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Abundance and Distribution of Large Mammals in the Upper Ogun Game Reserve, Oyo State, Nigeria

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Original/Review Articles

Abundance and Distribution of Large Mammals in the Upper Ogun Game Reserve, Oyo State, Nigeria

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In this study, three indirect methods (counts of animal droppings, footprints, and tracks) were used as indices to estimate the abundance and distribution of large mammals in the Upper Ogun Game Reserve, which is located in a typical Southern Guinea savanna zone of Nigeria. Thirteen animal species were recorded; kob, bushbuck, hartebeest, roan antelope and duicker were the most abundant. The distribution of large mammals appears to be controlled by several factors: accessibility to the River Ogun (the main source of water in the reserve), availability of food and cover, and the extent of illegal hunting.

An analysis of questionnaires distributed to various people living in villages around the reserve revealed that these people depend heavily on bushmeat for their animal protein requirements. They also use other wildlife products to meet their economic, social, and cultural needs. It is recommended that adequate protection should be accorded to the game reserve for at least 5 years. After that time, the area could be opened up to tourism, and controlled hunting could be permitted in the buffer zone around the reserve.

Zusammenfassung

In dieser Studie wurden drei indirekte Anzeichen (Vorkommnis von Losung, Tierspuren und Wechsel) dafür verwendet, um die Zahl und Verbreitung von grossen Säugetieren im Oberen Ogun Wildreservat, welches in einer für Süd-Guinea charakteristischen Savannen-Zone liegt, abzuschätzen.

Dreizehn Tierarten wurden festgestellt, unter ihnen Kamas, rötlichgraue Antilopen, Wasserböcke, etc. Die Verbreitung der grossen Säugetiere scheint durch folgende Faktoren bestimmt: Zugänglichkeit zum Ogun Fluss (der bedeutendste Wasserlauf im Reservat), Vorhandensein von Nahrung und Deckung und das Ausmass illegaler Jagd.

Eine Analyse der Fragebögen, die an die Einwohner verschiedener Dörfer in der Umgebung des Reservats verteilt wurden, vermittelte die Information, dass diese Menschen hauptsächlich von Fleisch aus dem Busch für ihren Tierprotein-Bedarf abhängen. Sie verwenden auch andere Tierprodukte, um ihre wirtschaftlichen, sozialen

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und kulturellen Bedürfnisse zu decken. Es wird empfohlen, dem Wildtierreservat für mindestens fünf Jahre ausreichend Schutz zu gewähren. Nach dieser Periode könnte diese Gegend wieder dem Tourismus freigegeben und eine kontrollierte Jagd in der Pufferzone um das Reservat gestattet werden.

Introduction

There is a paucity of information on the abundance and distribution of large mammals in Nigerian wildlife reserves (*i.e.,* the National Park and other game reserves), and much of the data that are available were obtained mainly from mere guesses made by casual observers and visitors. Apart from Kainji Lake National Park, where some careful research work has been carried out, the available information for other reserves is inadequate, unreliable, and insufficiently scientific for efficient management of a game reserve. Even in Kainji Lake National Park, where some general population studies have been carried out (Child, 1974; Pelink, 1974; Milligan, 1979), no study has been conducted on the individual large-mammal species. Similarly, work in the Yankari Game Reserve in the northeastern area of Nigeria performed by Sykes (pers. comm.) and Geerling (1973) is not sufficiently comprehensive for developing a reliable management plan for that reserve.

Generally, very little is known about the wildlife populations of the 60 Nigerian wildlife reserves, which include the Upper Ogun Game Reserve, the most important game reserve in the Oyo state of Nigeria. We therefore decided to investigate the abundance and distribution of animal populations in this reserve. A second reason for our selection of the Upper Ogun was its importance to the people living in the villages that surround the reserve. Bushmeat (*i.e.,* the flesh of wild animals) from this game reserve and from the surrounding forest reserves contributes immensely to the socioeconomic and cultural life of the people. There is a high demand for bushmeat in this area as a source of dietary protein, and it also plays a major role in traditional medicine.

The game reserve has suffered from indiscriminate hunting for a long time—most of the more valuable species are approaching extinction and are hard to find. In summary, then, the main objectives of this study were to provide reliable information on the abundance and distribution of large mammals in the reserve and to investigate the impact of illegal hunting by the local communities on the wildlife populations in the area. It is hoped that this information will be useful in the formulation of a long-term management plan for the game reserve.

