Essentials of Wildlife Management

AYODELE, I. A.
EBIN, C. O.
ALARAPE, A. A.

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BY

AYODELE, I. A.
Department of Wildlife & Fisheries Management,
University of Ibadan.

EBIN, C. O.
Cross River Natural Park, Calabar

ALARAPE, A. A.,
Department of Wildlife & Fisheries Management,
University of Ibadan.

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Ayodele, I. A.
Ebin, C. O.
Alarape, A. A.

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CHAPTER ONE

WHAT IS WILDLIFE MANAGEMENT

A precise and universally agreed upon definition of the word wildlife does not exist. The term implies all things that are living outside the direct control of man and therefore includes all non-cultivated plants and non domestic animals.

This definition does give coverage to plants, invertebrate animals, fish, reptiles and amphibians. Birds and mammals are featured disproportionately relative to their abundance in nature.

Management implies human decision and manipulation. Wildlife management sometimes is better termed wildlife conservation as in some cases/circumstances the best technique for conserving a landscape is to leave it alone and doing so may not fit the definition of management. While in such instance there may be no management at all. Conservation has been defined in Encyclopaedia Americana (1967) as getting the maximum use of the greatest number of available natural resources that are valuable to the greatest possible number of people for the longest period of time. Encyclopaedia Britannica (1981) on the other hand defines conservation as the achievement of the highest sustainable quality of living for mankind by the rational utilisation of the environment.

In the Funk and Wagnal dictionary (1963) it is the act of keeping or protecting from loss or injury while Chapman and Reiss (1995) defines it as the management of the earth's resources in a way which restores and maintains the balance between human requirements and the other species in the world.

The decision as to what is best is a human decision. Since we are human we have, like other animals, a natural bias towards our own survival. Try as we might, we cannot remove our human bias from our perception in dealing with animals and plants around us. Therefore, wildlife management could simply be defined as application of ecological knowledge to population of vertebrate animals and their plant and animal associates in a manner that strikes a balance between the needs of those populations and the needs of man.

Application of ecological knowledge involves three basic management approaches, viz.:

Preservation by allowing nature to take its course without human intervention.

Direct manipulation of animal population by cropping, culling, etc.

Indirect manipulation of animal population by altering the vegetation present.

IMPORTANCE OF WILDLIFE

Wildlife is a natural resource of an overwhelming degree of usefulness. However, the value of Nigeria's wildlife has only been realised a little (Adeyoju, 1975). Wildlife represents the principal source of animal protein for the rural majority in most African countries (Ajayi, 1979). He (Ajayi, 1979) further added that wildlife, particularly forest mammals, account for between 20% and 90% of total animal protein consumed in Benin republic, Cameroon, Ghana, Cote de Voire, Liberia and Nigeria. The supply of bush-meat from the wild no doubt serve as the only possible measure to bridge the gap between livestock production and human population growth. In developing countries livestock production was increasing at a rate of 1.25-2.0% per

annum, while protein demand was expected to grow at between 4 and 5% per annum over the period of 1985 (Ajayi, 1971).

Report from the Federal office of statistics indicates than the annual total value of bush-meat in Nigeria was about N60m in 1963. And the value of wild animal protein food was £50m annually, that is about 4% of the GDP (Gross domestic product) of Nigeria in 1965 (Ajayi, 1971). Nigeria and many other African countries derived substantial revenue from export of live animals and their trophies (Ayeni *et al*, 1982).

The quantity of live animals and birds exported as at March, 1974 is 223 with a total of ₦14,722, increasing to the quantity of 16,048 with a total value of ₦9,357 in 1976 (Nigeria trade summary, 1976). A total of 10,232 lb. (£1,397) natural honey was exported between January and June, 1960 (Nigerian Trade Summary: June, 1960).

The importance of wildlife to traditional medicine cannot be overemphasised. Among notable work on this are Ajayi (1979), Gbile (1986), and Sodipe (1986).

Wildlife has made charming contribution to medical research the world over. Life animals (rats, primates) have been used in many medical research laboratories spread over the world. Primates are widely used by virtue of their close relationship to man. The Rhesus factor was first discovered in Rhesus monkey before it was applied to man (Ajayi, 1979). The Clawed toad, Zenopus, is used in pregnancy test. Also, the common toad is used in countless undergraduate practical to demonstrate nerve muscle action (Eltringham, 1984). Organic compounds, that have great potential values for medicine and consumer products are yet to be discovered even at present from the bounty wildlife available to us.

Zoological gardens exist in many states of Nigeria. There are over thirty Game reserves (although some of these are yet to be fully gazetted), six National Parks, one Nature reserve and one biosphere reserve exist in Nigeria. Portions of some game and forest reserves are also designated as strict nature reserves (Inahoro, 1991). However, only a few are opened for game viewing and tourism. Some wildlife museums also exist in the states to enhance wildlife based tourism. These wildlife reserves, zoos, and museums provide opportunity for recreation and education of both young and old. However, if the tourism is developed, Nigeria as a country with potential resources can earn hundred of millions of Naira from game viewing and tourism like Kenya and Tanzania (Afolayan, 1987). Wildlife reserves have proved to be one of the world's greatest attractions for tourists. And this contributed to Kenya's economy to the tune of about ₦36m in 1970, ₦82m in 1972 and ₦1146m in 1976 (Ayeni et al, 1982). The average expenditure of each American (the largest number of visitors to Kenya came from United States of America) was about 4,000 U.S. dollars, travel fare included (Ajayi, 1972).

