

# The Leopard *Panthera pardus* in Africa

NORMAN MYERS



IUCN MONOGRAPH NO. 5

INTERNATIONAL UNION FOR CONSERVATION OF NATURE  
AND NATURAL RESOURCES, MORGES, SWITZERLAND, 1976

# The Leopard *Panthera pardus* in Africa

NORMAN MYERS

Report of a Survey of the present status  
and future prospects of the species throughout Africa  
south of the Sahara: IUCN/WWF Joint Project

IUCN MONOGRAPH No. 5



International Union for Conservation of Nature and Natural  
Resources, Morges, Switzerland, 1976

Copyright © International Union for Conservation of Nature and Natural Resources (IUCN). All rights reserved



PRINTED BY Unwin Brothers Limited  
THE GRESHAM PRESS OLD WOKING SURREY ENGLAND

*Produced by 'Uneoprint'*

A member of the Staples Printing Group



## Foreword

Increasing human pressures on ever-dwindling wild areas make it necessary to keep under review the use man makes of these areas and the wildlife they contain. IUCN is concerned that economic demands do not override other values and unnecessarily destroy natural communities or lead to the extinction of species of plants and animals.

The trade in the skins of spotted cats has resulted in the exploitation of wild spotted cat species at a rate which is likely to bring many, if not all, of their present populations to eventual extinction unless remedial action is taken. IUCN in association with its sister organisation, the World Wildlife Fund, commissioned Dr. Norman Myers to undertake a status survey of leopard in Africa south of the Sahara and to assess the nature and extent of the threats to its survival. The International Fur Trade Federation voluntarily imposed on its members a moratorium on the handling of the skins of several species, including the leopard, for a period of three years and contributed towards the cost of the survey.

The present publication has been prepared by Dr. Myers as a result of his enquiries and field investigations. The views expressed, the conclusions drawn and the recommendations made are those of the author.

Although the leopard still occurs in comparatively large numbers in certain areas and the species is not in imminent danger of extinction, it is clearly under very heavy pressure on account of the value of its skin. The extent of the leopard skin trade constitutes a major and continuing threat to the leopard, especially as the commercial incentives involved have led to considerable illegal traffic. The enforcement of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the leopard being listed in Appendix I, could do much to alleviate this threat.

The report draws attention to the resilience of leopard populations due to the adaptability of the species to a wide range of habitats, but emphasises that this characteristic can only be used to management advantage under conditions of very strict control throughout all stages of the management scheme. Such conditions cannot obtain under present circumstances.

IUCN urges that all Governments concerned should cooperate in taking necessary steps to control the demand, traffic and supply of wild animal products, and of leopard skins in particular, and is already encouraging initiatives to this end.

24 October, 1975

# Contents

	Page
SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS	9
CHAPTER I INTRODUCTION	
Aims and scope of the survey	11
Methods and procedures	11
Significance of the rainforest biome	13
Significance of leopard behaviour patterns	14
CHAPTER II ECOLOGY AND ETHOLOGY: CONSIDERATIONS OF RELEVANCE TO THE SURVEY	
Taxonomy	16
Habitats	16
Density	17
Diurnality and Secretiveness	18
Food resources	19
Conservation implications	20
CHAPTER III LEOPARD STATUS BY REGIONS	
(a) East Africa	24
Kenya	26
Uganda	28
Tanzania	28
(b) The Miombo Woodland Zone	29
Angola	31
Zambia	31
Mozambique	32
Malawi	33
(c) Southern Africa	34
Botswana	35
Rhodesia	36
Namibia (S.W. Africa)	38
South Africa	39
(d) West Africa	40
Senegal	45
Mali	46
Upper Volta	46
Niger	47
Tchad	47
Central African Republic	48
Gambia	48
Guinea	48
Sierra Leone	48
Liberia	49
Ivory Coast	49
Ghana	50
Togo and Dahomey	50
Nigeria	50
Cameroun	51
(e) North-east Africa	52
Sudan	52
Ethiopia	55

Somalia	58
Territory of Afars and Issas	59
(f) The Equatorial Rainforest region	59
Congo	59
Gabon	59
Zaire	61
Summary of Leopard Status in sub-Saharan Africa	62
CHAPTER IV	THE LEOPARD'S STATUS: BASIC FACTORS AND ISSUES
(a) Factors affecting present and prospective status	64
Intensification of agriculture	64
Other agricultural impacts	64
The international fur trade	65
(b) Current conservation measures	65
(i) Legal protection of the species	66
(ii) Creation of Reserves	66
CHAPTER V	A NEW APPROACH TO LONGTERM MANAGEMENT OF THE LEOPARD RESOURCE
Management in livestock areas	67
Regulated exploitation	68
Controls for sustained yield harvesting—	
(a) Bio-ecological aspects	69
(b) As applied to export procedures	70
(c) As applied to import procedures	70
Conclusions	71
REFERENCES.	73
APPENDIX	
Scientific names of species mentioned in text	78
TABLES	
1 Leopard distribution and status in East Africa	25
2 Leopard distribution and status in the Miombo Woodland Zone	30
3 Leopard distribution and status in Southern Africa	34
4 Leopard distribution and status in West Africa	42
5 Leopard distribution and status in North East Africa	54
6 Leopard distribution and status in the Equatorial Rainforest Region	60
FIGURES	
1 Map of leopard distribution in East Central and Southern Africa	24
2 Map of leopard distribution in West Africa	41
3 Map of leopard distribution in North East Africa	53
4 Map of principal zones of Ethiopia	56
5 Map of leopard distribution throughout sub-Saharan Africa	62
PLATES	
Frontispiece: photograph by N. Myers	(4)
Plate I: photographs by N. Myers	23

## Summary of Conclusions and Recommendations

By virtue of its ecological and ethological attributes, the leopard<sup>1</sup> is an exceptionally adaptable predator. In undisturbed conditions, it occupies every biome in Africa south of the Sahara except the most arid. In certain habitats, notably woodland and thornbush areas, it is reputed to reach remarkably high densities, even as high as one per 2 km<sup>2</sup>. In lowland and montane forests, its densities may sometimes be still higher.

Its capacity for adapting to changes in prey species, hunting conditions, carnivore competition, vegetation patterns and human activities, enables it to survive in developing Africa with more success than almost any other large wild animal. It can even persist in more or less advanced agricultural areas, though often in very reduced numbers. The one agency which represents an over-riding threat to the leopard—poison—is now readily and cheaply available in rangeland Africa, and coming into rapidly increasing use. If the use of poison can be regulated, the leopard should maintain satisfactory status, even though its numbers—like those of most species of wildlife in Africa—will decline in many areas during the next few decades. The leopard's present status is much more favourable than that of a number of other major mammal species, notably the cheetah, but also the lion, wild dog, three species of hyena and two of rhinoceros, giraffe, hippopotamus and crocodile. By 1980, the leopard, compared with several of these species, may enjoy yet more favourable status, a trend which could well continue throughout the years thereafter.

Meanwhile, the international fur trade, together with the poaching it has induced, has depressed leopard populations in several parts of Africa. Despite the moratorium in skins recommended by the International Fur Trade Federation in September 1971, demand for them in 1973 (when the survey was completed) was stronger than ever before, notably from France, Italy, Spain, Scandinavia and Japan. Fortunately the leopard shows more capacity to recover from over-exploitation than the other main spotted-fur species of Africa, the cheetah.

As a consequence of the survey's findings, the principal conservation measure recommended is strict control of the use of poison for destroying predators in and around livestock areas. The policy adopted should recognise that predator destruction is only one aspect of predator management, which in turn must be viewed as only a single part of a broad evaluation of natural resources and their worth to society. Such an approach would not exclude protection of their legitimate long-term interests on the part of livestock-owners.

It is further recommended that, since there are no bio-ecological grounds for permanently banning exploitation of the leopard by the fur trade, a framework for limited off-take on a sustained-yield basis could eventually be investigated. The methods for regulating this exploitation would entail a complete break from those of the past, which have proved grossly inefficient both economically and ecologically. A rigorous system of controls would have to operate throughout the production, processing and marketing phases, in producer and consumer countries alike. Without such a system which all participant parties would support in good faith, exploitation should not be countenanced in any form.

---

<sup>1</sup> Scientific names of all species mentioned in the text are listed in the Appendix.

Meantime, the leopard should remain for the foreseeable future in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. This category extends complete protection. The Convention, having come into force in a number of countries on 1 July 1975, should help protection to become more effective in much of the leopard's range in Africa.

## CHAPTER 1

# Introduction

### AIMS AND SCOPE OF THE SURVEY

The survey was instituted to assess the status of the leopard in Africa south of the Sahara (hereafter referred to as sub-Saharan Africa). The principal intention was to determine the leopard's distribution, and to ascertain whether its numbers were being unduly depleted by such factors as the fur trade and modification of Wildlands. Special emphasis was to be directed at trends in land use which may affect the leopard, in order to determine dynamic aspects of its status. Arising out of these investigations, guidelines were to be formulated for the more effective conservation of the species.

Since there is no evidence of significant numbers of leopards in northern Africa, the survey was restricted to sub-Saharan Africa. Although every country of this region had to be considered, detailed investigations were appropriate only in those areas which seemed important to the leopard's continental status. Sub-Saharan Africa now comprises well over 40 countries. With the limitations of time and funds available, visits could be arranged to no more than a selection of countries. The aim was to make an on-the-ground assessment of at least one country in each of the major biomes, viz. Sahel, Sudano-Guinean woodland, rainforest and *miombo* woodland, in addition to the basic study of East African savannah grasslands discussed in the next section. Special emphasis was directed at the countries of southern Africa, to ascertain what features of agricultural development have contributed to the decline of the leopard in that region and whether these are likely to be replicated elsewhere. There was also need to assess trade pressures in that region, since South Africa exports more products made from spotted cat skins than the whole of the rest of Africa. Ethiopia and Djibouti also merited visits, due to their reputation as significant channels for the trade in illicitly-obtained furs. In the event 22 countries were visited and an extensive correspondence conducted with 10 others.

### METHODS AND PROCEDURES

A survey of a secretive and solitary species in a region as large as the whole of the U.S.A. required a carefully designed methodology. The scale of operations offered little opportunity for techniques used in the intensive study of discrete populations of other predator species. Thus while marking of individual animals for Lincoln Index censusing may give reliable population estimates in a few localities, radio-tracking of leopard—usually an elusive and nocturnal species—has presented problems in Tsavo Park in Kenya, Serengeti Park in Tanzania and Kruger Park in South Africa; moreover, this approach is impractical for a whole country like Kenya, let alone for East Africa or the sub-Saharan region. Other techniques, such as analysis of hunters' success ratios or Game Department control operations, are useful only for giving some rough idea of distribution and density; without comprehensive data for an extended period for a particular area, they say little in terms of absolute status. The same applies to spotted-fur trade figures, which reveal little except when a sustained off-take suggests a substantial stock; in any case, these figures are difficult to obtain, given the secretive

attitude of most dealers both inside and outside Africa, and the tendency of governmental officials to lump skins of several species together when preparing turn-over statistics.

At an early stage in the investigation, however, it became clear that detailed population estimates would be unnecessary. It is usually quite sufficient to know if in a given locality more than a remnant population exists, and thereafter to determine whether it is expanding, declining or stable; nothing more precise is needed for planning long-term conservation measures. The reasons for this approach need emphasis, especially since no attempt was made to carry out the kind of detailed ecological study which has often been undertaken in Africa. The main analysis centred on trends over extended time horizons for entire regions, with focus on the information required to develop national or regional conservation programmes rather than specific research projects of self-validating worth. So no attempt was made to document every locality in which leopard have been seen in the past few years, or to establish a 'static' assessment of the position in 1972/73. A population of 100 leopard in a patch of forest is of little interest if the habitat is scheduled to be turned over to maize plantations within a few years. Rather the survey concentrated on the general distribution of viable populations, and on trends and constraints that affect them.

Nevertheless, in order to devise the most appropriate method of investigation at continental level, a design model was needed. For this purpose, the first six months of the survey were spent in East Africa, with which I was familiar after 14 years' residence. The region seemed particularly relevant on the grounds that it offers an exceptional range of physiobiogeographic patterns, of areas (many of them protected) which still sustain large numbers of wild animals, and of varying degrees of human disruption of wildland environments. It also has many people who are professionally involved in wildlife, and who can provide a fund of relevant experience.

The emphasis on this design aspect proved useful. For example, analysis of the situation over the spectrum of biotic associations in Kenya, Tanzania and Uganda helped to identify significant components of the concept 'status', and of criteria for 'plentiful', 'enough', 'rare' and 'threatened'. The basic ecology and behaviour of the leopard are so distinctive that special tools are needed to assess what degree of threat to its existence is tolerable. Assuming that the habitats, food and breeding requirements for the species can be determined, then if a local population can be shown to comply with 'safe minimum conditions', there is no need to seek anything like a precise estimate of numbers in order to assert that the population is in no immediate danger. But 'danger' must be viewed dynamically, like the leopard's habitat, full account being taken of any disruptive processes which may be accumulative, progressive and accelerating. Of course massive reservations attach to extrapolations of these design features to an extensive survey across such a large region as sub-Saharan Africa. But the guidelines developed from intensive study in East Africa served as a check on information collected in other parts of the region, while the latter helped to correct various analytical judgements based on East African data.

A survey of this kind depends heavily on consultation of experts. Wildlife and park officials at national and local level, private wildlife organisations, field scientists, anti-poaching teams, professional hunters, trappers, poachers, wildlife cropping units, fur-trade dealers, indeed anyone with specialist knowledge of wildlife, made up the 548 persons consulted directly and the further 244 with whom I corresponded. A second even larger group of persons with other field

experience of various kinds, including ranchers, veterinarians, livestock officials, forestry personnel, road gangs, customs officials, police and army personnel, anti-malarial teams, Peace Corps and other volunteers, and local chiefs and headmen, totalling around 850 in all, were interviewed, and over 100 additional contacts were consulted through correspondence. Many of these persons were able to make reliable contributions based on actual field observations. Even so, care had to be taken with some, particularly in the second group, who tended to confuse observation with interpretation, however good their intentions. This reservation applies especially to enquiries about spotted cats, a subject on which people often hold pronounced views one way or the other. Some people insist that the leopard is severely endangered, others assert that it will continue to proliferate (to some extent these two biases tend to cancel each other out). On the whole, however, it did not prove difficult to sift out grossly unreliable information by normal dialectical methods. At intervals in an interview, questions can be asked—whether of fact or of interpretation—to which the interviewer knows the answers. Or the questioner can play the devil's advocate in order to determine the degree of conviction behind an observer's statement. Various similar stratagems arise according to the occasion.

A special category of consultants, used to supplement field work, comprised representatives of the fur trade in Europe and North America. This part of the survey aimed at determining the extent of past off-takes and at evaluating the response of leopard populations to various degrees of human predation. It was hoped, and always explained to those approached, that this would provide the necessary indices of market trends as measures of supply and demand, and would thus facilitate a more precise appreciation of the potential for efficient and possibly expanded future exploitation of the resource. In the event some 52 interviews and 69 written enquiries (eliciting 17 replies) produced the most poorly documented section of the survey data, allowing only 'order of magnitude' estimates of past harvests. Fur dealers are naturally covert in their operations out of self-interest in a highly competitive market, but any eventual proposal for controlled exploitation, as discussed in Chapter V, will demand a much more forthcoming attitude from furriers, at least at national level, if the trade is to serve its own best interests in the long-term future.

## SIGNIFICANCE OF THE RAINFOREST BIOME

Two particular aspects of the survey's methodology merit separate discussion in concluding this Introduction. They are the problem of evaluating leopard populations in rainforest areas, and the extent to which the behaviour and ecology of the species, discussed in detail in the next Chapter, affect an assessment of its status.

Rainforest biotopes are reputed to present optimal habitats for leopard. Since detailed observations are difficult in forests, there are few detailed research findings of plant and animal biomass, and hence limited precise knowledge of carrying capacity of forest areas for particular animal species. Ungulate biomass is generally low, but primates and arboreal rodents, as well as birds, reptiles and fish of rivers and inundated areas, often attain significant numbers. Thus there may be abundant food resources at all levels for a carnivore able to take advantage of them. Moreover, the habitat favours a predator which is stealthy and an expert climber, and which operates alone

and hunts equally well by night or day. All of these attributes apply to the leopard.

At the same time, the forest environment makes it extremely difficult to arrive at even working estimates of leopard densities. Methods such as searching for kills—useful in savannah biotopes—are ruled out not only by poor visibility in high forest, but also by the fact that leopards there seldom cache food much above ground level, possibly because they have little to fear in the forest from marauding lions, hyenas, jackals and other scavengers. However, a considerable amount of circumstantial evidence has been collected by reliable observers. In enclosed environments of the forest, the leopard seems to prefer almost exclusively to move along paths and trails, which limits its main activities to 5 percent or less of the forest area. In these circumscribed localities its tracks, droppings and scratch marks, plus its various vocal signals at night, give some idea of numbers.

Since the leopard appears to be the principal if not the sole large predator in some rainforest areas, this may account for the high densities which it reputedly attains. In exceptionally favourable conditions, densities are put as high as one to three square kilometres or even one to each square kilometre. Although little is known about the upper density limits for large felids (e.g. how intense are spacing mechanisms at different densities), high population levels are not unlikely in view of what is known of the number of large predators in certain savannah areas. In the 115 km<sup>2</sup> of Nairobi Park, there are estimated to be, on a year-round basis, 25 adult lions, about 10 adult cheetah, and some leopards and hyenas. Ngorongoro Crater's 275 km<sup>2</sup> contain at least 75 lions and 400 adult hyenas. In habitats with dense vegetation and an abundance of impala in Kruger Park, there may be two leopards per 3 km<sup>2</sup>. Schaller (1972) gives total predator biomass figures per square kilometre as 95.7 kg in Ngorongoro, 44.7 in Manyara National Park and 32.4 in Nairobi Park. If the average weight of a leopard is put at 30 kg (viz. three-quarters that of an adult female), a rainforest density of one to one km<sup>2</sup> is by no means out of the question when the leopard is the only large carnivore.

Moreover, assessment of predator numbers is prone to underestimate true totals. This is partly due to the capacity of wild felids to exist in unlikely localities without betraying their presence. For example, the cougar or mountain lion in California was thought in 1971 to number only between 200 and 800. A systematic investigation showed, however, that the population probably exceeded 2000. Subjective factors are also significant. For example some observers are inclined to assume that constant and considerable pressure on a species like the leopard, or a marked increase in the number of traps found in a protected area, must be reducing the population to a low level. The objective factor at issue, however, is whether the off-take exceeds the recruitment potential of the species, and whether more numerous traps are actually resulting in more captures.

#### SIGNIFICANCE OF LEOPARD BEHAVIOUR PATTERNS

This account has already indicated how difficult it is to arrive at reliable estimates of leopard numbers due to the animal's secretive nature. To cite a specific example, Tanzania's Lake Manyara Park is believed to support considerable numbers of leopards in its 60 km<sup>2</sup>. The park receives some 70,000 visitors a year, yet these people see scarcely a single leopard. But scratch marks and other signs were little less frequent in 1973 than in 1968,

and park rangers believe the park still supports a moderate population. Since each animal tends to circulate within a territory or home range, the frequency of signs permits an estimate of population density.

Something the same applies outside forest environments. As already mentioned, the leopard likes to follow paths in parks, whether game trails or vehicle tracks. In Serengeti it is noticeable how a leopard, like a lion, when making its way across country will head for a track, even if that means a detour. Perhaps this is because the animal is thereby less likely to get thorns in its paws. In early morning, both cats fastidiously lift their feet high when moving through dew-wet grass, until they come to a path. In swampy areas leopard spoor can often be picked up where the animal has chosen a point to cross to drier ground without unduly dirtying itself.

Although these indications may not serve as a precise measure of numbers, they establish the leopard's existence in the vicinity. This factor is all the more relevant in those areas where the leopard is subject to harassment, particularly poaching. While leopards in protected areas can be seen on the move by day, they become exclusively nocturnal and much more cautious in places where they have learned to fear man. Throughout the survey, I came across areas where leopards were thought to have been eliminated on the grounds that they were seldom if ever heard or seen. A check on spoor and other signs, however, indicated more often than not that leopard still survived, even in fair to moderate numbers, though growing much more secretive.

A final important behavioural feature is that, unlike the cheetah, the leopard is not hyper-sensitive to marginal changes in land-use patterns. Bush encroachment in overgrazed savannah is of little adverse consequence, and may even enhance the animal's security. In some respects, indeed, the leopard thrives in seral stages of vegetation successional patterns, which makes it less susceptible than many other large mammals to man's disruptive activities. In this sense the leopard's status, unlike that of the cheetah, cannot be evaluated by analysis of land-use trends, except when fundamental modifications are imposed on natural environments.

## CHAPTER II

# Ecology and Ethology: Considerations of Relevance to the Survey

For conservation reasons, if no other, it is imperative to establish in as much detail and as quickly as possible the ecological and behavioural characteristics of any species which is or is likely to come under threat. This Chapter takes up some points already touched on in the Introduction, and adds a number of further relevant considerations.

The kind of information required for a predatory species includes: population variations according to biotope and other distributional factors, intra-specific mechanisms that regulate numbers, the main prey species, the response of prey species to predation pressures and how this in turn effects the predatory, the social organisation of the species and how it compares with that of other predators in the area or reflects local environmental conditions, and, finally, the inter-relations of all these attributes.

Despite the amount of attention the leopard has received, there is little substantial information about the species. This Chapter attempts only a brief review of the present state of knowledge, with particular reference to aspects which may affect practical conservation measures. For further details the reader is referred to Ewer (1973), Hamilton (1975), Myers (1974a), Schaller (1972) and Turnbull-Kemp (1967). Useful comparative data for the leopard in Ceylon is to be found in Eisenberg (1970) and Eisenberg & Lockhart (1972).

## TAXONOMY

The leopard's taxonomy has been recently reviewed by Smithers (1968). The evidence for the validity of various subspecies of leopard which have been described is inconclusive and likely to remain so. From a conservation and management point of view this is a pity, since if particular forms, for example the so-called Somali leopard, proved to be distinct, it would be easier to generate support for exceptional measures to conserve them.

Within the cat group as a whole, the leopard is in many respects the archetypal felid, and stands at the opposite end of the spectrum from the cheetah (Kleiman & Eisenberg 1973; Schaller & Lowther 1969; and, for diagrammatic and tabular presentations, Estes 1967 and Schaller 1972).

## HABITATS

The only habitat in sub-Saharan Africa with which the leopard is unable to cope is outright desert. It can exist in zones with as little as 50 mm rainfall (Monod 1965). In arid areas it is reported to survive on moisture from its victim's blood, or, as in the Kalahari, it derives moisture from 'desert melons'. At the other extreme, it can exist satisfactorily in the alpine zone of East African mountains (Bourlière 1965; Brown 1971). It is often plentiful in the ericaceous zone above the montane forest belt, which usually proves the limit for large mammals (Cloudsley-Thompson 1969). In the Virunga volcanoes, Bourlière & Verschuren (1960) found it more common in higher zones around

2680m, as in Nyamilagira Caldera, than in the forest belt. Traces were even found near the summits of several mountains at 4000m or above. In the Ruwenzori sector, leopards are reputedly scarcer in the semi-closed forest of the Semliki than on the mountain slopes. Altitudes about 3000m seem to be favoured: Verschuren found signs at 4350 and 4600m, and I have myself seen tracks near several mountain huts.

