
Elephant Management in Nyaminyami District, Zimbabwe: Turning a Liability into an Asset

Russell D. Taylor

WWF Multispecies Project, P.O. Box 8437, Causeway, Harare, Zimbabwe

ABSTRACT

In Nyaminyami District, on the southern shores of Lake Kariba, 20,000 people share Omay Communal Land, an area of nearly 3,000 km², with some 2,000 elephants and a range of other large wild mammals. Elephants are a major source of conflict between wildlife and people in Omay, largely on account of damage inflicted upon crops and property and injury or death to human life. Under the CAMPFIRE programme the management of elephants in Omay is presently being directed towards:

- (i) reducing conflict through combining problem elephant control with sustainable trophy hunting of elephants; electrified fencing to protect arable fields and homes from the depredations of elephant; zonation of land use for tourism development and agricultural planning at ward and village level;
- (ii) increasing tolerance towards elephants through revenues earned from safari hunting and other wildlife management activities, and wildlife-based tourism ventures with private sector operators.

The relative merits or otherwise of these various approaches are outlined and the implications for the long term conservation of elephants are discussed.

INTRODUCTION

A major source of conflict between wild animals and people is the damage inflicted by wildlife upon crops and property, and injury or death caused to livestock and on occasion to human life. This is especially true of elephant, but can also include other large dangerous game. Consequently, rural people are intolerant of wildlife. There is also often a tendency for farmers to inflate estimates of damage to crops and cultivated fields in anticipation of animals being shot and a supply of meat thus being made available (Taylor 1982).

The traditional and continuing response on the part of management authorities to problem animals, especially dangerous game, is attempted control through harassment and/or shooting of the culprits involved. The success of such action has yet to be critically evaluated despite the killing of many thousands of animals on control work, especially in colonial Africa (Bell 1985, Parker & Graham 1989). The nature of the problem needs careful assessment, especially where the economic value of problem animals potentially greatly exceeds their nuisance value, and where their sustainable use is threatened by excessive control measures.

Under the Zimbabwe Government's CAMPFIRE programme (Martin 1986; Anon. 1987) responsibility for wildlife was conferred on the Nyaminyami District Council of Kariba in northern Zimbabwe when it received "appropriate authority" status from the Department of National Parks and Wild Life Management (DNPWLM) in January 1989. The District Council is charged with the administration and management of the wildlife resources of the area for the benefit of the people of Nyaminyami. This paper outlines how the district is currently attempting to manage elephant in the area, both directly and indirectly, so as to minimise conflict and increase tolerance on the part of local people; improve the livelihoods of rural poor through sustainable wildlife use; promote sound and sustainable land use options and enhance biological conservation.

OMAY COMMUNAL LAND

Omay Communal Land in Nyaminyami District on the southern shores of Lake Kariba surrounds the inland boundaries of Matusadona National Park and has a total area of 2,870 km² (Figure 1). Omay has a population of some 20,000 people centred around four chieftainships, Mola, Negande, Nebiri, and Msampakaruma. Each chieftainship comprises two wards made up of a number of villages and households. Commercial growth based on tourism and fishing, is focused on Bumi Hills and Chalala, and Siakobvu is the administrative centre for the district.

Figure 1. Omay Communal Land in Nyaminyami District, Kariba, Zimbabwe. Hatching shows the major settlement areas within the chieftainships of Mola, Negande, Nebiri and Msamapakaruma. Siakobvu is the administrative centre of the district and Bumi Hills and Chalala are tourist and commercial growth points respectively. Completed (-) and proposed (—) electrified game fencing is also indicated.



Figure 2. Trend in elephant numbers in Omay Communal Land, Nyaminyami District, from aerial census data over the period 1979 -1991. Data from Taylor (1988b, 1991a).

