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Ministry of Environment and Tourism
Republic of Namibia

SPECIES MANAGEMENT PLAN

Hippopotamus

Hippopotamus amphibius

September 2005

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GLOSSARY AND DEFINITION OF TERMS

Acronyms

CITES	- Convention on International Trade in Endangered Species of Wild Fauna and Flora
DPW	- Directorate of Parks and Wildlife
DSS	- Directorate of Scientific Services
DWNP	- Department of Wildlife and National Parks, Botswana
GEF	- Global Environment Fund
MET	- Ministry of Environment and Tourism
NNF	- Namibia Nature Foundation
PAC	- Problem Animal Control
TFCA	- Trans-Frontier Conservation Area
UNDP	- United Nations Development Programme
WWF LIFE	- World Wide Fund for Nature: Living In a Finite Environment programme

Definition of Terms

Background Study: This refers to the *Background Study for Hippopotamus* prepared under the Ministry of Environment and Tourism's **Transboundary Mammal Project** (Martin 2005b).

“Caprivi” and “Caprivi Strip”: The word ‘Caprivi’ is used throughout the Plan to refer to the ‘peninsula’ of land extending eastwards from the north-eastern corner of Namibia as far as its junction point with Botswana, Zambia and Zimbabwe at the confluence of the Chobe and Zambezi Rivers. The phrase ‘Caprivi Strip’ is reserved for the narrow ‘isthmus’ connecting the broader part of the peninsula to the main body of Namibia.

Population and Subpopulation: In this report, the term subpopulation is loosely used to refer any geographically distinct subdivision of the overall population within a country.

“Kasane Workshop”: A workshop was held in Kasane, Botswana on 30th November and 1st December 2002 in which representatives of the Namibian Ministry of Environment and Tourism and the Botswana Department of Wildlife and National Parks participated with the aim of collaboration on joint management issues affecting the buffalo population shared between the two countries. The *Background Study for Southern Savanna Buffalo* (Martin 2002) was presented at the workshop.

“Windhoek Workshop”: A workshop was held in Windhoek on 23rd September 2003 in which representatives of the Namibian Ministry of Environment and Tourism and the Botswana Department of Wildlife and National Parks participated with the aim of collaboration on joint management issues affecting roan, sable and tsessebe. The *Background Study and Management Plan for Roan, Sable and Tsessebe* (Martin 2003) were presented at the workshop.

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I would like to thank all those people who gave so kindly of their time and valuable experience to this study. In particular, I thank Chris Brown of the Namibia Nature Foundation, who continues to provide me with the space to explore interesting concepts and whose enthusiasm, support, drive and organising ability has resulted in the study coming to fruition. From the Ministry of Environment and Tourism I thank Malan and Pauline Lindeque (both for their professional opinions and personal hospitality), Ben Beytell (who spared time for me when he should have been recuperating from a medical operation), Mike Griffin (who I can always rely on for the historical record and larger conservation context), Peter Erb (who responds instantaneously to requests for information), John Barnes (whose economic studies have been quoted in each of these reports), Joe Tagg (who sees considerable value in hippo as producers of *sjamboks*) and Uatjavi Uanivi (who has always helped with survey data). I am indebted to John Mendelsohn whose outstanding Namibian Atlas data base has been central to all these studies and who always allows me to waste an hour of his time when visiting Windhoek. Mr Schumann (the retired Director of the Namibian Scientific Society) has assisted me on each of these studies with rich historical material despite not yet having seen any one of the finished reports. Without Flip Stander's excellent survey of the Caprivi hippo this study would have been entirely superficial and Simon Mayes at NNF has supplemented the survey data with numerous other valuable items.

EXECUTIVE SUMMARY

Conservation status

The common hippopotamus is distributed throughout Africa (**Map 1**) and the continental population is estimated to lie between 130,000 and 155,000 animals. More than half of this number (some 80,000 animals) is in southern Africa and the major part of the population lies in a belt extending across the region between latitudes 15°-25° south of the equator. Namibia holds about 1% of the African hippo population – some 1,500 animals.

The conservation status of hippo is of ‘least concern’ in the IUCN Red Data Book. Despite this, the species was listed on Appendix II of CITES in 1995. Under Namibian law hippo are classified as *Specially Protected Game*. It is difficult to see the reason for this because the conservation status of hippo in Namibia is satisfactory and the listing may actually be preventing the species from playing a greater rôle in the developing wildlife industry.

The main hippo population in Namibia is in the Caprivi (**Map 2**). In 2004 it was estimated at 1,387 animals of which 872 were in State Protected Areas, 69 in conservancies and the remainder (446) in communal land. Some 400 of these animals should probably be regarded as ‘belonging’ to neighbouring countries. The highest numbers are in Mamili National Park (560) and, based on the densities here, it is estimated that the Caprivi might carry as many as 5,000 hippo. Numbers on the Zambezi River are disappointingly low (17) but this may be attributed to the high human and cattle populations on the floodplains and illegal hunting. No upward or downward trends in the population can be inferred from present data.

A small number of hippo occur on the Cunene River in the vicinity of the Ruacana Falls although it is not certain whether there are now any hippos downstream of the falls. There are also a few pockets of hippo on the Okavango River outside the Caprivi (less than 40 in total). Although the floodplains are not as extensive on this part of the Okavango River as, for example, below the Popa Falls, there are nevertheless numerous areas which would be suitable for hippo were it not for the fairly dense human settlement, crops and cattle along the river. The newly formed Joseph Mbambangandu conservancy near Shambyu on the Okavango River may well attract hippo to the floodplains in that area in the future.

There are few options for extending the range of hippo in the remainder of Namibia because of the absence of suitable permanent water supplies. The general feeling is that it would not be worthwhile stocking hippos in any of the large dams in the interior of the country because of the low carrying capacity of the pastures surrounding the dams. Reintroduction of hippo to the Orange River may be worthwhile and could assume the status of a flagship project. However, it should not be expected that the Orange could ever support large numbers of hippo as it falls below the 100mm rainfall isohyet.

Economic potential

The economic contribution which hippopotamus could make to the wildlife industry in the Caprivi is significant. Under a management regime which entails sustainable quotas for trophy hunting, problem animal control and harvesting, the combined annual net income from the present hippo population would be close to US\$100,000 (N\$630,000). This could rise to a half-million US dollars if the hippo population could be raised to the estimated ‘carrying capacity’ (5,000 animals). In economic terms, the ‘net value added’ could be expected to be at least double the value of the cash income. If put into practice, this management would more than offset the costs which hippo are presently causing through crop raiding in the Caprivi.

Were the proposed hippo management programme to be combined with sustainable use of the elephant population as recommended in the *Elephant Management Plan*, the potential combined net income from hippo and elephants would be about US\$5/ha – a figure which exceeds the value of agricultural and cattle production in the Caprivi.

Limiting factors

The majority of Namibia is unsuitable for hippo. Only the Caprivi has a high enough rainfall and suitable floodplain habitats to carry a significant hippo population. **The proximate factors limiting hippo in the Caprivi are human settlement, competition with cattle and some illegal hunting.** Conservancy development in the Caprivi has reduced illegal hunting by Namibians but, with the major rivers being shared international boundaries, Zambians and Angolans have the capability of reducing the Namibian ‘share’ of hippo in the Zambezi and the Okavango river.

The ultimate factor limiting hippo may be a lack of understanding of the potential value of wildlife management as the primary form of land use in Caprivi. There is still a deep cultural attachment to cattle raising and crop growing. Conservancies cover a relatively small part of the Caprivi and much of the potential range for hippo, particularly in the eastern Caprivi, lies outside state protected areas and conservancies.

Hippo are not tolerated in many parts of the Caprivi because of damage to crops and the fact that they are dangerous animals. Crop damage by hippos in the Kwando region conservancies has been estimated at about N\$20,000 per year and this has significant effects on household livelihoods. People who are not in established conservancies in the Caprivi receive little in the way of benefits from hippo and they also suffer substantial losses. Farmers are not free to defend their livelihoods from hippo depredations and the current arrangements for control of problem hippo are cumbersome.

Full devolution of rights over hippo to communal landholders may be the needed administrative measure to overcome these limiting factors and to creating the correct suite of incentives for hippo populations to expand. This authority would have to extend to stakeholders who are not formed into conservancies.

MANAGEMENT PLAN

Hippo are unlike any other species for which management plans have been prepared under this Transboundary Mammal Project. Not only do they require suitable habitats in which to graze but also they need a ‘daily living space’ in an aquatic environment. Hippo populations exhibit a remarkable ‘plasticity’ in their population dynamics, being capable of rapid population increase when conditions are favourable and long periods of self-regulated stasis when they are not. This implies that they would be resilient to harvesting: the corollary is that by not harvesting the population is unlikely to increase greatly – its own homeostatic mechanisms will come into play to limit population growth.

Vision, Goal, Objectives and Actions

The Vision Statement begins with a preambular statement which recognises the value of wildlife as a form of land use, notes the potential contribution which hippos could make to this value, expresses Namibia’s desire to work with neighbouring countries to enhance the status of hippos and concludes that a policy of sustainable use, as enshrined in the Namibian constitution, should benefit both hippos and people. The goal and objectives then follow –

GOAL

Namibia wishes to maintain and increase its population of hippopotamus whilst using it sustainably for the benefit of people

ECONOMIC OBJECTIVE

To enable the full economic potential of hippopotamus to be realised according to the provisions for sustainable use in Namibia’s Constitution

SOCIAL OBJECTIVE

To promote local management of hippopotamus in those places where they interact with people in order to reduce conflict and provide benefits

ECOLOGICAL OBJECTIVE

To create conditions under which hippo populations can increase

The three main **Actions** are – (see **Fig.1** at the end of this Summary)

- (1) to re-introduce Hippo to the Orange River;
- (2) to protect the remnant populations of the Cunene and upper Okavango rivers *in situ*; and
- (3) to manage the Caprivi hippo population for maximum sustainable benefit.

The remainder of the management plan focuses on the management of the Caprivi hippo to achieve this last objective.

Management of the Caprivi Hippo

Sustainable Use

The highest valued use for an adult male hippo lies in the sport hunting industry. A sensible strategy is to allocate the maximum quota for sport hunting, limit the number of problem animals to the minimum and implement a hippo harvesting programme which is sustainable and which will allow hippo numbers to increase gradually towards carrying capacity. In setting quotas for these three types of management, allowance has been made for population subunits which are shared with neighbouring countries. Quotas have been set using a population model specifically designed for this project.

Trophy hunting It is assumed that sport hunting will be restricted to male hippo aged 20 years or more. **An offtake about one-half a percent of the total population is sustainable and allows some males to reach the age of 30 years** (see **Fig. 2D**, page xii). This results in a **quota of 5 trophy males** for the Caprivi – which is much lower than the present quota of 15 animals. The offtake of trophy hunting quotas is not affected by any other management interventions taking place at the same time (problem animal control and harvesting) provided these other uses are unselective with regard to age and sex and fall within sustainable limits (**Figs 2E & 2F**).

Problem animal control (PAC) Although quotas of up to 6% of the total population are sustainable,¹ high offtakes of problem animals have the undesirable effect of narrowing the upper part of the age pyramid and broadening the base (see **Fig. 2C**). For this reason **the quota has been limited to 10 animals** (1% of the total population) – determined more by past practical experience in the Caprivi than by the biological factors. It would be good practice to kill even fewer than this and include any surplus animals in the harvesting quota.