The economic argument in favour of conservation is very great but equally important is the need to preserve our National heritage (of abundant genetic resources). Our role should be that of a trustee who must ensure that he does not pass unto future generations less than we have inherited (Steele, 1974). Our history and folklores are inseparable from the background of wild animals. These creatures are as much as part of our tradition of music, dancing and other art forms (Ayeni *et al*, 1982).

OBJECTIVES OF WILDLIFE MANAGEMENT

The objectives sought will vary from place to place and probably from time to time. However, some of the common objectives are:

1) Preservation of species.
2) Maintenance of population of useful species.
3) Stabilising or decreasing population of certain species.
4) Limiting utilisation to annual production capacity.

BASIC PHILOSOPHY

The work of the wildlife scientist/manager is basically that of producing the highest possible amount of wildlife, in the face of utilisation of vast area for other purposes, which to a greater or less extent limit wildlife production.

He has no choice than to tune his work and methods to forests which must produce lumber, grasslands which must furnish grazing for domestic stocks and farmland devoted to almost innumerable crops. His programme and plans must take into consideration these other uses in a way that will not seriously interfere with them.

The wildlife manager, as the business manager of a greater resource, must first maintain the resource and secondly, utilise it to the greatest possible advantage of the nation and his people.

THE OBJECTIVES OF WILDLIFE CONSERVATION IN NIGERIA

In Nigeria the main National wildlife management objectives are:

1) Bush-meat production to increase the animal protein available in rural and urban area of Nigeria with particular emphasis on rural areas.

2) To promote game viewing, tourism and foreign exchange earning, including game viewing, photographic safaris, sport fishing and sport hunting.
3) Preservation of National heritage.
4) To encourage and promote wildlife conservation for education and research.
5) To generate employment opportunities in rural areas.
6) Finally, to promote ecological diversity and stability through preservation of gene pool and maintenance of continuity in gene pool.

Afolayan (1987) expressed dissatisfaction at the fact that most of the above listed laudable objectives feature in our development plans from time but yet were never implemented due to dearth of funds and enough man power, and also due to ignorance and lack of proper awareness on the part of the planners and policy makers.

CHAPTER TWO

WILDLIFE UTILISATION

The utilisation of wildlife resources is as old as man's existence. It has found various uses in the past and present era of civilisation. Evidences have shown that man was able to maintain himself successfully (health-wise) for ages by hunting wildlife for food. He ate flesh of all animals that surrounded him. The family Bovidae being the major source of his animal food (Yassen, 1976). Wildlife resources are used in traditional medicine, bio-medical research, education, recreation, utility satisfaction and some other uses to mention but a few.

According to Eltringham (1984) wildlife resources are used in three main ways: firstly as edible products (food and medicine), secondly as non-edible products (trophies) and thirdly as sport hunting (Tourism). However, wildlife utilisation has been classified into consumptive and non-consumptive utilisation. And this is summarised in the figure below:

WILDLIFE RESOURCES

CONSUMPTIVE UTILISATION	NON-CONSUMPTIVE UTILISATION
BUSHMEAT. Fruits (Germ. Marmalade). Concoctions	Camping, Hiking, Skiing, Amphitheatre And Campfire talks, sport, hunting, Aesthetic (Appreciation and beauty), Game viewing, Bird watching, Trophy (Rhino horn, Tusk, Leather), Firewood, Leaves used in wrapping foods

Fig. 2.1 Wildlife Resources Utilisation

Almost all terrestrial mammals have at one time or another been used as food with the possible exception of skunks and their relatives. Such impossible species as tiger, jaguar and puma have been offered for human consumption. The most conventional meat of wildlife origin, perhaps, is venison. This strictly refers to the flesh of deer only, although the name has been used to include meat from antelopes and non-bovid ungulate (Eltringham, 1984). Among the mammals, whales have provided food for human consumption for centuries in the past. The most important product of whale is whale oil which are of two types-the edible variety from baleen or whale bone and the non-edible sperm oil from sperm whale. The edible one is used in the preparation of margarine and cooking fats. All parts of the whale is processed and utilised. The solid remains of bone and meat are not thrown away but dried and ground up to form whale meal, which is used to augment animal foodstuffs; the liquid residues are evaporated to obtain a highly proteinaceous mixture named whale soluble, which is often included in animal feed. However, whale meat is rarely used as meat except in Japan where it has been a delicacy for long (Eltringham, 1984).