Study Area

Upper Ogun Game Reserve (Fig. 1) with a total area of 1,100 sq km, is situated in the northwestern region of Oyo state, between latitudes 3½ and 4½°E and longitudes 8½ and 9°N. The mean annual rainfall in the reserve is about 1,250 mm with a 5-month dry season (November to March). The mean minimum and maximum daily temperatures are about 20 and 34°C, respectively. The terrain is gently sloping, with some rocky hills and inselbergs located on the southeastern section, along the boundary of the reserve.

The main drainage system in the reserve is the River Ogun. It runs from north to south and flows through the whole length of the reserve. In addition, several other streams can be found east of the River Ogun. The soils are derived from undifferentiated basement complex materials. These soils are generally sandy and are classified as feruginous tropical soils on crystalline acid rocks.

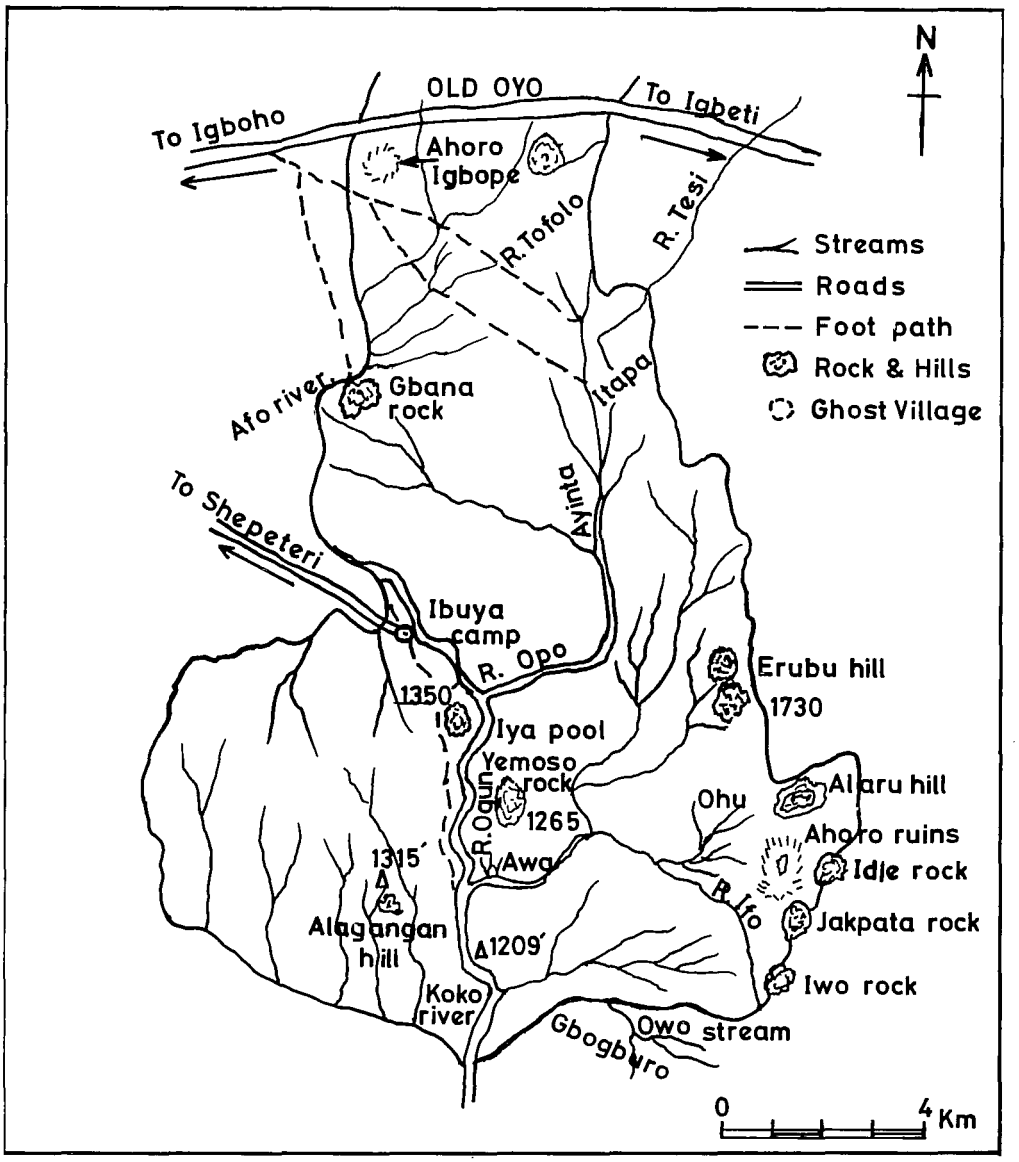

FIGURE 1 Physical features of Upper Ogun Game Reserve

The reserve is situated at the northern boundary of the forest-savanna mosaic. It lies in typical Southern Guinea savanna woodland, with fairly dense woodland and forest outliers found in the southern region (Geerling, 1973). In his analysis of vegetation, Geerling was able to identify the following principal vegetation types:

1. Dense woodland and forest outliers
2. Mixed open savanna woodland; *Terminalia macroptera* savanna
3. Ironstone and outcrop vegetation
4. Riparian grassland and fringing woodland, occupying the flood plains and the areas along the River Ogun, respectively.

Method

It was impossible to estimate the animal populations in the study area by direct methods because of poor visibility in the dense woodlands. We therefore resorted to indirect sampling techniques, which involved counting fecal droppings, animal tracks, and footprints. Similar indirect sampling methods have been used by Wing and Buss (1970) in Uganda and by Afolayan (1975) in the Kilimanjaro forest reserve in Tanzania to estimate elephant populations.

The most significant limitation in the use of these sorts of population indices is that they can only serve to indicate population trends over time and space and do not necessarily represent true head counts for the particular area under investigation. However, these methods were used in this study because they provided the only available means of obtaining information on animal activities and abundance in the study area. Only the animal species shown in Table 1 were included in this study.