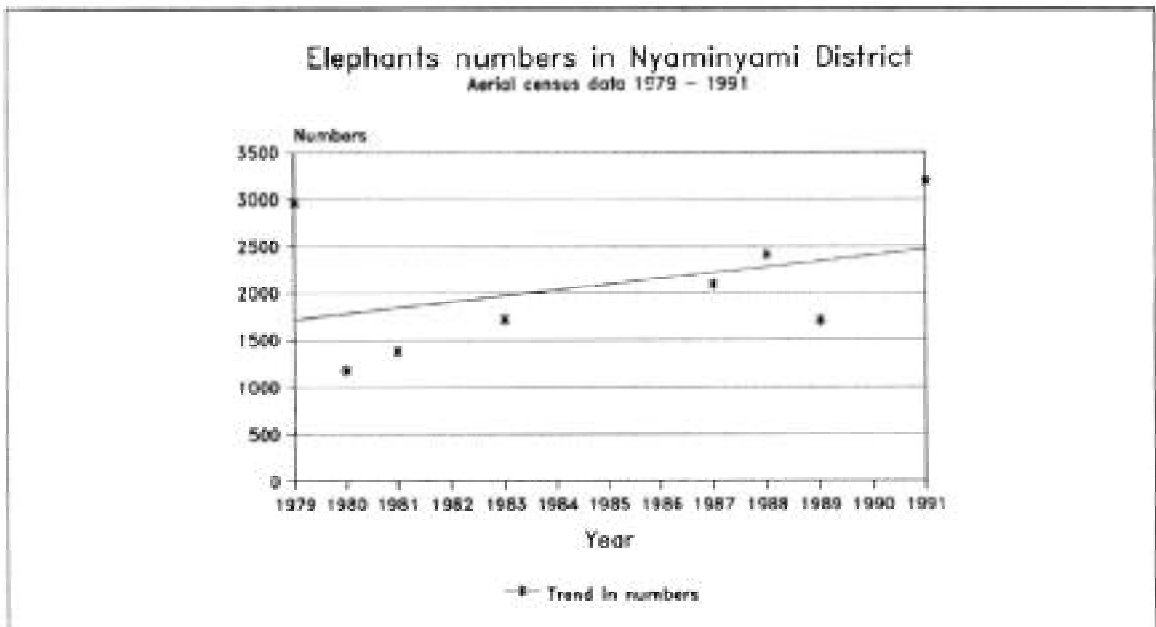
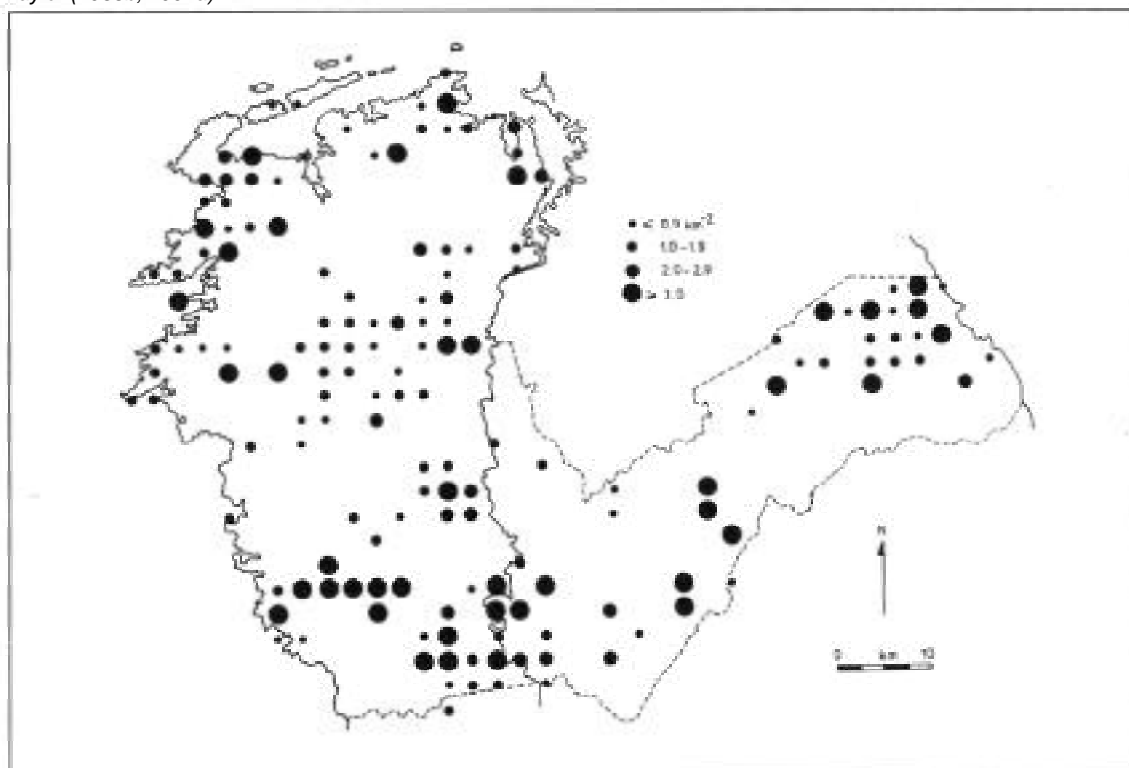


Figure 3. The dry season distribution and density of elephants in Omay Communal Land, Nyaminyami District. Data from Taylor (1988b, 1991a).



The environment is semi-arid with variable and seasonal rainfall amounting to 650 mm per annum, falling between November and March. The climate is hot with maximum temperatures in excess of 40 and minimum temperatures rarely falling below 17. Agriculture is limited to subsistence cultivation and livestock holdings are confined mostly to goats, cattle having been precluded until very recently due to the presence of tsetse fly (*Glossina spp.*). Large wild herbivore populations are typical of the Zambezi Valley (Taylor 1988a). They include 2,000 elephant (*Loxodonta africana*), 6,000 buffalo (*Syncerus caffer*), 15,000 impala (*Aepyceros melampus*) and lesser numbers of a further 12 species (Taylor 1991a, Taylor, Cumming & Mackie, 1992).