A significant number of wild birds are taken as food, usually as a by-product of sport hunting. Songbirds are shot and trapped for food in many places in Europe, particularly in the Mediterranean region, and the practice was once widespread in Britain. They feature as a delicacy and are often eaten whole, including the bones. It is, however, surprising to note that birds do not feature prominently in the consumption of wildlife in the tropics (Eltringham, 1984). In many parts of the world birds are exploited as much for their eggs as for their flesh. The eggs of almost all species of bird are taken as food. Seabirds are

particularly affected in this respect. Plovers eggs are taken to be luxury in the best hotels of European capitals (Eltringham, 1984). The esculent swifts' nest made of its saliva, gelatin of sea weeds is a delicacy in China (Zeng, 1985).

Frogs are consumed in many tropical countries and demand for their flesh has led to a drastic decline in numbers of the goliath frog in West-Africa, which can weigh more than 3kg (Eltringham, 1984).

Wild animals have made unparalleled contribution in the field of medical research. In 1966, U.S.A. alone utilised 62, 783 primates (consisting of new and old world species) and half a million rhesus monkeys during the 6 peak years of polio vaccine production a decade earlier (IUCN, 1970). Also in the year 1977 alone, 18million individuals of white rats and mice were used for research in pharmacology and physiology in the U.S.A. (Zeng, 1985).

The amino-acid extract and purified mill of earthworm have been used as raw materials for feed and medicine. The earthworm has also been employed in the manufacturing of cookies and skin ointment known to be more efficient in curing diseases such as ulcer, measles with promising effect (Zeng, 1985). Zeng (1985) also reported the use of the stomach, skin and bile juice of Giant salamander as tonics; the use of extracted dried oviduct of female Chinese forest frog (*Rana temporaria chensirensis*) in chinese medicine; the use of pipefish in preparation for good health, expedite child delivery, relieve of pain and cardioloric cure; the use of dried fresh toad as cardiotoxic stimulant to step blood pressure, to stimulate respiration, to control inflammation, and has been known to be effective as an antidote against certain diseases. The horn of rhinoceros is shipped to China as medicine. It is powdered in India as an aphrodisiac, or carved into dagger handles by Yemeni

tribesmen. The high demand for these horns have been responsible for the slaughter of thousands of African rhinoceros yearly by poachers (Richard, 1983).

The teeth of the sperm whale have been carved into chessmen or ornamental figuriness by whalers to while away their time on voyage. In the alternative they drew designs in Indian ink on the surface of the teeth (Eltringham, 1984). Furs are collected from a long range of animals both terrestrial and marine mammals. Furs or economic significance come from animals like the Grizzly bear, moles, otters, squirrels and Kangaroos but source of the most valuable specimens are those from spotted cats of the tropics (Eltringham, 1984).

Birds feather have been used from earliest times for practical purposes because of their softness and insulating properties. Feathers have served as ornaments. The most decorative and vividly coloured are chosen for this purpose (Stopfords, 1991 personal communications). In the early decades of the 20th Century, European ladies headgears were decorated with feathers of American egrets to such an extent that the price was even above that of gold (Zeng, 1985).

Birds provide a famous nitrogenous fertilizer, GUANO, which accumulates where large number of birds gather to nest. Some Islands, especially in Peru, have layers of bird manure as thick as 55 metres. Such birds manures exported as fertilizers from South-America and Africa totals 300,000 tonnes per year (Zeng, 1985).

Wildlife resources are extensively used in museums of natural history as mounted specimens such that animals are shot and taxidermised for display in museums.

Animals have been trained to act and amuse people as well as for various other reasons. A typical example is the Dolphin. It has been proved beyond doubt recently in

America that long tailed monkey could work as nurse in taking care of paralysed patients, doing lots of home work, such as opening the door with a key, switching on and off the gramophone, opening the refrigerator and bringing out food and feeding her host with spoon, under the supervision of the host (Zeng, 1985). Wild animals feature prominently in movies and circus display.

Corals are utilised as building materials, as raw materials for making industrial arts and crafts, and decorative ornaments (Zeng, 1985).

SPORT HUNTING

The restriction from hunting in protected areas might lead to increased wildlife population densities above carrying capacity with the degradation of vegetation as well as starvation and diseases. Such situations are usually kept under control by controlled hunting for meat as well as for sports.

Sport hunting is an aspect of wildlife utilisation in East and Southern Africa, usually done by foreign professional hunters (mainly from Europe and United States) licensed to shoot certain categories of animals, of specified sex and number. It is morally done inside hunting controlled areas which are divided into blocks and rented out by government to hunters (Ajayi, 1976).

These hunters are not allowed to kill endangered species such as large cats: Lion (*Pantera leo*) Leopard, (*Panthera pardus*) and Cheetah (*Acinonyx jubatus*) Rhinoceros (*Diceros bicornis*) and Elephants (*Loxodonta africana*) are protected by several African countries. The trophies which are usually sought for includes head of buffalo (*Syncerus caffer*), tusks of elephants and teeth/skin of hippopotamus (*Hippopotamus amphibius*). The meat from sport hunting is of secondary

interest. In other words, it is a by-product of sport hunting. However, the meat is normally sold wholesale to hoteliers who take their buys to local inhabitants (Ajayi, 1976).