This adaptability to higher altitudes could well prove advantageous to the leopard. As agricultural pressures on lowland environments increase, mountain massifs in sub-Saharan Africa will still provide at least half a million km<sup>2</sup> of rugged terrain habitats. In these regions the prey species—notably rodents and hyrax—are unlikely to decline; furthermore poaching has so far proved much less intensive and sustained than any which has been recorded in lowland environments, notwithstanding the boom in leopard skins of the past ten years.

## DENSITY

Since it is virtually impossible to census leopard populations, it is all the more important to devise methods of measuring approximate densities according to habitat types, prey distributions and predator competition. For example, prey of the right size must be *available*: the migration pattern of Thomson's gazelle in the Serengeti means that each leopard in its territory or home range encounters a situation of feast or famine. Then the prey must be *vulnerable*: in riverine localities, where the leopard normally has excellent opportunities for hunting reedbuck, a fierce grass burn which strips the banks of tangled undergrowth may make it much more difficult for a leopard to get close to its prey. This is one reason why ecotonal areas are especially favourable to leopards; by consequence higher densities of leopards are likely to be found where there is plenty of 'edge effect' than elsewhere except in forests. Even open grassland is seldom devoid of thickets which the stealthy hunter can use for ambush. Bush patches are also favoured by the leopard for feeding undisturbed, except where hyenas or lions in the vicinity induce the leopard to cache its kill well above ground.

These habitat constraints reflect upon realistic density levels as opposed to crude approximations of density. The leopard population of Serengeti National Park has been estimated by Schaller (1972) at 500-600, or one per 22-26.5 km<sup>2</sup>. This figure is primarily based on detailed observations around Seronera in the centre of the park. The calculation possibly underestimates the carrying capacity of other Serengeti biotopes, notably woodlands. At Seronera, leopard are largely confined to rocky outcrops (kopjes) or bushy gullies (korongos), since the grasslands that make up the rest of the zone provide little protection to leopard whether for hunting or feeding. A more accurate calculation might suppose that one quarter of Seronera supports leopards at a high density, the rest few or none. In the west and north of the park, leopard are believed (Bertram pers comm. 1973) to exist at higher densities than around Seronera, let alone in the more open scattered tree grassland to the east. In any case, the ecological theory behind density estimation is still imperfectly understood. It must take account not only of prey biomass, but of niche exploitation, inter-compensatory mechanisms and a spectrum of dynamic constraints for inter-specific relationships between large predators. Thus Schaller (1967) found reason to believe that in India leopard numbers may increase where the tiger has been reduced or has disappeared.

Within this analytic framework, it is worth quoting some estimates of leopard density. Kruger Park in South Africa is credited with over 1000 leopards in its 19,500 km<sup>2</sup>, and as many as 2 per 3 km<sup>2</sup> in certain localities (Pienaar pers. comm. 1973). Similar densities have been recorded in neighbouring Game Reserves with thick-grown vegetation and an over-abundance of impala. Othawa Farm near Sabi Sand Wildtuin reports that its 32 km<sup>2</sup> supports 3 or 4 territorial male leopards. If—a somewhat big if—each male territory supports one female for a good part of the year, total density reaches one leopard to 4-5 km<sup>2</sup> (Robson pers. comm. 1973). The Matetsi ranches in Rhodesia reputedly contain 380 leopard in 1600 km<sup>2</sup>—plus about 170 lion, 100-110 cheetah, 300-400 hyena and 260 wild dogs—(Longhurst pers. comm. 1973), which means an overall leopard density of 1 to a little over 4 km<sup>2</sup>. Rhodes Matopos Park in Rhodesia, with plenty of rocky outcrops to supply cover and an abundance of small prey such as hyrax, is reckoned to support at least 2 leopard per 3 km<sup>2</sup> (Grobler pers. comm. 1973).

In short, the leopard seems able to maintain a density of 1 to 10 km<sup>2</sup> in moderately suitable habitats, and 1 to 5 km<sup>2</sup> in favourable ones, with perhaps even 1 to 1 km<sup>2</sup> in exceptionally suitable conditions.

#### DIURNALITY AND SECRETIVENESS

The leopard is frequently considered to be a nocturnal hunter, in line with its generally stealthy and secretive habits. But this generalisation may not be so valid as supposed. In the Aberdare Park of Kenya, where poaching has been virtually excluded for 15 years, the leopard is often seen by day, whether prowling or lying up in the open. The same applies in the Botswana Kalahari, where Smithers (pers. comm. 1973) has seen more leopard in one day than in 20 years in Rhodesia. Similar experiences have been reported from Niokolo-Koba Park in Senegal, Lusira Valley in Upemba Park, Zaire, and the tourist-frequented area round Seronera in Serengeti Park, Tanzania. This suggests that leopard become almost exclusively nocturnal only when they feel insecure by day, whether because of human harassment or disturbance by competitive carnivores. Where lions and hyenas do not naturally occur, as is the case in the Aberdares Park and rainforest habitats, or where they have been eliminated as in the case in parts of South Africa (Brain 1969, 1970) and in parts of India (Joslin pers. comm. 1972), leopards often do not trouble to cache their food. Where human activities are pervasive, the leopard rarely shows itself by day.

This aspect of the leopard's behaviour may have an important bearing on assessment of its status. In several protected areas—for instance the Mara Reserve in Kenya, Gorongosa Park in Mozambique and Kafue Park in Zambia—the leopard has allegedly disappeared from one sector after another. This has often followed an upsurge of poaching, so is put down to a decline in numbers. But it may be partly due to greatly increased wariness and self-concealment whenever a human being, whether ranger or tourist, appears. In several areas where poaching is said to have eliminated leopards, a check shows that a moderate population nevertheless survives even though not a single individual is seen from one year to the next.

These ecological and behavioural attributes carry implications as regards an accurate assessment of poaching pressures. In the 11,500 km<sup>2</sup> Ruaha Park of Tanzania, lying entirely in the *miombo* biome and therefore perhaps capable of supporting up to 1 leopard for every 10 km<sup>2</sup>, poaching in the period 1970-72 was reported to have increased significantly, eventually reaching 'alarming

levels'. No measure was given of this situation, except that many more (number unspecified) traps and snares were being found, and poachers could apparently operate with impunity throughout the park since the ranger force was inadequately staffed to provide much beyond token protection. Evidence from elsewhere suggests that to catch 10 leopards per year, a poacher would need to tend 100 traps—a difficult task for an individual though not beyond the capacity of a gang. The traps needed to reduce a leopard population by 100, or under one tenth of Ruaha's possible total, would have been encountered so frequently as surely to cause the situation to be treated as an emergency. As this did not happen, a more likely assessment of poaching in Ruaha is that there had been a large increase of activity *relative* to the former situation, but that, in the absence of more specific evidence to the contrary, the pressure had not yet reached a level that would seriously endanger the survival of the park's leopard population.

### FOOD RESOURCES

The leopard is more catholic in its diet than any other of the large cats (see lists of prey cited by Kruuk and Turner 1967, Mitchell *et al.* 1965, and Pienaar 1969)<sup>1</sup>. Especially significant in the present context is the leopard's capacity to subsist on small prey. In mountain zones, it can apparently live off rodents such as mole-rats, of which there may be 40,000 per km<sup>2</sup> in some areas (Brown 1971). In the Rhodes Matopos Park, the leopard prefers rodents, snakes and game birds, even though hyrax, baboons, duikers, steinbok and other 'normal' prey are available (Wilson 1969). In the Arusha Park, rodents and other small mammals could ostensibly enable the leopard to survive even if the more usual prey—baboons, bushpig, Warthog and bushbuck—were to disappear (Vesey-Fitzgerald pers. comm 1972).

These examples indicate that the leopard will be much better placed than any other large predator in Africa if small and medium-sized herbivores continue to decline. In much of the continent outside parks and reserves, another decade could see the end of gazelles, impala, bushbuck, reedbuck and other antelope which frequently form the bulk of the leopard's food. While this trend could mean the demise of many cheetah populations (Myers 1975b), for the leopard it could entail only a decline in density. Furthermore, the leopard's adaptability allows it to survive in terrain that is too arid, rugged or inaccessible to be of much use for human settlement in the foreseeable future. By the end of the century, when development pressures will be acute in virtually all areas susceptible to human occupation, sufficient remote, harsh or uncultivable habitats should be left to support fair numbers of leopard, given its capacity to find sustenance from a wide range of prey species.

---

<sup>1</sup> The leopard exhibits a curious tendency to what Kruuk (1972) has called 'surplus killing'. Although there seem to be no African examples as well documented as one he quotes from India, where Joslin describes how in the Gir Forest out of 60 goats which broke out of a stockade at night 17 were killed by leopard though only 2 were eaten, the phenomenon almost certainly occurs. It is discussed at length by Kruuk, who concludes that 'surplus killing should be viewed not as the consequence of mere maladaptations but as a necessary and relatively small disadvantage accompanying behavioural compromises to meet conflicting environmental demands on both carnivores and prey'.

A further important feature of the leopard's diet is that it includes little domestic livestock. Although, as the survey showed, the leopard often lives close to man's estate, if not actually within it, instances of livestock depredation are remarkably few when compared with the many opportunities the leopard has to take calves, sheep and poultry, not to mention cats and dogs. Of course, there are numerous instances of leopard taking occasional animals, but it is altogether untrue to say that the leopard becomes habituated to living on domestic animals whenever it gets a chance, or that it is a source of pervasive impoverishment for African stock-owners. (Most inaccurate of all is the allegation that the leopard kills a fair number of people—an event so rare that it merits newspaper coverage.) As an instance of stock losses, a Malawi farmer lost 14 calves in 1971 worth US\$2100. In Cape Province of South Africa only 40 leopards were destroyed in defence of livestock during the period 1965/69. In Tanzania, leopard shot in defence of livestock totalled 54 in 1968 and 32 in 1969; in Zambia, 3 in 1971; in Uganda, 3 in 1968, 3 in 1969 and 2 in 1970; and in Kenya, 3 in 1969. When these figures are compared with numbers of livestock available to leopard, the rate of predation seems trifling. Such predation as occurs is probably in part a function of the amount of wild prey available, which would explain the higher figures for the intensively-farmed Cape Province. Similarly, the 510, 000 ha Leibig's range in Rhodesia lost 59 young stock to leopard in 1970, 82 in 1971, and 64 in 1972 (to cheetah 3, 3 and 13); during the previous ten years its stock-holding had increased from 35, 000 to 55, 000 head, with a concomitant decline in wild herbivores. The 22, 000 ha Valencia Ranch in Namibia, carrying 600 cattle and 4000 sheep and about 800 wild herbivores, lost 60-70 calves and 102 sheep in 1971 (worth around US\$2000), mostly to leopard but some to cheetah<sup>1</sup>. However, on Kenya ranches in recent years leopard have taken fewer stock than cheetah, while heaviest losses have been to hyena and jackal. In West Africa, an honorary game warden in a pastoral area of Sierra Leone reported that he shot on control a total of only 6 leopards in 40 years, 4 of them animals injured by hunters. In Nigeria, the demand for wild protein is so acute that antelope larger than duiker have mostly disappeared, and a cane-rat is now worth \$10-15. Yet despite this pressure on the leopard's normal prey, attacks on domestic animals are few and far between.

## CONSERVATION IMPLICATIONS

Many other aspects of leopard behaviour, such as social organisation, need not be discussed, since they appear to have less relevance to practical measures for the species' conservation. Indeed, sufficient preliminary information seems to be established on the leopard's habitat requirements, relationships with other carnivores, response to man and his domestic stock, and its overall adaptability, to make further research a low priority (in contrast to the situation for cheetah). (At the same time, of course, more data on leopard den-

---

<sup>1</sup> This ranch followed a policy of total predator elimination from 1907 to 1954, in which period 361 leopards (and 159 cheetah) were destroyed. Since 1954, the present owner, Mr. A. T. Port, has switched to live trapping, accounting for 106 leopards (and 159 cheetah) by 1972. This suggests that predators resist prolonged pressure of this order by increasing recruitment rates and establishing a new equilibrium with environmental conditions at a lower density level.

sities in forest biomes would be valuable since they could confirm or contravert some basic conclusions of the survey as to the leopard's continent-wide status and apparently positive future prospects.) Unlike many other endangered species calling for research, the leopard has an unusual capacity for looking after itself.

A principal consideration for conservation of the leopard is that its most favoured habitats, forest and woodlands, seem less likely to undergo extensive modification by 1980, and may remain little changed for some years after that. The equatorial rainforest may become subject to increased exploitation, now that West African forests are largely depleted. But all three countries concerned—Congo, Gabon and Zaire—possess rich mineral deposits, which may reduce pressure on forests as a means of financing development. Relict forests elsewhere, especially those in Eastern Africa, require much better conservation, but more for the sake of maintaining other wildlife species than the leopard whose continent-wide status will suffer far less from their destruction. As explained in the next Chapter, pressures in countries of the *miombo* woodland belt from population increases and development are likely to be less severe than in several other zones such as savannah grasslands. Even if a cheap and effective answer to the tsetse fly were devised, many of the *miombo*'s soils would prove too infertile to be of much use for agriculture.

In any case the leopard is exceptionally capable of responding to habitat changes. In early stages of man's modification of the landscape, the leopard possibly benefits from disruption insofar as it finds more 'ecotones' (see under 'Habitats' at the beginning of this Chapter). Of course when a large area is given over to crop farming, the leopard is scarcely more able to adapt to the new situation than any other form of wildlife (except rats and certain birds). Within another decade at most, this kind of fundamental modification is likely to affect considerable areas of savannah as drought-resistant maize becomes available.<sup>1</sup> But the leopard's total range, unlike that of the cheetah, will be only marginally reduced.

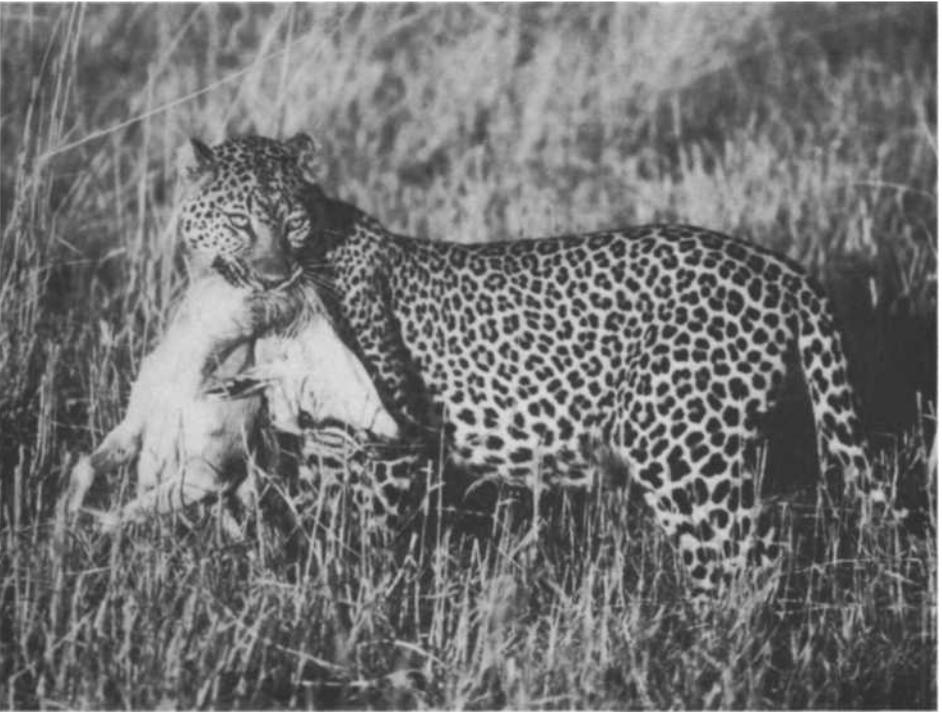
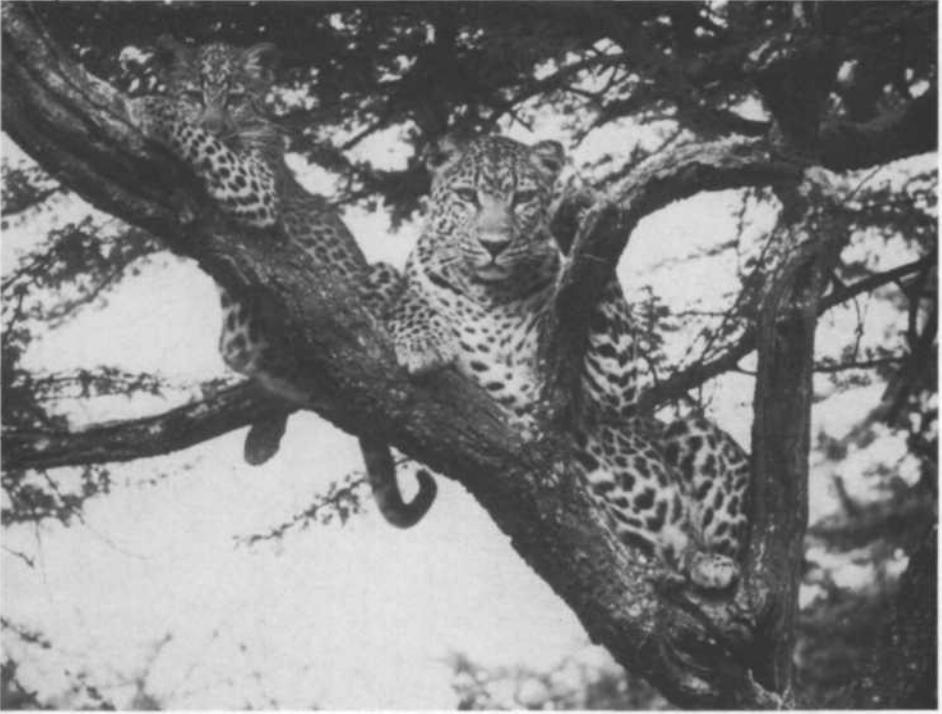
The greatest threat to the leopard derives from increasing use of poison. The leopard's propensity for scavenging makes it more susceptible than many carnivores to taking treated lumps of meat. Strychnine, which is usually well controlled, has largely gone out of use in African rangelands since the late 1960s. Instead organochlorines such as toxaphene can be obtained readily and cheaply for dipping to control livestock ticks. Chlorinated hydrocarbons like DDT, which can still be easily bought almost anywhere in Africa, serve well enough as a poison in baits. Like most poisons, these compounds are totally unselective and liable to kill at several stages along the food chain. Preliminary signs suggest that this threat is certainly capable of extirpating leopards from sizeable areas in a short space of time. As a factor in the leopard's future, it is of more consequence than traps, snares, guns and all other forms of combating the leopard put together.

Nevertheless, if the threat of poison can be contained, habitat destruction must in the long run be regarded as the main threat to the leopard. While this trend of course applies to African wildlife as a whole, the leopard by virtue of its adaptability will fare better than many other mammals. Poaching, by contrast,

---

<sup>1</sup> In Kenya the Katumani strain can mature if it gets a mere 125-175 mm. of rainfall in the growing season. This in effect means that more like 50% instead of 15% of Kenya's surface is now available for maize cultivation.

although increasing as a threat in absolute terms, is declining in relative impact. So the leopard, like the rest of African wildlife, is likely to find its range and numbers shrinking at an accelerating rate. By the end of the century if not sooner, it will almost certainly exist only in discontinuous populations. Individual animals will then be extremely difficult to sight in the harsh environments to which they will mostly have been confined. An example of the process is already offered by North African populations of the leopard, sometimes known as the Barbary leopard. After holding out in fair numbers in Morocco till about 1945, it is now restricted to two small localities, and its numbers are put at 100 or less (Fisher *et al.* 1969). Much the same applies in the rest of the Maghreb. Although Fisher (*loc.cit.*) believes the main reason to be the elimination of prey (despite the small animals which one might suppose would enable the leopard to survive in those areas), at least two other major factors have taken their toll: the elimination of leopards by livestock-owners, on the grounds that they are increasingly molesting livestock (whether or not a particular animal is a proven livestock-killer or not); and the allurements of the fur trade. The same fate has apparently befallen the leopard in several parts of the Middle East and Central Asia; while the accepted assessment of the status of these races, viz. 'on the verge of extinction', would be difficult to demonstrate in view of some of the extremely rugged and inaccessible country concerned, there is little doubt that numbers have been brought to low or very low levels. No doubt populations in sub-Saharan Africa could eventually be reduced to token remnants in a scattering of wild biotopes, unless more effective conservation measures can be brought to bear.



CHAPTER III

Leopard Status by Regions

(a) EAST AFRICA (See Fig. 1 and Table 1 for summarised data)

This is the most heterogeneous region of Africa. Its topography and climate are

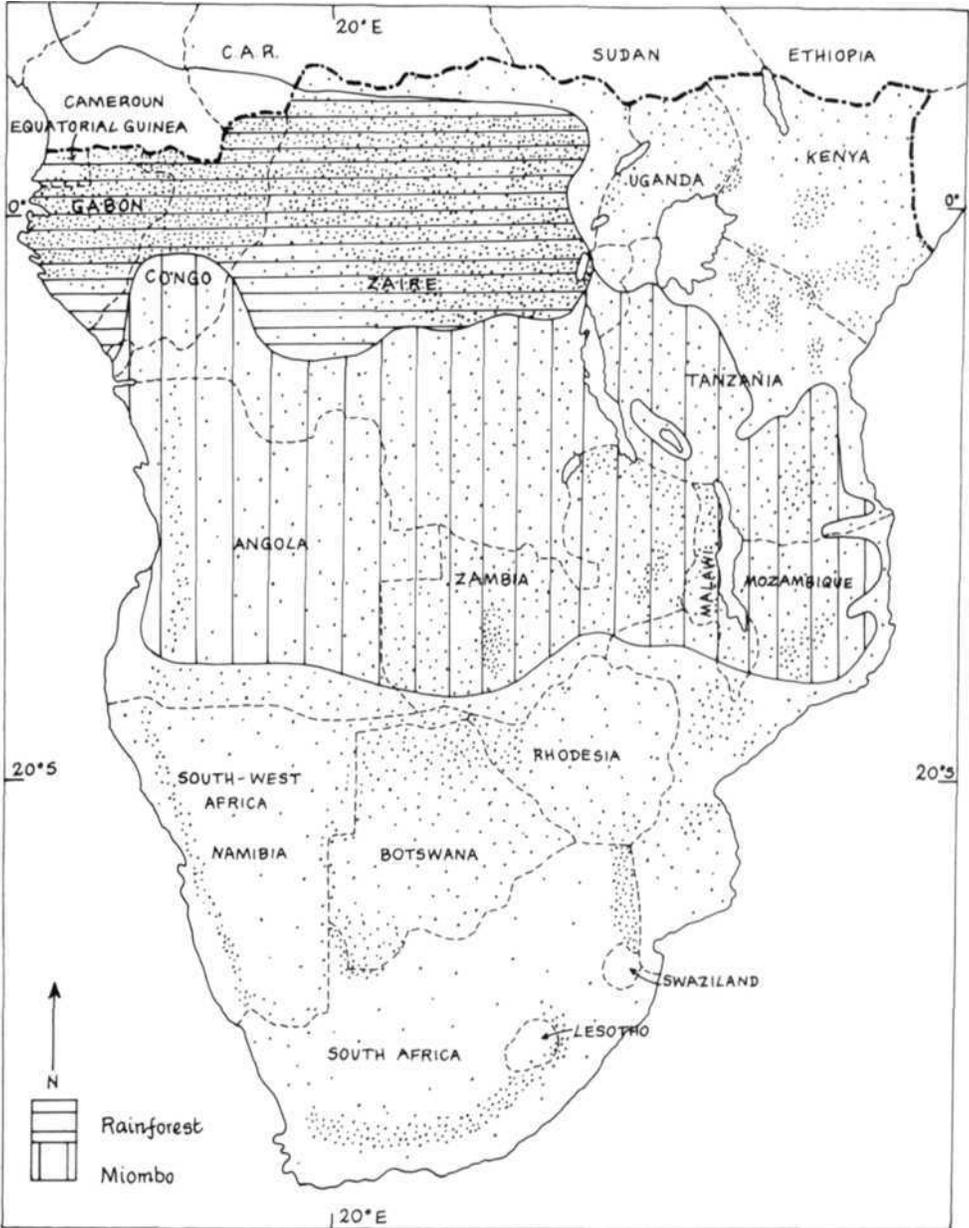


Fig. 1 Leopard Distribution in East, Central, and Southern Africa.