Population harvesting Harvesting should be practised unselectively to avoid altering the age structure of the population in a manner which may produce undesirable long term effects. **Offtakes of up to 7% of the total population are possible, provided the harvest is unselective** – in which case the age structure of the harvested population is identical to that of the unharvested population (**Figs.2A & B**). Allowing for the trophy hunting and PAC offtakes above, a **quota of 45 animals is sustainable** and should allow the population to increase. The age structure which results from this management regime is shown in **Fig.2F**.

Adaptive management

Given the high degree of variation in hippo reproductive parameters, the population response to these management interventions is difficult to predict. An adaptive management system is essential and the key parameters to be monitored are population numbers, and the ages and reproductive status of all animals killed.

1. It has been assumed that problem animal control (PAC) is limited to animals older than 5 years and that both males and females are included without selectivity for larger animals.

Implementation

The Caprivi hippo population is dispersed in a number of geographically discrete subunits on the different rivers in the Caprivi and this results in a number of small quotas for different areas (**Fig.1**, page xii).

Institutions Because these individual hippo population subunits are fairly localised and sedentary **management can be applied at a local scale**. A benefit of local management is that it preserves the ‘**principle of differential benefits**’ whereby those local communities who are successful in increasing or maintaining their hippo populations can deservedly gain higher benefits than others. This principle will become increasingly important if a hippo harvesting scheme is introduced: hippo should not be seen as ‘common pool’ resource.

The present institutions for conservancies would be adequate for the purposes of hippo management were it not for the substantial portion of the hippo population which lives in the communal land outside conservancies. Of the total hippo population in the Caprivi (1,400 animals), 70 occur within conservancies and 500 are in the communal land outside them. There is a good case for **devolution of hippo management to a stakeholder body within the Caprivi** which would include representatives from all areas where there are resident hippo including those outside conservancies. Provided such a caucus was advised by a competent scientist and a sound monitoring programme was in place, it would greatly improve the likelihood of the proposed project being successful.

A ‘Project’ approach There is scope for increasing benefits for all stakeholders in the Caprivi by introducing a harvesting programme for hippos. In calculating the potential gross and net incomes from hippo (**Appendix 1**) it was found convenient to put the various stakeholders into two groups: the first group includes all safari operators engaged in hunting hippo and the second group includes the land occupiers of State protected areas, established conservancies and communal land in the Caprivi. This second group are the stakeholders in the “**Project**”.

The question arises whether there is justification for some sort of central facility in the Caprivi to handle hippo carcasses efficiently so that the maximum value is obtained from the products on behalf of all the stakeholders in the ‘Project’. Because the total number of animals to be killed in the course of the ‘Project’ is only 60 and because they occur mainly in ones and twos over widely separated areas, a central facility for processing carcasses does not appear justified. There is, however, a good case for setting up a facility for storing skin prior to its being marketed. Slightly more than 3 tonnes of dry first crust salted skin valued at US\$50,000 (N\$300,000) is expected from operations. Wherever a hippo is killed in the Caprivi, it should be skinned by trained skimmers and the skin immediately salted. If it is later decided to expand to the first stages of tanning skins, such a facility would need to be near a good supply of water and close to a source of labour.

A larger facility might be justified if the hippo project was combined with a comprehensive elephant management operation (as put forward in the **Elephant Management Plan**). It would provide employment and increase the economic benefits of the wildlife industry.

Finance and Capacity

The budgets for the two stakeholder groups referred to on the previous page are calculated in **Appendix 1** (page 23) and summarised below. The total returns to the ‘project’ have to be parcelled out amongst the various stakeholders in the ‘project’ and this exercise has been done in the table at the end of Appendix 1.

All figures in United States dollars

Safari Operators		“The Project”	
<u>Income</u>		<u>Income</u>	
Hippo trophy fees	25,000	Hippo products	70,000
Daily rates	10,000	Operators’ rental	8,750
Gross income	35,000	Gross income	78,750
<u>Costs</u>		<u>Costs</u>	
Operating costs	2,000	Operating costs	5,500
Rental to ‘Project’	8,750	Net income	73,250
Net income	26,250		

Rental paid by the safari operators to the ‘Project’ is 25% of gross income and includes hippo trophy fees.

The numbers of hippos (N), management quotas (Q) and distribution of income amongst the various categories of land in the Caprivi are summarised below. Numbers of hippo have been adjusted to taken into account populations shared with neighbouring countries.

	Hippos		Sport hunting		PAC		Harvesting		TOTAL US\$
	N	Q	US\$	Q	US\$	Q	US\$		
State Protected Areas	575	3	11,250	1	1,400	28	25,200	37,850	
Conservancies	100	2	7,500	6	8,400	7	6,300	22,200	
Communal land	223	0	0	3	4,200	10	9,000	13,200	
Totals	898	5	18,750	10	14,000	45	40,500	73,250	

The current project to strengthen the system of national protected areas (UNDP 2005) should provide the necessary funding and capacity for MET to carry out its normal functions, including law enforcement and monitoring. In all areas where local communities will be processing hippo carcasses, training of specialised individuals for butchery and skinning is a prerequisite for the success of the project.

Risks and Assumptions

There is little risk that the proposed management interventions could have an adverse effect on the status of hippo populations in Namibia – provided the entire exercise is based on adaptive management with sound monitoring systems in place.

Transboundary Co-operation

The case for transboundary cooperation on hippo management is perhaps stronger than for all of the other species which have been considered under the Transboundary Mammal Project so far. Hippo live in perennial rivers on international boundaries and some 35 % of the Caprivi hippo population must be regarded as 'shared animals'.

Namibia is in the unique situation that the only perennial rivers in the country all form part of international boundaries. A past history of hunting by UNITA on the Cunene, Okavango and Kwando Rivers has had a significant impact on Namibia's hippo populations. With peace in Angola, it is to be hoped that co-operation on conservation and management of shared species such as hippo will result in benefits for both countries.

Hippo have not received much conservation attention from Zambia and Zimbabwe in recent years and there is little doubt that the illegal hunting which has taken place in the Zambezi has had an effect on Namibia's hippos. This is all the more reason for Namibia to seek cross-boundary collaboration with these countries – to the extent of suggesting joint management programmes which will produce benefits for local peoples in these neighbouring countries.

The situation along the Chobe, Linyanti and Kwando Rivers is somewhat different. Illegal hunting by Botswana citizens has been minimal and there are national parks and community-based natural resource management areas along the river frontages. Namibia needs to exercise considerable sensitivity in exploiting hippos along these rivers. There is a strong case for keeping Botswana fully informed on quotas, the assumptions made in setting them, the rationale behind any management programmes and, in general, seeking their full participation.

Most of the management activities identified for potential co-operation and collaboration between Botswana and Namibia at the Kasane Workshop (2002) and Windhoek Workshop (2003) repeat themselves in this Management Plan. The issue of joint management is an option which might be considered. Botswana has recently re-affirmed its intention to pursue a policy of sustainable use and it would be highly desirable if a common management programme for hippopotamus could be developed. If successful, it could be extended to the other countries sharing the Caprivi hippo population.

The population of hippo in Botswana is thought to lie between 2,000 and 4,000 animals. Only the proportion of these occurring along the Kwando, Linyanti and Chobe rivers would be involved in any joint operations with Namibia. Were Botswana to join with Namibia in harvesting from the shared population, the sustainable offtakes might be high enough to justify the construction of a permanent facility to process the meat and skins..

With or without the participation of neighbouring countries, Namibia should not be hesitant in going ahead with any harvesting scheme in the Caprivi. In common law, any animal which is on the Namibian side of the river is effectively owned by Namibia and, provided that no animals are actually killed on the Botswana side of the international boundary in the course of an officially sanctioned hippo management programme, no offence will have been committed.