The major economic benefits accruing to man from wildlife is derived from sport hunting. However, the real benefits of sport hunting to the local communities is in form of employment opportunities provided by sport hunting. Hunters are often equipped with photographic materials, liquor, tobacco, etc., which are purchased locally. They also hire a number of Safari personnel who are locally recruited to assist hunters in the preparation of trophies (Ajayi, 1976).

TROPHY COLLECTION AND MEASUREMENT

A trophy is any of the durable parts of animal-skulls, bones, horns, etc. Measurements of trophies are taken to give record of any variability in the species. It also keeps a check on the gene pool for that species for comparative purposes. And its very important for taxidermic studies.

TREATMENT: Skinning should be done immediately the animal is dead. It should be dried properly. The drying process involves brinning and subsequent laying out under shade. Then it is sprayed with insecticide afterwards.

DATA SHEET: Data must be available for any specimen collected and must be on standard form. A standard data form should contain the following:

1. Name of collector – this is important for reference purposes
2. Number – every specimen should bear collectors number also for reference purposes.
3. Species of animal concerned
4. Sex-male or female, this sometimes may be done by dissection.
5. Age of the specimen – this could be done by the use of ageing techniques.
6. Location – area where specimen was collected (very important).
7. Date of collection.
8. Habitat – this must be described.
9. Reproductive status – if it is a female, check whether it is lactating or not and note number of embryo. Dissect the animal and record the number of uterus.

   The number of dilation at the tip of the uterus will determine the number of embryo. Always retain the bladder (which is always on the left) in other to determine the right and left ovary.

   In case of males, the testes can be described as abdominal or scrotal.

   In some cases the specimen have foetus. This should be so stated and the weight of foetus should be recorded.
10. Measurement:
    (a) Overall length – this is from tip of nose to end of last vertebrae but does not include the hairs at the tip of the tail.
    (b) Length of tail – this is from the base of tail to the last vertebrae on the tail.
    (c) Length of head – sometimes taken but not common. It is from tip of the nose to the first edge of the ears.

(d) Shoulder height and hind quarter height – lie the animal in a natural position and measure from hoove tips to the back.

(e) Height of foot – this may be taken from the hind hoove to the knee.

(f) All the above measurement (a-e) must be recorded for foetus. Horn length and girth length are also important. The girth length is from the chest to the back bone of the animal.

11. Horn: Other measurements to be taken include GWT (Greatest Width Outside) – the most accurate methods of taking GWO for buffaloes and is to place a board on either side of the horns and then measuring the distance between the boards.

GWI (Greatest Width Inside)

LOC (Length of outside Curve) – measurement is made at the front surface of the longer horn from the base of the horn to the tip.

Length of Boss (Width of Palm).

Tip-to-tip – the measurement taken in a straight line from the exact tip of the other.

Circumference of base – the measurement should be taken round the horn at right angle to its axis, and near as possible to the head. However, care must be taken where the base of the horn has 'lip'.

The measurement should reflect the true circumference and not elliptical circumference.

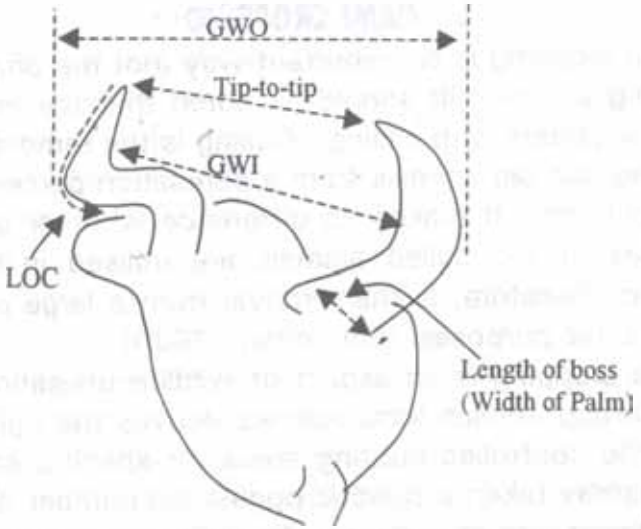


Fig. 2.2 Buffalo head showing head measurements

12. Remark - any other information that would be of interest should be recorded.

NOTE:

(i) All measurements should be done with a steel tape in view of the frequent inaccuracy of cloth tape.

(ii) All measurement should be quoted in inches to the nearest 1/8 of an inch and in some instances to 1/16 of an inch. Body measurements like that of elephant's tusks are done in feet and to the nearest ¼ of an inch.

(iii) In case of horns, measurement is delayed for about two months to allow for natural shrinkage of the horns.

(iv) The data obtained has to be submitted in good time to a game warden's office.

GAME CROPPING

Game cropping is an important way (not the only way) of exploiting wildlife. It should be noted that the cropping is not synonymous with culling. Culling is the removal of sick, deformed and old animals from a population perceived to be overpopulated. It makes no difference whether or not the carcasses of the culled animals are utilised in any way. Cropping, therefore, is the removal from a large population for economic purposes (Eltringham, 1984).