TABLE 1 EAST AFRICA

<i>Country</i> (with area in square kilometres)	<i>Land-Use Trends</i>	<i>Protected Areas</i> (area in square kilometres)	<i>Remarks</i>
Kenya (582,000)	Progressive settle- ment of some savannah zones	22, 000; some pressure on range outside park boundaries	200, 000 square kilometres of northern frontier territories afford little disturbed range for leopard, but poaching has been extensive
Tanzania (942,000)	Only certain sectors experiencing land-use pressures, but include Serengeti/Ngorongoro region	34, 000; some pressure on range outside park boundaries	Some poaching in Masailand, and parts of south
Uganda (236,000)	Only limited parts will remain in rela- tively undisturbed natural state by 1980	6, 000	Little poaching

unusually varied, and it includes examples of all major biomes from sub-desert to humid forest. Consequently its biotic associations, notably its wildlife, present unequalled diversity both qualitatively and quantitatively.

### Kenya

Kenya is the most varied of the three countries<sup>1</sup>. Before World War II leopard were common throughout the country, except in the arid north-west (Stewart & Stewart 1963). Increased development of settled areas since the war and occupation of new areas in the last decade, especially of savannah zones where people can pursue agriculture (for example, Wisner and Mbithi 1972 quote the population growth on the eastern plateau around Tsavo Park at 10-35% per year), has reduced both distribution and numbers. Masailand, with its extensive grasslands and formerly large numbers of plains game, is changing rapidly, not only through ranching schemes but through influx of people from other parts of Kenya.

These trends have been aggravated by unnecessary persecution of leopards, especially through poison, on the part of livestock interests, and by increased poaching of wildlife, especially of leopard. As noted in Chapter II, the leopard displays greater secretiveness under pressure. Thus, in areas such as those along the Mara and Tana Rivers, it is so seldom seen that it is often supposed to be virtually wiped out—but a search at waterholes or river crossings often reveals its traces. In the Nairobi suburbs, Ngong Hills, neighbouring Kamba and Kikuyu country (including Kiambu district with its 600 persons per km<sup>2</sup>), Limuru and the Machakos Hills—all areas close to or within heavily-populated zones—leopards still survive. About a dozen requests are made annually from several of these areas to the National Parks agency to trap troublesome leopard.

Nevertheless in all the localities mentioned, and further afield e.g. around Kibwezi and Kiboko, south-east of Nairobi, in the Kedong Valley and Loodokilani sector of Masailand, and as far as Nakuru and Eldoret in the west, Nanyuki in the north, and the south-east coast (where up till 1971 the leopard was a frequent scavenger at beach hotels), leopard signs are not found nearly as frequently as ten or even five years ago. The same applies to many other parts of Kenya, as far away from major population zones as the Tana River where all carnivores have thinned out rapidly during the past few years. Poison is at least as responsible as poaching for the decline, especially in livestock zones. In some other areas the leopard is 'holding out' rather than prospering, notably in the Kwale District near the Tanzania border in the south-east, around Isiolo, Doldol and the hill country towards Maralal, the Nyambeni hills towards Meru, and the Matthews range towards Lake Turkana. Nonetheless a formerly dense population on Mt. Nyiro at the southern end of Lake Turkana has been decimated. However, the Aberdares Park and Mt. Elgon have been spared intensive poaching despite heavily-settled farmlands in their environs and despite high leopard density in their montane forests (estimated, in some sections, to be as high as 1 per 1 km<sup>2</sup>, on the basis of discussions with F.W. Woodley, Warden for Mountain Parks, who has many years experience of patrolling the area on foot). Leopard poaching seems

---

<sup>1</sup> The mass of material accumulated on each country cannot be presented within the confines of this report. Rather these country-by-country accounts review the situation in terms of trends and patterns derived from the survey's detailed documentation.

to vary a good deal from tribe to tribe, and is practised less by those to the west of Nairobi. Nevertheless, despite the existence of areas throughout Kenya with fairly favourable habitats, the present stronghold of leopard is confined to the northern arid zone, which comprises roughly two-thirds of the country and should be discussed in some detail.

Discounting the area west of Lake Turkana (formerly Rudolf), which has little wildlife (though leopards are still found in several places), the northern region suffered from local poachers in the first half of the 1960s, when spotted furs began to command high prices over the border in Addis Ababa. After 1965, this local poaching was replaced by much more sustained hunting at the hands of Somali *shifita* or guerillas, who found they could raise money readily through the fur-trade network in Mogadishu. Apart from modern firearms, they could also obtain Italian steel-jaw traps for the equivalent of U.S. \$40; so great was the demand they could re-sell them in Kenya for \$65. The trade has recently tended to switch back to Addis Ababa and even Nairobi itself, but the northern region appears to have experienced, and continues to experience, extensive poaching. To what extent this has inflicted a marked decline in the leopard population is a matter of much dispute.

Despite efforts during the survey to arrive at an answer to the question whether or not the offtake has exceeded sustainable yield, which is what matters (rather than questions of legality) from the point of view of the continent-wide status of the species, no definite conclusion could be reached. Leopard numbers in the zone were still high enough in 1973 to permit a considerable harvest; on the other hand, in some localities all traces of the animal have vanished over extended periods. One warden, who spent three years on patrol—mainly on camel or foot, which permits better evaluation than from a motor vehicle—considers that signs of leopard are not hard to find in thick country by those who know where to look for them (a fact which may help the trapper, but also aids the game ranger to make a reliable assessment of the status of particular populations). This warden believes that the pattern of leopard distribution in the region is now only sporadic. Extensive discussions with persons who know the area well, including tribal hunters and traders, tend to confirm this. Offers to buy any skins available at U.S. \$70, or rather above current average price, are met with indifference; away from the road skins are on offer for less, and a selection of at least half a dozen is often available for inspection by a potential buyer, though the increasing difficulty of obtaining skins is invariably emphasised. The fact that the transactions would be illegal seems to carry little weight; although exemplary punishment is occasionally imposed on poachers—usually a fine of \$850 for possessing a single skin, or a fine worth \$4100 or 5 years imprisonment in default for a Somali caught with 59 leopard and 17 cheetah skins—cases are dismissed or trivial penalties imposed just as frequently, and poaching remains a traditional activity with hunters operating as individuals more often than in any organised manner. In fact, poaching is now big business, with elephant ivory and rhino horns even more important than spotted furs. Since the time when Kenya banned trade in spotted furs, the actual decline in exports was reported to have fallen by 1973 by only one third. In 1968, 2200 leopard skins were sold legally (FAO, 1970), of which 4% came from animals killed on control; most of the rest were classified as imported, though they could have originated from poachers within Kenya (i.e. they were 'laundered' via Addis Ababa).

In summary, leopard have declined in numbers and distribution in Kenya during the last decade. They should hold out, however, in many hilly areas of the south, and they could recover to former levels in the north if the con-

siderable trade in skins, which has been maintained for some 15 years (with undoubted over-exploitation in some areas), could be put on a strictly legitimate and properly controlled footing, and if consumers abroad could be persuaded to restrict purchases to legally obtained skins. In other parts of Kenya, poison already presents a greater threat than poaching.

### Uganda

Approaching 50% of Uganda is at present suitable for agriculture, a far higher proportion than in the rest of East Africa. The trend for Wildlands to be given over to agriculture is well illustrated by the contraction of elephant range, from 70% of the country in 1929 to 17% in 1959 and less than 10% in 1973.

Despite this trends, the leopard has shown itself to be remarkably persistent. Even along the shores of Lake Victoria where the density of human population tends to be highest, signs of its presence are still found, for example near Entebbe or Masaka. The same applies to the environs of Lake Kioga. Research staff in Ruwenzori Park have estimated local density at up to 1 per 8 km<sup>2</sup>, though five of the persons concerned had not sighted a leopard in two years.

In the less heavily populated northern regions of Uganda, local people state that leopard still occurs around Gulu, Nimule and Arua. Much the same applies to Karamoja in the east, where a good deal of environmental degradation since 1960, due to overgrazing by domestic stock, has apparently left the leopard little affected. At only two out of 24 trading centres in various parts of Uganda was there any indication of stocks of skins, although poaching is generally widespread even if not very intensive. In 1970, the Game Department confiscated nearly 4500 traps and snares, albeit mainly of the sort designed for smaller antelopes rather than powerful predators. Penalties for poachers were reported to be light, for example three months in prison.

### Tanzania

In general, the pace of new settlement suggests (Moore 1971) that within another decade or two Tanzania will cease to have more and better concentrations of wildlife than any other country of Africa. Yet over a third of the country is *miombo* (see next section of this Chapter), while wooded grassland or bush account for 27% and 16% respectively. Open grassland such as that of the atypical Serengeti Plains amounts to only 10%. So there is a good range of biotopes suitable for leopard. Indeed the species still seems widespread, with signs found by game wardens almost everywhere. However, whether in the highly populated region of Lake Victoria, or in the Masai steppe, the central bush country centred on Dodoma and stretching west to Tabora and east to Morogoro and Dar es Salaam, or further south around Iringa, leopard are reported to have declined since the mid-1960s. In the extreme south, they are still rated as numerous in mountains round Mbeya and along the border with Mozambique. In the 35,000 km<sup>2</sup> Selous Reserve and the 11,500 km<sup>2</sup> Ruaha Park in the southern sector, spoor is found everywhere, though in Ruaha the number of illegal traps has recently increased.

All accounts emphasise the extent of poaching. They also point in some areas to a sharp decrease during the past decade of leopard tracks and other signs. These two trends seem to apply particularly to forests of Kilimanjaro, Mt. Meru, Monduli and the Ngorongoro highlands, and to hilly country westward to Loliondo and along the western borders of Serengeti Park. This is attributed partly to new settlement and agricultural development, partly to more frequent

use of poison. The pattern is aggravated by intensive poaching, mainly of herbivores but with predators indirectly affected in the Serengeti (Schaller 1972), near Lake Manyara (Douglas-Hamilton pers. comm. 1972) (the leopard population of the 85 km<sup>2</sup> Manyara Park could not sustain heavy pressure for more than a few years), and in the Ruaha Park which is especially difficult to patrol during the rains. However, following reports that as many as 1000 illegal leopard skins may have been exported from Tanzania in 1971, there has been a tightening up of control, although in 1972 enquiries at wayside trading centres made it clear that skins were still available though at a higher price. There is little doubt that higher penalties for poaching, above all the confiscation of weapons and vehicles, could at any time bring poaching swiftly to a halt.

In Tanzania as a whole, though leopard will certainly become scarce in areas of expanding agriculture, the future of the species should be assured as long as parks and other protected areas are maintained. The Ruaha Park and Selous Reserve alone could contain as many as 2000.

(b) **THE MIOMBO WOODLAND ZONE** (see Fig. 1 and Table 2 for summarised data).

One of the largest expanses of homogenous vegetation in Africa, the *miombo* woodlands stretch from Angola to Tanzania, and take in substantial portions of Zaire, Rhodesia, Malawi and Mozambique as well as most of Zambia. They are interrupted only by floodplains and by drainage lines known variously as 'dambo' or 'mbuga'; these account for only 10-15% of the total zone but support the greater part of its human population. The base-line data available on the latter suggest that the next 10 years will not see great change, and that the biome will remain relatively undisturbed; settlement is likely to be focussed on the more open alluvial sectors, so a potential leopard habitat of some 2½ million km<sup>2</sup> may appear little susceptible to disruption. However, *miombo*, does not necessarily support even moderate populations of wild herbivores and predators. Moreover, being largely tsetse-infested, it normally carries comparatively small numbers of domestic livestock; the consequential demand for wild protein is therefore higher, and hunting is more prevalent. How far these long-standing limitations have depressed predator numbers is unknown, but the apparent density of large carnivores compares unfavourably with that still found in East African savannahs. Several prey species, including zebra, eland and Lichtenstein's hartebeest, have disappeared from many floodplains, and other species have diminished in the wooded hinterlands of arable areas. It has been further suggested (Metzke 1971) that the productivity of woodland animal species is dependent on the valley systems. Fifty thousand cultivators in a floodplain would probably disturb less than 50,000 hectares of adjacent woodland in any one year, on the basis of a shift of cultivation every five years, so that over 25 years they would cultivate probably as small a proportion as 2% of a wildland ecosystem centred on valley water-courses. But these human activities could effectively sterilise a large sector of the ecounit, especially in hilly terrain with an extensive network of minor tributaries of main drainage lines: although these water-courses in theory help to diversify the vegetation and favour wild herbivores, they also mean that human influence extends more widely through the *miombo*, with consequent impoverishment of the wild mammal fauna. True, this land-use pattern affects leopards less than cheetah. Moreover, the increased 'edge effect' stimulated by shifting cultivation should favour leopard (as explained in the previous Chapter), and cropland allows certain wild

TABLE 2 MIOMBO WOODLAND ZONE

<i>Country</i> (with area in square kilometres)	<i>Land-Use Trends</i>	<i>Protected Areas</i> (area in square kilometres)	<i>Remarks</i>
Angola (1,247,000)	Agriculture little problem to wildlife	24,460	Extensive poaching in the past; the situation following recent develop- ments unknown
Zambia (753,000)	Pressure on alluvial floodplains and dambo, but miombo woodlands little affected	61,000 plus extensive game conservation areas	Over-exploitation of leopard in Barotseland in 1960s; stability now restored; little poaching elsewhere
Mozambique (770, 930)	Agriculture exerts little pressure	5,670	Extensive poaching in the past; the situation since independence not yet known
Malawi (118,000)	Only the mountain chain, approx. one quarter of country, remains undis- turbed	3,100	Poaching traditional, now being curbed

herbivores to persist in appreciable numbers, notably bushpig, bushbuck, reedbuck and baboon and other monkeys—all favoured prey of leopard. Nevertheless the leopard's density will on the whole probably be reduced by disruptive trends of increasing human settlement.

### Angola

Three-fifths of Angola lies in the *miombo* biome. A belt of savannah, a few patches of rainforest in the north, and an arid zone of the Kalahari sands system on the southern border make up the remainder. For detailed information on the wildlife of this country I am greatly indebted to B. J. Huntley, who at the time of the survey was the resident ecologist attached to the Veterinary Services and had a number of experienced and reliable contacts. I also had opportunities for correspondence or discussion with several other persons who knew Angola well, and who were very critical of certain aspects and therefore asked to remain anonymous. Since then, of course, Angola's independence at the end of 1975 and the subsequent disorders have greatly altered the situation.

Nevertheless, much of the basic information relevant to the status of the leopard remains valid. Leopard still exist in virtually all parts of the country, even if in low numbers in many regions. Regrettably it is no longer possible to state that there are better prospects for the stability of wildlife habitats in Angola over the next ten or fifteen years than in most of Africa. Huntley (1973) states that in 130,000 km of travel he saw little more than a few impala, dikdik and klipspringer. As a measure of the intensity of poaching, an amnesty produced in a single locality over 6700 skins and hides, including 180 leopard and cheetah skins, plus 242 elephant tusks and 126 rhino horns. Until the recent upheavals, leopard could still be legally hunted on a licence costing \$200, but most skins were taken without any such sanction (largely by soldiers going on leave to Portugal), so the total could well have amounted to 3000 or more per year.

Prior to recent developments, four national parks and reserves covering a total of 24,460 km<sup>2</sup> were re-admitted to the United Nations list, following a drastic review of their status and a partially-completed overhaul of their management. In theory most of these protected areas should be able to support leopard in fair numbers; whether they will ever do so again depends very much on the attitude and resources of the government that finally emerges. Meanwhile, the best that can be said is that as recently as the late 1950s, Angola may have had larger populations of leopards than any other sub-Saharan country with the exception of Zaire, and that, with comparatively low human population pressure, much of the country should remain relatively undisturbed for the foreseeable future once the political situation has settled down.

### Zambia

Almost the entire country lies within the *miombo* biome, except for fairly extensive areas of *mopane* woodlands and somewhat sweeter grasslands in the Luangwa Valley and along the Zambesi. Leopards are reported virtually throughout Zambia. They are plentiful in several sizeable areas. The general view of both officials and private conservationists is that numbers should be maintained as long as protective measures remain adequate. Ansell's (1960) distribution map showed especially good populations in the Luangwa Valley and the Kafue Park, and this situation seems to have changed little. Excessive hunting of leopard has been a problem only in Barotseland in the

west, especially in the 1960s. Between 1964 and 1968 official exports of skins from Zambia amounted to 471, derived primarily from Barotseland (imports during the same period, many from Angola, Botswana and Mozambique, totalled 1052). Subsequently, with tighter control, the traffic declined, though in mid-1972 traders confirmed that spotted cat skins were still coming in from countries to the south and east. For obvious reasons this trade has now largely ceased. Moreover, leopard populations in western Zambia are reputed to be recovering their numbers again: there are many more sightings, and tracks are frequently found. Zambia has a system of cheap (\$0.50) game licences for local subsistence hunters, 11,000 being issued in 1971; this system however does not apply to leopard, and serves to emphasise the illegal nature of commercial hunting of the species.

Zambia is in the fortunate position that, due to low pressure for agricultural expansion into undisturbed Wildlands, it can set aside considerable areas as parks and reserves. These now total 18, and cover 59,000 km<sup>2</sup> or over 8% of the country, while 166,000 km<sup>2</sup> of Wildlands are classified as game management areas. This means that over one quarter of the country is under some degree of protection or control, and capable of supporting good numbers of leopard. In fact leopard numbers in protected areas could hardly be less than 10,000, and could be as high as 20,000.

Although large human populations are concentrated along the Lusaka/Ndola industrial axis, there is a steady spread of agriculturalists into fertile dambos and floodplains, most of which are likely to become occupied by 1980 or soon after. As noted, however, the leopard is much less dependent on such areas than the cheetah, and is capable of subsisting in *miombo* woodlands even where the zone is faunistically impoverished by human occupation of drainage lines.

### Mozambique

The government's wildlife ecologist at the time of the survey, K. L. Tinley, was a prime source of information due to his extensive knowledge of the country. But as with Angola, the impact of recent developments in Mozambique cannot yet be assessed, and some of the conclusions of the survey may soon have to be modified.

About four-fifths of the country is *miombo* woodland. Much of this zone is thinly populated, and likely to remain so for at least a few more years, with little modification of Wildlands. Both the *miombo* and the coastal plain are suitable for leopard. Travelling through northern areas, I received reports of leopard traces being found readily if not frequently. In other areas, notably between Beira and Cabora Bassa and south of the Limpopo, populations have been depleted. The best concentrations seem to be centred on the River Lurio and its tributaries in the north, in the sector between the Zambesi and Gorongosa Park in the centre, and along the River Save south of Beira. Something the same applies to certain sectors of the coastal evergreen forest, where Warthog and bushpig—favoured prey of leopard—are not eaten because of Muslim tradition. Tinley pointed out that considerable sectors of Mozambique are undergoing change: bush and thorn-scrub are spreading as a result of over-grazing and over-burning, which enables a stealthy predator like the leopard to extend its range.

Since the early 1960s the principal threat to the leopard has been poaching. This traditional pursuit of local people is now aggravated by the need for money as well as meat (and until recently it was severely exacerbated by the uncontrolled poaching of Portuguese soldiers). W. von Alvensleben, with 37

years experience of the country, placed the peak of the spotted fur traffic between 1966 and 1971, with an average of 1200 skins exported annually; thereafter it declined with the collapse of the American market. During the ten years up to 1972, von Alvensleben found 142,000 wire snares in his 20,000 km<sup>2</sup> concession on the Save river. Rather higher figures for hunting were quoted by A. J. Roseinha of the Repartição Técnica de Fauna in Lourenço Marques, about 100 a year taken by sportsmen hunters and game control authorities, but as many as 2000 by poachers. A poacher was getting about \$25 a skin, while the middle-man obtained a much higher figure from South African dealers. The trade was further encouraged by the fact that the wildlife agencies were poorly staffed (with one ranger having to police 20,000 km<sup>2</sup>), and that penalties imposed in the courts were light. By 1972, however, articles made from leopard skins were difficult to find in Lourenço Marques and Beira, though still obtainable in Gorongosa Park without permits or other documentation. Nevertheless large shops undertook to procure such articles within a few days, while one had 13 skins on sale for the equivalent of \$240 each—a stock sufficient to last only one month. It was stated that Johannesburg was now the main outlet for skins from Mozambique and served as a channel to European markets.

### Malawi

Malawi is one of the smallest countries covered in the survey, and with rural population densities as high as almost anywhere in sub-Saharan Africa. Leopard distribution seems more or less continuous over the whole 1000 km from north to south, though I got the impression that while its numbers are considerable along the northern part of the mountain chain which forms the backbone of the country and comprises one quarter of national territory, it is more rare in the central sector. G. D. Hayes, who is Secretary of the Malawi Fauna Preservation Society and speaks with 50 years experience in the country, considers that leopard are still widespread, if not always plentiful, in nearly every district, including for example the tea area near Blantyre (with its very high human population) and on the outskirts of Zomba. In the southern region, where the hills give way to plains, it is still common around Lengwe, especially in the National Park. In the extensive forest patches, especially on the mountains, Hayes believes leopard are numerous, whether in natural forests or in conifer plantations as on the Nyika Plateau. He suggests that although its range is shrinking as the human population spreads up the slopes, its remaining habitats could well support high densities, since the mountainous terrain is unsuited to lion or hyena so there is little competition from these other carnivores.