The field study was carried out in the dry season of 1979. Ten transects were randomly selected, with a 100 X 20 m plot marked off along each transect. Indices of animal activities such as fecal droppings, trails, and tracks were observed on each of the plots. Information on types of vegetation and weather conditions at the time of observation were also recorded. After the droppings were counted for the first time, they were marked with wooden pegs and left for observation on a second occasion, to determine the nature and speed of decomposition over time.

Mathematical formulations were constructed for estimating populations from these data: Let d_i be the number of droppings accumulated in each plot for each species in the interval between the first and second observations (after decomposition). The mean for the whole sample is $\bar{d}_i$, and the estimated total number of droppings accumulated for the species, for the whole study area, $\hat{D}$ may be given by:

$$\hat{D}_i = N\bar{d}_i \quad (1)$$

$$\text{Where } N = \frac{\text{Area of the study area}}{\text{Area of plot}}$$

The population of each species P_i may be estimated using the formula

$$P_i = \frac{D_i}{R \times T_i} \quad (2)$$

where D_i is equal to its estimate $\hat{D}_i$ as above, R_i is the defecation rate per day of species i, and T_i is the number of days that elapsed between the first and second observations.

In the second part of the study, questionnaires were administered to determine the frequency of hunting activities, the value of the various wildlife species in terms of meat and medicinal uses, and the extent of protection afforded to the animals. A total of 150 of these questionnaires were distributed to hunters, market women, community leaders, and elders who resided in villages around the game reserve. The villages include Aha, Shepeteri, Agunrege, Ago-Amodu, and Ago-Omu.

Market prices for various kinds of bushmeat, trophies, and skins and bones were obtained from a sample of market women and hunters. Experienced hunters, patrolmen, elders, and community leaders were interviewed on the medicinal uses of wildlife. Data on the number of offenses and arrests, and information on compoundings and fines, was collected from the Game Management Headquarters of Oyo state.