Game cropping is an aspect of wildlife utilisation in East Africa through which local hunters derives the right to limit in specific controlled hunting areas, at specific seasons of year, thereby taken a specific population number of wildlife. The intrinsic rate of increase of wildlife species which have reached a stable population growth gives room for certain percentage of that species to be removed annually in other to make total number relatively constant. Cropping schemes are developed on the understanding of the rate of increase of African herbivores so that people in rural areas may have constant supply of meat. A typical example is the Kikope wildlife cropping scheme in Kenya, organised by the United Nations Food and Agricultural Organisation.

Farmers are allocated pieces of land which are usually demarcated where they can graze their cattle and crop the wildlife. There are closed and harvest seasons, and shooting is normally done at night with a 0.22 hornet riffle which causes little disturbance to the animals. A team of scientist is attached to this project by F.A.O. who investigates various parameters of population dynamics of gazelles from cropped specimens so as to have a better understanding of their sustained yield. Some biologists are also developing techniques of faecal analysis of ungulates

with a view to understanding better their food preferences and utilisation of habitats (Ajayi, 1976).

Some specific information are inevitable to Rational cropping Schemes. In the face of a great deal of information required, the area of priorities for getting a cropping scheme moving forward are:

(a) A census

(b) A classification which gives a measure of recruitment

(c) An estimate of natural mortality (Ajayi, 1974).

To ensure perpetual supply on a long term ecosystem research is unavoidable. An area of concern for research would be a study of the habitat requirement of the species to be cropped. And there is an urgent need for developing ecologically and economically sound harvesting, processing and marketing techniques so that wildlife cropping could be a profitable use of vast areas of savannah, because of the scanty and erratic rainfall which are not conducive to arable farming and abundance of tsetse flies which is unsuitable for livestock production (Ajayi, 1974).

In support of the above mentioned facts, Asibey (1979) reported that in order to utilize wildlife populations economically and avoid extermination, it is necessary to be able to assess the size of the population from time to time so as to find out the crop to be taken and to ensure the effectiveness of both management and cropping techniques.

THE THEORY OF SUSTAINED YIELD HARVESTING

A lot of points of significance in harvesting theory are demonstrated by the simple logistic curve. The first is that once the asymptotic level is attained, that is the point at which the exponential increase begins to level off, the population ceases to grow, for its productive increase is exactly balanced by mortality. Hence, it would be

impossible to take a yield from such a population in that it is non-productive. However, simply removing a portion of animals can make the population productive. The population is now below carrying capacity at a point somewhere on the steep exponential part of the logistic curve where the intrinsic rate of natural increase (rm) is at a maximum. If the yield is increased until it equals the number being recruited to the population by reproduction (that is when observed rate of increase, r = 0), the population being harvested at its maximum sustainable level it will stabilise at about half its density at carrying capacity. This can be demonstrated by plotting the sustained yield at any population density (Eltringham, 1984) (figure 2.3).

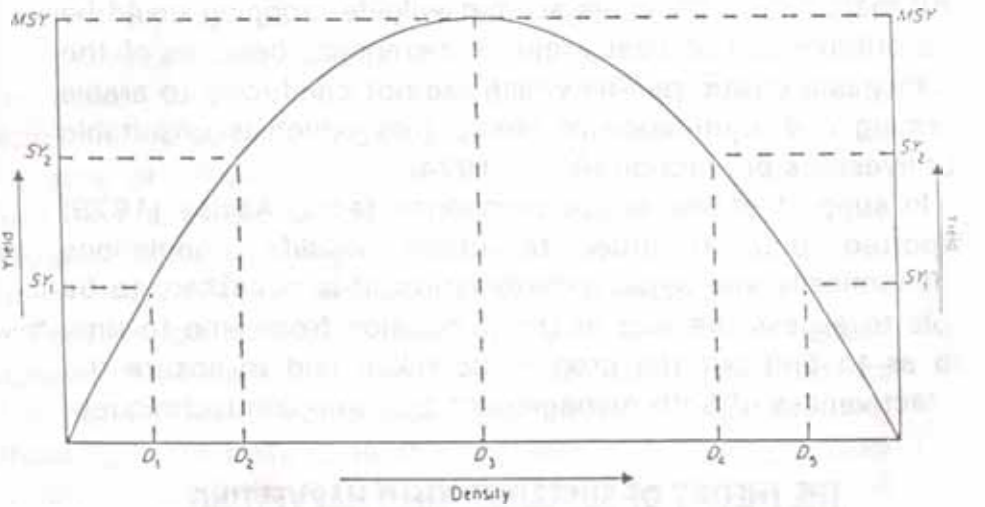


Fig. 2.3: Diagram illustrating the fact that the same sustainable yield can be taken at two densities (e.g. SY_1 at D_1 or D_5 and SY_2 at D_2 or D_4 but that a maximum sustainable yield can be taken only at one density, D_3, which is usually about half the density at carrying capacity.

The curve in the above figure shows that the same sustained yield can be removed from the population at two densities, one is at a higher level while the other is at a lower level. All things being equal, it is better to crop a population at the higher level of the two densities to minimise the risk of driving the smaller population to extinction through inadvertent over cropping (Eltringham, 1984). If the maximum is exceeded, the population will simply continue to decline to extinction. This has happened to many exploited wildlife populations in the past.