There were more reports in Malawi than in other countries of leopard predation on domestic stock. This is perhaps due to the fact that the leopard's habitats are hemmed in on every side by medium-density agricultural communities, whose hunger for meat induces much poaching of the leopard's herbivore prey and who are not averse to taking an occasional leopard. A good many leopard skins are said to find their way over the borders into Tanzania and Zambia. However, the main threat to the leopard is undoubtedly the overall impact of human population and development pressures, which have already achieved a level where most large mammals have been phased out. The trend is clear and apparently irreversible: although a few leopard should persist in Malawi till the end of the century, its present widespread distribution and generally satisfactory status will have declined considerably well before then.

TABLE 3 SOUTHERN AFRICA

<i>Country</i> (with area in square kilometres)	<i>Land-Use Trends</i>	<i>Protected Areas</i> (area in square kilometres)	<i>Remarks</i>
Botswana (601,000)	Widespread livestock-raising accentuates natural desiccation processes, encourages spread of bush	115,000	Over-exploitation in Ngamiland in late 1960s; now more moderate; some use of poison by livestock owners
Rhodesia (391,000)	Intensified methods and narrowing profit margins in livestock industry aggravate antagonism towards wild predators	7,400	Increasing use of poison by livestock owners.
S.W. Africa (824,000)	Intensified methods and narrowing profit margins in livestock industry aggravate antagonism towards wild predators	22,270; plus abandoned farms purchased by government, and some private reserves	Much use of poison by livestock owners
South Africa (1,221,000)	Intensified methods and narrowing profit margins in livestock industry aggravate antagonism towards wild predators	29,375	Much use of poison by livestock owners; leopard now rare outside protected areas, following progressive depletion 1950-70.

(c) **SOUTHERN AFRICA** (see Fig. 1 and Table 3 for summarised data).

Much of this region, which equals Western Europe in size, is ranchland savannah. Some of it still supports satisfactory wildlife populations, which could be safeguarded in conjunction with modernisation and intensification of the livestock industry, if the traditional South African and Rhodesian policy of wildlife elimination (as the only answer to 'farming in a zoo') were replaced by a thoroughgoing reappraisal of wildlife values.

### Botswana

Annual rainfall in Botswana is low, ranging from about 300 mm in the west to 475 in the east. The central two thirds have very little surface water or human population; the Okavango Swamps in the north are an exception, but as yet they are little populated or developed. A process of desiccation has affected the country for most of this century, especially for the past two decades (Campbell & Child 1971; Jarman & Butler 1971; Parris 1970, 1971). This could in part be attributed to climatic trends, but an equally likely cause is human over-utilisation of grasslands leading to spread of bush. The usual consequence of human pressures is a cycle with an eruptive peak of wild herbivore numbers in grasslands degraded by domestic livestock expansion, followed by a 'crash' and take-over of the area by scrub and less numerous browsing species. At least a quarter of Botswana has experienced this spread of bush, especially where the land has been ranched by white immigrants with capital and technological assets. African ranchers will increasingly acquire similar means for intensifying their activities, bringing on an aggravation of the process. While Botswana probably contains as many wild animals at present as the rest of Southern Africa, a marked decline in numbers is likely in years ahead. The question is whether the spread of bush will favour the leopard's hunting methods enough to offset the decline in prey numbers.

At present the leopard is widespread (Smithers 1971) throughout Botswana. Skins are brought in to dealers from all parts of the country, which indicates a sound distribution. In general, the leopard seems to be maintaining itself much better in Botswana than in other countries of the region. Reports in mid-1972 suggested a recovery from the situation in the late 1960s, when populations in some localities had been depleted by high prices offered for skins at the peak of the leopard fur boom in North America. One such area was Ngamiland in the northwest, where seasonal water pans are comparatively frequent and are readily visited by leopards (though they can do without them); a trap line covering approaches to a pan takes a steady toll, often beyond the survival capacity of a local population. But it is extremely unlikely that populations in the country as a whole, or even in extensive areas, were ever threatened beyond recovery.

Botswana is among leading nations of Africa in terms of controlled harvesting of wildlife on a sustainable-yield basis. Meat is consumed locally, while hides, skins and other trophies are exported. The industry has grown to a considerable size (Richter 1969, 1970; Campbell 1971 a and b), and is due to be further expanded. In this context the exploitation of the leopard in the last ten years is worth reviewing in some detail.

Accorded 'conserved animal' status under a 1968 law, the leopard could thereafter be hunted or trapped only on condition that an alleged depredation justifying the action had been screened by a tribal chief. This local authority was also entitled to impose conditions of sale in doubtful cases, thus removing incentive to dispose of a skin through illicit channels. During the years 1964

to 1967 before these regulations, leopard killed by tribesmen in defence of livestock amounted to 94, 176, 154 and 232; in the next four years numbers fell to 145, 93, 169 and 101, or by rather more than 20%. This pattern suggests that leopard populations are stable, rather than that declining numbers are coming into increasing conflict with expanding human activities. Additional offtake by sportsmen hunters amounted to 20 per year, and illicit killings probably accounted for another 75, so that the rate of exploitation in 1972 is estimated to have been around 200. If the number were twice as large, it would probably not have made significant difference to Botswana's total leopard population.

All authorities agreed that leopard skin exports in 1972 were well down on 1968. According to the leading dealer, Ngamiland Trading Company of Maun, prices which had been the equivalent of U.S. \$10-15 in the 1950s rose as high as \$200 in the 1960s (mostly because of a peak in fur trade demand, though probably also because of a decline in supplies). Of these sums, half went to the money-conscious trapper (according to game wardens and other officials, many tribesmen were little inclined towards the cash economy). In 1968, the Company handled 300 leopard skins, and at least five other concerns in Maun possibly accounted for another 700; but with the drop in demand following restrictive legislation in the U.S.A. in 1969/70, together with much stricter control within Botswana itself, the trade swiftly declined until by 1972 the Company had had no stock of skins on hand for over a year.

This assessment was corroborated by two other concerns. Botswana Tanning and Taxidermy, also of Maun, stated that only two skins had been received in the middle four months of 1972, and that the price paid per skin was only \$50-75. The spokesman asserted, however, contrary to the official view, that every legally handled skin is still matched by one smuggled across the border to South Africa or despatched illicitly by mail direct to Europe. Botswana Game Industries of Francistown, the principal fur dealers in the country, stated that they had handled only 12 Botswana-taken skins in the first half of 1972, as against about 60 a year in 1967-69. The firm paid a rather high price of \$100-120 each for skins (most of which were brought in singly by individual hunters, many from Zambia), then resold for \$250-300, which included an export levy of \$55 on a raw skin and \$20 on a tanned one. The firm pointed out that, as a consequence of the levy, a South African dealer could pay less for an illicit skin smuggled over the border than for a legally imported skin. So great was demand from France, Japan and Hong Kong that the firm would have no difficulty in disposing of 200 leopard skins immediately. Being primarily a retail organisation, they would not mind if exports were confined to manufactured articles or merely to tanned skins, as this would help to eliminate the wares of petty poachers.

About 16% of Botswana is already set aside as parks or reserves (Campbell 1973). The total is expected to be increased to about 115,000 km<sup>2</sup>, while part of the Central Kalahari is designated as a wildlife utilisation project for its Bushmen inhabitants. Although several areas are as large as 12,000 km<sup>2</sup>, they do not constitute self-contained ecological units. Nevertheless their designation as parks or reserves means they are safeguarded in principle not only from poaching (difficult to control over such extensive areas) but also from agricultural development which could prove more detrimental to the leopard. The network of protected areas should therefore be capable of supporting substantial leopard populations. However, as existing rangelands become increasingly occupied or grow less productive through mismanagement, there will be growing pressure to expand the livestock industry into the

Kalahari region. These sub-desert territories must represent Botswana's main wildlife stronghold in the long term, and their reserved areas may be threatened by competitive forms of land use unless wildlife can be given every chance to pay its way. At present hides, trophies, meat and other returns from wildlife are reckoned to bring in about \$7.5 million a year (Richter 1969, 1970 and pers. comm. 1972). Within this context, there could be a role for regulated exploitation of leopard skins. Botswana's leopard stocks could surely support an appreciable and sustainable offtake, there is an established network of reputable traders, and the government has considerable experience of deriving financial returns from wildlife exploitation. A further advantage could lie in the proven capacity of the wildlife industry to tan skins and fashion them into high quality products (notwithstanding doubts expressed in fur-trade centres abroad to the effect that commercial concerns in Botswana are not capable of producing tanned furs or manufactured products of a good enough standard for international markets). True, the potential for leopard exploitation cannot yet be put to the test, since the aim of the Washington Convention, in force from mid-1975, is to halt trade in such products in those countries that have ratified the Convention. But there can be little doubt that in Botswana a properly devised system would be easier to operate, with less risk of illegal dealings, and could make a greater proportionate contribution to national income than in almost any other country of Africa.

### Rhodesia

The importance of Rhodesia for the survey derives from the degree of agricultural development in a largely savannah country, with consequences for wildlife and especially predators. In particular, upgraded ranching methods now permit (as already noted on p. 20) many parts of Rhodesia to carry many more head of cattle than before. This change has contributed to the growing antipathy of ranchers toward wild predators, which in turn has led to increasing use of poison. In fact Rhodesia constitutes a prime example of the way poison may well become the greatest threat yet faced by the leopard (see p. 21), being unselective and relayed through food chains. An additional factor in Rhodesia is the tendency towards expropriation of more and more state land, including some of the best remaining wildlife areas, for settlement schemes. Up till recently the leopard has nevertheless been widely distributed, being still occasionally found even within ten miles of Salisbury in the Mzui Hills. It continues to favour riverine habitats, despite the fact that they are a target for agricultural development. Loss of cover is an overriding limitation for the leopard, but the animal can survive even if its only refuge is a minor kopje in an open plain. In the opinion of J. V. Wilson of the Bulawayo Museum, few areas have as yet been effectively cleared of leopard, though its numbers have been significantly reduced in the face of recent agricultural expansion. Indeed the leopard seems to have maintained its position better than most wild creatures, many of which have been grossly reduced in much of the country since 1960.

In the circumstances, it is not surprising that trade in leopard skins had declined from the moderate levels of the 1960s. Official records indicate an export of just over 300 from 1968 to 1972; prices rose by 1972 to U.S. \$250-300, even to \$400 for a good skin. The principal source of demand shifted from U.S.A. to Italy and (more ominously) Japan. The principal dealer stated that the number of skins brought to his firm had declined since 1970, and dropped below 30 in the first half of 1972. This fall-off was allegedly due to what is described by the trade as the growth of bureaucratic controls: the rancher's method of dealing with a troublesome leopard is now reputed to be to

shoot it without applying for permission, whereupon he either retains the skin or smuggles it out of the country.

#### Namibia (South West Africa)

With a population of only 750,000, half of them living in the northern one tenth of the country, much of Namibia is desert or sub-desert, too arid for anything but low-density commercial stock-raising or subsistence pastoralism. Thus the Kaokoveld in the north-west is so dry that it is estimated to support no more than 5000 wild herbivores year-round, though seasonal livestock holdings are considerable. Ovamboland in the north has suffered from such severe over-grazing that wildlife has been virtually eliminated, although the Etosha National Park to its south-west has recently featured moderate aggregations of zebra and other herbivores. Only the Caprivi Strip and its environs receive more rainfall and have lush vegetation, but this area is too densely inhabited by humans to allow much wildlife to survive. The other half of the country outside these areas is mostly taken up by European ranches, some of 70 km<sup>2</sup> or more. Because of recurrent drought, however, many ranches remain unoccupied, which has enabled the government to buy back about 10,500 km<sup>2</sup>, mostly along the south-east fringe of the Namib desert and along the country's southern border; as a consequence these tracts become *de jure* if not *de facto* game reserves. The parks, reserves and other government-owned land in the country as a whole occupy about 24% of the territory. In view of Namibia's low levels of human population pressure, these areas should constitute wildlife reservoirs of considerable proportions well into the future.

In general leopard are found in the more hilly zones that cover about one tenth of the country. These include the 2500 km-long western scarp that lies outside farming capacity—a limitation likely to endure for the foreseeable future. The coastal belt of the Namib is too harsh to support much mammal life of any kind. A few leopard survive in ranchlands of the interior, as in African homelands. They are reputed to be more numerous in Damaraland, the Grootfontein district and the Caprivi strip. They still occur sparsely in the Kaokoveld and Namaqualand, but in Ovamboland they have virtually disappeared. They are most plentiful in undisturbed parts of the country, viz. parks and other state lands.

As for the fur trade, the general view of Windhoek dealers was that skin exports had fallen by half between 1970 and the time of the survey, 1972. One dealer was handling only 50 skins a year. Another said he had disposed of 20 skins in 1971, all to tourists, in the form of made-up coats priced at about \$2,250-3000 (or less than half what they would cost in Europe or North America); he stated he had a waiting list for these coats, and thought that demand was steadily increasing. Prices for a raw skin were around \$90-120, and for a tanned skin \$250-400.

From these and other reports, made-up products may be estimated to account for 150 skins, and exports of entire skins another 200 a year. Unlike the case for cheetah, few leopards—5 or 10 at most—appear in the annual quota of live exports of spotted cats. A number of other leopard are accounted for by deaths of cubs when a mother is eliminated. Moreover, many skins do not reach the market, e.g. those of poisoned animals (the hair slips within two of three hours of death making the pelt worthless). All these instances could bring the total off-take to 400-500 a year. But there are few signs as yet of over-exploitation. The trade in skins began in 1950, and has been conducted with significant quantities since 1960. Several dealers stated that most of their skins came from ranchers who have been regular suppliers for a decade or more, which

suggests that the harvest from ranches represents a sustained yield and that leopard in these areas have adjusted to trapping pressure. If so, this situation could serve as a pattern for a system of regulated off-take elsewhere, provided that trade activities could be adequately controlled, and provided that leopard populations in limited areas could be safeguarded from exploitation (by contrast with what happens all too often at present).

### South Africa

This country not only constitutes by far the largest centre in Africa for the fur trade, but it serves as a useful measure of certain land-use trends which could spread to much of Africa by the end of the century. Its stock-raisers have long tried to eliminate wild carnivores. Part of this practice might have been necessary to safeguard legitimate livestock interests, but part of it has far exceeded anything that could be justified by livestock economics. There has been too much of the attitude that a wild predator is a creature that may, one day, be likely to attack somebody's cow and that, therefore, the practical rancher should take precautions by eliminating every predator he comes across. Predator control should be viewed as only one aspect of predator management, within a broad framework of a policy founded on evaluation of *all* natural resources. Meantime the leopard in South Africa is officially classified as vermin. Within this context Dr. D. Hay, Director of Nature Conservation in the Cape, summed up the leopard's status as follows: 'Numbers.... are disturbingly low, although the position is fairly stable. There are no grounds however for complacency, as the situation could easily become critical if any of the existing adverse factors were enhanced.' This view was supported by two other leading wildlife authorities, U. de V. Pienaar (pers. comm 1971) and W. von Richter (pers. comm. 1972).

Leopards have now virtually disappeared from the Orange Free State the Karroo and the high veld, though occasional individuals still persist close to Pretoria and Cape Town. Natal, except for its game reserves and the Drakensberg escarpment, has been practically cleared of large wild carnivores. The leopard survives, however, in several parts of Cape Province, notably in the mountains paralleling the coast, in the north-west, in the north along the Molopo river and in the Kalahari Gemsbok Park, and in forest blocks of the south and west. Its numbers have long been thought to be very low, but a recent district-by-district survey has shown that although certainly very sparse locally, the provincial total can be put at  $950 \pm 200$  (C.T. Stuart pers. comm. 1973). Nevertheless, the leopard's stronghold now and increasingly in future must be South Africa's parks and reserves: population estimates include Kruger 650 in late 1960s (Pienaar 1969) and now at least 1000 (Pienaar pers. comm. 1972 and 1973), and Kalahari Gemsbok 150 (Labuschagne pers. comm. 1972). In favourable habitats of the 19, 500 km<sup>2</sup> Kruger Park, such as areas with dense bush and plentiful impala prey, leopard density may be as high as 1 per 5 km<sup>2</sup>, and in a few habitats such as the riverine strips between Skukuza and the Lower Sabie area, density may even rise to 1 per 2 km<sup>2</sup>. High densities are also recorded in the neighbouring game reserves of Sabie Sand, Timbavati and Groot Letaba, which cover an extra 1750 km<sup>2</sup>; but these are subject to development pressures in their environs, and may not last many more years. All Forestry Reserves give specific protection to wildlife. In addition to the indigenous forests of the Cape, viz. those around George, Knysna and King Williamstown, and a few in the Transkei, several plantations of exotic trees constitute an extensive forest reserve in the Cederberg Range in the west of Cape Province; though artificial forests do not usually support much wildlife, they nevertheless harbour a good number of

leopard. However, in areas where natural prey—notably baboons, hyraxes, hares and small antelope—has grown scarce, the leopard is forced to make occasional forays into settled areas, where it is hunted down, trapped or poisoned. By the end of the decade the leopard could have been eliminated everywhere in South Africa except in parks and large reserves, mountain ranges and in forests that still provide plenty of natural food.

Since South Africa contains the greatest concentration of fur dealers in the whole of Africa, and serves as a funnel for spotted skins en route to world markets, the trade situation is reviewed in some detail. Furriers obtain most of their skins from outside South Africa, following the gross depletion of the country's own leopard stocks. Many illicit skins are included in imports. Moreover, for reasons indicated in the account of the Botswana situation and because of the customs union which operates between South Africa and Botswana and Namibia, there is often little incentive to exercise control. As a result, fur dealers in South Africa have hitherto been not the least concerned to provide documentation proving that skins have been legally acquired. The trade urgently needs to be regularised in the interest of the exporting countries that have more desire to safeguard their stock of wild predators (see Rowland 1971 and de Graaff 1971). South African prices are much as elsewhere in the region, averaging about \$250-300, but rising to as much as \$680 for a good tanned skin; a major increase of 100%, took place during the period 1966-72. The overall pattern suggests that while demand has remained fairly elastic, there are growing shortages of supply. At the time of the survey in mid-1972, stocks in 23 shops and stores amounted to 350 skins (these covered most outlets in Cape Town, about half those of the Johannesburg area, a few in Durban, but none in smaller centres such as East London or Port Elizabeth). Total stocks on hand in the country could easily have amounted to twice as many. A fairly reliable estimate of overall turnover in 1966 would be about 2500 skins, falling off by 1972 to 1500.

(d) **WEST AFRICA** (See Fig. 2 and Table 4 for summarised data).

For convenience the eco-political region of West Africa has been taken to include Cameroun, Tchad and the Central African Republic, substantial parts of which fall within West Africa's dominant biomes from the survey's standpoint, viz. the Sahel and Sudano-Guinean vegetation zones. (The same applies to the Sudan, but this is grouped with north-east Africa in the next sub-section). The two zones in question form a broad belt across the continent south of the Sahara, passing from desert into sub-arid scrub, dry steppe and bush, and ending in the south in moist woodland. The Sahel extends roughly from the 100 mm to 400 mm isohyets, of 19°N to 14°N. In the last two decades it has witnessed a decline in its wildlife, more rapidly since 1970. This change in the Sahel has been linked with desiccatory climatic trends which, in the light of a prolonged drought ending (at least for the time being) in 1974, have received much attention (see Cloudsley-Thompson 1971; Lamb 1972; Baker 1973; Grove 1973; and Winstanley 1973). Since there are severe ecological constraints on development in the zone, and range exploitation should not envisage much manipulation of wildlife habitats, long-term management could not only accelerate the Sahel's recovery but could also assist the survival and compatibility of both wildlife and domestic stock. Regrettably present patterns of 'development' tend to emphasise short-term palliatives.

As shown in Fig. 2, the Sudano-Guinean belt covers an area twice as large as the Sahel. It penetrates to the Gulf of Guinea in Togo and Dahomey, and thus

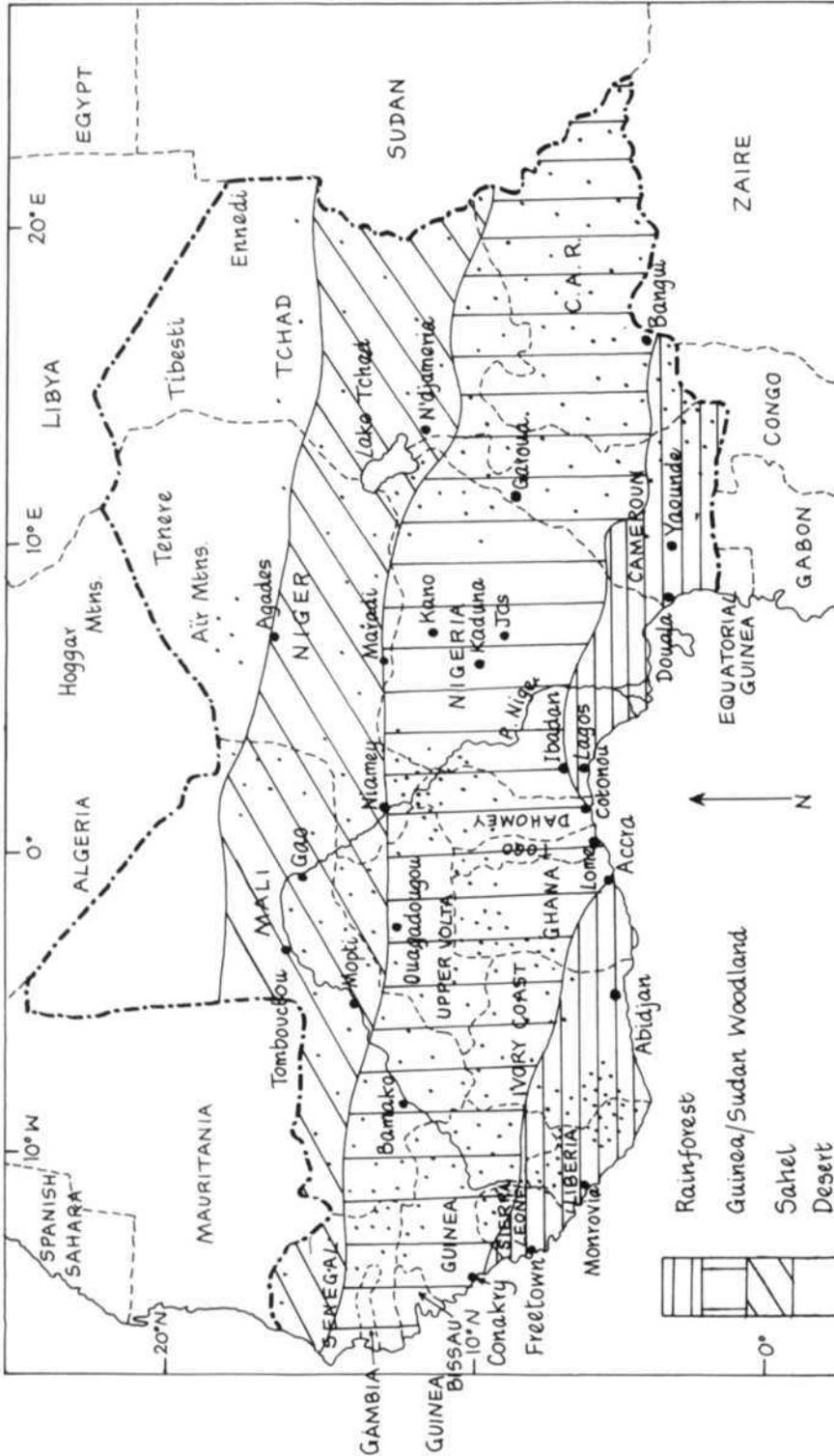


Fig. 2 Distribution of the Leopard in West Africa.