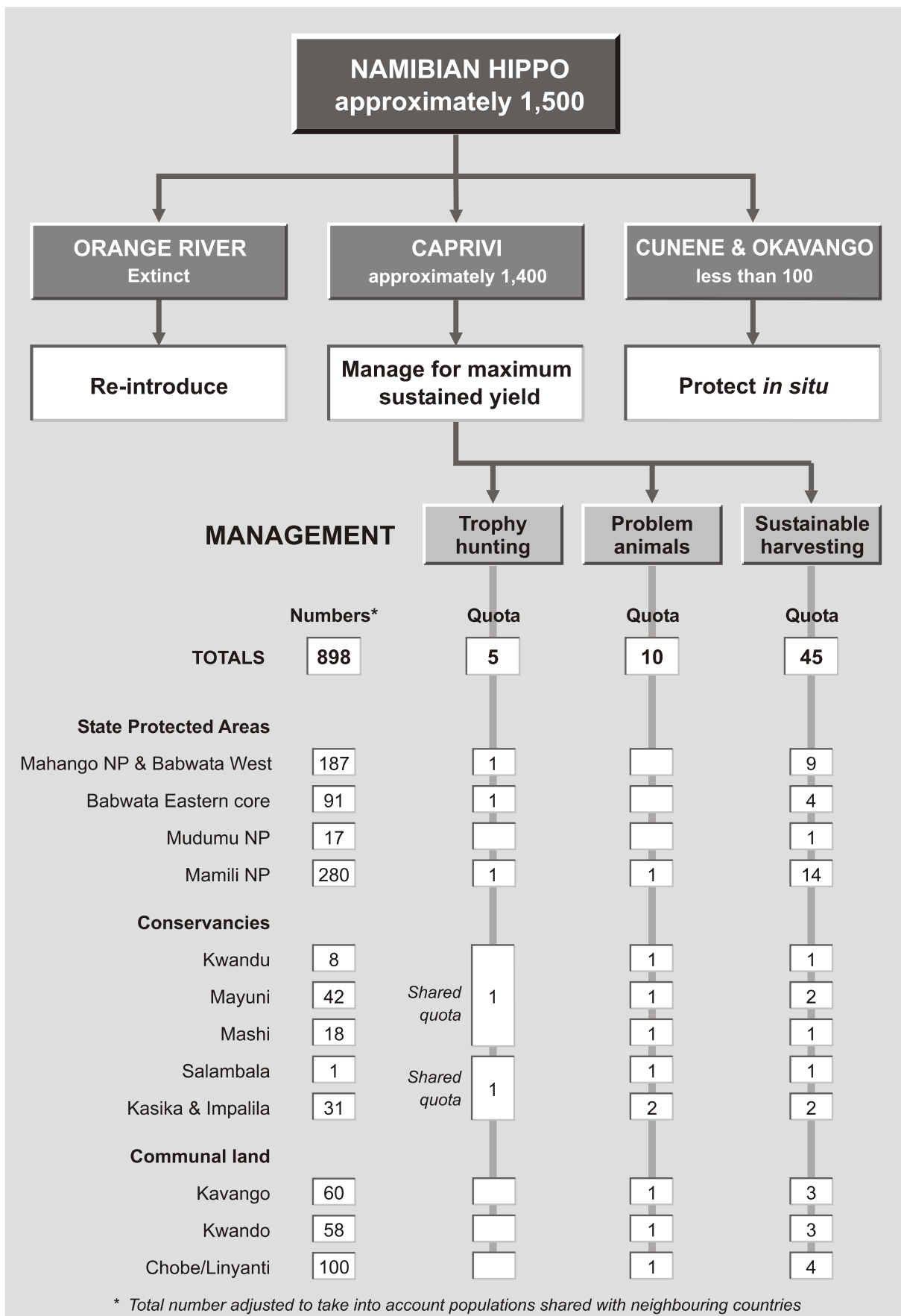


Fig. 1: Management of the Namibian Hippopotamus Population

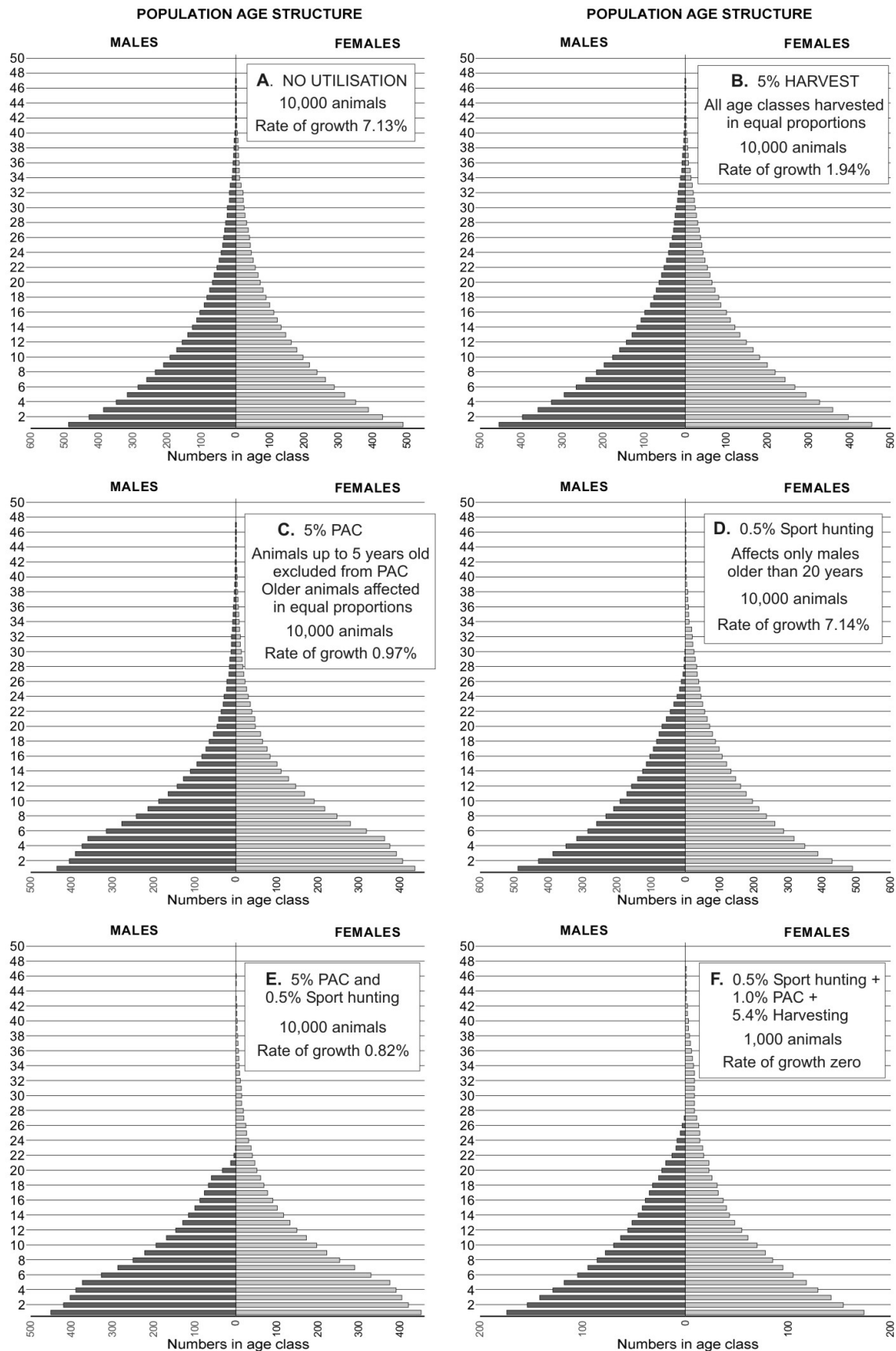


Fig. 2: Effects of various management practices on the age structures of a hippo population

INTRODUCTION & BACKGROUND

This **Species Management Plan** should be read in conjunction with the **Background Study for Hippopotamus** prepared under the **Transboundary Mammal Project** of the Ministry of Environment and Tourism in August 2005.

Conservation Status and Significance

The Common Hippopotamus (*Hippopotamus amphibius* Linnaeus 1758) is in the **Family** SUIDAE (wild pigs and boars), one of three families in the **Suborder** SUINA which is one of three suborders in the **Order** ARTIODACTYLA (even-toed ungulates) which, together with the Perissodactyla, form the **Group** UNGULATA (Ungulates) in the **Superorder** LAURASIATHERIA (mammals with Old World origins) in the **Infraclass** EUTHERIA (placental mammals) in the **Subclass** THERIA (mammals bearing live young) in the **Class** MAMMALIA (mammals). No subspecies of common hippo are recognised and the only other hippo species, the Pygmy Hippo (*Hexaprotodon liberiensis*), is a separate genus (Macdonald 2001).

The species is classified as 'Least concern' in the IUCN Red Data Book (Hilton-Taylor 2000). It was listed on Appendix II of CITES in 1995 contrary to the provisions of the criteria for listings.

The common hippo is distributed throughout Africa (**Map 1**) and the population in the whole of Africa is estimated to lie between 130,000 and 155,000 animals (HSG 2004). More than half of this number (some 80,000 animals) is in southern Africa and the major part of the population lies in a belt extending across the region between latitudes 15°-25° south of the equator. Namibia holds about 1% of the African hippo population and most of the animals (about 1,500 – ignoring for the moment that this population is shared with neighbouring countries) are in the Caprivi.

The species is not under any threat in Namibia although the subpopulations on the Cunene River and upper Okavango are very small. However, given the aridity of the Cunene region and the high human population densities on the Okavango River it cannot be expected that there will ever be large subpopulations in these areas. The Orange River held hippo until very recently (1925) and reintroduction of the species could be considered now that wildlife is becoming a major land use in the south of Namibia and there are initiatives to form a trans-frontier conservation area with South Africa. The Caprivi population could be increased to perhaps 5,000 animals but this is dependent on wildlife in general playing a larger rôle as the primary land use in the region.

The economic contribution which hippopotamus could make to the wildlife industry in the Caprivi is significant, especially if it were to be combined with sustainable use of the elephant population (see Elephant Management Plan – Martin 2005a). Under a management regime which entails sustainable quotas for trophy hunting, problem animal control and harvesting, the combined net income is close to US\$100,000 (N\$630,000). Applying this to the area of hippo habitat in the Caprivi (3,181km² of floodplains) it translates to a land use return of US\$0.31/ha (N\$2/ha). If the hippo population could be increased to 'carrying capacity' (5,000 animals), the net return would rise to US\$1.71/ha (N\$11/ha). At this level it would amount to more than half of the potential land use value of elephant (US\$3.3/ha calculated in Martin 2005a) and the potential combined net income from hippo and elephants would be about US\$5/ha.

In economic terms, the 'net value added' to land use values through such a management system could be expected to be at least double the value of the cash income (Barnes & de Jager 1995). If put into practice, this management should more than offset the costs which hippo are presently causing through crop raiding in the Caprivi.

Hippo are classified as *Specially Protected Game* under Namibian law (Schedule 3, Nature Conservation Ordinance, Order No.4 of 1975). The original justification for such a listing may well have disappeared. However, designating the species as *Protected Game* (Schedule 4) or as *Huntable Game* (Schedule 5) or as a *Problem Animal* (in terms of Section 53(1)) would not introduce any greater flexibility in the management of the species as long as the provisions of section 37 (hunting of game to protect grazing, cultivated lands and gardens) expressly exclude hippopotamus from being hunted by communal lands residents (subsection 37(1)(a)(ii)) in defence of their own livelihoods. **To achieve the objectives of this Management Plan, several revisions to the legal provisions for hippopotamus under Namibian legislation would be desirable.**

Populations

The main hippo population in Namibia is in the Caprivi (**Map 2**) and was estimated at 1,387 animals by Stander (2004) of which 872 were in State Protected Areas, 69 in conservancies and the remainder (446) in communal land.² Martin (2005b) calculated that some 390 of these animals should probably be regarded as ‘belonging’ to neighbouring countries. It is difficult to infer any trends in the population because there are no survey data which compare readily with those of Stander (2004) and because the earlier data are too sporadic to permit any meaningful trend analysis. The estimates from Stander’s individual survey strata are shown below.

Kavango	Kwando	Mamili NP	Chobe/Linyanti	Zambezi	TOTAL
247	308	560	255	17	1,387

The survey strata included the following areas –

Kavango – Mahango NP, Babwata West and the floodplains northwards as far as the main road

Kwando – Babwata east, Kwandu, Mayuni and Mashu conservancies and Mudumu NP

Mamili – Mamili NP only

Chobe/Linyanti – the full extent of these rivers eastwards of Mamili including Salambala conservancy

Zambezi – the international boundary from Katima Mulilo to the Chobe River confluence.

Although the most extensive floodplains in the Caprivi occur along the Zambezi River, the hippo numbers are disappointingly low. This is entirely due to high density human settlement and cattle populations (**Map 3**). The high density hippo population in Mamili national park has been used to estimate the possible carrying capacity for hippo in the Caprivi – about 5,000 animals.

A small number of hippo occur on the Cunene River in the vicinity of the Ruacana Falls although it is not certain whether there are now any hippos downstream of the falls. There are also a few pockets of hippo on the Okavango River outside the Caprivi (less than 40 in total). Although the floodplains are not as extensive on this part of the Okavango River as, for example, below the Popa Falls, there are nevertheless numerous areas which would be suitable for hippo were it not for the fairly dense human settlement, crops and cattle along the river. The newly formed Joseph Mbambangandu conservancy near Shambyu on the Okavango River may well attract hippo to the floodplains in that area in the future.

There are few options for extending the range of hippo in the remainder of Namibia because of the absence of suitable permanent water supplies. The general feeling is that it would not be worthwhile stocking hippos in any of the large dams in the interior of the country because of the low carrying capacity of the pastures surrounding the dams. Reintroduction of hippo to the Orange River may be worthwhile and could assume the status of a flagship project. However, it should not be expected that the Orange could ever support large numbers of hippo as it falls below the 100mm rainfall isohyet.

2. Included in this number are 184 hippo which more correctly should be seen as being in Chobe National Park, Botswana.

Limiting Factors and Threats

Hippo are unlike any other species for which management plans have been prepared under this Transboundary Mammal Project. Not only do they require suitable habitats in which to graze but also they need a 'daily living space' in an aquatic environment. Hippo populations exhibit a remarkable 'plasticity' in their population dynamics, being capable of rapid population increase when conditions are favourable and long periods of self-regulated stasis when they are not.

The majority of Namibia is unsuitable for hippo. Only the Caprivi has a high enough rainfall and suitable floodplain habitats to carry a significant hippo population. **The proximate factors limiting hippo in the Caprivi are human settlement, competition with cattle and some illegal hunting.** Conservancy development in the Caprivi has reduced illegal hunting by Namibians but, with the major rivers being shared international boundaries, Zambians and Angolans have the capability of reducing the Namibian 'share' of hippo in the Zambezi and the Okavango river.

The ultimate factor limiting hippo is that there is still not a commitment to wildlife management as the primary form of land use in Caprivi. Because of a larger choice of land use options than in the arid areas of Namibia, the Caprivi is the focus for conflict between wildlife management and people, domestic livestock and cultivation. There is still a deep cultural attachment to cattle raising and crop growing. Conservancies cover a relatively small part of the Caprivi and much of the potential range for hippo, particularly in the eastern Caprivi, lies outside state protected areas and conservancies.