ELEPHANT ABUNDANCE AND DISTRIBUTION

Census data for elephant in Omay have been obtained on an annual basis over the past 13 years, the mean number estimated being $2,098 \pm 25\%$ (95% C.L.; $n = 10$ counts). Notwithstanding the variability of individual estimates, these data indicate a longterm

upward trend which predicts an annual growth rate of 3.4% (Taylor unpublished data, Figure 2). The mean crude density of elephants is $0.75/\text{km}^2$ but distribution is clumped and closely associated with uninhabited terrain (Figure 3) so that localised densities may be as high as 3 elephant/ km^2 .

Although overall densities of elephant in the adjacent Matusadona National Park and Omay do not differ markedly between the two areas there are differences in distribution, ecological density, group size, home range size and movement (Taylor, 1988b). This is largely a reflection of the management treatments to which elephants are subjected in the two areas. Whereas elephants enjoy protection in the absence of human disturbance in the National Park, they are subjected to hunting, harassment and human activities in the communal land.

MANAGEMENT OF ELEPHANTS SAFARI HUNTING

Big game trophies in Africa are highly sought after by foreign clients, mostly from the developed countries of

the West in particular North America and Europe. Wildlife in Omay has been put to this form of use successfully over the past 20 years in both ecological and economic terms (Cumming 1989, Taylor 1990a). The safari hunting season usually commences at the end of April or beginning of May, following the cessation of the rains. This traditional date for commencement of hunting is largely for reasons of practical convenience and client comfort. Consequently, most elephants shot on the safari hunting quota are taken from May onwards, during the dry season. There is, however, no legal restriction to hunting earlier and indeed, in any given year, can commence on 1 January. Quotas for elephant, based on a population estimate of 2,000, have not exceeded 0.8% of total numbers in any given year over the past 10 years (Table 1).

ELEPHANT CONTROL

Elephants have been shot as part of control measures to protect crops and people in Omay since the late 1950s, following the re-location of the Tonga people displaced by the filling of Lake Kariba. For the northern Sebungwe as a whole, some 348 elephants were shot between 1955 and 1979 on crop protection measures (Cumming 1981). In Omay, probably less than 10 elephants were shot annually during the 1970s (Taylor unpubl. data.). Numbers, both of elephants and

people were still relatively low at the time, so that conflict was minimal. Furthermore DNPWLM personnel probably considered elephants more important than people and minimised efforts in dealing with the problems that arose.

From 1980 onwards the question of conflict between people and wildlife, especially elephants, took on a much greater importance in the eyes of a new government, and DNPWLM was required to deal with problem animals in communal lands far more diligently than had been the case previously. Nevertheless, the numbers of elephants shot on problem animal control (PAC) in Omay did not increase substantially although the number of requests to do so far exceeded the numbers actually killed. Although elephants hunted as trophies have been part of a strictly controlled quota, there has been no limit set for animals shot on PAC.

PROBLEM ANIMAL REPORTS

With the granting of Appropriate Authority in 1989, Nyaminyami District implemented a PAC monitoring programme in Omay (Taylor 1990a). A comprehensive, yet simple report and return form was designed for completion by authorised control officers and others involved in dealing with PAC. Between January 1989 and December 1991 some 1,000 PAC reports were filed

Table 1: Male PAC and trophy elephant offtakes in Omay Communal Land, 1983-1992. (Assumes an elephant population of 2,000).

YEAR	PAC OFFTAKE		TROPHY OFFTAKE		TOTALS	
	NUMBER	%	NUMBER	%	NUMBER	%
1983	5	0.25	12	0.60	17	0.85
1984	8	0.40	12	0.60	20	1.00
1985	6	0.30	12	0.60	18	0.90
1986	10	0.50	12	0.60	22	1.10
1987	6	0.30	12	0.60	18	0.90
1988	9	0.45	16	0.80	25	1.25
1989	9	0.45	14	0.70	23	1.15
1990	8	0.40	12	0.60	20	1.00
1991	12	0.60	10	0.50	22	1.10
1992	8	0.40	12	0.60	20	1.00
TOTAL	81		124		205	
MEANS	8.1	0.41	12.4	0.62	20.5	1.03

at Siakobvu, providing three years of information together with supplementary data extracted for the previous six years from DNPWLM records. Analysis of this data indicated that over 70% of reports were elephant-related and occurred during the rainy season, between January and the end of April (Figure 4). There was a peak of activity in February and March during which time growing maize, millet and sorghum are most attractive to crop-raiding elephants. Despite the high number of incidents, the number of elephant males shot on PAC between 1983 and 1992 averaged only eight each year (Table 1).