TABLE 4 WEST AFRICA

<i>Country</i> (with area in square kilometres)	<i>Land-Use Trends</i>	<i>Protected Areas</i> (area in square kilometres)	<i>Remarks</i>
Senegal (196,000)	Sahel zone impoverished, inducing pressure on woodlands	9,400	Small trade in spotted skins; drought main determinant for wildlife
Mali (1,240,000)	Sahel zone impoverished, inducing pressure on woodlands	3,500	Drought main determinant for wildlife
Upper Volta (274,000)	Sahel zone impoverished, inducing pressure on woodlands	5,300	Drought main determinant for wildlife
Niger (1,267,000)	Sahel zone impoverished, inducing pressure on woodlands	3,100	Drought main determinant for wildlife; much poaching of spotted cats and wild herbivores by officials, military, expatriate staff
Tchad (1,284,000)	Sahel zone impoverished, inducing pressure on woodlands	53,000	Drought main determinant for wildlife; much poaching of spotted cats and wild herbivores by officials, military, expatriate staff
Gambia (11,300)	Forest much modified	—	Small trade in spotted skins
Guinea (246,000)	Woodlands little disturbed in interior	—	No trade in spotted skins

Sierra Leone (72,000)	Forests being much reduced; mining also disrupts natural areas	No parks; but several Forest Reserves ban hunting	Leopard range overlaps with live-stock area; some use of poison
Liberia (111,900)	Forests being much reduced; mining also disrupts natural environments	(National Forests available to timber exploitation)	Small trade in spotted skins
Ivory Coast (322,000)	Populace spreading into woodlands in northern half of country	15,000	Limited trade in spotted skins; leopard prey diminished by huge demand for bush meat; trend now accentuated by lack of protein supplies from Sahel
Ghana (239,000)	Spread of savanna/forest and savanna/woodland mosaics	9,000	Leopard prey diminished by huge demand for bush meat; trend now accentuated by lack of protein supplies from Sahel
Togo (56,000)	Populace spreading into woodland in northern half	637	No trade in spotted skins
Dahomey <sup>1</sup> (113,000)	Populace spreading into woodland in northern half	7,700	No trade in spotted skins

<sup>1</sup> Renamed Benin since this report went to press

<i>Country</i> (with area in square kilometres)	<i>Land-Use Trends</i>	<i>Protected Areas</i> (area in square kilometres)	<i>Remarks</i>
Nigeria (924,000)	Population and development pressures leave few undisturbed environments	6,100	Limited trade in spotted skins in Kano; leopard prey diminished by huge demand for bush meat; trend now accentuated by lack of protein supplies from Sahel; some use of poison
Cameroon (475,000)	Some exploitation of forest; no pervasive pressures in north as yet	9,100	Small trade in spotted skins
Central African Republic	Little agricultural pressure as yet except in southern one third	10,000	

bisects the coastal forest zone. Rainfall in the belt ranges from 600 mm to 1200 mm, with a 4-6 months dry season, so that these woodlands are characterised by comparatively lush savannah with perennial grasses and taller trees, showing a north-south gradient from drought-resistant to fire-resistant species and to more frequent strips of gallery forest as the biome gradually merges into rainforest. The zone also supports at least 60 million people as opposed to 14 million in the Sahel, with the result that there has been much greater modification of the environment by human activities—mainly pastoral to the north and mainly agricultural south of 13°N where tsetse becomes widespread. Disruptive pressures are likely to increase with the massive growth of human populations, so that the outlook is for severe over-burdening of wildland habitats. In the process, wild herbivore stocks, which since the early 1950s have been steadily reduced due to meat hunger and land-use changes, are likely to survive only in the most inaccessible or thinly populated areas. Although some respite may be afforded to wildlife by newly-created parks and reserves, the long-term trend is clear. At the beginning of the century the leopard was reputedly plentiful throughout the zone. During the last 50 years, it has been forced into a gradual retreat to more rugged terrain of hill country and plateaus of the interior. This pattern will continue, until by the end of the century, the leopard could be confined to rocky areas and other localities of little human use. Meantime, sparse populations survive in the woodlands, and along the fringes of the coastal forest with their ecotonal variety of habitats. Moreover, since these areas still support plenty of prey, such as lagomorphs, rodents, birds, reptiles and monkeys which are able to subsist off neighbouring croplands, the leopard is less badly placed now than wild ungulates (except for duikers) have become exceedingly scarce. Indeed this persistence of prey, together with recent protective measures such as restriction of casual hunting, may have allowed leopard numbers in a few back-country areas—notably in Sierra Leone, Guinea, Liberia and northern Ivory Coast—to stabilise or even to show a slight increase for the first time in decades.

In the final zone of West Africa, the coastal forest belt, suffice it to note that apart from numerous areas of conurbations and dense human populations, the leopard was long ago expunged from much of the zone, especially from lagoons and swamps and wherever the numerous rivers allowed hunters to penetrate. By 1945, it was known to survive only in a few remote tracts of forest.

### Senegal

Leopards are said to persist in much of Senegal, in fair though reduced numbers. They are moderately common in the Casamance River region in the south, especially in riverine and gallery forest patches with their numerous monkeys, small antelopes and other prey creatures. Leopard signs are far from rare along the Senegal River in the north, and tracks are occasionally found even in the Ferlo desert country. The species appears to be plentiful in the 8000 km<sup>2</sup> Niokolo-Koba National Park in the south-east, living on an estimated antelope population of 25, 000, half of them kob (Dupuy 1971).

Leopard hunting has been banned by law for some years. A similar ban was imposed in 1973 on trade in leopard skins, which two years earlier could be readily bought in Dakar. In March 1973, however, local hawkers stated that they still had a collective turnover of 50 skins a year, and the actual figure could probably be put at between one and two hundred (indicating that an official estimate of 'no more than several hundred leopard' for Senegal as a whole is almost certainly too low). A regular overseas trade in skins has never

developed, one result of which is a lack of expertise in curing: only a few tattered relics were to be found in back-street stores (though this poor selection could also be partly attributable to stricter control). In these circumstances it is less surprising that leopard still exist in a small patch of forest within 50 km of Dakar; they could never have survived if demand had been such that every leopard within 150 km of Dakar's half a million inhabitants had had a dozen impoverished poachers on its trail.

## Mali

The southern quarter of the country lies in the Sudano-Guinean zone, the middle third in the Sahel, the rest is desert. The River Niger floodplain once provided large areas of leopard habitat, now much reduced by cultivation. As might be expected, leopards are most often found in the hillier savannah country of western Mali—an indication of their capacity to adapt to man's activities, since these areas are quite densely inhabited. In the sub-Saharan belt, there is usually no animal protein deficiency, due to enormous numbers of livestock; there is therefore little incentive to hunt for the pot, and wild herbivores have tended to hold up quite well until the recent years of drought. A factor less favourable to the leopard, however, is that the drought has not only reduced wildlife numbers but it has greatly increased pressures on the 3% of forestland as well as on the 5% of Mali that is arable. The overall trend, as elsewhere in West Africa, points toward a gradual elimination of leopard in all but a very few rugged hill tracts.

Curiously enough more leopard skins were on sale in Bamako than in any of the other nine West African cities visited. At least 60 skins were inspected, and another 5 traders whose stocks were not available made offers of sale. Traps of all sorts proliferated, though hunters apparently abandon many traps in the bush—perhaps an indication of declining numbers of leopards as well as of their increased wariness. A leopard can be legally hunted on a supplementary licence. Conversely, traders agree that all skins reaching them are illegally taken. The main difficulty facing wildlife agencies lies in shortage of staff and funds for control in the field. Fines levied on poachers are greater than the value of the skins in question, which are in any case confiscated.

## Upper Volta

Aggravated by the recent drought, a combination of climatic desiccation and human degradation of the environment has affected Upper Volta's wildlife for decades. The semi-arid Sahel belt, which formerly occupied only the northern third of the country, has pushed southwards. In turn the woodland savannah has had to support many more people, reducing its carrying capacity and making it more susceptible to desertification; the zone's grasslands have given way to bush and scrub, woodland to thornbush. Nevertheless the leopard is still widely found in Upper Volta. Provided some natural prey remains available, the leopard can withstand environmental impoverishment better than most carnivores. Regrettably, however, the drought has put progressively severe pressure on the dwindling stocks of wild herbivores. The leopard looks likely to decline steadily in distribution and status.

Meanwhile predators can still be hunted on permit from December to April (until the mid-1960s, a bounty was paid on them). Official figures indicate an annual offtake of not more than half a dozen leopard and cheetah together. Although foreign furriers occasionally visit Ouagadougou, there seems to be little active trade in skins. In any case, most traps in use are unsuited to catching a large and powerful felid.

## Niger

As can be seen from Fig. 2, less than 10% of this country falls within the Sudano-Guinean zone with its favourable habitats for leopards. Until recently, however, leopard stocks in Niger were moderately sound. Though eliminated in many localities, they have survived well in others. This has largely been due to a factor frequently stressed in this report, viz. that the leopard can subsist on various smaller creatures when medium to large wild herbivores disappear. But recently several much more adverse trends have set in: greater competition for suitable habitats by pastoralists and cultivators; increased poaching by all groups of society, including—or even especially—European expatriates; progressive settlement pressures on the better woodland areas of the south, as nomads retreat from the drought; and reduced staff and funds to safeguard wildlife. In fact, the one major protected area, the Parc du W (shared with Dahomey and Upper Volta), could easily succumb to these adverse trends in land use, even were revenues from visiting tourists to be greatly increased.

Since the mid-1960s, leopard (and cheetah) have been much hunted, partly because of the incentives offered by the fur trade and partly because they have allegedly started to prey on domestic stock following the decline of wild prey. As an indication of the level of exploitation, fur dealers are said to visit Niamey every month of the year, coming from elsewhere in Africa and from Europe and Japan. A few hundred skins a year are probably exported, though the number is thought to have declined. But even if the trade were regulated or reduced to very low levels, the leopard's future would still be jeopardised by development pressures and in particular by cheap poisons. It may however hold out for longer than most other large species in this vast country, especially in the extensive mountain areas.

## Tchad

Tchad's southern quarter is Sudan woodland, the next quarter northward is Sahel, the rest is desert. Leopard are still to be found south of 18°N, i.e. in around one third of the country (Anna 1971). A major refuge is the Ennedi massif on the northern edge of this area. Only after World War II were profits to be derived from leopard skins in Europe's markets, whereupon a supply network was established (Anna 1973). This exploitation was continued, albeit on smaller scale, after the country gained independence. Unlike the case in several parts of both West and East Africa, almost all leopard are trapped rather than shot (even though traps of any sort are illegal). This is the practice even of expatriates stationed in the country, who would certainly have access to firearms, so presumably trapping is preferred to avoid damage to leopard skins. Expatriates use 4-wheel-drive vehicles to visit traps over wide stretches of country each weekend, or to service a supply network of poachers over even larger tracts.

From 1969 onwards, the leopard has had some protection, insofar as the government has tried to eliminate illegal hunting (not much attention is given to fur-trade activities). A hunting permit is available only to a non-resident, and covers a bag of only one leopard a year at a cost equivalent to 200 U.S. dollars, so that the number of leopard shot on licence is negligible. This means that the vast majority of skins exported are illicit for one reason or another. (These observations were made, of course, before the revolution of 1975. It remains to be seen if the new regime succeeds in applying more effective control.)

According to M. Anna, the former Director of the Service des Chasses who had an intimate knowledge of the country based on 15 years experience, leopard populations at the time of his retirement in 1974 had decreased to a total of about 800 animals. This number seems low in the light of the activities described above; it is difficult to see how such a small stock could provide a year-by-year offtake of the size indicated by Anna's accounts of skin exports. On the other hand, in the open environments that are characteristics of large parts of Tchad, with little cover such as the leopard needs except for scattered rocky outcrops, nothing better can be expected than very low densities.

#### Central African Republic

Most of C.A.R. lies within the Guinea/Sudan woodland zone. Up to 1960 the wildlife of the north and east of the country was as plentiful as anywhere in central Africa. In several sectors it still is (Corfield & Hamilton 1971). But poaching has steadily increased. Many hunters come from over the Tchad or Sudan borders, though local people also indulge, residents and non-residents, officials and non-officials alike. The Sahel drought accentuated the influx of poachers from the north, while in the south prior to 1966 there was a steady increase in the number of firearms available, which subsequently allowed large-scale poaching to be organised. Moreover, during the rains a network of waterways gives access to remote parts of the woodlands. In 1970, there were less than one hundred game guards and half a dozen vehicles to protect the 285,000 km<sup>2</sup> of wildlife country considered worth patrolling, the remaining 260,000 km<sup>2</sup> being left unguarded. Since then there has been a marginal improvement, but conservation still remains well below standards achieved in many other countries. Despite these deficiencies, the leopard's status is fairly satisfactory. The country is too thinly inhabited and undeveloped, as well as too large, for an adaptable species like the leopard not to persist in good numbers. This conclusion is borne out by all recent scientist visitors. There is no evidence that the fur trade has been an important factor.

#### Gambia

The former forest along 300 km of the Gambia river was well suited to leopard requirements. It has now been largely replaced by a mixture of grassland and open woodland, under the various pressures exerted by a rural population of over half a million people in a very small country. Fortunately, the new landscapes still support plenty of baboons, Warthog, birds and reptiles on which a leopard can subsist. Whether the few skins to be found on sale in Banjul (Parker pers. comm. 1973) are obtained locally or from Senegal or even further afield, is unknown.

#### Guinea

No recent information could be obtained about the status of leopard in Guinea. Most of the country lies within the Sudano-Guinean zone, while a small area of rainforest survives in the south-east. As far as is known, population pressure in the interior is only moderate, and development is centred on mineral resources. Habitats and other factors should therefore be well suited to the widespread survival of leopards in fair numbers. Western-world fur dealers have shown little interest in Guinea with its strongly socialist orientation.

#### Sierra Leone

With a remarkable diversity of habitats despite its modest size, Sierra Leone in the past had an equally diverse fauna. During the past 25 years, however,

the country's wildlife has been subject to growing pressures from hunting and from landscape modification through agriculture and timber exploitation (Lowes 1970). In the north and east there are a few areas still comparatively undisturbed, but their development could be only a question of time. Meanwhile a number of areas in the north—the hilly savannahs with their elephant grass, and the gallery forests with their numerous ecotones—seem well suited to leopard requirements. Yet the animal is rarely found except in remote parts of localities such as the Koinadugu District and the Lama, Tingi and Wara Wara hills. (The lion disappeared around the turn of the century). In the south and east, especially on the Liberian border, some rainforest remains, but it is steadily being cleared. For the most part it is replaced by cultivation rather than by secondary forest, which, whether in the form of natural regeneration or plantation, offers a new set of niches for herbivores in sufficient numbers to support moderate populations of leopards.

On top of these adverse trends in land use, birds and other small animals have recently been decimated by shooting for 'bushmeat', for which, as elsewhere in West Africa, the demand is insatiable. In particular the virtual disappearance of such small species as duikers could have contributed to the decline of leopards, and this in turn, according to the Chief Conservator of Forests, J. S. Sawyerr (1971), has been responsible for an explosion of cane rats which cause much damage to crops. Furthermore livestock losses are now rarely attributed to leopard as compared with the past, even though livestock numbers have increased greatly at a time when the leopard's wild prey has diminished. Insofar as leopard do not maraud on cattle and goats, this could be due to growing use of firearms in recent years (Robinson 1971), especially in view of the fact that most of the leopard's present range, estimated at about a fifth of the country, overlaps the main stock-rearing areas. In early 1973, a few leopard skins were available in Freetown at prices about half those which have been quoted for other countries.

### Liberia

The leopard is believed to be evenly distributed throughout the country, except in farming and mining areas. Mountain tracts which would normally afford refuge to leopard contain iron ore, so they are mostly undergoing exploitation. Timber extraction also affects the leopard to the extent that it brings logging personnel and other human communities to otherwise undisturbed areas. Wherever the leopard holds out, it faces no shortage of prey or much competition from other carnivores. Predation of livestock is so rare that villagers do not bother with fencing, and traps are rarely seen. The leopard may still be hunted on licence, whereupon its skin is usually sold to traders for re-sale to foreigners. This traffic seems little organised, and as recently as 1971 demand was so moderate that a skin retailed at only between \$20 and \$75 (Robinson 1971).

### Ivory Coast

Nothing was learned during the survey of the status of the leopard in Ivory Coast. As about half the country lies in the rainforest belt and half in the Sudano-Guinean zone, there should be habitats well suited to the leopard provided that they remain relatively undisturbed. However, as the human population grows, settlement is steadily advancing from south to north, and it seems unlikely that leopard will be able to hold out in the long run except in a few inaccessible corners.

## Ghana

In this country too there has been a steady spread of people into hitherto undisturbed areas, though three-quarters of the population still live in the south and 20% of it in towns. The Sudano-Guinean zone is now largely a mosaic of cultivation and woodland patches, giving way in the south-west to a mixture of forest and savannah; to the extent that herbivore populations survive, the 'edge effect' of these areas favours the leopard. But the next 15 years are likely to witness greater modification of landscapes than the last 50. Ghana is a major timber exporter, and only a quarter of the original 78,000 km<sup>2</sup> of primary forest is left (Lawson 1972), much of it 'forest zone' rather than forest, since farmers can readily move along timber tracks (one patch of 1000 km<sup>2</sup> in western Ghana has 1500 km of track, according to Jeffrey 1970) in order to settle and open up new areas. Cultivators are followed by hunters and trappers, operating on a commercial scale to satisfy urban demands for 'bushmeat'. In fact, bushmeat covers all manner of species, accounts for 40% of protein intake in Ghana (Currey-Lindahl 1968), and has been valued at the equivalent of U.S. \$7.4 million a year (Asibey 1971). Although many wild herbivores breed fast and tolerate a heavy continuous harvest (notable examples are duikers, pigs and rodents—one Accra market recorded 15,564 cane rats sold in one year at an average price of U.S. \$5), the pressure is so sustained that wide areas can eventually be cleared of all major forms of wildlife, whereupon the leopard finds its natural prey sources sorely depleted. Compared with this factor, the trade in skins has been negligible; it was never great, and is now moderately controlled. Asibey (1971) considers the leopard very rare in many areas; by the 1980s it may hardly survive at all except in the most remote localities.

## Togo and Dahomey<sup>1</sup>

Both these countries, on which no specific information was obtained during the survey, lie mostly in the Sudano-Guinean zone, which in its undisturbed state offers reasonable leopard habitat. Large sections are now being opened up for settlement. For example, parts of south-west Dahomey, where there were less than 10 people per km<sup>2</sup> until the 1960s, are now absorbing a population spillover from the north-east where density long ago reached 100 per km<sup>2</sup>. Neither country has featured as a significant supplier to the fur trade. By the end of the century it is unlikely that the leopard will survive except in a few isolated pockets.

## Nigeria

Vegetation maps (see Fig. 2) show the Sahel zone as scarcely touching the northern borders of Nigeria. As a result of the recent drought, however, the border zone appears more akin to Sahel conditions than to Sudano-Guinean woodlands which occupy most of the rest of the country except for a belt of rainforest in the south (much forest has been totally eliminated; little remains, for example within 100 km of Lagos). Extensive blocks of the country carry over 50 persons per km<sup>2</sup>. In fact, human pressures on wildlife have been significant for most of this century (Service 1969; Henshaw & Child 1971). A principal threat has stemmed from bush clearing to make way for livestock, followed by over-use of the pasturelands; in this manner, Fulani herds in the extensive northern savannahs were affecting wildlife adversely as long ago as the 1930s (Happold 1971). In both woodland and forest zones, leopard favour

<sup>1</sup> News of the renaming of this country, now Benin, arrived too late to be reflected in this Report.

riverine patches—precisely those areas first occupied by human communities when looking for new lands to settle. As pioneer farmers gradually extend their activities, the leopard eventually survives only in occasional rocky outcrops. Not that habitat change need be the primary reason for decline of wildlife (Petrides 1965), since certain species have fared well enough under similar conditions in Dahomey and Cameroun. Rather the principal cause may lie with demand for 'bushmeat', consumption of which in certain sectors of Nigeria has been put as high as 30% of total animal protein intake (Henshaw 1971) and whose value has been estimated at U.S. \$25 million annually (Charter 1971). Where larger game has been eliminated—which applies to most of Nigeria outside a few protected areas—the subsequent competition for small mammals, especially the fast-breeding and early-maturing duiker, is bound to put pressure on leopard. Nevertheless, there have been few reports of leopard killing livestock—perhaps because few leopard are left.

Although capable of adapting to a wide variety of prey, the leopard therefore looks like being largely confined to protected areas by the end of the decade. Of its few main refuges, those between Katagum and Azare in the north-east, to the west of Bauchi, and on the Mambilla plateau, will certainly be eliminated unless they are specially safeguarded. Although Forest Reserves, where no hunting is allowed (the leopard may otherwise still be freely hunted except in parks and reserves), cover a considerable part of Nigeria, they are too fragmented to support much wildlife. Legislation may soon be enacted, however, to ban leopard hunting, and to regulate if not suppress the trade in products of protected species.

Meanwhile, at the time of the survey, skin dealers took little notice of regulations requiring proper documentation of trophies. Unexpectedly, no leopard skins were found in the huge Kano market, but three were on sale unobtrusively near one of the main hotels in Kano, their owner admitting that he had another 17 in store and that he could get hold of up to 50 a year (but no more whatever the price). These skins were largely from surrounding countries to the north, a change from the late 1960s when the U.S. market was at its peak and moderate numbers of skins derived from within Nigeria itself. No skins were seen or reported during the survey in any of Nigeria's other main centres such as Kaduna, Jos, Ibadan and Lagos.

### Cameroun

Although a forest zone occupies rather more than the southern half of the country, it is no more than a mosaic of cultivated areas and small forest patches. This pattern is much what one would expect in a country where most of the 6 million inhabitants live in the south-west. In this densely settled sector, and in one other area near Lake Tchad, human population density is about 50 per km<sup>2</sup>, elsewhere averaging only 5. For this reason leopards are reported in fair numbers in the south-east and in scattered relict populations elsewhere. In the north the only areas with satisfactory wildlife communities are said to be at the foot of the Adamaoua plateau, though leopards seem to flourish still in several other mountainous areas and in a few woodland territories. According to P. Flizot, Senior Game Warden for 27 years, leopard numbers have certainly fallen off throughout the country—a decline which started as long ago as the late 1940s.