Results

Table 1 lists the 13 species of large mammals studied in the reserve and the indices of their abundance, calculated from counts of droppings, tracks, and foot-

TABLE 1. Density of Animals (Number/Square Kilometer) in the Upper Ogun Game Reserve

Count	Pellet Group	Trail	Footprint	Average Density	Confidence Limits*
Kob	25.08	11.87	18.04	18.33	±6.60
Cane rat	3.37	1.60	1.77	2.24	±0.97
Hare	1.31	0.64	0.80	0.91	±0.34
Duicker	1.93	2.03	3.11	2.35	±0.65
Aardvark	1.00	0.80	0.93	0.91	±0.10
Bushbuck	4.11	5.61	8.19	5.97	±2.06
Hartebeest	3.01	2.81	4.63	3.48	±0.99
Roan antelope	1.96	2.08	3.55	2.53	±0.88
Buffalo	0.19	0.44	0.80	0.47	±0.30
Crocodile	0.04	0.03	0.04	0.03	±0.005
Spotted hyena	0.07	0.07	0.11	0.08	±0.02
Elephant	0	0.03	0.05	0.026	±0.02
Red River hog	0.01	0.01	0.01	0.01	±0.00
Total	**42.08**	**28.01**	**42.03**	**37.4**	**±8.10**

*Confidence limits were calculated at the 5 percent probability level.

prints. High counts for pellet groups, footprints, and trails were recorded for kob, cane rat, bushbuck, duicker, and hare in the riparian savanna grassland, while low counts were recorded for hartebeest and roan antelope. (The nomenclature for the animals discussed follows that of Dorst and Dandelot, 1970.)

In the mixed-savanna woodland, the following species were identified: kob, aardvark, bushbuck, hartebeest, and duicker. High pellet counts were recorded for these species, while low counts were noted for buffalo, elephant, and Red River hog.

Seven animal species were identified in the open savanna woodland. Here, there was a decrease in pellet, footprint, and trail counts for kob, cane rat, and hare but a rise in the counts for bushbuck.

In the dense woodland, a total of seven species was observed. Of these,

there were high counts for hartebeest, roan antelope, duicker, buffalo, and bushbuck. Nothing was recorded for hare, cane rat, and crocodile, but the first sign of a spotted hyena was recorded in this vegetation zone.

Considering the entire study area, and the 13 animal species studied, kob had the highest pellet, footprint, and trail counts, except in the dense savanna woodland. The density of kob populations was also highest (25.08/sq km, according to the pellet count index), followed by bushbuck (5.97/sq km). The average density of all animals in the reserve, calculated from the indices used, is 37.4/sq km.

Distribution of animals

Figure 2 shows the effect of the River Ogun on the distribution of large mammals in the game reserve. The distance from the river is presented on X axis, while the Y axis shows the abundance and distribution of pellets, trails, and footprints. Counts for pellets, trails, and footprints were higher along the river course; counts decreased gradually as the distance from the river increased. Variations in the distribution of animal species also appear among the different vegetation zones. For example, buffalo, hartebeest, and roan antelope were more frequent in the dense savanna woodland than in the other vegetation zones, while kobs were commonly seen in the riparian grassland and in the areas around the River Ogun.

Utilization of Wildlife

The analyses of the questionnaires showed that wildlife is a very important part of the life of the local people, in traditional medicine and witchcraft, and as a source of protein. A wide variety of wild animals are eaten by the local communities, including all of the wild ungul-