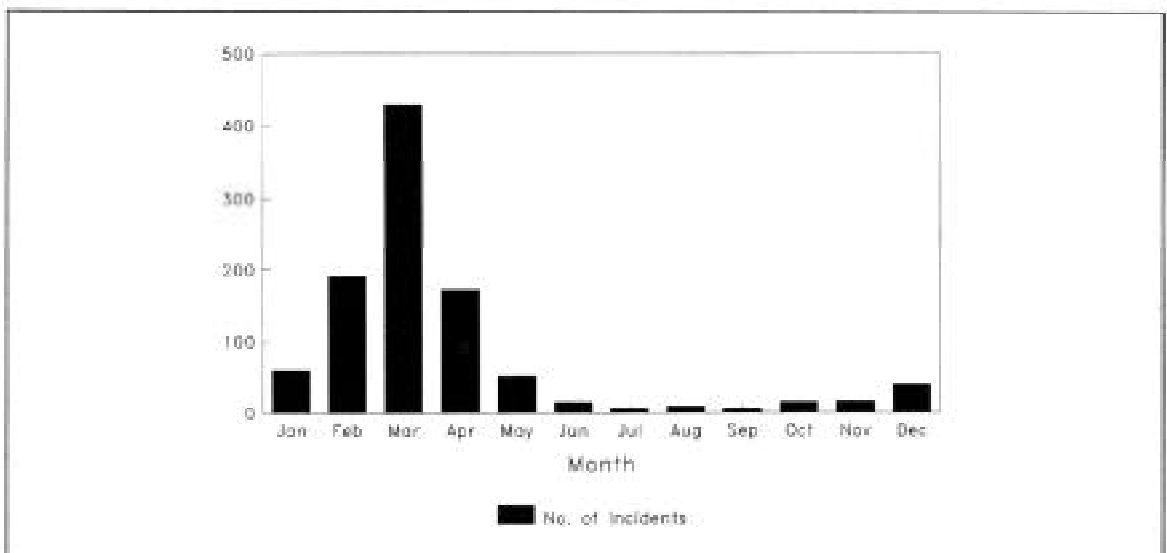
SUSTAINABLE TROPHY ELEPHANT HUNTING

To sustain good quality trophy elephant hunting, quotas ideally should not exceed 0.7% (Martin 1990). Based on a population of 2,000 elephant in Omay, this has been maintained over the years at $0.62 \pm 0.049\%$ (Table 1). However, when the PAC offtake is added to the trophy quota, a sustainable trophy offtake is exceeded, as is also shown in Table 1. The longterm total offtake amounts to 1.03% and, clearly, either the numbers of animals shot on safari or the numbers shot on PAC have to be reduced if Nyaminyami District is to continue offering competitive big game hunting on the international market.

One possible solution to reducing both the conflict and the number of elephants destroyed on PAC is to open a wet season “window” of safari hunting. By bringing the safari hunting of elephant bulls forward into the wet season, it is possible for PAC animals to double up as safari trophies. In order to achieve this, the shift in hunting season will have to occur gradually over time and a number of conditions will need to be in place. Using the 10 year data set contained in Table 1, the following should apply:

- i. A combined PAC and trophy hunting offtake of 20 elephant bulls is equivalent to 1% of the estimated population of 2,000 elephant. Such an offtake is not biologically damaging to the population as a whole, but it will not allow a sustainable offtake of trophy elephant bulls in the longterm. The desirable longterm trophy quota should be less than 0.7%, and initially 0.6% of the population, which is equivalent to 12 bulls per annum, if trophy quality is to be maintained.
- ii. Setting an initial quota of 12 bulls only and hoping that this number will adequately cover PAC is not workable because it is not realistic. Setting a quota of 20 bulls to cover both PAC and safari hunting and then reducing this number to 12 over time is more workable, and especially so if the safari hunting can take place during the wet season.

Figure 4. The monthly incidence of problem animal reports in Omay Communal Land, Nyaminyami District, 1989-1991 (n1.013 reports).



iii. Assuming a quota of 20 bulls in year 1, this quota can then be allocated between PAC in the wet season and trophy hunting in the dry season, with the safari operator being allowed to market PAC elephant in addition to the trophy portion of the quota. However, the taking of PAC elephant by the safari operator should be subject to a number of conditions, and these are outlined below.

iv. Over a five-year period, the 20 bulls allocated to the combined PAC-trophy hunting quota are progressively reduced to 12 elephant in year 5 and thereafter, when all or most are marketed as trophy elephants, but which are hunted in both the wet and dry season. The number actually allocated to wet season hunting would depend on the level of tolerance achieved and marketing success.

In adopting this approach, PAC problems are being effectively dealt with and at the end of the five-year period, sufficient awareness should have been generated to encourage greater tolerance of problem animals. Such animals can now be shot as trophies, as and when they cause problems. Moreover, there is an increased financial return to the producer

community, with a previous liability now converted into an asset.

Table 2 illustrates how such a scheme might operate. The allocation between wet season PAC and dry season trophy hunting can vary between years, but with the combined PAC-trophy quota constantly being reduced to the target figure of 12. Over five years a total of 80 elephant would be shot, representing no more than 0.8% of the total population. The decision as to how to allocate between PAC and trophy hunting can be taken by the District Council in consultation with the resident safari operators. Five different permutations are illustrated in Table 2, but these are by no means exhaustive. These permutations also indicate the allocation of even numbers of animals. This is because there are currently two safari operators in Nyaminyami District so that the quota must be divisible by two.