Obviously, it is impossible to take a constant maximum sustainable yield (MSY) from a population each year since the crop must be related to the total number of animals present which can vary over a period of years. Therefore, any cropping scheme must be combined with a monitoring programme in which population size is estimated annually, This does not necessarily require a complete census of all animals but some reliable index of population size must be obtained (Eltringham, 1984).

MARKET STRUCTURE OF BUSH-MEAT TRADE

The market structure is the organisational characteristics which determines the relationship between sellers in the market and the buyers. These organisational characteristics influence the nature of competition and prices of commodities within the market. The production and distribution, and marketing of bush-meat in West Africa is not as complex as for some Agricultural products. In most cases there seems to be general simple pattern (Ajayi, 1979). The production channel starts with the hunter.

Most producers reside in the rural areas, and the producer either sells his fresh products locally for consumption in the rural areas or gives it to his wife who preserves and

subsequently sells it to a village collector. Sometimes, the producer sells directly to a village collector who does the smoking himself. Alternatively, the producer's wife may sell fresh carcasses to roadside sellers who does the smoking and sells by the roadside simultaneously. Otherwise the roadside seller may have to buy from the village collector. The urban retailer can only buy from the village collector (often in dry smoked condition) or from roadside sellers. The ultimate consumer buys afterwards.

Another aspect of market structure is posed by traditional hunting tribes who may travel several kilometres and organise communal hunting for several weeks. Eventually carcasses are dry smoked and sold directly to village collectors, and urban retailers who eventually sell to ultimate consumers. Sometimes they do sell fresh carcasses to final consumers.

The following chart shows a generalised production, preservation and marketing structure of bush-meat in West Africa.

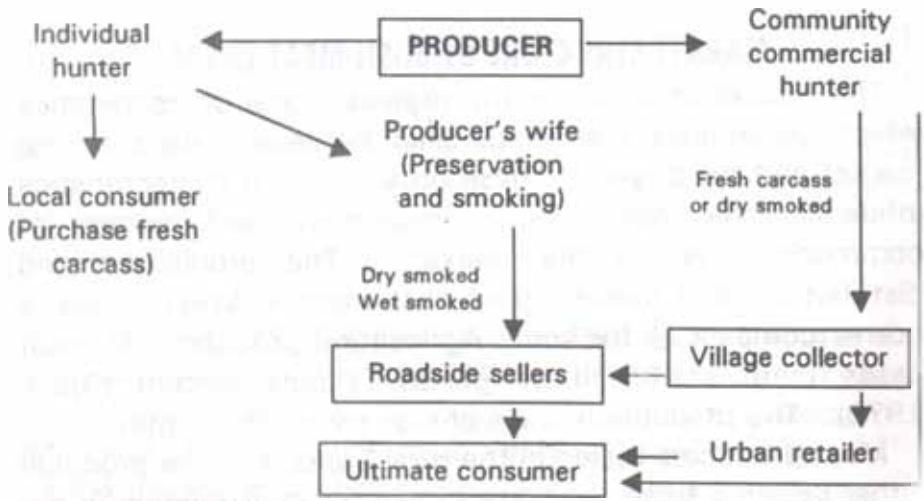


Fig. 2.4: Market Structure for Bush-meat in West Africa.

BUSH-MEAT PRESERVATION

Throughout West Africa, the commonest method used to preserve bush-meat is by smoking. This may be soft smoking or dry smoking. Smoking is usually done in a mud build smoking chamber (kiln) or drum.

Salting and sun-drying are other methods of preservation. At present there is no technologically similar alternative preservation method that could be suggested for bush-meat in West Africa apart form smoking method. Attempts to sundry may lead to decomposition. Salting as a method of preservation could make bush-meat too expensive and out of reach of common people in that salt is an expensive commodity.

However, the way in which bush-meat is smoked in parts of West Africa leaves much to be desired. In the first instance, there is a question of hygiene. Smoking should be done in a manner that meets with the highest standards of sanitation. It is also desirable that smoking be carried out by retaining the meat in the smoking chamber for as long as its practicable. This is to reduce the moisture content to the bearest minimum ensuring that it does not decompose quickly.

Secondly, the method by which bush-meat is preserved often affects the nutritive value or availability of nutrients in the meat.

CONSEQUENCES OF HUMAN UTILISATION

The search for material well being, the soaring increase in consumption and an extra ordinary rate of demographic exploitation of the resources of nature by man have led to the destruction of wildlife habitat, the extinction of certain species of animals and the loss of ecological diversity (FAO, 1970).

Man as a hunter is thought to have contributed to a reduction in the number of species of large mammals inhabiting the earth. In some parts of the world over-hunting almost caused the extinction of some species, an example is the saiga antelope of central-Asia (Eltringham, 1984).