To what extent the decline is due to hunting is uncertain. Enquiries in early 1973 in Douala, which is an important communications centre with Europe, failed to produce much evidence of a significant trade in skins. Four skins were on offer in the market, said to have been smuggled into the country and

available for export only via further smuggling. Traders said their individual turnover was about 20 skins a year, all disposed of to tourists. In Garoua, by contrast, the local representative of a company which trades extensively in wildlife products said he could supply ten leopard skins two or three times a year, but that it would be impossible to get larger consignments through the Customs even once a year. Nevertheless, the company contrived to export skins to half a dozen European countries, and to Canada and Japan, at a price averaging about U.S. \$200 apiece at Garoua. But in the view of several local authorities, notably staff members of the College of Wildlife Management, such exports have had less effect on leopard populations than has habitat disruption. All in all, however, although habitat disruption is increasing, it seems likely to have only limited impact on the leopard's general status, until the time when Cameroun undertakes massive modification of its remaining forests.

(e) **NORTH EASTERN AFRICA** (see Fig. 3 and Table 5 for summarised data).

At least two fifths of this region is desert, or semi-arid country similar to the Sahel, while another one sixth comprises the Ethiopian highlands. The remainder is Sudano-Guinean woodland, and, in southern Sudan, Sudd swamp. A good third of it could provide suitable habitat for leopard, and probably in the past it supported large numbers. During the present century, however, much of the Horn of Africa has become so degraded that even the array of rodents and other small animals on which leopard can subsist is no longer available. In Sudan, the zones immediately to the south of the desert are experiencing pressures similar to those of the Sahel and woodland belts of West Africa, which results in reduced carrying capacity for domestic stock and wildlife alike.

#### Sudan

A recent official breakdown (Republic of Sudan 1971) of the 2.5 million km<sup>2</sup> of this vast country, where a population of only 17 million people nevertheless has a considerable impact on the biota, classifies 730,000 km<sup>2</sup> as desert, 490,000 as semi-desert, 690,000 dry and 350,000 humid woodland savannah, 250,000 as flood zone and 6000 as montane. Of the 5% of the total area to be set aside as forest reserve, only one tenth has been so far designated. The semi-desert or Sahel zone now has permanent settlements, and is quickly becoming degraded. The savannah zones which support most of the country's wildlife also feature the most rapidly expanding human populations; as a result of this upsurge in human numbers and because the climate comprises a single wet season of torrential rain, soil erosion in savannah lands has been growing worse since 1950, aggravated by burning and clearing of forest and bush (whether as an anti-tsetse measure, for new cultivation, or to meet demand for fuel) and by settlement projects (Republic of Sudan 1971; Wickens 1973). These processes have everywhere reduced the carrying capacity of the land, and have set in train a southward shift of vegetation zones: desert into steppe, steppe into savannah, savannah into forest (Cloudsley-Thompson 1971). Dense acacia woodlands which used to be a feature of the Khartoum area as recently as 1955, have retreated 90 km to the south, and the gum arabic belt has been similarly displaced, while even parts of the humid Equatoria Province are becoming desiccated.

In general, little wildlife is to be found outside reserves (Cloudsley-Thompson 1966, 1973). An exception is the southern border zone, where rainfall rises to 1500 mm and is better distributed, and where vegetation patterns are not so susceptible to human disruption. In 1973, wildlife specialists from East Africa reported good numbers of fifteen species of ungulates in these southern



TABLE 5 NORTH-EASTERN AFRICA

<i>Country</i> (with area in square kilometres)	<i>Land-Use Trends</i>	<i>Protected Areas</i> (area in square kilometres)	<i>Remarks</i>
Sudan (2,506,000)	Sahel zone impoverished; woodland zone and moist south encountering progressive pressure from agriculture	35,340	Years of strife seem to have subdued rather than stimulated poaching in south; trade in spotted furs somewhat curtailed by government regulation since 1972
Ethiopia (1,222,000)	Agricultural pressures widespread, especially on forest areas	19,000	Considerable stock of leopard still survives in forest of S.W. Ethiopia; expanding use of poison
Somalia (638,000)	Pervasive environmental degradation for past century has greatly depleted biotic produc- tivity of most areas; government now stimulating livestock industry	6,250	Government-sponsored use of poison

territories, and there is no doubt that the 500,000 km<sup>2</sup> of this region could become some of the best wildlife country left in eastern Africa when the government establishes conservation programmes. Almost certainly there are plenty of leopard, possibly as many as in Ethiopia, Somalia, Kenya and Uganda together. Most habitats of the region are suitable for leopard, and have been little modified during the troubles of recent years (which had a side-effect of limiting rather than stimulating poaching).

Eleven of the country's parks and reserves are in the south. The largest, the Southern or Bahr-el-Gazal National Park, now reckoned to cover nearly 20,000 km<sup>2</sup>, and one of the smallest, at Nimule, were reported at the time of the survey to have satisfactory leopard populations. The situation in other southern parks and reserves could not be ascertained. Further north, the 7120 km<sup>2</sup> Dinder Park, one of the northernmost parks in Africa, is reckoned to contain good stocks of leopard, but it is cut off for four or five months of the year during the rains, which gives poachers a free hand (once numerous gazelles are now extremely scarce, though their decline is partly attributable to interruption of their migration routes by irrigation works related to the Roseires dam). In the same area, the 3367 km<sup>2</sup> Rahad Game Reserve now features a string of villages, and its wildlife potential is considered largely finished (W. Dasmann, pers. comm. 1972). Nothing is known of factors relating to leopard status in the Tokar and Sabaloka Game Reserves to the north and east of Khartoum; together they cover nearly 7,700 km<sup>2</sup>, and it is unlikely with the shortage of men and equipment in the Game Department that they receive much supervision. Outside protected areas, leopard once survived in good numbers in Red Sea Province and Darfur to the west, but more recently both regions have experienced heavy poaching. In general, it is doubtful whether anywhere north of 12°N leopard can survive except in isolated pockets.

The market in leopard skins in the Khartoum area became established in the 1960s. It reached its peak, around one thousand a year, in 1968. Between 1960 and 1971 the price of an average skin rose from about the equivalent of U.S. \$25 to \$170 (Cloudsley-Thompson, pers. comm. 1972). Hunting does not seem to have been organised commercially, as in several other African countries, but was an affair of individuals who saw in it a means of supplementing their low level of subsistence. As a consequence, skins were poorly cured and demand tended to outrun supply. In March 1973, 63 skins were found in the hands of 11 traders in Omdurman, at prices up to about \$220 for a large, well-cured skin. Traders said that, following control legislation in 1972, the supply of skins from Ethiopia had dried up, although regulations for skins originating within the Sudan were less strict; while export documentation was obtainable with moderate difficulty, it was usually easier for a few skins to be smuggled out. In any case, large supplies of skins were virtually unobtainable.

## Ethiopia

Although a great deal of information was amassed during the survey on the ramifications of the trade in leopard and cheetah skins, for which Ethiopia has long been renowned as a main outlet to world markets, the findings have to some extent been overtaken by events. Attitudes and policies of the new regime as regards wildlife resources have yet to be determined, so some of the survey's observations must be considered less relevant now than three years ago. For the purposes of this report the information can be dealt with rather summarily (further details available in Myers, 1974a).

As shown in Fig. 4, about half a million km<sup>2</sup> or two-fifths of the country consist of arid lowland savannah, much of it affected by the same drought that has devastated the Sahel zone in West Africa. Until recently these savannah lands suffered only moderate disruption by nomadic pastoralism, and must have supported great quantities of wildlife. In some areas, notably around Lake Turkana and the Omo River, game still survives in fair numbers (Urban & Brown 1969), but in general, as in the highland bloc, there has been extensive deterioration (Blower 1968; Brown 1971). In the Rift Valley sector, for example, gross overstocking has forced many Galla cattleowners into sedentary cultivation, which has led to as much bush clearing in three years as in the previous fifteen. Landscape modification on this scale severely affects the leopard. In fact the leopard's principal remaining areas are forest lands, totalling in all about 7.2% of the country. They are mainly to be found in the south-west (13,000 km<sup>2</sup>) as indicated in Fig. 4, though some are located south-east of the Rift. Even the forests, however, are affected by population pressure; they are steadily cut

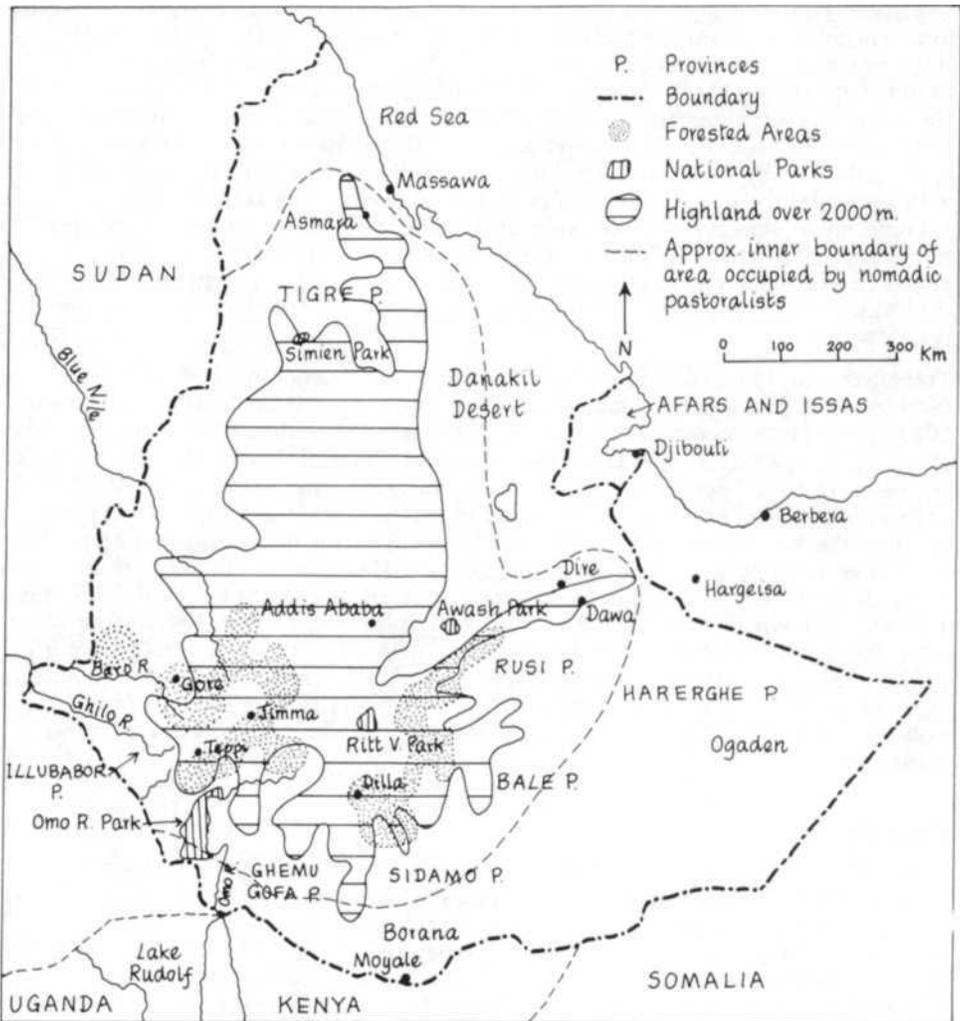


Fig. 4. Ethiopia (after Mariam 1970)

back by new settlers arriving from the crowded western highlands where human density sometimes rises as high as 10 persons per cultivated hectare. Forest clearing along the Gonga and Ganji Valleys pushes steadily westwards from Teppi and the head of the Ghilo River towards the Godare Valley, while the great expanse of dense woodland north to the Baro River and south to the Akobo River could be devastated within five years. Beyond the Baro, in more accessible country, the biotas have undergone massive degradation since 1967. At Gambella a reserve was approved in 1966, but has not been made effective and no supervision has been provided. This situation in south-west Ethiopia has not been helped by incursions of Nuer herdsmen during the Sudan troubles, and by settlements of Anuak cultivators—both groups being habitual hunters. Wild-life populations are reported to have been cut in half in the past few years, with even worse depletion for spotted cats.

Where blocks of forest still remain comparatively undisturbed, large numbers of ungulates, and particularly of blue, de Brazza's, vervet and colobus monkeys and baboons are still found. In these areas the leopard's traces are so common that its density may sometimes be as high as two per 3 km<sup>2</sup> (Brown & Urban 1970). Without such concentrations, the high offtake of the last decade could scarcely have been sustained since outside forest areas the leopard has become scarce and locally rare, even though it is still fairly widespread in areas such as the Omo River lowlands and mountainous areas of several provinces. How far current yield constitutes an increasing proportion of declining populations, is difficult to say. In general, hunting has probably been not very intensive, rather sporadic and directed at the fringes of the last large populations. But that situation is bound to change as communications improve and rural populations become more money-conscious, and as the remaining forests are steadily eliminated.

Official statistics for the export of leopard skins in the seven years 1964-70 total 964, with a rise in price of almost 150% to the equivalent of U.S. \$200 per skin. Yet in the U.S.A. alone, 1741 skins were recorded as imported from Ethiopia in 1968 and 1027 in 1969. At the time of the survey in early 1973, all participants in the trade agreed that, notwithstanding the 3-year moratorium recommended by the International Fur Trade Federation, more skins than ever were being sold, and supply still fell short of demand. Furthermore, an unknown but probably considerable number of skins was being exported through other channels, for example Djibouti. At every centre visited during 2500 km of travel, I found skins on offer; the same was said to apply in some Eritrean and other northern towns not included in the itinerary. All the skins appeared to have been obtained by leg traps, of which large numbers had been imported from Italy (ostensibly for use against monkeys and other small crop pests, but seemingly much too heavy for that purpose). Skins were more readily available and control slackened as one travelled southwards, while at Moyale on the Kenya border there were reports of a considerable two-way traffic. In Addis Ababa, two dealers displayed at least 100 skins apiece, all acquired in the last few months; one of the dealers claimed to have as many again in his store. Apparently an order for 20 skins a month could be readily met, even as many as 60 a month with sufficient notice. The main sources seemed to be the forests of the south-west and the Bale mountains of the south, but as roads improve other areas will come within range of the weekend poacher. All evidence suggested a large turnover, taken from plentiful if declining stocks.

The need for better control of the trade and to stop illegal dealings was officially recognized. In 1973, the government attempted to register all skins in possession of traders, whether legally obtained or not, as a first stage in effecting control and reducing the traffic to a lower level. Two cooperatives, with 14 and 20 members respectively, were thought to include all dealers, and by

July 1973 around 3000 skins had been registered. How far this effort was any more successful than earlier ones is uncertain, but for a time at least, until overtaken by other events, the conservation situation improved. In the long run, however, there cannot be a properly regulated trade, which could make a sustained contribution to the Ethiopian economy, without far greater cooperation on the part of all consumer countries.

## Somalia

This country exemplifies the extreme of habitat degradation through man's destructive activities (Hemming 1966). It serves as a measure of what may overtake other pastoral zones, notably the Sahel, within a decade. Though the process probably originated over a century ago, it has accelerated during the last 30 years. In much of the country, environmental impoverishment with its indirect impact on wildlife has been accompanied by wholesale slaughter of wildlife (Funaioli & Simonetta 1966). Many habitats in the north are described as 'on the verge of stark desert' (Simonetta, pers. comm. 1973). The government is trying to restore the situation, through for example an ecological and faunistic survey launched by the Italian National Council for Scientific Research in 1969. Being nomads for the most part, however, Somalis have little use for mountainous areas, so the devastation has been mostly confined to the lowland plains. In the Erigavo regions in the north, for example, moderate stands of cedar still exist at 2000 m. These are of obvious relevance to leopard. In the south, the lower reaches of the Juba and Shebeli Rivers offered suitable cover until recently, but they are being rapidly taken for human settlement. A few localities, mainly in the southern interior, such as east of Belet Uen and in the Noghal Valley and Plains, still feature moderate populations of wild herbivores; the same applies to the region north of Uarsek, where rolling hills and broken bush could provide fine country for leopard. Dikdik, as might be expected, are plentiful, and in more open country, warthogs are often common, partly because they are not eaten in a Muslim country and partly because they show a predilection for deteriorating grasslands and sporadic low-level growth; both these creatures could form a main item in the leopard's diet.

Apart from general environmental impoverishment, a major threat to the leopard lies in the trend for cattle-owners to move into the less-misused southern areas. As these stockmen try to squeeze a marginal living out of unpromising territories, they are inclined to eliminate every source of loss, whether actual or potential, as speedily as possible. In late 1973, leopards as well as lions were reputedly being killed by poison during government-sponsored vermin eradication campaigns (Simonetta, pers. comm. 1973).

All local authorities agreed that leopard numbers have fallen to very low levels. This decline has been matched by a rise in the price of skins, to U.S. \$125 in 1969, or double ten years earlier. Most skins now come from mountain regions. A few are smuggled in from Ethiopia, though they do not have the characteristic silky pelage and exceptional colouring of the 'Somali leopard' variety which is much sought after by dealers. Populations have diminished so much in northern Somalia that the situation is considered to be critical for the leopard. Populations in the south have never fully recovered from the extreme over-exploitation of the 1950s and 1960s (official exports for 1953 were 500 skins, rising to 700 in 1959 and 800 in 1961; unofficial exports could have accounted for at least as many again). As late as 1968, dealers from Europe were still finding it worth their while to travel to Mogadishu in search of the special 'Somali leopard' skins. Well aware of the extreme rarity of this variety of leopard, they offered three times as much for these skins—so much

for furriers' assertions that their best interests coincide with those of conservationists.

The leopard was at last put on Somalia's protected list in 1969, whereupon ownership of a skin for whatever reason became illegal. Measures have been taken to enforce control at points of entry and exit. At the time of the survey in 1972, no skins at all were on display in Mogadishu.

#### Territory of Afars and Issas

Djibouti has long been a main outlet for the Ethiopian as well as Somali hinterland. With the re-opening of the Suez canal and the eclipse of Aden, it could become an even more significant trading centre than in the past. During the 1960s hundreds of leopard skins a year, mostly illegally obtained and drawn not only from neighbouring countries but from Kenya and even further afield, were exported to Europe and North America. Since 1971 the trade has declined. A special check on the situation was made during the survey in early 1973. Four skins in the hands of three street hawkers were all that could be found. A considerable traffic was maintained, however, by members of the then 1600-strong French community. The three hawkers indicated that a week's turnover was still as high as ten skins, half leopard and half cheetah, although the old trade channel from Ethiopia had been restricted by tougher checks and higher dues.

#### (f) **THE EQUATORIAL RAINFOREST REGION** (see Fig. 1 and Table 6 for summarised data).

Rainforest covers only 9% of tropical Africa, as compared with 32% of the Neotropical Region. The greater part of it lies in the three countries included in this subsection, Congo, Gabon and Zaire. The strip of forest extending north and west around the Gulf of Guinea has been so reduced by human settlement and timber extraction as to be of little significance for this report.

#### Congo

Outside Brazzaville and a few other urban centres, human population densities are low to very low. The southern and most thickly inhabited third of the country is woodland savannah and no longer supports many wild herbivores. The rainforest section, covering most of the country, has hitherto been little disturbed, either by cultivation (accounting for a mere 1% of the total area) or by hunting. Hardly any leopard skins seem to have come out of the Congo even at the height of the 1960s fur-trade boom in North America. There is no good reason to suppose the status and prospects of the leopard are anything but satisfactory.

#### Gabon

Except for the montane forest of the Iboudji massif (c. 1500 m), rainforest is the natural vegetation of the whole country. With a population of only one million, it has been little disturbed. Less than 1% per year is exploited, and regeneration is rapid. Secondary growth supports a rather different fauna, yet sufficient to maintain leopards at quite high densities. Reports of scratch marks and other signs, as well as actual sightings, suggest that the leopard is both widespread and numerous. During the past few years mineral prospectors have penetrated into every part of the country, and they encounter leopard in all sectors. Survey teams in camp in the heart of the forest have heard grunts and coughs from more than one leopard at once; in an environment

TABLE 6 EQUATORIAL RAINFOREST REGION

<i>Country</i> (with area in square kilometres)	<i>Land-Use Trends</i>	<i>Protected Areas</i> (area in square kilometres)	<i>Remarks</i>
Congo (342,000)	Populace mostly in woodland zone of southern one third little pressure on forest	1,110	Rainforest could hold appreciable numbers of leopard; little or no poaching; spotted-skin trade of no account
Gabon (268,000)	Sparse populace; minerals-based develop- ment exerts no pressure on forest	1,730	Rainforest could hold appreciable numbers of leopard; little or no poaching; spotted-skin trade of no account
Zaire (2,345,000)	Only one third is rain- forest; some agricul- tural pressure in the peripheral areas	74,860	Rainforest could hold appreciable numbers of leopard; little or no poaching; spotted-skin trade of no account

where sound travels poorly, this suggests a high density. Little hunting of any kind takes place. As long as Gabon's development centres mainly on mineral exploitation, the leopard's status and prospects appear to be as good as in other coastal countries of western Africa many times as large.

### Zaire

This vast country of 2.3 million km<sup>2</sup> is by no means entirely within the rainforest zone. The southern two thirds, from the equator to 10°S., extends well into the *miombo* woodlands. Both in the south and along the northern borderland there are several extensive savannah areas. Thus the equatorial rainforest accounts for only one third of the country. Savannah also tends to penetrate the forest margins, facilitating human encroachment, with the result that some, primary forest has been disturbed by recent occupation and has assumed a secondary character. Now that West African timber sources have been widely exhausted, heavier forest exploitation is expected in the near future. As discussed at some length in Chapter I (pp. 13-14), there is good reason to believe that at least in some parts of the rainforest (which totals 800,000 km<sup>2</sup> in Zaire, with another 450,000 km<sup>2</sup> in Congo and Gabon) leopard densities may be as high as one per 3 km<sup>2</sup> and sometimes even higher. Despite increasing exploitation, prospects for the equatorial forest must be considered good, since living space for the human population is not in short supply and the mineral and industrial potential of Zaire allows a large proportion (over 20%) of people to live in urban areas than in most of developing Africa (generally under 10%). Forest lands should therefore be capable of supporting large numbers of leopards for at least another decade, possibly longer. In view of the significance of this situation for the overall status of a species that is often considered elsewhere to be in critical straits, it is appropriate to stress that the conclusion, albeit tentative, has been reached only after lengthy investigation in consultation with many persons familiar with the rainforest region. There is plenty of evidence to support the contention that the region could serve as a major reservoir for leopard in Africa for at least one more decade and possibly far longer.

Outside the rainforest zone, the leopard can generally find suitable habitats in *miombo* woodlands and certain savannahs, though they support lower densities. In Zaire as a whole, there is a trend for some sectors of forest to be replaced by woodland and some sectors of woodland by grassland. The first of these changes could reduce leopard populations somewhat, the second significantly. But overall conditions—in particular the only moderate population pressure; were the populace to start to grow at 4% a year by 1980, Zaire would still have fewer than 50 million people by the end of the century—suggest that leopard populations are not likely to be unduly depleted in the foreseeable future. Of course there are exceptions, fortunately few: in the densely populated vicinity of Lake Kivu, the Kahuzi-Biega Park, established primarily as a gorilla sanctuary, no longer contains any leopard at all.