CONDITIONS AND MARKETING

‘Clearly, a number of detailed conditions must apply for such a scheme to work properly, but since these would be very area specific only a general outline is

Table 2: Suggested allocations and permutations for PAC and trophy hunting quotas for elephant in Nyaminyami District. (PAC=control quota; TH=trophy quota; GT=total quota).

SEASON	YEAR 1			YEAR 2			YEAR 3			YEAR 5			YEAR 4		
	PAC	TH	GT	PAC	TH	GT	PAC	TH	GT	PAC	TH	GT	PAC	TH	GT
WET	10			10			10			10			10		
DRY		10			8			6			4			2	
GT			20			18			16			14			12
WET	10			10			10			8			6		
DRY		10			8			6			6			6	
GT			20			18			16			14			12
WET	10			10			8			8			6		
DRY		10			8			8			6			6	
GT			20			18			16			14			12
WET	12			10			8			8			6		
DRY		8			8			8			6			6	
GT			20			18			16			14			12
WET	14			12			10			10			10		
DRY		6			6			6			4			2	
GT			20			18			16			14			12

given here. The total quota must not be exceeded, with all PAC being undertaken only in the wet season, either as such or on safari, and the quota must reduce to a sustainable trophy hunting quota over a specified time period. The elephant shot on PAC by a safari operator must be a genuine problem animal destroyed as and where the problem arises and prospective hunting clients would have no choice in the matter. Should the PAC quota have to be exceeded, as in the case of loss of life, then only the appropriate authority will be permitted to shoot an elephant over and above the quota. Once the sustainable trophy quota has been achieved, animals still not shot on the PAC quota at the end of the wet season could then be carried over into the dry season as trophy animals.

The question of whether safari hunting can take place in the wet season or not is really a question of marketing. Certain safari operators are very keen to market wet season elephant hunting, particularly as very good trophy elephant (80-000lb tusk weight) have been shot in Zimbabwe during the wet season. Unfortunately, a number of these animals have been PAC animals. The same safari operators also recognize it is in their (and the country's) interests to reconcile the problem of PAC and trophy hunting.

Initially there may be market resistance so that the safari operator will be unlikely to market full hunts nor will there be enough hunting periods in the wet season "window" of 120 days (January-April) to cater for the number of PAC elephant likely to be on quota. Therefore the safari operator should be encouraged to market cheaper hunts (at least initially) for shorter periods of time. Because of the conditions imposed on the client, a sliding price scale can be attached to both the daily rate and weight of ivory from a PAC elephant, with the full trophy and daily rate fees being charged for an elephant shot with ivory greater than or equal to the average trophy weight for the district.

FENCING

An electrified fence of 18 km encircling the 50km² settlement area at Negande was erected in September 1990. The fence is open along 12 km to the north where an abrupt, steep-sided escarpment provides a physical barrier to elephant movement (Figure 1). Fence erection followed protracted community debate which commenced in late 1988 and involved the moving of three villages which, through their exclusion, the fence would not have protected otherwise. The ward has an

area of 550 km² of which approximately 10% (5,000 ha) are protected by the fence. Following completion of the fence, crop raiding incidents fell by 65% (122 incidents in the 1990/91 season compared to only 42 in the following season, 1991/92) (Mackie 1992). Arguably, the effectiveness of the fence could be improved if the open end of the fence were to be closed but continued monitoring is necessary to ensure such closure is cost-effective.

Prior to the erection of the larger encircling fence, a smaller fence was installed around a 3 ha irrigation plot which produced green crops at the height of the dry season. This fence was severely challenged during the first dry season of its erection but no elephant entered the irrigation plot. Following reaping of the crop, villagers returned to their traditional wet season fields and abandoned maintenance of the fence. Not only did elephant and other animals penetrate the fence but much of it was either badly damaged or swept away by the seasonal rains. Technically, both these initial fencing projects have been successful and although there were some construction defects, these were easily rectified.

No economic cost-benefit analysis has been undertaken for the Negande fences. Whilst the most important perceived benefit is the reduction in crop losses there is no quantification of the economic saving thus made, especially when the costs of fence construction and maintenance are taken into account (Jansen 1992). Moreover the real economic benefit may well be the elephants saved from being destroyed as PAC animals. Further fencing programmes are planned for the other major settlements in Omay (Figure 1), but cost-benefit analyses are essential prerequisites to their implementation.

ZONATION OF LAND USE

The longterm conservation of elephant will depend very much on an integrated approach to land use, which takes into account not only their presence, but also their management and productive role in the economy of the district. There are two levels of land use planning and zonation in the context of elephant and other wildlife management activities in Omay which need to be considered; firstly at the district level and secondly at the ward and village level. To date, planning has occurred at both levels but not necessarily in full consultation with the community in the case of the former and largely by agricultural extension officials in the case of the latter but without taking into account all the implications of wildlife management.