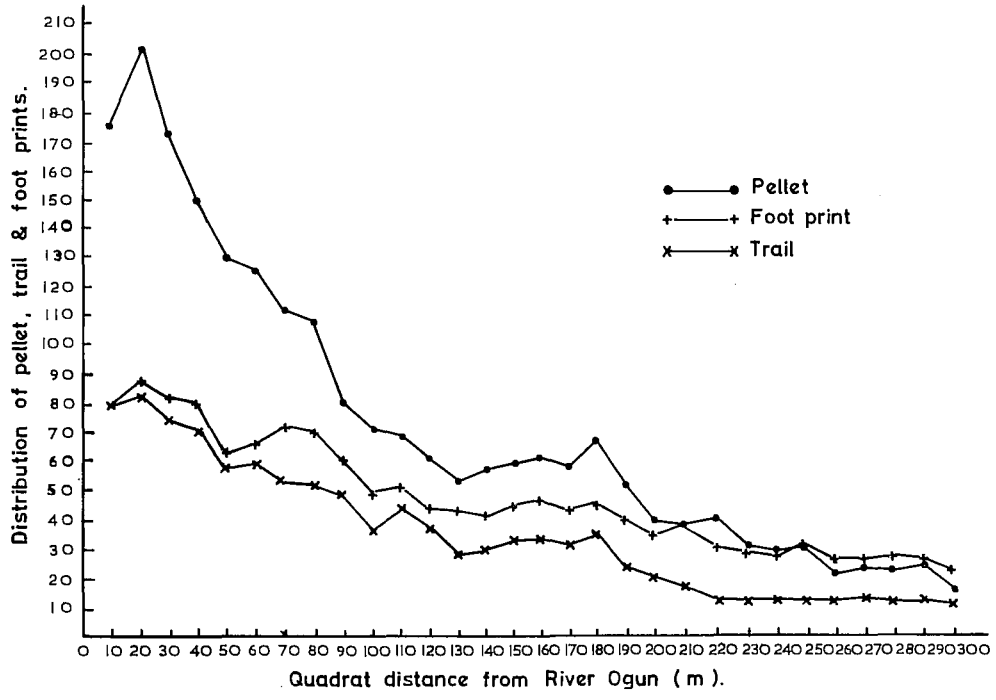

FIGURE 2 Effect of River Ogun on the distribution of large mammals in Upper Ogun Game Reserve

ates, primates, hyrax, rodents, birds, and reptiles. About 80 percent of the rural population depends on bushmeat, and approximately 40 percent take up hunting as a profession. About 65 percent of the hunters interviewed stated that kob is the most abundant animal species in the game reserve and that bushbuck, hartebeest, roan antelope, and duicker also occur in great numbers.

Among the Fulani, Hausa, and Bororo hunters, the weapons used for hunting range from bows and arrows to dane guns. Also, most of the local hunters use traps and ropes. About 90 percent of the hunters interviewed affirmed that they were aware that hunting in the reserve is illegal but claimed that they hunted only in the area outside the reserve. The migrant hunters set up camps and are able to remain in the reserve for as long as 3 weeks at a time. Hunting is carried out principally during the dry season, when the animals are easier to spot. The dressed carcass is often chopped up into small pieces, hard-roasted, and then packed into sacks.

About 40 percent of the hunters interviewed stated that they would prefer to send their children to school instead of training them to become future hunters. On the other hand, about 50 percent held the view that hunting represents an important tradition that ought to be passed down to future generations. The other 10 percent could not state categorically categorically whether it was preferable to train children to hunt or to educate them for other kinds of work.

Table 2 lists the 21 species of animals that were for sale in various markets around the reserve at the time of our study, including Aha, Ago-Amodu, Shepeteri, Iseyin, Agunrege, Ago-Omu, and Shaki. The average market price is given for each species. Note that these prices are not fixed: they fluctuate with time and region.

In Table 3, the number of arrests of hunters and the fines paid from 1967 to 1978 are presented. This information was obtained from the Game Management Headquarters in Oyo. A total of 151 arrests were made in 12 years; the total amount of fines collected was 2,610.39 Naira. Most of the arrests were made between December and May, but at least 1 person was arrested in every month.

Discussion

This study has revealed the importance of the River Ogun in determining the abundance and distribution of some ungulates and reptiles in the Upper Ogun Game Reserve. The animals that are more closely associated with the river during the dry season are kob, bushbuck, cane rat, duicker, and crocodile. Other species such as hartebeest and roan antelope were encountered at some distance from the riverine areas. These latter species are often referred to as typical upland savanna animals (Afolayan and Ajayi, 1980; Milligan, 1979). Their choice of habitat does not mean that these animals do not require water—they do visit watersides at least once daily, but then return to the upland savanna areas.

Studies carried out on kobs in Nigeria (Child, 1974; Pelinck, 1974; Milligan, 1979) and elsewhere in East Africa have shown that the animal is fairly sedentary. Normally, it does not travel farther than 5 km from a source of water.

Figure 2 also shows the effect of the River Ogun on the distribution of the riparian species mentioned above (*i.e.*, kob and allied species). High counts of pellets, footprints, and trails of these species are found along the River Ogun, but the counts decrease rapidly as one moves away from the river. A high relative population density was recorded for kob and the allied species that are more water-dependent, while lower densities were noted for hartebeest and roan ante-

lope, which are less dependent on water.