The species is not tolerated in many parts of the Caprivi because of damage to crops and the fact that hippo are a physical threat to humans. The greatest recorded conflict between humans and hippos occurs on the Kwando River frontage and incidents reach a peak in the crop growing season. In 2003 the number of incidents involving hippo in the eastern Caprivi conservancies was 263 – which exceeds the number of incidents involving elephant (253).³ The estimated value of damage to crops by elephants from 1995-2000 for the whole Kwando River region was about N\$20,000 per year (O'Connell-Rodwell *et al* 2000): it might be expected that the value of hippo damage is similar. This has significant effects on household livelihoods.

The present hippo quota allocations to conservancies in the Caprivi are substantially higher than those for elephants and the benefits may be sufficient to provide tolerance for hippo in some areas. However, those people who are not in established conservancies in the Caprivi receive little in the way of benefits and they suffer substantial losses. Farmers are not free to defend their livelihoods from hippo depredations and the current arrangements for control of problem hippo are cumbersome. O'Connell (1995) found a hostile attitude towards wildlife amongst the Caprivi peoples and the inception of conservancy projects did little to ameliorate this attitude.

Full devolution of rights over hippo to communal landholders is a prerequisite for creating the correct suite of incentives for hippo populations to expand and this authority would have to extend to stakeholders who are not formed into conservancies.

3. Incidents of crop damage in conservancies are recorded in the Conservancy Event Book (NNF 2004). Hippo incidents do not appear to be increasing in number – unlike elephant incidents.

Background and Rationale for the Management Plan

Under the present Namibian environmental legislation, management plans are required for species which are rare or valuable and which share boundaries with neighbouring countries. The hippopotamus is not rare but is potentially valuable and could contribute a significant financial return to the people of the Caprivi and provide employment. **A management plan which treats hippos as the valuable resource which they are could become an engine for development in the Caprivi.**

With Namibia's commitment to sustainable use and highest valued forms of land use, it seems justified to assume that hippopotamus will continue to be subjected to consumptive use⁴ and that **there are sound reasons for trying to maximise the benefits which could be derived from scientific management of the Caprivi population.**

The southern African region holds more than half of the hippo population in Africa and the largest concentrations are in a zone extending across the continent between latitudes 15°-25° south of the equator. Because a large number of hippo occur in rivers which are shared international boundaries **there is strong justification for a focus on hippo in the present initiatives to create trans-boundary conservation areas in the region.**

This plan has no relationship to standard government five-year budgeting plans – except insofar as the required operational expenditure for State Protected Areas needs to be maintained continuously above the minimum threshold needed for effective management and law enforcement. To increase the numbers of hippo to the carrying capacity for the Caprivi (and in the Cunene and Okavango rivers) will require many factors to act favourably – including continued success in conservancy development, greater devolution of authority to manage wildlife and a reversal of the present spread of unplanned settlement and land clearance. Enhancing the value of hippo and wildlife in general is likely to be the most effective antidote to this last factor.

4. At present about 23 hippo are killed on quotas in the Caprivi as opposed to the 60 proposed in this study. A small amount of 'harvesting' takes place in the form of traditional use quotas for the Kwando conservancies.

Plan Structure

In each of the preceding species management plans under the Transboundary Mammal Project it has been found necessary to make minor adjustments to the *pro forma* layout which formed part of the original terms of reference. Some additional small changes have been made in this plan – to suit the specific requirements for the species.

Conventionally, most wildlife management plans begin with ecological and biodiversity considerations. **This plan begins with the economic considerations**, followed by the social issues and ecological factors. In order to achieve the ecological objective, that of creating the conditions for the Caprivi hippo population to increase, it may be necessary to achieve both the social and economic objectives first. Fortunately in the case of hippopotamus, there is far less controversy over consumptive use than in the case of elephant. Thus the emphasis in this plan is more on sustainability issues than on the ethics of exploiting hippos.

- (1) The plan begins with a **VISION** statement which incorporates a **GOAL** and three objectives – an **ECONOMIC OBJECTIVE**, a **SOCIAL OBJECTIVE** and an **ECOLOGICAL OBJECTIVE**. The Vision builds on evolving Namibian policy.
 - (2) A set of **ACTIVITIES** needed to achieve the objectives follows. The point is made that hippo are an unusual species with variable population dynamics and the management interventions require an **ADAPTIVE MANAGEMENT** approach based on sound monitoring. Some practical details for **IMPLEMENTATION** of a project are given.
 - (3) **FINANCE AND CAPACITY**: Like the elephant management plan which preceded this, the income from hippo management should more than meet all implementation costs and it is recommended that the plan is not submitted to donors. An estimate of the expected income from hippo management is presented in **Appendix 1**.
 - (4) The **RISKS AND ASSUMPTIONS** implicit in the plan are then detailed.
 - (5) The key issues on which **TRANS-BOUNDARY COOPERATION** is desirable are highlighted, and it is noted that of all the species studied in the Transboundary Mammal Project, hippo are perhaps the highest priority for collaboration.
-

MANAGEMENT PLAN

VISION, GOAL AND OBJECTIVES

This Vision Statement consists of a preambular part and an operative part in which the overall goal and objectives are stated. The activities to achieve the objectives are then presented.

VISION

PROMOTING wildlife management as the optimum land use in the arid environment of Namibia and treating hippos as one of many valuable species in the diverse large mammal community;

NOTING the significant financial and economic contribution which hippos could make as part of wildlife-based land use;

RECORDING the fact that Namibia has a secure and viable population of hippos in the Caprivi;

WILLING to continue to commit public funds to the protection and management of the species;

DRAWING ATTENTION TO the costs entailed in conserving the species which include the damage which hippos inflict on human livelihoods;

BEING AWARE of the unique biological characteristics and habitat requirements of the species;

CO-OPERATING with neighbouring countries to achieve the security of hippos and improve their biological status;

CONVINCED that a policy of sustainable use, as enshrined in the Namibian constitution, will result in the long term conservation and enhancement of hippo populations;

Accordingly, the **Ministry** has the following goal and objectives –

GOAL

Namibia wishes to maintain and increase its population of hippopotamus whilst using it sustainably for the benefit of people

ECONOMIC OBJECTIVE

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

SOCIAL OBJECTIVE

To promote local management of hippopotamus in those places where they interact with people in order to reduce conflict and provide benefits

ECOLOGICAL OBJECTIVE

To create conditions under which hippo populations can increase

ACTIONS

The management strategy for the Namibian hippo population appears in **Fig.1** (page xii). It is recommended that –

- (1) The **Caprivi hippo population** should be managed for maximum sustainable returns for both the State and local communities. The main content which follows will be on how to achieve this.
- (2) The small populations of hippo on the **Cunene River** and **Okavango River** (upstream of the Caprivi) should be protected as far as is possible *in situ*. There is some doubt whether any hippo now occur downstream of the Ruacana Falls on the Cunene and, in any case, the aridity of this region will always limit the potential for hippo. The area along the Okavango River where it forms the international boundary with Angola is densely settled by people and any hippo surviving here will always have the status of problem animals. The only exception to this may lie in initiatives (such as have been taken by Joseph Mbambangandu conservancy) which establish unsettled zones for wildlife on the river frontage. There are strong arguments for collaboration with the Angola wildlife authorities to reduce illegal hunting of hippo on both of these rivers.
- (3) Hippo went extinct on the **Orange River** in recent times (1925) but, with the very positive conservation developments in the south of Namibia, it may be an appropriate time to re-introduce them.⁵ This will not be a simple or cheap exercise. The nearest hippo populations to the Orange river are in the Caprivi (see **Map 1**) and the distance over which the animals would have to travel is daunting. No budget has been included in this management plan for the operation and it is suggested that, if it is decided to go ahead with the reintroduction, funds should be sought from donors.

Management of the Caprivi hippo

Smuts & Whyte (1981) describe the reproductive strategy of the hippo as one well adapted to the semi-arid environments of Africa. When resources become limiting, populations are able to maintain stable populations by delayed sexual maturity and fecundity and so adjust to the carrying capacity of the environment: equally, populations are capable of rapid increase when resources become abundant. This finding has important implications for hippo management. It should be possible to maintain a hippo population in a highly productive state by harvesting: the corollary is that by not harvesting the population is unlikely to increase greatly – its own homeostatic mechanisms will come into play to limit population growth.

This section begins with an analysis of the expected response of a hippo population to various forms of management, then discusses adaptive management and monitoring, and concludes with the practical requirements to implement the programme, including institutional development.

5. The author travelled along the Orange River in June this year and noted the presence of hippo ‘lawns’ and reasonable pasture in Ais Ais national park near the confluence of the Nuab River.

(1) Sustainable Use

The management recommendations which follow are based on tests using a population model developed for this project. The model needs to be used with caution – hippo are one of the most unusual species encountered so far in this series of transboundary mammal studies. The adjustments which can occur in their reproductive parameters as a result of environmental conditions and management treatments are not easily predictable. The results of this population modelling should be treated as the underpinning hypotheses within an adaptive management system rather than rigid prescriptions for ‘correct’ management outcomes. The reproductive parameters which have been used in the model are given below.

Selected reproductive parameters for the Namibian hippo populations

Longevity	50 years
Age at sexual maturity	8 years
Age at full reproductive capacity	10 years
Fecundity	0.5 calves/female/year
Central mortality	3%
Juvenile mortality (first year)	12%
Mortality (second year)	6%

These values result in a growth rate of 7.13% when there is no exploitation of the population. Numerous tests of the effects of varying these parameters have been done in the Background Study and the values finally selected are based on an assumption that hippo in the Caprivi are below carrying capacity and would therefore be capable of increasing rapidly given favourable conditions. Equally, they would be fairly resilient to sustainable exploitation.

Whilst it is tempting to think of hippo populations as having similar population dynamics to elephants, it would be erroneous to do so. The short gestation period (8 months versus 22 months for elephants), the high fecundity (one calf every 2 years versus 4 years for elephants) and the wide range of possible ages at first parturition (4-12 years versus 10-12 years for elephants) make hippo populations capable of much higher growth rates and productivity. The tests indicate that with low central mortalities and early ages for sexual maturity hippo populations are theoretically capable of growth rates in excess of 10% per annum.

The highest valued use for an adult male hippo lies in the sport hunting industry. It makes sense to allocate the maximum quota for sport hunting, limit the number of problem animals to the minimum and implement a hippo harvesting programme which is sustainable and which will allow hippo numbers to increase gradually towards carrying capacity. In the quota setting which follows, the hippo population estimate of 1,387 animals for the Caprivi (Stander 2004) has been adjusted downwards to 900 animals to allow for population subunits which are shared with neighbouring countries.

Trophy hunting

It is assumed that sport hunting will be restricted to male hippo. Hunting clients seek trophies with large canines and large body size and these characteristics are limited to males. The canine teeth of a hippo begin to assume full size at about 20 years of age (approximately 2kg for the pair) and increase only slightly over the remainder of the hippo's life. The largest weights seldom exceed 3kg and, in some cases, the teeth may decrease through breakage and wear (Laws 1968). The body weight of a 20 year old hippo is about 1,250kg and hunting clients are unlikely to shoot much smaller animals.