DISTRICT LEVEL LAND USE PLANNING

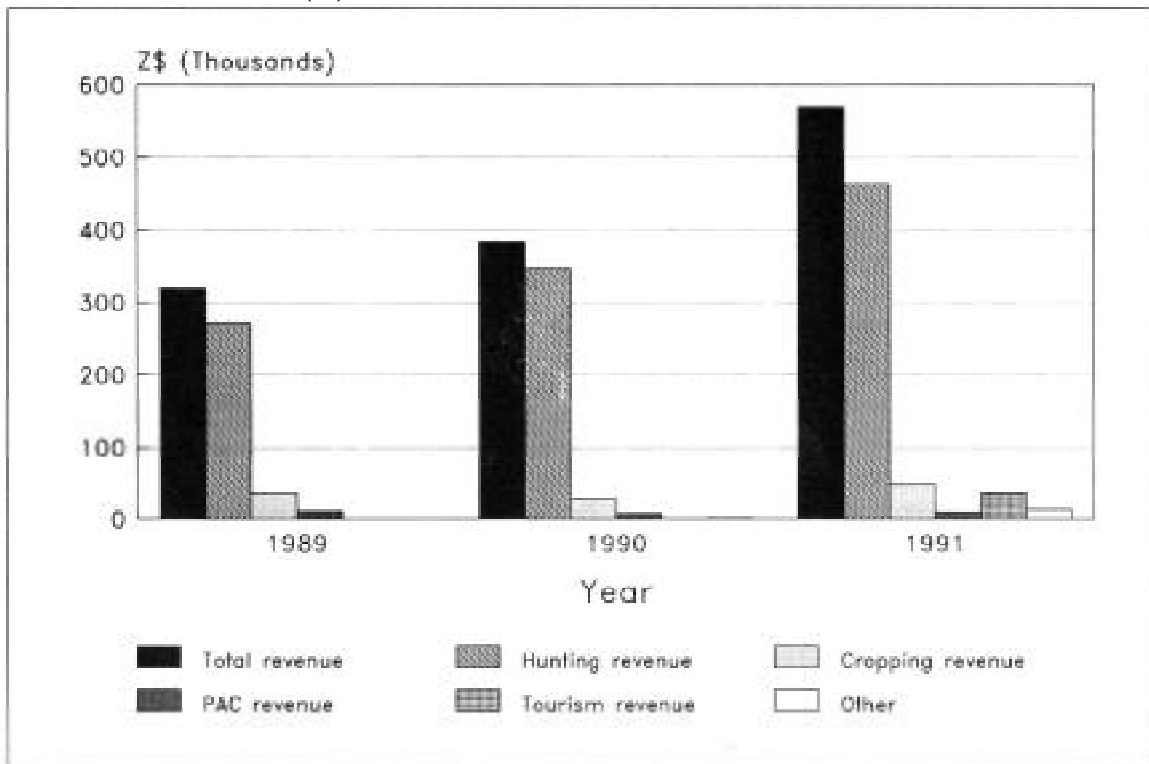
The district has embarked upon a plan for the development of tourism based on wildlife which includes proposals for zonation for different uses (Taylor 1990b). The salient features of these proposals include:

- The formal establishment of a wildlife sanctuary within the existing Bumi Hills State Land where wildlife presently enjoys complete protection. (Bumi Hills is an important international tourist destination with spectacular views of Lake Kariba amidst a full spectrum of wildlife. Here, elephants are especially important as a tourist attraction.)
- The zonation of a range of hills, the Mapongolas, as a Conservation Area which would exclude human expansion and settlement and provide an effective link between Matusadona National Park on the Ume River in the east and Chizarira National Park on the Sengwa river in the west. This link would be particularly important for the longterm maintenance of genetic variability within the Sebungwe elephant population as a whole.

- The establishment of a number of lease sites with lakeshore frontage for the establishment of small (less than 20 beds) rustic camps for commercial safari operators who would make use of adjacent Parks and Wild Life areas, namely Lake Kariba Recreational Park and Matusadona National Park for walking, photographic and game viewing.
- The formal recognition of a number of key conservation areas including unique stands of vegetation such as thickets which constitute important habitats for elephant, crocodile breeding areas on the lakeshore, and smaller areas of wetlands and minor escarpments in the Omay hinterland.

Much of the remainder of the area would be devoted to safari hunting which, in terms of consumptive resource use, is an extremely conservative land use option and one in which elephants are a key component. Areas designated for cropping for meat production (Taylor 1991 b) would not conflict with other options such as tourism. Overall zonation would be linked to development objectives which are compatible and internally consistent.

Figure 5. Revenues from wildlife management activities in Nyaminyami District, 1989-1991. All values in Zimbabwe Dollars (Z\$)



Elements of this planned zonation are in the process of being adopted. For example, five 10 ha lease sites have been identified for non-consumptive tourism, advertised in an open and competitive market and private sector operators objectively selected. The district is now entering into joint venture partnerships with these operators who will not only generate additional revenues for the district but also provide local employment (Jansen 1990; Taylor 1992).

AGRICULTURAL PLANNING AT WARD AND VILLAGE LEVEL

As much as 80% of Omay is unsuitable for arable agriculture due to poor soils and broken terrain. Settlement presently extends over some 10% of the district but this is expanding due to illegal in-migration (Taylor in prep.). Consequently there is a need for appropriate and participatory subdistrict level land use planning: and officers of the Department of Agricultural Technical and Extension Services (Agritex) are currently preparing residential, arable and grazing area plans for individual households at a ward and village level.