The passenger dove that were wide spread in the Northern American continent about a hundred years ago, totalling about 0.005 billion in number, such that when they passed over through the sky, the sun would be hidden often times for several hours, looking like a scene of solar eclipse with a mucky sky over a dark earth are no more in existence. These doves were exploited indiscriminately. Those on the breeding ground were not spared. Consequently by 1900, the whole population was gone for good. The only specimen that remained in a zoo died in 1914. Such a large population of birds was exterminated within twenty years (Zeng, 1985). This uncontrolled exploitation of wild-animal has also brought the duck billed platypus to the brink of extinction (Zeng, 1985).

The medicinal leech was greatly utilised in the treatment of diseases and over 30,000,000 was imported (annually) into France alone during the first half of the 19th century, such heavy removal of wild stocks led to the extinction of the leech in several European countries and reduced it to remnant population everywhere except Hungary. It is still demanded for medical research into blood clotting and fears for its survival continues (Eltringham, 1984).

A few decades ago it was reported that Nigeria has up to 250-species of animals: Two dozen different kinds of antelopes, Dama gazelle and Dorcas gazelle in the lake Chad area, Red fronted gazelle widespread throughout the Sudan zone. It was added that there were not less than two local races of klipspringer found in the Zaria province which then

had become rare. The Giraffe was reported rare while the Black rhino was at the point of extermination; the leopard widely spread throughout the country. The lion was found in parts of Oyo, Ilorin, Niger, Sokoto, Katsina, Benin and Adamawa (Rosevear, 1953). Today the greater part of these animal species have either been completely alienated from the earth or driven to the brink of extinction.

According to Afolayan (1987), species such as Black Rhino (*Diceros bicornis*) and Giraffe (*Giraffa carmelopardalis*) have already been exterminated in Nigeria while other species such as chimpanzee, gorilla, ostrich, pigmy – hippopotamus, chevrotain, sitatunga and manatee are considered seriously endangered. He (Afolayan, 1987) added that white throated monkey, mangabey, Drill (forest baboon), yellow backed duiker, chimpanzee, buffalo, leopard and elephants in Ondo State are facing an imminent danger of extinction, owing to the devastation of the rain-forest areas, while manatee, pigmy hippopotamus and sitatunga have almost disappeared in the riverine areas of the state.

A recent analysis of the present status of Nigeria's protected area system shows that only 1.7% of Nigeria's land area is included within the protected areas with another 1.1% proposed for protection (Table 2.1).

These figures do not include forest reserves since these are not adequately protected but managed primarily for timber extraction.

This destruction of forest and the destruction through shifting cultivation, has contributed a lot to the elimination of Wildlife Resources in Nigeria (Afolayan, 1987). He (Afolayan, 1987) also reported that if deforestation should continue at the rate quoted by Nigerian conservation Foundation that more than twenty hectares of rainforest will be destroyed at every minutes of the time, thereby turning the forest lands into wastelands by the year 2,000. If this

is allowed to continue a considerable number of wildlife and plant species of the country may become extinct, which can bring a great loss that we and our children would bitterly regret in the nearest future.

The persecution of wildlife is world-wide and this phenomenon prompted the joint pledge of International trade on endangered wild animals and plants. However, as long as there is a lucrative market for these species of animals there will be illegal trade on them.

Unfortunately, the public service function of the environment (Wildlife included) cannot be replaced by technology now or in the foreseeable future (Martin and Wright, 1957). And the loss of a species, or even the loss of genetic diversity within a species, is the loss forever of a potential opportunity to improve human welfare (Holdren and Ehrlich, 1974).

Table 2.1

Vegetation types (and codes after white, 1983) with estimates of original areas, percent remaining, area protected and proposed as protected. Note that this analysis is after MacKinnon and MacKinnon (1986), has not bee updated, includes only areas larger than 50 sq. km, and excludes areas not protected primarily for nature conservation purposes

Vegetation type	Vegetation code	Phytochorion code	Orig. area	Rem. %	Prot. area	Prot. %	Prop. area	Prop. %
Lowland rain forest (wetter type)	1A	I	60,300	10	0	0.0	4,620	7.6
Lowland rain forest (drier type)	2	I	37,000	10	0	0.0	1,715	4.6
Swamp forest	8	I	18,000	30	0	0.0	0	0.0
Mosaic of lowland rainforest and secondary grassland	11A	I	253,000	20	0	0.0	0	0.0
Mosaic of lowland rainforest, woodland and secondary grassland	12	XI	23,100	20	0	0.0	1,900	8.2
Afromontane vegetation	19A	VIII + XVI	3,700	50	0	0.0	0	0.0
Sudanian woodland with *Isoberlinia*	27	III	147,500	30	6,441	4.3	0	0.0
Sudanian woodland	29A	III	286,500	30	0	0.0	2,000	0.7
Sudanian woodland with *Isoberlinia* Islands	30	III	23,100	30	2,240	9.6	0	0.0
Jos Plateau mosaic	32	III, XI	13,000	30	0	0.0	0	0.0
Mandara Plateau mosaic	33	III	1,700	30	0	0.0	0	0.0
Saheel wooded grassland and deciduous bushland	43	XVI	24,900	20	7,044	28.2	0	0.0
Herbaceous swamp and aquatic vegetation	75	Various	2,100	20	0	0.0	0	0.0
Mangrove	77	Azonal	24,500	50	0	0.0	85	0.3
TOTALS			919,800	25	15,725	1.7	10,380	1.1

Source: World Conservation Monitoring Centre (1988)

CHAPTER THREE

FIRE AS A TOOL IN HABITAT MANAGEMENT

Fire can be caused by some natural phenomena and by man consciously or inadvertently through his actions. Most of the semi-natural savannah owes their origin to fire. Fire is also necessary for maintaining them in their savannah state. Their structural complexity and species composition, are also influenced by the severity of the annual fires. Fire is an important tool in the management or range lands and livestock, and in the control of the ectoparasites of livestock. It is equally important in wildlife management.