The importance of water, food, and cover in the distribution of ungulates has been shown by Afolayan (1976), who studied these species at the Mkomazi Game Reserve in Tanzania and by Field (1968), who also worked in East Africa. Field observed that ungulates require water for drinking, as well as for wallowing during hot weather. Geerling and

TABLE 2. Approximate Market Prices of Bushmeat, Trophies, and Skins of Some Large African Mammals

Animal species	Part of Animal Involved	Price (in Naira)
Bushbuck	Dressed carcass	50-90
Elephant	Dressed carcass	500-800
	Tusk	400-600
Buffalo	Dressed carcass	300
	Skin	80
Lion	Dresed carcass	100
	Skin	80
Leopard	Dressed carcass	110
	Skin	100
Red River hog	Dressed carcass	20
	Skin	10
Bush pig	Dressed carcass	120
Cane rat	Dressed carcass	2
Bush fowl	Dressed carcass	5
Duicker	Dressed carcass	20-30
Cane rat	Dressed carcass	10-15
Python	Dressed carcass	100
	Skin	60
Kob	Dressed carcass	70
	Skin	8
Warthog	Dressed carcass	20
Waterbuck	Dressed carcass	150
Roan Antelope	Dressed carcass	150
	Skin	20
Hartebeest	Dressed carcass	150
Oribi	Dressed carcass	10
Spotted hyena	Dressed carcass	60
	Skin	40
Aardvark	Dressed carcass	40
Dwarf mongoose	Dressed carcass	3

Data from interviews with market women in Ago Omu, Shepeteri, Agungere, Ago Amodu and Aha villages.

TABLE 3. Total Number of Hunters Arrested and Fined per Year in the Upper Ogun Game Reserve, 1967-1978

Year	No. of Arrests per Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Fine (in Naira)
1967	1	0	0	0	0	0	0	0	0	0	0	0	1	90
1968	10	0	0	1	0	0	2	0	0	1	3	1	2	11
1969	19	0	6	13	0	0	0	0	0	0	0	0	0	116.39
1970	16	0	0	11	4	1	0	0	0	0	0	0	0	18
1973*	16	1	0	0	0	13	0	0	1	0	0	0	1	215
1974	14	1	3	2	0	3	2	0	0	0	1	0	2	485
1975	17	2	0	13	2	0	0	0	0	0	0	0	0	705
1976	18	1	6	8	0	0	3	0	0	0	0	0	0	525
1977	8	1	0	0	4	2	0	1	0	0	0	0	0	305
1978	5	0	1	3	0	0	0	0	0	0	0	0	1	140
TOTAL	**124**	**6**	**16**	**51**	**10**	**19**	**7**	**1**	**1**	**1**	**4**	**1**	**7**	**2,610.39**

Data from the Regional Game Management Headquarters in Oyo town (Oyo state)
*No arrests were made in 1971 and 1972.

Bokdam (1973) classified the large-mammal species they identified in Comoe National Park, Ivory Coast, into three categories on the basis of the animals' water requirements. Kob, waterbuck, and red-flanked duicker were classified as species that reside near water. This was also found to be true for the kob and the other allied species that we studied in the Upper Ogun Game Reserve. Elephant and buffalo were classified as species that were partial to water and shade but that were also wide ranging. The third category included those species that do not have a daily need for water. Species in this category included hartebeest, roan antelope, warthog, oribi, and grey duicker.

The different vegetation zones also showed variations in the abundance and distribution of large mammals. This finding may be attributed in part to differences in plant species composition among the the several zones. For example, kob, cane rat, and hare were more abundant in the riparian grassland than in the other vegetation zones. This fact demonstrates that water is not the only factor that determines the distribution of large mammals; the relative availability of perennial grasses for feeding is crucial as well. The availability of food (especially browse species) and cover in the dense savanna woodland is responsible for the relatively high density of roan antelope, hartebeest, bushbuck, and the somewhat lower numbers of duickers in this area. This finding supports the conclusion of Odum (1971) that distribution of large mammals is affected by availability of food and cover. Napierbax and Sheldrick (1963) have also demonstrated the importance of browse plants in the distribution and abundance of herbivores.