Whilst this involves greater community participation than does the district level planning, there has been a failure on the part of the agency involved to recognise the increasingly important economic role wildlife is beginning to play in the district. Consequently much of the planning at this level is being undertaken without due cognisance being given to wildlife. For example, grazing holdings are being allocated in anticipation of cattle introductions (cattle are excluded from most of Omay since tsetse fly has been eradicated only recently), rather than as holdings for wildlife. The major concerns surrounding the introduction of cattle relate to the appropriate numbers that should or can be supported in relation to ecological sustainability, competition for resources with wildlife and wildlife predation upon cattle, as well as upon other domestic livestock.

Table 3: The proportion of revenue earned from the hunting quota of elephants in relation to the total value of the quota in Nyaminyami District.

YEAR	TOTAL VALUE OF QUOTA (Z\$)	VALUE OF ELEPHANTS (Z\$)	%
1989	189,400	83,000	43.8
1990	238,100	90,000	37.8
1991	223,100	75,000	33.6

WILDLIFE REVENUES

Over the three years 1989-1991, Nyaminyami District has earned Z\$1,273,503 (US\$467,397) from its wildlife. Moreover, in each successive year these revenues have increased, albeit only slightly in real terms (Figure 5). Earnings have come from a number of management and utilization activities, including hunting, cropping for meat production, problem animal control and, more recently, from tourism. Elephants are very much at the centre of these earnings, in particular, sport hunting. Not only does hunting generate 85% of the total wildlife revenue (Figure 5), but elephants themselves contribute 38% of the total value of the hunting quota (Table 3). Even though PAC contributed only 2% to income, this again was generated mostly from elephants shot on control. More importantly, it serves to illustrate the imperative of avoiding shooting elephants on PAC wherever possible and rather to convert them to safari animals as described above. Income is increased nearly twenty-fold, and the prospects for sustaining and conserving this valuable resource are much improved.

Present guidelines issued by DNPWLM (Anon. 1991) in respect of wildlife revenues earned by districts with appropriate authority under the CAMPFIRE programme require that District Councils retain no more than 15% of gross revenue as a levy; that up to 35% may be allocated to district level capital and recurrent expenditure, provided such expenditure is linked to wildlife management; and that at least 50% of revenue should be returned to wards, villages or households. Nyaminyami District has yet to meet these requirements. Only in 1989 was the ward dividend in excess of 50% of revenue and of the total Z\$ 1.27m earned to date only 39% has been returned to the wards.

DISCUSSION

Despite a growing human population in Omay, elephant numbers in the district have remained high,

at around 0.7/km² over the past 12 years and indeed have probably increased. Their continued existence, whilst ultimately linked to a limit in human population growth and immigration, is very much dependent upon human tolerance towards their presence. Such tolerance in Omay is being achieved through placing an economic importance on elephants which presently is being realised through high valued international safari hunting. To retain this value, limits have to be placed on the numbers of elephants destroyed in protecting crops.

During 1992 a quota was set for the number of elephants which could be shot on PAC and four such animals were successfully hunted by safari operators as trophy elephants following the approach described in this paper. Moreover, the District Council agreed to the revenues earned from these elephants being returned to the affected communities. Cheques varying in value from Z\$13,000-Z\$22,000 for each of the elephants shot were paid over to ward wildlife committee chairmen at the end of the rainy season by the safari operator concerned. In this way the offending crop raiding elephants were effectively dealt with; people benefited directly from the money earned through hunting; the safari operator was able to market more elephant and PAC was kept within sustainable limits.

The more benign forms of tourism based on game viewing, walking and photographic safaris are likely to become increasingly important in Nyaminyami as the joint venture partnerships come into operation over the next few years. Although this activity earned the district only 6% of its income in 1991, it is anticipated this will exceed the hunting revenue threefold over the next five years. Projected total earnings are likely to be around Z\$6m per annum with non-consumptive tourism and hunting contributing Z\$4.5m and Z\$ 1.5m respectively (V.R.Booth pers. comm.). Elephants, of course, are an essential and key component to such revenue generation, together with the full spectrum of spectacular wildlife and scenery which characterise the district.

Earning money from wildlife can be achieved with a great measure of success as Nyaminyami District has demonstrated, and elephants are very much a part of that. But this is only one-half of the task at hand. It is even more important that the district ensures the wildlife revenues are returned, to the appropriate beneficiaries who are the rural poor and peasant

farmers who have to live alongside the wildlife which has been so much of a problem to them in the past. Returning such benefits to people who bear the cost of living with wildlife is at the heart of the CAMPFIRE programme and this has yet to be meaningfully achieved. Not only must benefits be returned, however. There must also be greater participation on the part of local inhabitants and communities in the control and management of wildlife so that they become both responsible and accountable for their wildlife and wild-land resources.