The proportion of a hippo population which can be sustainably hunted to provide trophies is as low as that for elephant. If it is assumed that the earliest age at which hippos are likely to be taken as trophies is about 20 years of age, this restricts hunting to less than 7% of the total population. This is not the important statistic, however. In a population of 1,000 animals the annual recruitment to the 20 year old age class is about 7 animals and it is this figure which cannot be exceeded. However, if quotas were set as high as this, all males older than 20 years would be removed from the population and hunting would be reduced to the annual recruitment of 20 year olds. The effects of increasing levels of hunting quotas on the age structure of a hippo population is shown in the table below. A slight selectivity for large males is built into the model;

An offtake about one-half a percent of the total population is sustainable and allows some males to reach the age of 30 years. (see Fig. 2D, page xii). The sustainable offtake of trophy hunting quotas (0.5% of the total population) is not affected by any other management interventions taking place at the same time (problem animal control and harvesting) provided these other uses are unselective with regard to age and sex and fall within sustainable limits (Figs 2E & 2F).

Quota (% of total population)	Age classes (years)					Male population
	0-9	10-19	20-29	30-39	40-49	
0	305	129	46	13	1	494
0.1	306	130	46	12	0	494
0.2	308	131	44	9	0	492
0.3	310	132	42	5	0	489
0.4	313	133	36	1	0	483
0.5	316	134	29	0	0	479
0.6	319	135	19	0	0	473
0.7	321	136	11	0	0	468
0.8	324	137	3	0	0	464
0.9	325	138	0	0	0	463

Applying this proportion to the adjusted population of some 900 animals in the Caprivi results in a **quota of 5 trophy males** which is much lower than the present quota of 15 animals.

These might be the quotas set in 2006. Under adaptive management, the ages of the animals killed should be monitored⁶ and, in succeeding years, the quotas should be adjusted upwards or downwards according to the criterion that there should be some animals amongst those killed which have reached an age of 30 years.

6. In the Background Study, the ageing system for hippopotamus of Laws (1968) is given in detail.

Problem animal control

It has been assumed that problem animal control (PAC) is limited to animals older than 5 years and that both males and females are included without selectivity for larger animals. Under this assumption, **the maximum sustainable offtake of problem animals is slightly under 6% of the total population** (see table below). In a population with a stable age structure, about 59% of the total population consists of animals older than 5 years and the annual recruitment into the 6 year old age class is slightly less than 6% of the total population. Removing 5% of the population as problem animals has the effect of narrowing the upper part of the age pyramid and broadening the base (see **Fig. 2C**, page xii).

	PAC offtake – % of total population									
	0	0.25	0.5	0.75	1	2	3	4	5	6
Rate of growth %	7.13	6.82	6.51	6.2	5.9	4.65	3.45	2.25	1	Unsustainable
Initial population 1,000	PAC offtake – fixed number of animals									
Number of animals	65	70	80	90	100	150	200			
% of population at start	6.5	7	8	9	10	15	20			
Years to extinction	46	34	23	18	15	8	5			

These relatively high offtakes of problem animals are possible only if the assumption that both males and females are hunted in equal proportions is satisfied. If it is satisfied, it has the further effect that sport hunting quotas are not affected by the level of problem animal control – provided it is sustainable (**Fig.2E**). If the assumption is not satisfied and more males than females are killed as problem animals, then sport hunting quotas would have to be reduced to compensate for this effect.

It might appear that it makes little difference whether a hippo is killed under the heading “problem animal” or “harvest” – provided the products of the hippo (meat, skin and teeth) are recovered efficiently and sold or used to maximum advantage. There is a difference – and it lies in the degree of selection imposed on the population. Under a harvesting programme, where all animals irrespective of age and sex are included with an equal probability, there is no selective pressure and the age structure of the harvested population is identical to that of the unharvested population (**Fig2B**). **PAC preferentially affects mature animals and this should be seen as undesirable.** However, the contingency may well arise of having to deal with a problem animal and this would take precedence over any harvesting programme. In the comprehensive management plan proposed, a quota of 10 problem animals has been set (1% of a population of 1,000 animals) and animals should be killed only when absolutely necessary under this management ‘heading’. At the end of the management year any balance left on the PAC quota can be harvested – using the random selection method of harvesting.

Population harvesting

If harvesting (cropping) of hippo is to take place, it is strongly recommended that it is practised unselectively.⁷ Any cropping system which targets particular age classes will alter the age structure of the population in a manner which may produce undesirable long term effects. It has already been shown that by excluding the first five age classes from PAC the age pyramid assumes a ‘bottom-heavy shape’ (Fig.2C, page xii) and by selectively hunting large males for trophies the age pyramid becomes skewed in favour of females and has a ‘bite’ out of it for all the male age classes above 30 years (Fig.2D). If further selective pressures are introduced through harvesting it becomes increasingly difficult to predict the outcomes.

For a hippo population growing at 7.13% per annum (using the characteristics defined on page 9), **offtakes of up to 7% of the total population are possible, provided the harvest is unselective** (see table below). For a population of 1,000 animals, the maximum sustainable harvest would be about 70 animals annually if there were no sport hunting or problem animal control. At this level, population growth would effectively be zero. The age structure of the harvested population is identical to that of the unharvested population (Figs.2A & B).

	Harvesting – % of total population										
	0	0.25	0.5	0.75	1	2	3	4	5	6	7
Rate of growth %	7.13	6.87	6.6	6.33	6.07	5	3.99	3	1.78	0.71	0
Initial population 1,000	Harvest annual offtake – fixed number of animals										
Number of animals	71	75	80	90	100	120	150	200	300	500	
% of population at start	7.1	7.5	8	9	10	12	15	20	30	50	
Years to extinction	59	40	32	24	19	14	10	7	5	3	

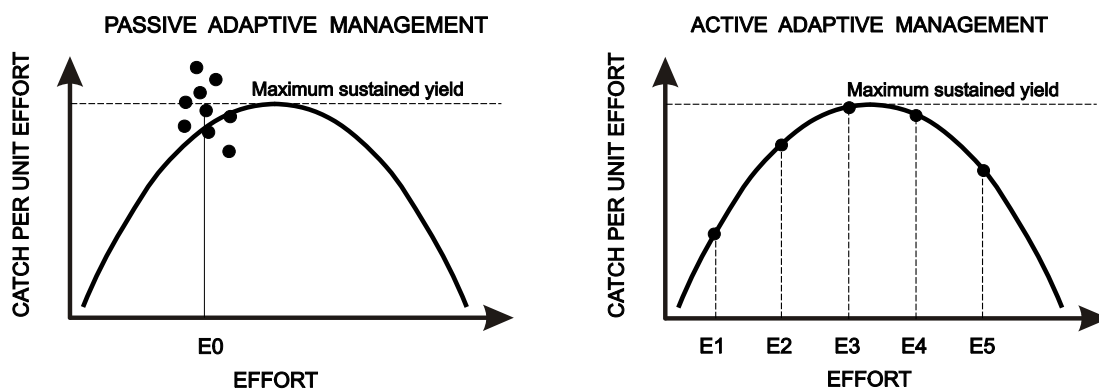
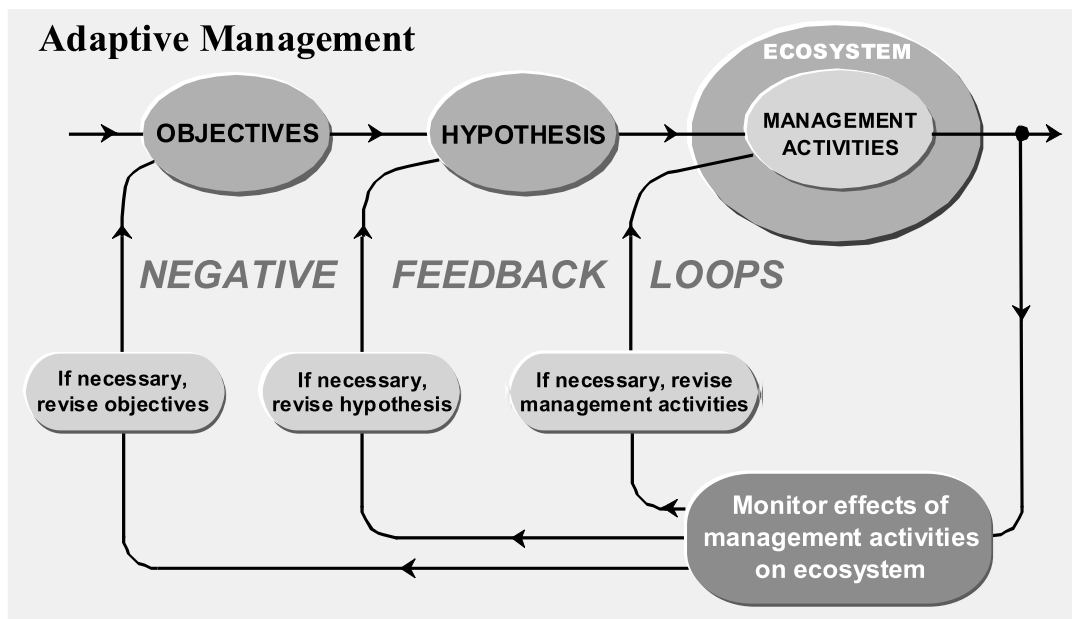
When harvesting is combined with problem animal control and sport hunting, the maximum harvest must be reduced. If 5 sport hunting trophies are taken annually from the adjusted population of about 1,000 animals in the Caprivi (0.5% of the total population) and if 10 animals are killed as problem animals (1% of the total population), then the maximum harvestable balance which would result in zero population growth would be about 45 animals. The age structure which results from this management regime is shown in Fig.2F.

Setting the quotas is not as simple as it might appear. The Caprivi hippo population is dispersed in a number of geographically discrete subunits on the different rivers in the Caprivi and, because of the relatively low numbers involved in some of the separate subgroups, applying the quota calculations results in fractions of a hippo in many cases. The allocation of quotas shown in Fig.1 (page xii) has been done, firstly by performing the arithmetical calculations, secondly by rounding fractional values up or down and, lastly, by using practical judgement.

7. To harvest with no bias towards any particular age class requires the application of random number techniques and some discipline in sticking to the outcomes.

(2) Adaptive management

It has been emphasised throughout this study that the population dynamics of hippo are most unusual and the population response to management interventions is difficult to predict. What has been put forward as the expected population dynamics of hippo in response to various management treatments should be seen as hypotheses in an adaptive management system (Holling 1976). Indeed, the proposed ‘project’ which involves harvesting, sport hunting and problem animal control should be seen as an active adaptive management research opportunity.



Under Passive Adaptive Management (“cautious fiddling”) the effort is varied narrowly around some point for fear that any major change will result in system collapse. The result is that the optimum operating point is seldom detected. Under Active Adaptive Management the effort is deliberately varied over a period of time so that the population characteristic (or response to the harvest) can be defined. This may have considerable relevance to the hippo ‘project’.

To understand the population dynamics of the Caprivi hippo several key parameters need to be monitored –

Population numbers: Once population harvesting starts, an aerial survey such as that done last year by Stander (2004) should be carried out annually. To make comparisons from one year to the next it is worth maintaining the same strata and counting blocks. The ecological objective of this management plan is to create the conditions for the hippo population to increase and such surveys will be needed to establish whether this is happening.