In conclusion there are several other favourable factors which make the position even more hopeful. Poaching in most of Zaire, except perhaps the north, never seems to have been significant. In particular, there is no evidence of a response to the recent upsurge in prices of spotted-cat skins on international markets. Poaching would have to become exceptionally extensive and intensive to exert much effect on leopard stocks. Moreover, the national parks, of which in 1960 there were only three covering about 1% of the country, have been increased by 1975 to seven, totalling 74,860 km<sup>2</sup> or 3.2% of the national territory. An appreciable number of additional parks and reserves are under con-

sideration, to cover 15% of this huge country. Salonga Park alone, 36,560 km<sup>2</sup>, could well support a leopard population of several thousand. Since development processes seem unlikely to exert the same pressures on parks and reserves as are commonly encountered in many other countries in Africa, the network of protected areas should endure. These alone could make a significant contribution to the status of the leopard in Africa.



Fig. 5 Leopard Distribution Throughout Sub-Saharan Africa. A few leopard may persist outside the areas indicated but not sufficient to affect the overall distribution and status significantly.

### **SUMMARY OF LEOPARD STATUS IN SUB-SAHARA AFRICA**

The overall position, based on the country-by-country reports in this Chapter, is illustrated in Fig. 5.

In sum, the leopard's status declined markedly in many parts of Africa, while remaining substantially stable in other parts. Its prospects include the likelihood that, outside the rainforest and *miombo* zones, it will become increasingly restricted to isolated localities in remote areas where it can subsist without undue interference from man. In effect this means that it will be confined largely to mountain tracts, patches of forest and woodland, rocky and broken country, and environments too harsh to attract human settlement, with the exception that in the forestlands of the Zaire River basin it should survive in considerable numbers until well towards the end of the century.

## CHAPTER IV

# The Leopard's Status: Basic Factors and Issues

This Chapter reviews the causes of the leopard's decline in recent years, the factors that will decide whether it will survive in emergent Africa, and the value of various measures designed for its conservation.

### (a) FACTORS AFFECTING PRESENT AND PROSPECTIVE STATUS

As indicated in the previous two Chapters, the leopard enjoyed a wide distribution and good numbers prior to human modification of its habitats on a large scale. The disruptive process became apparent in North Africa and South Africa by the start of the present century, though it is a measure of the leopard's adaptability that it survived in both areas long after the lion had been generally eliminated. The next two regions to be affected were West Africa and Somalia, although the leopard withstood the process better than most mammal species even while a loss of preferred prey and general biotic deterioration led to a decrease in its range and numbers. Elsewhere the leopard's status remained satisfactory until at least the end of World War II. Thereafter the broad-scale use of prophylactics for humans and livestock triggered an accelerated change in wildland environments. Despite its adaptable capacities the leopard began to decline over wide tracts of Africa. An indication of the trend is seen in Kenya, where the leopard's preferred prey species such as small antelopes started to disappear from ranchlands—and shortly thereafter the leopard itself.

### **Intensification of agriculture**

A corollary of this factor, as demonstrated in South Africa, is that stockmen have been inclined to view the leopard not as a species deserving some protection except under certain circumstances, but rather as a creature to be treated as vermin and eliminated almost out of duty. Regrettably this attitude seems to be spreading in southern Africa, although a sounder objective would be to maintain the highest number and widest possible distribution of leopards without leading to unacceptable conflict with livestock interests. In other words, although the livestock industry has legitimate interests which deserve protection, wholesale predator control (i.e. elimination) is not necessarily the best way to achieve this aim. Predator control needs to be viewed as no more than one aspect of predator management, which in itself should be planned as part of an overall policy of natural resource conservation for the welfare of society as a whole. Within this context, it is plain that unselective methods such as the use of poison should have no place except in extreme circumstances. The application of more intensive rangeland practices is already spreading to Masailand in East Africa, to Somalia, Ethiopia and parts of West Africa, and some predator species will certainly undergo some reduction in some areas for some periods; but a more discretionary and selective strategy needs to replace the indiscriminate approach which characterises southern Africa's response to predators, if the widest possible spectrum of resources is to be maintained.

### **Other agricultural impacts**

Another factor (which may affect the cheetah more than the leopard, see Myers

1975b), is the spread of what may be termed semi-subsistence agriculture. The upsurge in human numbers, linked to a still more powerful phenomenon—the upsurge in human aspirations, manifests itself in part through a population overspill from more fertile areas into savannah zones. This is already apparent in several countries, and is likely to become so in many others. Technology may help to check the process by permitting more concentrated cultivation of cash crops in high fertility areas, but equally technology aids the taking up of land in savannahs through developments such as drought-resistant strains of maize. Ultimately the habitat modifications involved must constrict the life-support systems of the leopard, though less so and less quickly than it does for other predators and many herbivores.

#### The international fur trade

This factor has severely aggravated the pressures described above. The trade may not have considered it to be its business to support protection programmes and assist in solutions for the highly complex problem of assuring the conservation of a common property resource, the leopard. This attitude is different, however, from actively conniving in the evasion of controls, as has all too often been the case. For at least 15 years the industry must have been aware that in certain areas the resource was under unsustainable pressure by virtue of fur market demands. Yet, to cite but the case of the so-called Somali leopard, the industry has not investigated whether market indications called for curbs on the excessive exploitation of this particular form of leopard; instead the reaction of furriers was to lay hands on any skin available, regardless of price and regardless of the cost to Somali leopard populations. In short, the trade's operations have been inefficient to extreme degree, both ecologically and economically.

The numbers of leopards for which the trade may have accounted in the recent past is hard to estimate, given the reluctance of competitive interests within the industry to divulge even rough figures of turnover. However, statistics of the U.S. Department of Commerce show that totals of leopard skins imported into the U.S.A.—a few from Asia, but mainly from Ethiopia, Kenya and South Africa—were 9556 in 1968 and 7934 in 1969; and it would be reasonable to assume that as many again went to Europe. Furthermore, it is generally agreed in the trade that for every skin leaving Africa another is rejected as useless because of damage or poor curing; some leopards are destroyed by hyenas before the trapper gets to them; and, if a female with a litter is killed, the death of the cubs must also be accounted as a loss directly attributable to the trade. All in all, the offtake in 1968 and 1969 could have been of the order of 50,000 each year. In 1970 imports to the U.S.A. and in 1972 to the U.K. tailed off markedly as a consequence of new controls, but in 1973 the demand for skins from continental Europe was said to surpass that of the late '60s—that is to say, back again at a level of 50,000 a year. It is the concentration of this demand upon certain localities which had led to gross over-exploitation in several countries, when a more even spread over the leopard's whole range might have had less serious consequences. On the other hand, the impact has sometimes been localised to the extent that it causes depletion of leopard numbers in only a single sector of a country, as in the case of Ngamiland in Botswana and Barotseland in Zambia (see Chapter III).

#### (b) CURRENT CONSERVATION MEASURES

Conservation measures have mainly depended hitherto on legislative protection of the species itself and reservation of its habitat.

## (i) Legal protection of the species

Most countries of sub-Saharan Africa now extend some degree of legal protection to the leopard. Although still only ratified by about half the signatories, the African Convention of 1968, while permitting some forms of exploitation such as sport hunting, prohibits commercial dealings in skins. This at any rate, was the position reached in most countries by 1974, though several had by then outlawed all forms of exploitation including licensed hunting<sup>1</sup>.

Regulations vary from country to country in detail and in the frequency with which they are changed. This confusing situation should be partially resolved now that the Washington Convention has come into force in a number of countries of Africa, since the Convention's schedules require that exploitation of the leopard and trade in its skin be totally prohibited. This requirement may seem hard on the stock-raising community wherever it suffers appreciable livestock losses from leopard; it may even seem hard, in the view of some observers, on certain segments of the fur trade. In light, however, of the pressures that these two bodies presently direct at the leopard, the leopard's position in the top protected category of the Convention seems justified, and should not be altered unless provisions can be made to eliminate inordinate attrition from livestock interests and the fur trade.

There remains the problem of enforcement of the law. Few countries have the resources to finance and staff wildlife protection in the way they would wish. Tanzania, for example, has recently been spending a higher proportion of its budget for wildlife conservation than the U.S.A. (though like the U.S.A. it achieves only moderate success in controlling poaching). The previous Chapter referred several times to light sentences imposed on those who offend against the law. To emphasise a main point again, confiscation of skins, traps, guns and vehicles serves as a sound deterrent. This measure is at present applied only rarely, though it could equitably be applied invariably.

## (ii) Creation of reserves

The countries dealt with in this report have established over 150 parks and reserves, with a total area nearly twice that of Great Britain. In many cases, they offer favourable or even optimal habitats for leopard; very few are likely to contain no leopard, and at a rough guess they extend protection to at least 50,000, possibly many more. At the same time, many protected areas are by no means assured of a stable future, particularly in savannah zones (Myers 1972). This is due not only to constraints imposed by human population growth in surrounding areas, but to adverse factors of physiobiotic processes. For example, much of the woodland in the Kabalega Park in Uganda has been converted to grassland by elephants and fire, which must have affected the park's carrying capacity for leopard; and in Amboseli Park in Kenya a rise in the water table and subsequent increase in soil salinity has killed off acacia woodlands (Western and van Praet 1973), with similar consequences for leopard.

---

<sup>1</sup> Published figures indicate that the total continent-wide offtake by sport hunters has probably not exceeded 500 a year during the past few years. In areas of sound leopard density, sport hunting could be encouraged as a highly lucrative form of land use—though it tends to raise difficulties if, at the same time, local people are forbidden to molest the leopard even for the protection of their livestock.

## A New Approach to Long-Term Management of the Leopard Resource

In this final Chapter, an appraisal of the effects of the Washington Convention (which have already been briefly touched on previously, e.g. pp. 37 and 66), is deferred until the end. The main part of the Chapter presents an exploration of opportunities for conservation—or 'wise use'—of the leopard as a resource, followed by formulation of a framework for sound ecological and economic management of the resource. These are, after all, the basic conditions to be met before there can be relaxation of the total protection which the Convention now affords in countries that have ratified. The evidence collected in the survey suggests that, due to the leopard's exceptional adaptability, its status still remains generally satisfactory, despite severe local depletion. Thus there is no overriding bio-ecological reason for ruling out exploitation of the leopard by the international fur trade. The point at issue here—a highly contentious one—is: on what kind of conditions could some form of exploitation by the fur trade eventually merit consideration?

### MANAGEMENT OF LIVESTOCK AREAS

Before taking up that major issue, however, there is need to consider certain rangeland management problems that affect the present and future status of the leopard. These are of more immediate urgency, both because it is necessary to assure the livestock owner that his legitimate interests are protected, and because without such assurance he is liable to take matters into his own hands. Now that poison provides the stockman with a cheap and convenient way to eliminating predators, the leopard could disappear from wide areas of Africa within the present decade. To stress a central factor, the rancher is in an entirely different position from the fur dealer. He is not basically interested in profit from a leopard's skin (unless he is offered such lucrative allurements by the trader as to see depredations where none have occurred); nor does he aim to 'come out ahead' in financial terms—he merely wants to avoid coming out behind. If his losses are genuine though marginal, he should accept them as he would accept other natural setbacks to stock-raising in Africa, such as drought. But if his losses are exceptional and sustained, they should be offset by some sort of compensatory adjustment on the part of those who benefit from the leopard's survival, viz, society at large.

What the problem calls for is a rigorous appraisal of the nature, purpose and methods of predator control, within—to emphasise a basic constraint—an overall policy for natural resource conservation in the interests of society at large. Present attitudes in Africa to predators are much too reminiscent of those that held sway in the western United States for two decades before ranchers were presented with an alternative approach (Wagner 1972). In brief, this fresh strategy involves a concise definition of problems and needs, recognition of the various imperatives of the livestock industry (of which protection from predators is but a single item, to be achieved by various methods), a holistic approach to analysis of man-wildlife relationships, and a calculation of the exact incremental benefit per unit cost of control operations (the essential benefit of such operations lies in overall losses prevented, not in the value of current losses).

**REGULATED EXPLOITATION**

In the light of what the survey revealed of leopard stocks in Africa, various approaches are available for better conservation of the leopard. One possibility is to continue a major strategy of the past 10 years, and try to impose a ban on the use of leopard skins for any purpose anywhere. This view is held with much sincere conviction by people of utmost good faith: they believe it is right in principle, and applicable in practice if enough effort is put into the campaign. But protectionists should distinguish between their sentiments against the use of wildlife products for frivolous fashion, and their commitment to saving the leopard from over-exploitation. It is one thing to refrain from buying a fur coat, it is another to assert that anyone else who does so is not only devoid of taste but indifferent to the leopard's status. At the same time, the fur trade should abandon its more absurd rationalisations in support of its activities. Wearing a leopard fur coat is not the same as wearing cow-leather shoes; the cow is not trapped with snares, nor has it been severely depleted in any part of its range.

The principal question facing conservationists is not whether the leopard will be exploited but how it will be exploited. After all it will be exploited on a casual basis for what may be termed its 'opportunity costs' if for no other reason—that is to say, it will be reduced or eliminated to the extent necessary for rangeland management (as discussed in the previous sub-section). But efficient exploitation implies sustained-yield harvesting under a regulated system, in place of the present total lack of system which can only be described as grotesquely wasteful, inefficient and corrupting. Above all, organised exploitation of the leopard could enhance the image of wildlife in general and predators in particular, as perceived by citizens of emergent Africa.

This exploitation rationale does not, however, reflect the theory that the best way to safeguard a declining resource is to establish its economic value in the marketplace. According to this view, when a species undergoing exploitation is so reduced that its commercial exploitation is no longer worthwhile, its 'commercial extinction' supposedly intervenes some time before its biological extinction (Davis, Hanke & Mitchell, 1973). But for reasons of resource economics, this theory does not invariably hold good, especially under modern conditions of high discount rates for exploitation systems (Clark 1973; McManus 1972; Watt 1963).

A cropping operation properly conducted does not diminish a stock year by year. This has been demonstrated for several species, such as the saiga antelope and the northern fur seal. The case of the seal is particularly relevant to the leopard in Africa, since it illustrates how exploitation of a resource with no property rights for the entire resource vested in individual countries or organisations, does not necessarily mean over-utilisation until the final demise of the resource. A number of other common property resources, particularly of the sea, feature arrangements for institutionalised harvesting with varying degrees of success. Where they have failed, as in the case of the whales, it is because management has been primarily geared to the health of the industry rather than to the scientific assessment of stocks (Myers 1975a; Ray 1970; Ray & Norris 1972).

In the majority of countries reviewed in Chapter III, leopard populations are too reduced or scattered for exploitation even to be considered until they have been given an adequate period to recuperate. Conversely, in about half a dozen countries populations are almost certainly large enough for a cropping programme to be feasible. The basic approach to the organisation of any exploita-

tion project could well be centred on a 'most concerned nations' strategy, such as is often applied to the utilisation of a resource shared by several countries. For the leopard, two groups—producer countries inside Africa and consumer countries outside Africa—would have to be represented in the managing organisation. There might be advantages in providing for circulating membership, particularly if the idea of a rotational or cyclical system of harvesting (as discussed below) were applied. Thus, when a country's 'season' of three years (or however long) of contributing to the continent-wide harvest is completed, that member of the regulatory body might be replaced by another country. The important point is that, initially at least, the members should be composed of the more prominent participants in the trade, so as to ensure a powerful organisation; this opens up the possibility, if need be, of putting international pressure on non-members to conform to national exploitation measures.

## **CONTROLS FOR SUSTAINED YIELD HARVESTING**

### **(a) Bio-ecological aspects**

For markets in Europe, North America and Japan, an annual offtake of the order of ten to fifteen thousand skins would probably be sufficient, according to fur industry spokesmen. Any tendency for demand to exceed supply could be dealt with by price adjustments. This scale of exploitation should not place much strain on stocks of several countries (as estimated in Chapter III), so that there would be no need for highly sophisticated regulation of the harvest (see Caughley 1972; Odum 1971; Silliman 1968; Slobodkin 1968; Wagner 1969, and Watt 1968, for detailed reviews of sustained-yield cropping methodology). A truly random crop might be the most satisfactory outcome from a biological standpoint, since it would spread pressure as widely as possible. But haphazard cropping should be avoided, since it would be far too liable to perpetuate the unbalanced exploitation which has been typical practice to date, and which tends to go for the most accessible and cheaply exploitable populations. Instead, in accord with the principle of sustained-yield operations, the aim should be to harvest the annual increment of various stocks. This could perhaps be best achieved by concentrating on places where the croppable surplus is indicated by leopard populations themselves. For example, Arusha Park in Tanzania has a high density of leopard, and is adjoined by zones of intensive agriculture. Into these peripheral areas a number of excess leopards are ejected each year by resident populations, whereupon they are generally destroyed by local people whether for profit or not. These surplus leopard could be harvested under control, without adverse effects on permanent stocks or distortion of population structures. Much the same applies to several other parks and reserves, such as Kalahari Gemsbok in South Africa, Ruwenzori in Uganda, Lengwe in Malawi and Lake Manyara in Tanzania, and to more extensive areas such as the 1500 km long scarp along the west side of Namibia and the mountain backbone of Malawi. Not that this approach would be suitable in all countries. In Zaire, for example, the aim should be to spread the offtake—which could be very considerable—over as wide an area as possible.

A further basis of control, especially pertinent to a regional group of countries, would be a rotational system of harvesting. Each country would participate in turn on an annual basis, or alternatively, the offtake in any one country could be strictly limited to, say, two months a year, with processing and disposal (linked where necessary with periodic auctions) confined to the succeeding few months.

In general, therefore, the strictly bio-ecological aspects of control present problems which are tractable enough compared with, for example, the politico-economic problems of fixing quotas. Plenty of useful precedent is available, however, in the equitable division of quotas for other commodities among African countries, for example the apportionment arrangements established by the International Coffee Agreement.

In sum, no regulation procedures can be made entirely foolproof. The attempt would prove worthwhile, however, if it reversed the present proportion of 90% illicit to 10% lawful dealings in leopard skins. An illegal offtake of even one hundred or two leopard skins, which could possibly then be involved, would of course have serious consequences for depleted stocks of a country such as Somalia, let alone those of the Maghreb or of many countries of Asia. None of these countries should participate in any way in a regulated exploitation project.

#### (b) Controls as applied to export procedures

It is in this area that problems of control are most difficult and opinions on solutions differ most widely. Any surveillance of exports implies some degree of governmental involvement. This could take the form of a monopoly in the handling of raw skins or of licensing only a limited number of dealers, thus facilitating inspection and making it more likely that dealers would have too much to lose to risk being caught in illegal transactions. In addition, a single channel could be established through which all skins must pass on leaving a country. But the export of raw skins offers many opportunities for malpractice; for example illegally-taken skins can be incorporated in consignments of 'clean' skins. Moreover, too many controls at too many points along the line can serve to stimulate the incentive to smuggle or engage in other forms of evasion. Enhanced control can be achieved at the raw-skin stage, by for example marking a skin with an identifying tag or stamp, the mark and ink to be changed at intervals. If such a procedure were linked to a single point of sale on world markets, such as the Hudson's Bay Company auctions, it could conveniently eliminate much opportunity for abuse among both producer and consumer countries.

An alternative approach could entail a ban on the export of anything other than tanned skins and finished articles. This would enhance the scope for control in many ways. Most fur dealers in London and New York are adamant that the quality of tanning in Africa is not good enough for this purpose. They are also sensitive to the fact that much of their profit margin lies in the processing stages—profit which would be switched to producer countries, together with employment opportunities involved. Contrary to that point of view, however, several firms in, for example Kenya, Botswana and South Africa produce finished products of sufficiently high quality to compete in world markets. If the best way of achieving effective control were found to lie in a regulation to the effect that skins can be exported only in tanned or made-up form, then presumably a compromise could somehow be found. If the fur trade rejected the idea but still insisted that it supports control, it would be up to the industry to propose an acceptable and workable alternative.

#### (c) Controls as applied to import procedures

There are plenty of precedents for a close link between controls exercised by exporting countries and those on the part of importing countries. The coffee trade is an example of this 'double check' system. If applied to the spotted-fur trade, it would be desirable, for many reasons of efficiency and convenience,

that all skins should be imported (as well as exported) through a single centre or a very limited number of centres. The sealskin trade in the U.S.A. is run in this manner: for the past 60 years, all seal furs have been processed by the Fouke Company under Department of the Interior supervision, before being marked, identified and sold through public auctions. For leopard skins a single company, such as the Hudson's Bay Company, could be designated to play a similar role. Supervision would be exercised by officials appointed by the government of the country in which operations were to be based and by a recognized independent international authority such as IUCN. Such supervision may be needed for only a limited period each year, say the two months preceding each of two annual auctions. The officials concerned would also be responsible for keeping permanent records and for seeing that the proceeds, less handling charges, revert to appropriate agencies in the exporting countries. This kind of system should not be too difficult to work out in detail nor to implement, since it corresponds closely to what already applies to hides and skins of several other species. The fewer than one hundred traders who handle 90% of the fur trade in western Europe are familiar with similar mechanisms. Moreover, in the whole of Western Europe there are only five major dressers, who prepare the bulk of high-grade products from leopard skins. Control could also be exercised at this level—precedents exist elsewhere, for example in Australia, where a variety of skins is handled through a system of this sort.

## CONCLUSIONS

Summing up the last two sections, a few points need to be emphasised. There is a wide range of methods available for regulating a trade which deals with small-bulk, high-priced items, precisely the kind which lend themselves to illicit dealings. It is by no means impossible to devise adequate control measures. But what counts is to persuade all participants in the trade to accept whatever system is devised. As long as one country in the producer group or one in the consumer group is not prepared to abide by the regulations, comprehensive control is immediately prejudiced: the chain is no stronger than its weakest link. This aspect is much stressed by the fur trade: a new strategy is fine provided everybody agrees to play the rules of the new game. When breaches of regulations arise, the honest dealer finds it difficult to refrain from imitating the practices of illicit operators in order to stay competitive. Nevertheless, with sufficient commitment—a readiness to operate the system rather than abuse it—the main participants should be able to ensure that no representative of either the producer or consumer group falls out of line, since this will be a situation where all gain together or all eventually lose together. The critical time would arrive during the early stages, which should not be rushed; the evolution of a determination to make the system work would have to be slow enough to allow participants' perceptions to adjust, and to encourage trust to grow with experience.

In terms of financial returns, African countries are likely to require a greater share of benefits in future, either through processing before export or other means of deriving a larger share of overall profit. Up till now the differential has been great, with the producer organisation receiving only one tenth to one twentieth of the final retail price of a fur coat—a situation which gives too little support to the principle of making Africa's wildlife pay its way. An annual harvest in Africa of, say, 10,000 leopard skins a year could generate 1000 fur coats or equivalent made-up products. At present retail prices, this represents a final turnover of around \$20 million. If a sizeable proportion of

this sum could be assigned to Africa, it could help the image not only of the leopard and other predators but of wildlife in general in emergent Africa.