CONCLUSION

Elephant conservation is as much an institutional problem as it is a technical one and its resolution lies in the hands of local people who will make the ultimate decision as to how they finally use their land. That decision will be strongly influenced by what benefits from wildlife, and elephants in particular, perceived and actual, accrue to individual householders and farmers. Only when perceived as an asset will the conservation of elephants truly become part of a locally developed and integrated approach to land use, and part of an economy that makes wise and sustainable use of natural resources.

ACKNOWLEDGEMENTS

The assistance of the Nyaminyami District Council and the Nyaminyami Wildlife Management Trust is gratefully acknowledged. In particular, Simba Hove, Elliot Nobula and Imke van der Honing were especially helpful with the collection of field data and the compilation of records. Rob Style of Buffalo Range Safaris provided much of the initial stimulation on how to reduce conflict between safari hunting and problem animal control, as well as putting these ideas into practice. Doris Jansen and Ivan Bond kindly provided access to their unpublished financial data, and David Cumming made valuable comments on the paper.

REFERENCES

- Anon. (1987). The National Conservation Strategy. Zimbabwe's Road to Survival. Ministry of Natural Resources and Tourism. Government Printer, Harare.
- Anon. (1991). Guidelines for CAMPFIRE. Department of National Parks & Wild Life Management, Harare.

-
- Bell, R.H.V. (1985). The man animal interface: an assessment of crop damage and wildlife control. In: *Conservation and Wildlife Management in Africa*. eds. R.H.V. Bell & E. McShane-Caluzi. U.S. Peace Corps, Washington.
- Cumming, D.H.M. (1981). The management of elephant and other large mammals in Zimbabwe. In: *Problems in Management of Locally Abundant Wild Mammals*. (eds) P.A. Jewell & S. Holt. Academic Press, New York.
- Cumming, D.H.M. (1989). Commercial and safari hunting in Zimbabwe. In: *Wildlife Production Systems*. eds. R.J. Hudson, K.R. Drew & L.M. Baskin. Cambridge University Press, Cambridge.
- Jansen, D.J. (1990). What is a joint venture? Guidelines for District Councils with Appropriate Authority. WWF Multi-species Project Paper No. 16.
- Jansen, D.J. (1992). Economic evaluation of fencing projects. In: *Fencing as a management tool.. in Zimbabwe's wildlife programmes*. (ed.) R.E. Hoare. Proceedings of a seminar. Department of National Parks & Wild Life Management, Harare.
- Mackie, C. (1992). Implementing electric fencing projects in communal lands of Zimbabwe. In: *Fencing as a management tool in Zimbabwe's wildlife programmes*. (ed.) R.E. Hoare. Proceedings of a seminar, Department of National Parks & Wild Life Management, Harare.
- Martin, R.B. (1986). Communal areas management programme for indigenous resources (CAMPFIRE). A report of the Branch of Terrestrial Ecology, Department of National Parks & Wild Life Management, Harare.
- Martin, R.B. (1990). Elephant and rhino conservation in Zimbabwe. Paper presented to the Japan Wildlife Research Centre, Tokyo, August 1990. Department of National Parks & Wild Life Management, Harare.
- Parker, I.S.C. & Graham, A.D. (1989). Elephant decline: Downward trends in African elephant distribution and numbers (Part 1). *International Journal of Environmental Studies* 34, 287-305.
- Taylor, R.D. (1982). Buffer zones: Resolving the conflict between human and wildlife interests in the Sebungwe Region. *Zimbabwe Agricultural Journal* 79, 179-184.
- Taylor, R.D. (1988a). The indigenous resources of the Zambezi Valley: An overview. *The Zimbabwe Science News* 22, 5-8.
- Taylor, R.D. (1988b). Elephant numbers, distribution and movement in Omay Communal Land. Unpublished report, Department of National Parks & Wild Life Management, Harare.
- Taylor, R.D. (1990a). Ecologist's Report for 1989: Nyaminyami Wildlife Management Trust Annual General Meeting, February, 1990. WWF Multispecies Project Paper No. 9.
- Taylor, R.D. (1990b). Plan of zonation for wildlife and tourist development in Nyaminyami District, Kariba. Unpublished report submitted to the Board of Management, Nyaminyami Wildlife Management Trust.
- Taylor, R.D. (1991a). Aerial census of large herbivores in pilot project areas, October 1989. WWF Multispecies Project Paper No. 11.
- Taylor, R.D. (1991b). Socio-economic aspects of meat production from impala harvested in a Zimbabwean communal land. In: *Wildlife Production: Conservation and Sustainable Development*. eds. L.A. Renecker and R.J. Hudson. University of Alaska, Fairbanks.
- Taylor, R.D. (1992). Ecologist's Report for 1990: Nyaminyami Wildlife Management Trust Annual General Meeting, February, 1991. WWF Multi-species Project Paper No. 28.
- Taylor, R.D., Cumming, D.H.M. & Mackie, C. (1992). Aerial census of elephant and other large herbivores in the Sebungwe 1991. WWF Multi-species Project Paper No. 29.