This should be supplemented with local level counts on the ground (or in the water) in all the conservancies. Hippo are one of the few species whose numbers can be reasonably measured by direct observation. If conservancies are to be seen to be genuinely managing their wildlife then this sort of inventory is necessary and it should not be confused with Event Book monitoring. It requires one or two individuals to spend long hours with binoculars getting to know exactly what hippo are in their areas. The numbers to keep track of are fairly low: Salambala - 1; Kwandu - 8; Mashi - 18; Mayuni - 42; Kasika and Impalila ~30). This data is useful also for 'ground-truthing' aerial surveys.

This intensive ground observation is also an excellent method of monitoring illegal hunting. Apart from the likelihood of actually seeing illegal hunters, the disappearance of known animals from local populations is a good indicator that illegal hunting is taking place.

Ages of all hippo killed: All lower jaws from hippo killed or dying naturally should be collected, clearly tagged⁸ and transported to a central place where one person can determine the ages of the animals. Over several years an age structure for the population⁹ can be built up and, in conjunction with the population model of this study, a great deal can be inferred about the population dynamics.

This is also the most reliable method for adjusting quotas of trophy animals: the hypothesis put forward in this study is that a half-percent quota will result in a few males living beyond 30 years of age. If this is not the case, then the quota should be reduced: alternatively, if most trophies are over 30 years of age, quotas can be increased. These data also allow some inference about the age-specific natural mortality for the older males.

Reproductive data: For all females killed under a harvesting programme, it is worth recording whether or not they are pregnant or lactating in order to establish both fecundity and age at first conception for the population.

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8. Each lower mandible should carry a label giving date of death, locality and category of death (e.g. natural mortality, hunting trophy, problem animal or animal harvested).
 9. This is another reason for ensuring that animals are harvested randomly.

In addition to population dynamics data, the following information would be valuable –

Habitat use: The full extent of the grazing range in the Caprivi used by hippos is not well-defined. This can be established from the Event Book monitoring, including its seasonal variation and how it changes with episodic events (e.g. flooding).¹⁰ This information is useful for management and for gauging the carrying capacity for hippo. It is also a valuable starting point for monitoring the condition of the habitat – which may or may not be needed depending on the trends in the hippo population under the management regime.

Human/hippo conflict: Incidents involving hippos should continue to be monitored under the ‘Event Book’ system (NNF 2005).¹¹ There may be a lack of data in areas where there are no conservancies (e.g. parts of the eastern Caprivi). If crop damage is reduced under a harvesting programme or if communities are well satisfied with the benefits derived from hippos this can be used as a criterion to assess the success of management programmes.

The vexatious question of the extent to which hippo along international boundaries need to be regarded as shared populations is worth investigating. A simple management approach is to assume half of the animals belong to each country but this might not be true. If conservation efforts on one side of the boundary result in larger hippo populations, this should be taken into account in any hippo exploitation. This is obviously a case-specific research question and it might form a worthwhile MSc project for a local university student.

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10. For example, if Lake Liambesi and the Zambesi Channels were to fill it might be necessary to revise the management programme drastically.
 11. In present The Event Book recording system, incidents involving various species are tabulated by month of the year in Table C5A and damage is categorised into human attack, livestock attack and crop damage in Table C5B. The system might be improved if it could be established which of the various incidents in Table C5a were linked to the various categories of damage.

(3) Implementation

Institutions

In all of the previous transboundary studies in this series there has been strong advocacy for forming co-management institutions which would allow management of the target species at a scale larger than the individual park or conservancy. This is less necessary in the case of hippo. The individual units making up the Caprivi hippo population are fairly localised, discrete and sedentary: **management can be applied at a local scale**. There are good reasons for adjacent conservancies to co-operate with each other and neighbouring State Protected Areas on hippo management but the need is more for coordination than co-management.

A benefit of local management is that it preserves the ‘**principle of differential benefits**’ (Murphree 1994). Conservancies and other communities who are successful in increasing or maintaining their hippo populations should deservedly gain higher benefits than others. This principle becomes increasingly important if any hippo harvesting scheme is introduced: hippo should not be seen as ‘common pool’ resource.

The present institutions for conservancies would be adequate for the purposes of hippo management were it not for the substantial portion of the hippo population which lives in the communal land outside conservancies (see **Limiting Factors and Threats**, page 4). There is a good case for **devolution of hippo management to a stakeholder body within the Caprivi** rather than continuing to retain it as a ‘Head Office’ function. This body should include representatives from all areas where there are resident hippo including those outside conservancies. Provided such a caucus was advised by a competent scientist and a sound monitoring programme was in place, there are good reasons for such a step. Each of the previous studies in this series has emphasized the desirability of greater devolution of authority as a prerequisite for the scaling up of institutions in the Caprivi – using the rationale of Murphree (2000) and Ruitenbeek & Cartier (2001). A substantial number of rare or valuable species in the Caprivi has now been identified which would benefit from such policy changes.

A ‘Project’ approach

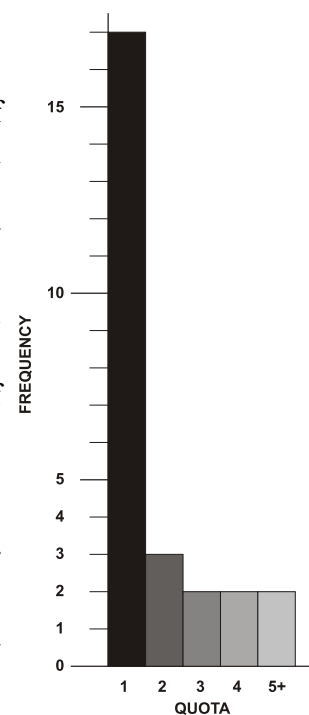
There is scope for increasing benefits for all stakeholders in the Caprivi by introducing a harvesting programme for hippos. In calculating the potential gross and net incomes from hippo (**Appendix 1**) it was found convenient to put the various stakeholders into two groups: the first group includes all safari operators engaged in hunting hippo and the second group includes the land occupiers of State protected areas, established conservancies and communal land in the Caprivi. This second group are the stakeholders in the “**Project**”.

Not only are the products from hippo valuable but the proportion of the net income which can be secured by the stakeholders is far higher than for most other species.¹² The autonomy of individual stakeholders would not be threatened by such a project and the enhanced returns might increase the incentives to conserve hippo and reduce illegal hunting.

12. The maximum value for most species lies in sport hunting where it is inevitable that safari operators will take the lion’s share of the income.

The concept of a 'Project' could be more than an artifice for the purpose of calculating budgets. The question arises whether there is justification for some sort of central facility in the Caprivi to handle hippo carcasses efficiently so that the maximum value is obtained from the products on behalf of all the stakeholders in the 'Project'.

The total number of animals likely to be killed is 60 (**Fig.1** page xii). An examination of the quotas for the individual areas yields the result that 17 of these are single animals, there are 3 quotas of 2, 2 quotas of 3, 2 quotas of 4 and 2 quotas larger than 5 (see frequency diagram opposite). Where the quotas are 2 or more animals they would not necessarily be killed at the same time. This suggests that, in the majority of cases, it would not be cost efficient to transport carcasses to a central facility. Even the two largest quotas (9 and 14 animals to be harvested from Mahango and Mamili national parks respectively) only require the hiring of casual labour to do the butchery *in situ*. The total amount of meat anticipated from the 60 animals is about 19 tonnes and in the majority of cases this meat would be consumed locally. The dressed meat from operations in Mahango and Mamili would be about 6 tonnes and this would probably be transported directly to Katima Mulilo and/or Rundu for sale as fresh meat in butchereries. At this stage, the establishment of any refrigerated facility is not justified: there may be a case for meat to be salted and dried in some situations (where transport for fresh meat is not readily available).



The handling of skin is another matter. Slightly more than 3 tonnes of dry first crust salted skin valued at US\$50,000 (N\$300,000) is expected from operations.¹³ Wherever a hippo is killed in the Caprivi, it should be skinned by trained skimmers and the skin immediately salted. There is strong justification for establishing a central facility for storing skin (e.g. at Kongola on the Kwando river) prior to its being marketed. If it is later decided to expand to the first stages of tanning skins, such a facility would need to be near a good supply of water and close to a source of labour (the cost of providing housing should be avoided).

A larger facility might be justified if the hippo project was combined with a comprehensive elephant management operation (as put forward in the **Elephant Management Plan**). It would provide employment and increase the economic benefits of the wildlife industry. The detailed planning, design and costing of the combined operation is outside the scope of this consultancy and justifies a separate exercise.

13. This includes the skin from the 5 trophy hunted animals. It is suggested that a condition of the hunting licence is that the trophy does not include the hippo skin or meat. The hunting client wishing to obtain part or all of these products would purchase them from the 'project'.

FINANCE AND CAPACITY

In presenting the expected income and costs of implementing this management plan it is necessary to distinguish between the two main groups of stakeholders. The first group includes all safari operators engaged in hunting hippo and the second group includes the land occupiers of State protected areas, established conservancies and communal land in the Caprivi. This second group is referred to as the “**Project**” below. The budgets for the two stakeholder groups are calculated in **Appendix 1** (page 23) and summarised below. The total returns to the ‘project’ have to be parcelled out amongst the various stakeholders in the ‘project’ and this exercise has been done in the table at the end of Appendix 1.

All figures in United States dollars

Safari Operators		“The Project”	
<u>Income</u>		<u>Income</u>	
Hippo trophy fees	25,000	Hippo products	70,000
Daily rates	10,000	Operators’ rental	8,750
Gross income	35,000	Gross income	78,750
<u>Costs</u>		<u>Costs</u>	
Operating costs	2,000	Operating costs	5,500
Rental to ‘Project’	8,750	Net income	73,250
Net income	26,250		

Rental paid by the safari operators to the ‘Project’ is 25% of gross income and includes hippo trophy fees.

The numbers of hippos (N), management quotas (Q) and distribution of income amongst the various categories of land in the Caprivi are summarised below.

	Hippos		Sport hunting		PAC		Harvesting		TOTAL US\$
	N	Q	US\$	Q	US\$	Q	US\$		
State Protected Areas	575	3	11,250	1	1,400	28	25,200	37,850	
Conservancies	100	2	7,500	6	8,400	7	6,300	22,200	
Communal land	223	0	0	3	4,200	10	9,000	13,200	
Totals	898	5	18,750	10	14,000	45	40,500	73,250	

The current project to strengthen the system of national protected areas (UNDP 2005) should provide the necessary funding and capacity for MET to carry out its normal functions, including law enforcement and monitoring.

RISKS AND ASSUMPTIONS

There is little risk that the proposed management interventions could have an adverse effect on the status of hippo 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 Directorate of Parks and Wildlife through the fiscus to maintain its essential functions in State Protected Areas.
- (2) Present legislation which prevents the devolution of rights over hippo will be amended.
- (3) MET will devolve hippo management to the Caprivi stakeholders (which includes representatives of MET).
- (4) The devolution of rights over hippo will improve the security of the Caprivi hippo, result in sustainable use of the species and create the conditions for population increase.

Risks

- (1) If the assumptions are satisfied, the risk of illegal hunting by Namibian citizens further depleting hippo numbers is low. However, successful conservation of hippo in Namibia may attract illegal hunters along the rivers which form international borders – particularly from poorer countries whose local peoples are not benefitting from wildlife.
 - (2) If the recommendations for ensuring unselective harvesting are not observed, there is a risk that unnatural changes in the age structure of the hippo population could alter breeding performance and productivity in the long term.
 - (3) If Namibia harvests hippos, there may be some negative reaction from non-hunting tourism operators and ‘green’ lobbies. Provided the necessary devolution has taken place it should not be difficult to counter this – with reference to the provisions for sustainable use in the Namibia constitution.
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TRANS-BOUNDARY COOPERATION

The case for transboundary cooperation on hippo management is perhaps stronger than for all of the other species which have been considered under the Transboundary Mammal Project so far. Hippo live in perennial rivers on international boundaries and some 35 % of the Caprivi hippo population estimated by Stander (2004) must be regarded as 'shared animals'.

