A Final Plan should be ready for adoption by 2013. Thereafter the management plan should undergo mandatory reviews every five years – preferably synchronized with the results from the surveys. If any changes are needed in the plan, the document should be modified, updated and re-approved.

Appendix 1

Actions for the establishment of a crocodile ranching industry in Namibia

1. Formulate supportive subsidiary legislation.
2. Encourage a system or group of people to orchestrate a national crocodile sustainable use program. A 'crocodile management association' consisting of public and private stakeholders could facilitate collaborations, regulation, production efficiency and marketing.
3. Encourage the establishment of a crocodile ranch in NE Namibia. Kongola is probably a feasible location based on proximity to feed, water and tourists
4. Encourage the establishment of a tourism section within the park
5. Encourage and support existing or emerging private sector crocodile farms to collaborate with a strong emphasis on ranching rather than closed system farming.
6. Ensure all problem animals that are not taken by sport hunters or otherwise destroyed are captured and retained as captive breeding stock
7. Encourage conservancies to partake in crocodile specific management actions such as monitoring basking animals, locating crocodile nests or likely nesting beaches. An Event Book crocodile sheet should be encouraged, including conflict, monitoring and sustainable use.
8. Ensure that annual returns from ranches include information on eggs collected, number and location of nests searched, number of eggs per nest and number of eggs hatched.
9. Allocate egg collection to ranches and prohibit egg collection by third parties or middlemen.
10. Develop a capture and transport protocol.
11. Carry out feasibility study on crocodile ranching in Namibia and submit proposal to CITES for consideration and approval.

12. Establish minimum standards for: the percentage of fertile eggs which hatch, the percentage of hatchlings which die before end of year, and the percentage of yearling and older animals which die each year
13. Ensure a suitable penalty system if standards are not met
14. Monitor to ensure that no illegal farms or ranches are established without appropriate permission.
15. Ensure that annual reports of all ranching activities are submitted on an annual basis
16. Ensure compliance with CITES requirements including: a) CITES tags and relevant inspections before export b) origin of specimens to be correctly tagged and recorded by MET c) MET to submit annual report to CITES secretariat
17. Initiate and maintain collaborative research and monitoring between academic institutions, MET, NGOs and conservancies. Themes should focus on improving in- and ex-situ aspects of ranching efficiency and output.
18. As a medium to long term goal, a value adding production industry involving local skilled craftsman should be encouraged. Crocodile skin, skulls, teeth and claws all make excellent materials for a variety of curios.
19. Explore ways to capitalize on Namibia's superior commitment to the conservation and social benefits of crocodile ranching and the crocodile skin industry.