Utilization of Wildlife in the Upper Ogun Area

It became clear from our study that bushmeat comprises the bulk of the animal protein consumed by the people around the Upper Ogun Game Reserve. They also depend upon wildlife trophies for traditional medicine and for invoking or appeasing the practices of witchcraft. Studies conducted by Ajayi (1971, 1978) and Asibey (1974) revealed that wildlife plays a significant role in the nutrition, dress, religion, and employment of the rural communities of the west African coast. In the study area, the hunters and other traders in bushmeat realize a high level of revenue from their illegal sales. They therefore strive to maintain a flourishing trade in animals, irrespective of the law and the counter-efforts made by game managers. The number of arrests made, and the cash received in fines realized from these arrests, are negligible when compared with the number of animals that are being killed illegally every day, especially during the hunting season.

Therefore, it must be particularly emphasized that illegal hunting greatly affects the abundance and distribution of the animals in the study area, and constitutes an important factor in determining population levels, in addition to the other crucial factors, water, food, and cover.

Conclusions and Recommendations

In this study, we found that the Upper Ogun Game Reserve, which is located in a typical Southern Guinea savanna of West Africa, still contains high densities of kob, bushbuck, hartebeest, and roan antelope. The important factors that were identified as affecting the abundance and distribution of large mammals in the reserve are: source of perennial water, food (browse and grass species), cover, and illegal hunting.

Future prospects for tourism, and consequent benefits to management, seem favorable if the present methods of protection can be improved upon. One means of ameliorating present con-

ditions might be to increase the number of patrolmen in the area. Those patrolmen who work only on a daily basis should be absorbed into the permanent service to ensure their effective cooperation and participation. Also, more patrol posts and stations should be built. Every effort should be made to encourage the participation of the local communities in every step taken by the state government to conserve wildlife in the area. The revenue realized from the management of the reserve should be used to develop the local communities, in order to ensure their confidence and cooperation, as well as the success of the whole program. We also suggest that the reserve not be opened to tourism until 5 years after an adequate level of protection has been achieved and maintained.

This study has shown that wildlife meat and trophies make a significant contribution to the socioeconomic and cultural life of the people in the area. We therefore recommend that hunting not be banned completely in the region. Instead, a buffer zone should be created around the reserve where controlled hunting can take place, while the reserve itself serves as a breeding and growing ground for the various wildlife species.

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Feral Dogs of the Galápagos Islands: Impact and Control

Bruce D. Barnett and Robert L. Rudd

Organisms introduced onto insular ecosystems, after they have become established, frequently increase to destructive numbers. Several species of mammals introduced onto the Galapagos Islands illustrate this ecological axiom. For example, domestic dogs intentionally introduced now exist as three major types: domestic, free-ranging or pariah, and feral. Problems derived from their presence are most apparent on the islands of Santa Cruz and Isabela. Feral and pariah dogs are both scavengers and predators. While other introduced mammals (chiefly feral cattle and pigs) have served as prey, in recent years severe depredations on the unique endemic Galapagan fauna have been caused by the dogs. The chief targets have included land and marine iguanas, tortoises, and colonially nesting marine birds. To counter this problem, a coordinated eradication and study program on all dog populations has been underway since 1979, and an eradication program on Isla Isabela, begun in 1981, continues with marked success. Control rests primarily on carefully placed flesh baits poisoned with Compound 1080 (sodium monofluoroacetate). Field studies on distribution, demography, behavior, and disease transmission also began on Isla Isabela in 1981. Particularly notable is the high incidence of filarial heartworm in several species of mammals, including the local human residents. Dogs are important reservoirs of this parasite. Descriptions of the problems created by the dogs and speculations on the nature of selective return to the wild state are presented.

Zusammenfassung

Lebewesen, die in insulare Oekosysteme eingeführt werden, vermehren sich nach ihrer Etablierung oft in einem zerstörenden Ausmass. Einige der Säugetierarten, die auf den Galapagos Inseln eingeführt wurden, illustrieren dieses ökologische Axiom. So existieren zum Beispiel Hunde, die mit Absicht eingeführt wurden, heute in drei Hauptgruppen: als Haustiere, als streunende Tiere oder Parias, und als wilde Tiere. Probleme, die sich aus deren Gegenwart ergeben, zeigen sich deutlich auf den Inseln Santa Cruz und Isabela. Wilde und streunende Hunde sind sowohl Aasfresser

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