Namibia is in the unique situation that the only perennial rivers in the country all form part of international boundaries.¹⁴ A past history of hunting by UNITA on the Cunene, Okavango and Kwando Rivers has had a significant impact on Namibia's hippo populations. With peace in Angola, it is to be hoped that co-operation on conservation and management of shared species such as hippo will result in benefits for both countries.

Hippo have not received undue conservation attention from Zambia and Zimbabwe in recent years and there is little doubt that the illegal hunting which has taken place in the Zambezi has had an effect on Namibia's hippos. This is all the more reason for Namibia to seek cross-boundary collaboration with these countries – to the extent of suggesting joint management programmes which will produce benefits for local peoples in these neighbouring countries.

The situation along the Chobe, Linyanti and Kwando Rivers is somewhat different. Illegal hunting by Botswana citizens has been minimal and there are national parks and community-based natural resource management areas along the river frontages. Namibia needs to exercise considerable sensitivity in exploiting hippos along these rivers. There is a strong case for keeping Botswana fully informed on quotas, the assumptions made in setting them, the rationale behind any management programmes and, in general, seeking their full participation.

Most of the management activities identified for potential co-operation and collaboration between Botswana and Namibia at the Kasane Workshop (2002) and Windhoek Workshop (2003) repeat themselves in this Management Plan.

- (1) Maintaining liaison between wildlife departments and communities managing wildlife on either side of the international border.
- (2) Maintaining linkages between species subpopulations;
- (3) Ensuring compatible forms of land use on either side of the international boundary;
- (4) Co-operating on law enforcement directed at illegal hunting;
- (5) Controlling fire;
- (6) Collaborating on air surveys to improve population estimates.

The issue of joint management of this species is an option which might be considered. Botswana has recently re-affirmed its intention to pursue a policy of sustainable use and it would be highly desirable if a common management programme for hippopotamus could be developed. If successful, it could be extended to the other countries sharing the Caprivi hippo population.

14. The only exceptions are the short sections of the Okavango and Kwando Rivers where they cut across the Caprivi.

The management activities on which collaboration might occur are –

(7) Setting hunting quotas and monitoring the sustainability of hunting

Both Botswana and Namibia allow sport hunting of hippo and the trophies are coming from a shared population. This is a test case for developing workable transboundary institutions which, in the first instance, result in cooperation on quota setting and, ultimately, lead to income sharing.¹⁵

(8) Problem animal control

Hippo are problem animals in both countries. Experience gained from problem animal control could be shared, including successful deterrents which do not involve killing hippo.

(9) Sustainable harvesting of hippopotamus

HSG (2004) estimate the population of hippo in Botswana as lying between 2,000 and 4,000. Only the proportion of these occurring along the Kwando, Linyanti and Chobe and rivers would be involved in any joint operations with Namibia. Were Botswana to join with Namibia in harvesting from the shared population, the sustainable offtakes might be high enough to justify the construction of a permanent facility to process the meat and skins..

With or without the participation of neighbouring countries, Namibia should not be hesitant in going ahead with any harvesting scheme in the Caprivi. In common law, any animal which is on the Namibian side of the river is effectively owned by Namibia and, provided that no animals are actually killed on the Botswana side of the international boundary¹⁶ in the course of an officially sanctioned hippo management programme, no offence will have been committed.

15. In the Kasane Workshop, the opportunity to develop such an institution involving Salambala Conservancy in Namibia and the Chobe Enclave community in Botswana was identified. These communities are directly opposite one another on the Chobe River and are almost certainly hunting from the same populations.

16. There remains to this day certain sections of the international boundary along the Chobe River between Botswana and Namibia which are still not resolved (Fisch 1999) and it would be as well not to allow the issue of harvesting hippo to cause an international incident in the contended areas.

IMPLEMENTATION PROCESS & UPDATE PROCEDURES

Timing and Duration of Plan

Implementation of this plan should commence only after certain key actions have been taken.

- (1) **The intention to harvest should be discussed with the Botswana wildlife authorities.** The largest number of ‘shared animals’ in the target population are those on the Namibia/Botswana international boundary and the potential for misunderstandings should be removed at the outset. The situation is less critical in the case of Angola and Zambia: it is not planned to harvest any hippo on the boundaries with Angola and very few will be taken from the Zambesi river (the shared boundary with Zambia).
- (2) All of the stakeholders in the ‘**Project**’ (page 16) need to be fully aware of the planned management activities before any harvesting commences.¹⁷ MET staff, conservancy members and local communities outside conservancies need to understand the key constraints on hippo management, the responsibilities expected of them in monitoring and the procedures to be followed for handling hippo carcasses.
- (3) From the outset, an **adaptive management monitoring system** (page 14) should underpin the implementation of the Plan 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 analyse the data.
- (4) The above implies that some training should take place before the project starts, particularly in monitoring, handling of carcasses and skinning. It would be as well that all the ‘actors’ who will carry out the local management tasks have been identified in advance.

The first draft of this Species Management Plan was completed in September 2005 and will be reviewed during October 2005. Following comments and decisions from the Directorate of Parks and Wildlife and the Directorate of Scientific Services in the Ministry of Environment and Tourism, a second draft should be prepared for submission to the Ministry by December 2005. Subject to any further revisions which might arise from inter-ministerial discussions or transboundary liaison with Botswana, a Final Plan should be ready for adoption early in 2006.

This should be followed by meetings between the Ministry of Environment and Tourism and primary stakeholders to discuss implementation. Central to the plan are the devolutionary aspects, coordination amongst stakeholders and the establishment of the monitoring system. Notwithstanding any modifications made as and when necessary during implementation, there should be a mandatory review of the plan every two years – preferably synchronised with the results from the hippo population surveys. If any changes are needed in the plan, the document should be modified, updated and re-approved.

17. If the recommendation is followed for the project to be run by a decentralised stakeholder body in the Caprivi there should be no difficulties with this requirement.

Appendix 1

Potential Income from Hippo Management

The management quotas for hippos in the Caprivi (**Fig.1**, page xii) are based on a population of 900 animals (taking into account numbers of hippo ‘shared’ with neighbouring countries). Quotas are –

- Problem animal control: **10** animals (both sexes, animals older than 5 years, no selectivity)
- Sport hunting: **5** animals (adult males)
- Harvesting: **45** animals (both sexes, all age classes, no selectivity)

When these values are inserted in the population model (page 9), the population growth rate is effectively zero over a period of 100 years. The average values for hippo products which result from the stable age distribution after 100 years are given in the table below –

	Body weight kg	Dressed meat weight (35%) kg	Dry crust skin weight kg	Canine teeth (pair) kg
Trophy hunting	1,695	593	88	Taken by client
PAC	1,137	398	67	1
Harvesting	744	260	49	0.5
		600	90	
		400	70	
		260	50	
		Value	Value	
		USED	USED	

The values of meat and skin have been rounded to the nearest 10kg for use in the calculations which follow.

The average value of the animal products in the three categories of management is as follows –

Prices	Dressed meat weight		Dry first crust skin weight		Canine teeth (pair)		TOTAL VALUE	
	US\$1/kg		US\$15/kg		US\$100/kg			
	kg	US\$	kg	US\$	kg	US\$	US\$	Rounded
Trophy hunting	600	600	90	1,350	Taken by client		1,950	2,000
PAC	400	400	70	1,050	1	100	1,550	1,500
Harvesting	260	260	50	750	0.5	50	1,060	1,000

Note: The price of hippo skin is approximately double that of elephant skin (Parker, *pers.comm*).¹⁸

The value of dry elephant skin is about US\$7.5/kg (Mochaba Developments, Pvt Bag 98, Maun, Botswana).

18. Hippo skin is more valuable than elephant skin because it is a stronger leather, has a finer pattern and can also produce multiple splits (a ‘split’ is the process whereby a hide of sufficient thickness is passed between two rollers with a centrally placed fine and sharp band saw so that the hide emerges from the rollers as two hides). Hippo skin is sufficiently thick and solid to produce up to six splits. The top one with the epidermis has the hippo grain, while the five other splits are smooth on both sides without a pattern. The pattern is fixed by making a photographic plate of the grain on hippo hide and stamping it on to all the splits so that they resemble genuine hippo hide. Elephant hide is so loosely fibrous that the splits can be torn in two by hand and, lacking substance, they will not take a pattern. Only the elephant epidermis is tough enough to hold together.

Applying these unit financial values to the quota, the total value of hippo products is shown below.

	Quota (numbers)	Unit value (US\$)	Total value (US\$)
Sport hunting	5	2,000	10,000
Problem animal control	10	1,500	15,000
Harvesting	45	1,000	45,000
			Gross income US\$
			70,000
Operating costs @	US\$100/animal	Operating costs US\$	5,500
			Net income US\$
			64,500
1US\$ = N\$6.3		N\$	406,350

The operating costs attached to such a project would include killing the hippo (ammunition, hunter time, labour and transport), labour for skinning and butchering, transport of meat and skin, replacement of equipment (knives, hooks, racks etc) and salt for curing hippo hides. An arbitrary cost of US\$100/animal has been used above to provide for animals killed as problem animals or harvested. It is assumed that the safari operator would meet these costs for hippo killed as trophy animals.

The final budgets are presented below. It has been assumed that safari operators conducting trophy hunting will pay one-quarter of the gross income from hunting to the ‘project’ as ‘rental’ for the hunting and that this sum includes the official trophy fees for the hippos.

Safari Operators		Project	
Trophy fees: 5 animals @	US\$5,000	25,000	Net income from products: 64,500
Daily rates: 5 x 2 days @	US\$1,000	10,000	Operator’s rental: 8,750
	Gross income US\$	35,000	Total net income: 73,250
Operating costs: 5 x 2 days @	US\$200	2,000	
Rental to project: 25% of gross income	US\$	8,750	
	Net income US\$	26,250	Safari Operators plus Project
			TOTAL NET INCOME: US\$ 99,500

The allocation of the returns to the individual stakeholders on whose land the hippo were killed is shown in the table on the next page.