Reverting, finally to the Washington Convention the terms of the agreement state that a species such as the leopard and its products, being included in Appendix 1, will 'only move between countries when authorities in both exporting and importing states are satisfied that the transfer will not be detrimental to the survival of the species, that the specimen is not taken in contravention of the law of the exporting state, and that the specimen is not to be used for commercial purposes'. In order that the leopard be made available for the kind of cropping scheme that has been explored, it would have to be moved to Appendix 2, which allows a species to be commercially exploited'.. only when an authority in the exporting state is satisfied that this will not be detrimental to the survival of the species, and that the specimen was not taken in contravention of the law of the state'. No such move should even be contemplated for a considerable period—at least one year and preferably several years—after the Convention comes into force, and than *only* if all parties to putative exploitation have shown beyond doubt that they intend to abandon the harvesting procedures followed hitherto. This means that authorised cropping of leopard could not actually begin for some years from now. It would also mean that, in terms of the provisions of the Convention, any cropping programme eventually approved would be subject to periodic review. If it failed to operate in accord with the kind of principles and practices which have been outlined in previous sections of this Chapter, it would be suspended until more effective controls were devised—an additional incentive to all parties to apply their best efforts to make the system work.

As the survey has shown, there seem to be no bio-ecological or technical reasons why a sustained-yield offtake of leopard skins from Africa should not be possible. The main deficiency at present is a lack of will to make an exploitation scheme operate in a way which is both efficient and equitable. The fur trade must recognise the need to erase its past record. At the same time, the trade can show how rational exploitation of a valuable resource is not beyond human capacity, even though it calls for the cooperation of several producing countries and several consuming countries at once. The manner in which such a cropping programme was implemented could serve as a model of how to utilise a common property resource to the benefit of society at large. The same basic strategy—and spirit—holds good for a number of other common property resources, held in common by, if not for, mankind.

## References

- ALTMANN, S.A. 1967. The Structure of Primate Social Communication. In S.A. Altmann (ed.), *Social Communication Among Primates*: 325-362. University of Chicago Press, Chicago.
- & ALTMANN, J. 1970. *Baboon Ecology: African Field Research*. University of Chicago Press, Chicago.
- ANNA, M. 1971. *Report concernant le Léopard d'Afrique dans la République du Tchad*. Directorate of National Parks and Game Reserves in Tchad. 2 pp., mimeo.
- 1973. *Etude du Léopard et du Guépard dans l'Afrique au Sud du Sahara: leur situation actuelle dans la République du Tchad*. Directorate of National Parks and Game Reserve in Tchad. 4 pp., mimeo.
- ANSELL, W.F.A. 1960, *Mammals of Northern Rhodesia*. Government Printer, Northern Rhodesia.
- ASIBEY, E.O.A. 1971. The Present Status of Wildlife Conservation in Ghana. In D.C.D. Happold (ed.), *Wildlife Conservation in West Africa*: 15-21. I.U.C.N. New Series 22, Morges.
- ASIBEY, E.O.A. 1972. Ghana's Progress. *Oryx* 11 (6): 470-475.
- BAKER, R. 1973. The Need for Long-Term Strategies in Areas of Pastoral Nomadism. In *Proceedings of a Symposium on Drought in Africa*. Centre for African Studies, London University, July 19-20, 1973.
- BLOWER, J. 1968. The Wildlife of Ethiopia. *Oryx* 9: 476-285
- BOURLIERE, F. 1965. Discussion comment. In F.C. Howell and F. Bourlière (eds.), *African Ecology and Human Evolution*: 43-54. Methuen, London.
- and VERSCHUREN, J. 1960. *Introduction à l'Ecologie des Ongulés du Parc National Albert*. Institut des Parcs Nationaux du Congo Beige, Brussels.
- BRAIN, C.K. 1969. The Probable Role of Leopards as Predators of the Swartkrans Australopithecines. *S. Afr. Arch. Bull.* 24 (3 and 4).
- 1970. New Finds at the Swartkrans Australopithecine Site. *Nature* 225: 1112-1119.
- BROWN, G.H.H. 1970. The Conservation Situation in Ethiopia. *Biol. Cons.* 2 (4): 293-298.
- BROWN, L.H. 1969 Ethiopia's Wildlife Conservation Programme. *Biol. Cons.* 1: 332-334.
- 1971. *East Africa: Mountains and Lakes*. East African Publishing House, Nairobi.
- and URBAN, E. K. 1970. Bird and Mammal Observations from the Forests of South West Ethiopia. *Walia* 2: 13-40.
- CAMPBELL, A. C. 1971a. Traditional Utilisation of Wildlife in the Kalahari. *Botswana Notes and Records*, Special Edition No. 1: 108-113.
- 1971b. The Development of the Wildlife Industry in the Kalahari. *Botswana Notes and Records*, Special Edition No. 1: 270-275.
- 1973. The National Park and Reserve System in Botswana. *Biol. Cons.* 5 (1): 7-14.
- and CHILD, G. 1971. The Impact of Man on The Environment of Botswana. *Botswana Notes and Records* 3: 91-110.
- CAUGHLEY, G. 1972. *Sustained Yield Harvesting*. Paper presented at F.A.O. Ad Hoc Working Party on Wildlife Management, Nairobi, Feb. 1-3, 1972. 3 pp., mimeo.
- CHARTER, J.R. 1971. Nigeria's Wildlife: A Forgotten National Asset. In D.C.D. Happold (ed.), *Wildlife Conservation in West Africa*: 37. I.U.C.N. New Series 22, Morges, Switzerland.
- CLARK, C.W. 1973a. Profit Maximisation and the Extinction of Animal Species. *J. Pol. Econ.* 81 (4): 950-61.
- 1973b. The Economics of Overexploitation. *Science* 181: 630-4

- CLOUDSLEY-THOMPSON, J. L. 1966. *Animal Twilight: Man and Game in Eastern Africa*. Foulis, London.
- 1969. *The Zoology of Tropical Africa*. W.W. Norton, New York.
- 1971. Recent Expansion of the Sahara. *Intern. J. Environmental Studies* 2: 35-39.
- 1973. Developments in the Sudan Parks. *Oryx* 12 (1): 49-52.
- CORFIELD, T. F. and HAMILTON, P. H. 1971. *The Conservation and Management of Wildlife in Central Africa*. Report of the Cambridge Central Africa Project 1969-70, I.U.C.N., Morges.
- CURRY-LINDAHL, K. 1956. Ecological Studies on Mammals, Birds, Reptiles, and Amphibians in the eastern Belgian Congo. *Annals of the Royal Museum of the Belgian Congo*, Tervuren, Belgium.
- 1968. *Report to the Government of Ghana on Conservation, Management and Utilisation of Ghana's Wildlife Resources*. 23 pp., mimeo. I.U.C.N., Morges.
- DAVIS, R. K., HANKE, S. H. and MITCHELL, F. 1973. Conventional and Unconventional Approaches to Wildlife Exploitation. *Trans. 38th N. Amer. Wildl. & Nat. Res. Conf.* : 75-89
- DORST, J. and DANDELLOT, P. 1970. *A Field Guide to the Larger Mammals of Africa*. Collins, London.
- DUPUY, A. F. 1971. Le Parc National du Niokolo-Koba, Sénégal. *Biol. Cons.* 3 (4): 308-310.
- EISENBERG, J. 1970. A Splendid Predator does Its Own Thing Untroubled by Man. *Smithsonian* 1 (6): 48-53.
- EISENBERG, J. S. and LOCKHART, M. 1972. An Ecological Reconnaissance of Wilpattu National Park, Ceylon. *Smithsonian Contributions to Zoology* No. 101.
- ESTES, R.D. 1967. Predators and Scavengers. *Natural History* 76 (3): 38-47.
- EWER, R. 1973. *The Carnivores*. Weidenfeld and Nicholson, London.
- FISHER, J., SIMON, N and VINCENT, J. 1969. *The Red Book: Wildlife in Danger*. Collins, London.
- FOOD AND AGRICULTURE ORGANISATION, 1970. *Wildlife Management in Kenya*. Report of an UNDP/FAO Mission, June, 1970. FO:SF/Kenya/1, WS/A6404. F.A.O., Rome.
- FUNAIOLI, U. and SIMONETTA, A. M. 1966. The Mammalia Fauna of the Somali Republic: Status and Conservation Problems. *Monitore Zoologico Italiano*, Supplement to Vol. 74.
- GRAAFF, G. De. 1971. The Impact of Development on Wild Areas (including National Parks) and on such Areas across International Boundaries. In *Proceedings of Symposium on Nature Conservation as a Form of Land Use*: 67-70. Southern African Regional Commission for the Conservation and Utilisation of the Soil, Pretoria.
- GROVE, A. T. 1973. Desertification in the African Environment. In *Proc. of a Symposium on Drought in Africa*. Centre for African Studies, School of Oriental and African Studies, London University, 19-20 July 1973.
- HALL, K. R. L. 1967. Social Interactions of the Adult Male and Adult Females of a Patas Monkey Group. In A. S. Altmann (ed.), *Social Communication among the Primates*: 261-280. University of Chicago Press, Chicago.
- HAMILTON, P. 1975. Ecology and Ethology of the Leopard in Tsavo National Park, Kenya. Ph.D. dissertation.
- HAPPOLD, D. C. D. (ed.) 1971. *Wildlife Conservation in West Africa*. I.U.C.N. publications new series No. 22, p. 10; Morges.
- HEMMING, C. F. 1966. The Vegetation of the Northern Region of the Somali Republic. *Proc. Linn. Soc. London*, 177(2): 173-252
- HENSHAW, J. 1971. Priorities in Wildlife Research. In D.C.D. Happold (ed.), *Wildlife Conservation in West Africa*: 38-39. I.U.C.N. New Series 22, Morges, Switzerland.
- HENSHAW, J. and CHILD, G.S. 1972. New Attitudes in Nigeria. *Oryx* 11 (4): 275-83.

- HUNTLEY, B.J. 1973. *Outlines of Wildlife Conservation in Angola*. Serviços de Veterinária, Luanda, Angola. 35 pp., mimeo.
- JARMAN, T.R.W. and BUTLER, K.E. 1971. Livestock Management and Production in the Kalahari. *Botswana Notes and Records*, Special Edition No. 1: 132-139.
- JEFFREY, S.M. 1970. Ghana's Forest Wildlife in Danger. *Oryx* 10 (4): 240-243.
- KLEIMAN, D. G. and EISENBERG, J. R. 1973. Comparisons of Canid and Felid Systems from an Evolutionary Perspective. *Anim. Beh.* (in press).
- KRUUK, H. 1972. *The Spotted Hyena*. University of Chicago Press, Chicago.
- and TURNER, M. 1967. Comparative Notes on Predation by Lion, Leopard, Cheetah, and Wild Dog in the Serengeti Area. East Africa. *Mammalia* 31 (1): 1-27.
- LAMB, H. H. 1972. *Climate: Past, Present and Future*, Methuen, London.
- LAWSON, G.W. 1972. The Case of Conservation in Ghana. *Biol. Cons.* 4 (4): 292-300.
- LEE, R. B. and DEVORE, I. (eds.) 1968. *Man the Hunter*. Aldine Publishing Co., Chicago.
- LOWES, R.H.G. 1970. Destruction in Sierra Leone. *Oryx* 10 (5): 309-310.
- MCFADYEN, A. 1963. *Animal Ecology: Aims and Methods*. Pitman, London.
- MCMANUS, J.C. 1972. An Economic Analysis of Indian Behaviour in the North American Fur Trade. *J. Econ. Hist.* 32 (1): 36-53.
- MARIAM, M. W. 1970. *An Atlas of Ethiopia*, Addis Ababa.
- METZKE, G. E. 1971. Settlement Reorganisation for the Production of African Wildlife in Miombo Forestlands: A Spatial Analysis. M.Sc. Thesis, University of California, Berkeley.
- MONOD, T. 1965. Comment—Discussion Section. In Howell, F.C. and Bourlière, F. (eds.), *African Ecology and Human Evolution*: 547-654. Methuen, London.
- MOORE, J. E. 1971. Rural Population Carrying Capacity of the Districts of Tanzania. Bureau of Resource Assessment and Land Use, Research Paper No. 18. University of Dar es Salaam, Tanzania.
- MYERS, N. 1972. National Parks in Savannah Africa. *Science*, 178: 1255-1263.
- 1974a. *The Leopard: Ecology, Ethology and Conservation*. Van Nostrand, New York (in prep.).
- 1974b. *Proposals for U.N.E.P. Project on Conservation of Genetic Resources*. U.N.E.P. Nairobi. 18 pp., plus appendices.
- 1975a. The Whaling Controversy. *American Scientist* 63 (4): 448-455.
- 1975b. The Cheetah *Acinonyx jubatus* in Africa. IUCN Monograph No. 4, Morges.
- MITCHELL, B. L., SHENTON, J. B. and UYS, J. C. M. 1965. Predation on Large Mammals in the Kafue National Park, Zambia. *Zool. Afr.* 1 (2): 297-318.
- ODUM, F.P. 1971. *Fundamentals of Ecology*. Saunders & Co., Philadelphia.
- PARRIS, R. 1970. Important Role of the Kalahari Pans. *African Wildl.* 24: 234-237.
- 1971. The Ecology and Behaviour of Wildlife in the Kalahari. *Botswana Notes and Records*. Special Edition No. 1: 96-107.
- PETRIDES, G. A. 1965. Advisory Report on Wildlife and National Parks in Nigeria, 1962. *American Committee for International Wildlife Protection, Special Publication 18*, New York.
- PIENAAR, U. de V. 1969. Predator-Prey Relations amongst the Larger Mammals of the Kruger National Park. *Koedoe* 12: 108-176.
- RAY, G. C. 1970. Ecology, Law and the Marine Revolution. *Biol. Cons.* 3 (1): 7-17.
- and NORRIS, K. S. 1972. Managing Marine Environments. *Trans. 37th N. Amer. Wild. & Nat. Res. Conf.*: 190-200.

- REPUBLIC OF THE SUDAN, 1971. *National Report of the Democratic Republic of the Sudan to the United Nations Conference on the Human Environment*. National Council for Research, Khartoum.
- REPUBLIC OF ZAMBIA, 1971. *National Report on the Human Environment: An Assessment Prepared for the United Nations Conference in Stockholm*. Government Printer, Lusaka.
- RICHTER, W. VON, 1969. *Survey of the Wild Animal Hide and Skin Industry*. Report to the Government of Botswana, FAO TA 2637. F.A.O., Rome.
- 1970. Remarks on Present Distribution and Abundance of Some South African Carnivores. *J. Sn. Afr. Wildl. Assoc.* 2 (1): 9-16.
- ROBINSON, P. T. 1971. Wildlife Trends in Liberia and Sierra Leone. *Oryx* 11 (2-3): 117-121.
- ROWLAND, P. J. 1971. Coordination of Control of the Movements of Wildlife Products across International Boundaries. In *Proceedings of Symposium on Nature Conservation as a Form of Land Use*: 83-84. Southern African Regional Commission for the Conservation and Utilisation of the Soil, Pretoria.
- SAWYERR, J. S. 1971. *Primates and Fields in Sierra Leone*. F.A.O. Release, Feb. 5, 1971. Rome.
- SAAYMAN, G. S. 1970. Baboon Responses to Predators. *Afr. Wildl.* 25:46-49.
- SCHALLER, G. B. 1967. *The Deer and the Tiger*. University of Chicago Press, Chicago.
- 1972. *The Serengeti Lion*. University of Chicago Press, Chicago.
- and LOWTHER, G. A. 1969. The Relevance of Carnivore Behaviour to the Study of Early Hominids. *S. W. J. Anthropol.* 25 (4): 307-41.
- SERVICE, M. W. 1969. Wildlife Conservation in Northern Nigeria. *Biol. Cons.* 1 (4) 338-339.
- SILLIMAN, R. P. 1968. Population Models and Test Populations as Research Tools. *BioSc.* 19 (6): 524-8.
- SLOBODKIN, L. B. 1968. How to be a Predator. *Amer. Zool.* 8 (1): 43-51.
- SMITHERS, R. H. N. 1971. *Mammals of Botswana*. Trustees, National Museums, Rhodesia, Salisbury.
- 1968. Carnivora, Felidae. In *Preliminary Identification Manual for African Mammals*. Smithsonian Institution, Washington, D.C.
- STEWART, D. R. M. and STEWART, J. 1963. The Distribution of Some Large Mammals in Kenya. *J. E. Afr. Nat. Hist. Soc.* 24 (3): 52 pp.
- STRUHSAKER, T. T. 1967. Auditory Communication among Vervet Monkeys (*Cercopithecus aethiops*). In A. S. Altmann (ed.), *Social Communication among Primates*: 281-324. University of Chicago Press. Chicago.
- SWIFT, J. 1972. Pastoral Nomadism as a Form of Land Use: The Tuareg of the Adraf and Inforas. *Proc. Int. Afr. Inst. Symposium on Pastoralism in Tropical Africa: Traditional Societies and Their Development* (Niamey, 1972). Oxford University Press (in press).
- 1973. *Disaster and a Sahelian Nomad Economy*. Paper presented at *Symposium on Drought in Africa*. Centre for African Studies, School of Oriental and African Studies, London University. 11 pp., mimeo (in press).
- TURNBULL-KEMP, P. 1967. *The Leopard*. Timmins, Cape Town.
- URBAN, E. K. and BROWN, L. H. 1968. Wildlife in an Ethiopian Valley. *Oryx* 9 (5): 342-52.
- WAGNER, F. H. 1969. Ecosystem Concepts in Fish and Game Management. In G. M. Van Dyne (ed.), *The Ecosystem Concept in Natural Resource Management*: 259-308. Academic Press, New York.

- WAGNER, F.H. 1972. Coyotes and Sheep. *Some Thoughts on Ecology, Economics and Ethics*. 44th Honor Lecture, Faculty Association of Utah State University, Logan.
- WATT, K. E. F. 1968. *Ecology and Resource Management*. McGraw-Hill, New York.
- WESTERN, D. and VAN PRAET, C. 1973. Cyclical Changes in the Habitat and Climate of an East African Ecosystem. *Nature* 241: 104-106.
- WICKENS, G. E. 1973. Overgrazing: A Social Problem in the Sudan. *Symposium on Drought in Africa*. Centre for African Studies, School of Oriental and African Studies, London University, 19-20 July, 1973.
- WILSON, V. J. 1969. The Larger Mammals of the Matopos National Park, *Arnoldia* 4 (13): 1-9.
- WINSTANLEY, D. 1973. Drought in the Sahel Zone: Severity, Causes and Prospects. *Symposium on Drought in Africa*. Centre for African Studies, School of Oriental and African Studies, London University, July 19-20, 1973.
- WISNER, B. and MBITHI, P. M. 1972. *Drought in Eastern Kenya: Comparative Observations of Nutritional Status and Farmer Activity at 17 Sites*. Paper presented at 22nd. Int. Geog. Congr., Commission on Man and Environment, July 24-30, Calgary. 28 pp.
- WRIGHT, B. 1960. Predation on Big Game in East Africa. *J. Wildl. Mgmt.* 24(1): 1-15.

## Appendix

### SCIENTIFIC NAMES OF SPECIES MENTIONED IN TEXT

Baboon, *Papio anubis*.

Barbary Sheep, *Ammotragus lervia*.

Buffalo, *Syncerus caffer*.

Cheetah, *Acinonyx jubatus*.

Coyote, *Canis latrans*.

Dikdik, *Madoqua kirki*.

Dog, Wild, *Lycan pictus*.

Duiker, grey, *Sylvicapra grimmia*.

Duiker, yellow-backed, *Cephalophus silvicultor*.

Eland, *Taurotragus oryx*.

Gazelle, Dama, *Gazella dama*.

Gazelle, Dorcas, *Gazella dorcas*.

Gazelle, Grant's, *Gazella granti*.

Gazelle, Red-fronted, *Gazella rufifrons*.

Gazelle, Thomson's, *Gazelle thomsonii*.

Gerenuk, *Lithocranius walleri*.

Hare, *Lepus capensis*, *crawshayi*, *victoriae* and others.

Hartebeest, *Alcelaphus buselaphus* and *A. lichtensteini*.

Hyena, Spotted, *Crocuta crocuta*.

Hyrax, *Procavia capensis*, also *Dendrohyrax brucei*.

Impala, *Aepyceros melampus*.

Jackal, black-backed, *Canis mesomelas*.

Jackal, golden, *Canis aureus*.

Klipspringer, *Oreotragus oreotragus*.

Kob, Buffon's, *Kobus kob*.

Kudu, greater, *Strepsiceros strepsiceros*.

Kudu, lesser, *Strepsiceros imberbis*.

Lechwe, *Kobus leche*.

Leopard, *Panthera pardus*.

subspecies: Amur leopard *P.p. orientalis*

Anatolian leopard *P.p. tulliana*

Barbary leopard *P.p. Panthera*

Sinai leopard *P.p. jarvisi*

South Arabian leopard *P.p. nimr*

Lion, *Panthera leo*.

Monkey, Patas, *Erythrocebus patas*.

Oribi, *Ourebia ourebi*.

Oryx, *Oryx gazella*.

Oryx, Scimitar-horned, *Oryx too*.

Ostrich, *Struthio camelus*.

Porcupine, *Hystrix africaeacaustralis*, *stegmanni* and *galata*.

RaXel, *Mellivora capensis*.

Reedbuck, *Redunca redunca*.

Rhinoceros, Black, *Diceros bicornis*.

Rhinoceros, White, *Ceratotherium simum*.

Roan, *Hippotragus equinus*.

Sable, *Hippotragus niger*.

Serval, *Felis serval*.

Sitatunga, *Limnotragus spekei*.

Springhaas, Jumping Hare or Spring Hare, *Pedetes capensis*.

Topi, *Damaliscus korrigum*.

Tsessebe, *Damaliscus lunata*.

Warthog, *Phacochoerus aethiopicus*.

Waterbuck, *Kobus defassa*.

Wildebeest, *Connochaetes taurinus*.

The International Union for Conservation of Nature and Natural Resources (IUCN) is an independent international body, formed in 1948, which has its headquarters in Morges, Switzerland. It is a Union of sovereign states, government agencies and non-governmental organizations concerned with the initiation and promotion of scientifically-based action that will ensure perpetuation of the living world—man's natural environment—and the natural resources on which all living things depend, not only for their intrinsic cultural or scientific values but also for the long-term economic and social welfare of mankind.

This objective can be achieved through active conservation programmes for the wise use of natural resources in areas where the flora and fauna are of particular importance and where the landscape is especially beautiful or striking, or of historical, cultural or scientific significance. IUCN believes that its aims can be achieved most effectively by international effort in cooperation with other international agencies, such as UNESCO and FAO.

The World Wildlife Fund (WWF) is an international charitable organization dedicated to saving the world's wildlife and wild places, carrying out the wide variety of programmes and actions that this entails. WWF was established in 1961 under Swiss law, with headquarters also in Morges.

Since 1961, IUCN has enjoyed a symbiotic relationship with its sister organization, the World Wildlife Fund, with which it works closely throughout the world on projects of mutual interest. IUCN and WWF now jointly operate the various projects originated by or submitted to them.

The projects cover a very wide range, from education, ecological studies and surveys, to the establishment and management of areas as national parks and reserves and emergency programmes for the safeguarding of animal and plant species threatened with extinction, as well as support for certain key international conservation bodies.

WWF fund-raising and publicity activities are mainly carried out by National Appeals in a number of countries, and its international governing body is made up of prominent personalities in many fields.