Allocation of net financial returns from hippo population management

All figures in United States dollars

	Hippo Numbers	Sport Hunting		PAC		Harvesting	Net Total Income	
Net unit values US\$		3,750		1,400		900		
Kavango	247	1	3,750	1	1,400	12	10,800	15,950
Mahango NP & Babwata Western Core	187	1	3,750			9	8,100	11,850
Communal land	60			1	1,400	3	2,700	4,100
Kwando	234	2	7,500	4	5,600	12	10,800	23,900
Babwata Eastern Core	91	1	3,750			4	3,600	7,350
Kwandu	8			1	1,400	1	900	2,300
Mayuni	42	1	3,750	1	1,400	2	1,800	6,950
Mashi	18			1	1,400	1	900	2,300
Mudumu	17					1	900	900
Communal land	58			1	1,400	3	2,700	4,100
Mamili NP	280	1	3,750	1	1,400	14	12,600	17,750
Chobe/Linyanti	128	1	3,750	3	4,200	6	5,400	13,350
Kasika & Impalila	27			1	1,400	1	900	6,050
Salambala	1	1	3,750	1	1,400	1	900	2,300
Communal land	100			1	1,400	4	3,600	5,000
Zambezi	9			1	1,400	1	900	2,300
Kasika & Impalila	4			1	1,400	1	900	2,300
Communal land	5							0
TOTALS	898	5	18,750	10	14,000	45	40,500	73,250

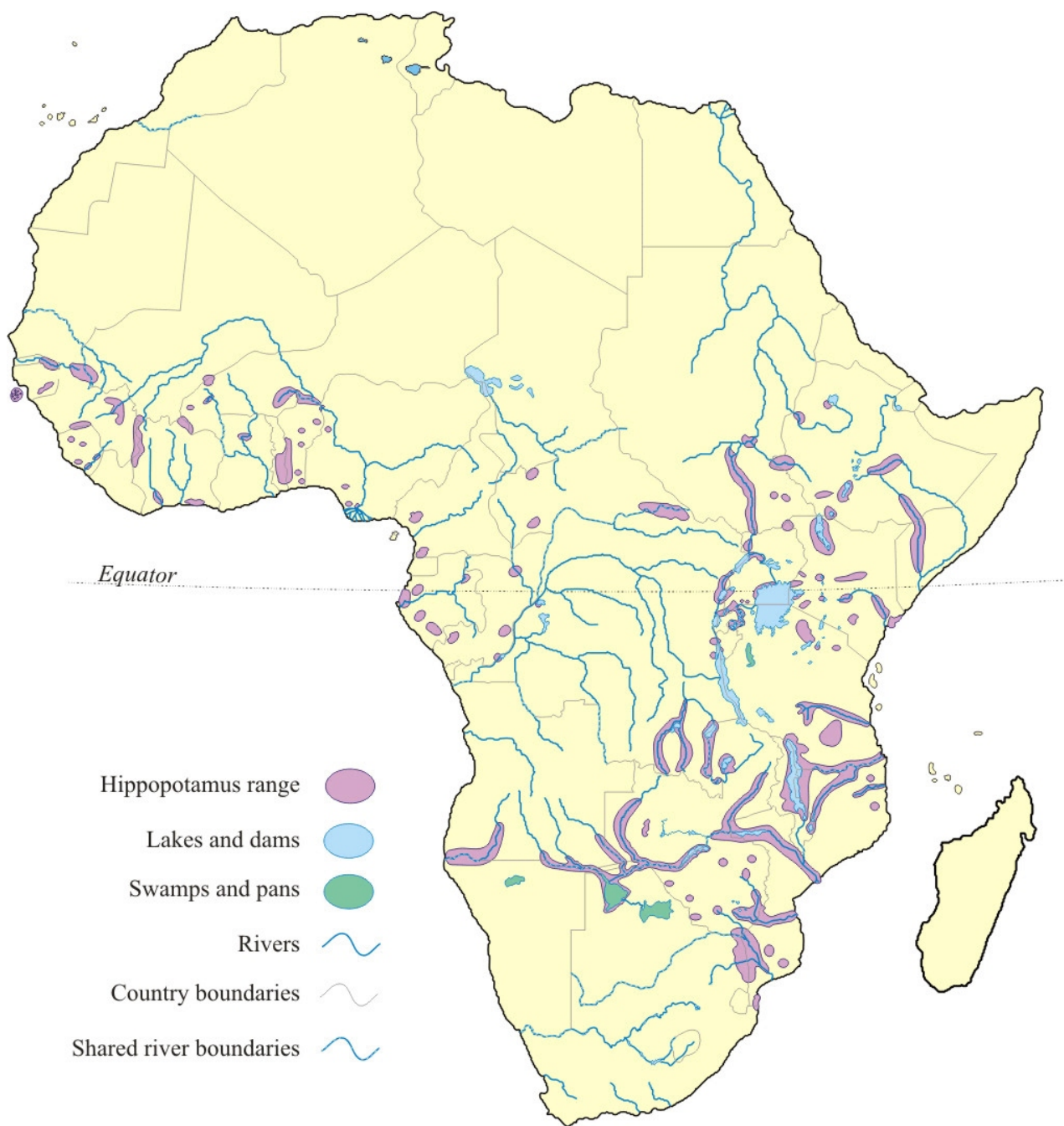
Summary

State Protected Areas	575	3	11,250	1	1,400	28	25,200	37,850
Conservancies	100	2	7,500	6	8,400	7	6,300	22,200
Communal land	223	0	0	3	4,200	10	9,000	13,200
Totals	898	5	18,750	10	14,000	45	40,500	73,250

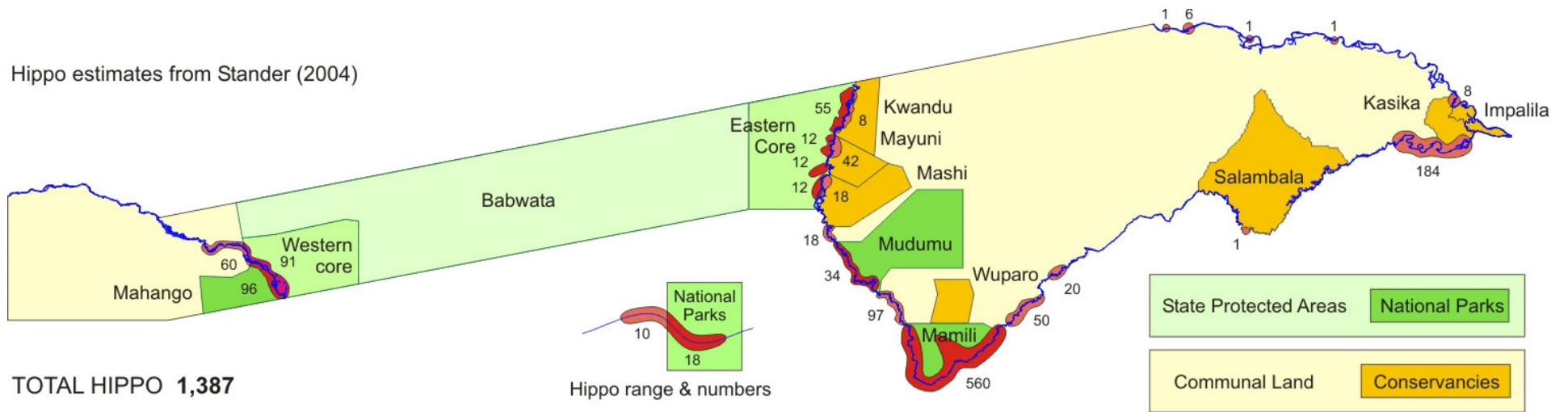
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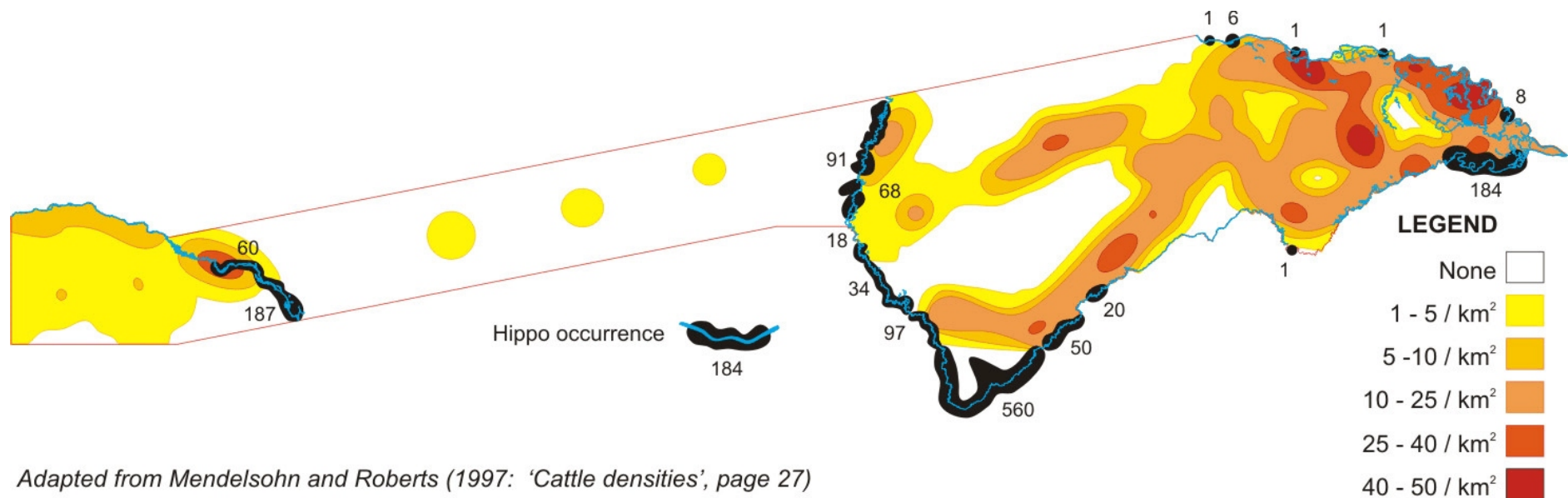
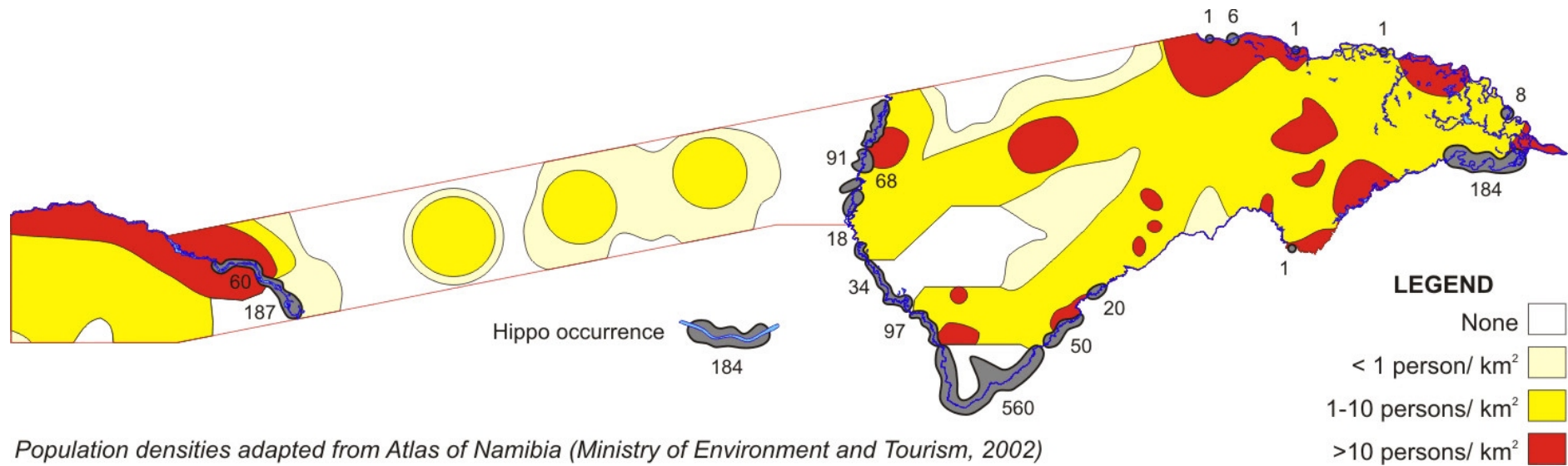
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Map 1: Distribution of the common hippopotamus in Africa



Map 2: The hippopotamus range in the Caprivi in relation to land tenure



Map 3: Distribution of hippo in the Caprivi in relation to human and cattle densities