It should be pointed out that even though effects of the fires caused by lightning, volcanic eruptions and sparks from rock boulders may be significant in natural ecosystems, they are relatively milder in their destructive effects and spread than the man caused fires (Fatubarin, 1984).

Man deliberately sets fire to vegetation to prepare land for cultivation, to flush out animals during hunting expeditions, to remove old impalatable growth while promoting new flush, to control bush and encroachment of range land by wood species and to destroy parasites.

THE RANGE OF FIRE EFFECTS

According to Rogers (1979) fire can affect the following environmental variables either directly or indirectly:

(1) Soils by:

(a) Affecting numbers and rate of activity of soil organisms,

(b) Removing or changing rates of soils organic matter formation and accumulation,

(c) Affecting surface compactness,

(d) Affecting soil water retention properties,

(e) Affecting amounts and availability of essential nutrients,
(f) Removing soil surface horizons through surface run off and sheet erosion.

(2) Land surface by:
(a) Affecting degree and rates of surface erosion by effects on soil and vegetation cover,
(b) Effects on water environment.

(3) Water by:
(a) Changing rates of transpiration and evaporation,
(b) Changing rates of permeability and subsurface flow,
(c) Affecting amount and rate of sedimentation
(d) Changing stream and river structure, through bank and surrounding vegetation destruction.

(4) Vegetation, both directly and indirectly through the habitat effects mentioned above e.g.
(a) Changing direction and speed of vegetation succession,
(b) Affecting plant biomass, structure and shape,
(c) Affecting plant phenology,
(d) Affecting plant quality in terms of nutrient content and availability.

(5) Animals by:
(a) Changing the shape or amount of cover,
(b) Changes in plant palatability and availability,
(c) Indirectly altering water availability,
(d) Causing death or injury (especially lower orders of animal).

He further stated that many of these effects are related and interacting, thus the study of fire ecology and implementing its management is extremely complex.

TYPES OF FIRE REGIME

Daubenmire (1974), recognised three main types of fires considering the portion of the vegetation that is consumed by the fire. They are ground fires, surface fires and crown fires. Ground fires are usually flameless and can penetrate to subterranean depths. They are mostly common in places where the soil is overlaid with a thick layer of organic matter. Surface fires feature above the ground surface and their flames usually consume the litter, living herbs and shrubs. They also scorch the bases of any tree along their route. Crown fires are also those fires that burn to the crowns of trees and shrubs. Fires are also classified on the basis of the time of the year when they occur.

A cool fire (otherwise known as early burning) is an early dry season fire, set when the grasses are still green and have high moisture content. A cool fire is usually mild, and as such does not consume all the vegetation.

Early burning fire moves close to the ground, shooting up to grass tops as they are encountered. Temperatures rarely reach 300°C and are minimal at 2cm below ground level. Tree tops escape damage as do the denser shrubs and greener shade loving grasses. Dead wood is slowly consumed. Small tracks, watercourses, valleys and ridges can act as barriers to these fires, and a heavy dew fall can extinguish them. Thus, they rarely cover very large areas (Rogers, 1979).

A hot fire (late burning) occurs towards the end of the dry season, when the grass cover is completely dry and have low moisture content. According to Rogers (1979) this kind

of fire moves rapidly at 1-2m above ground level, temperatures can reach 600°C or more, and temperatures effects can reach down to 5cm below ground level. Tree tops are scorched and leaves killed, shrubs and seedling, are engulfed. Dead wood is rapidly consumed small barriers as mentioned above can be jumped and such fires can cover large areas in a short space of time. Late burning in addition to its severity is also devastating on vegetation.

Cool and hot fires are not necessarily determined by calendar months. The severity (temperatures) of any of the different types of fires, and the degree of their impact on an ecosystem, are dependent on some factors, among which are the onset and termination of rains (the weather condition at the time of burning), soil moisture, wind direction and velocity, the topography, plant species and stage of maturity and its water content, and the kind, amount, dryness and the disposition of the fuel that has accumulated since the last fire (Fatubarin, 1984, and Rogers, 1979).

FIRE AND THE SAVANNAH VEGETATION

The Savannah vegetation owes its existence to a number of factors operating singly, severally or in different combinations in a particular area. These factors include climate, soil, topography and human influences. The use of fire is seen to be the most prominent and perhaps the most potent factor in the production of derived savannah. Late burning is however, very important in the continued maintenance of the derived savannah.

Fire among other factors, is known to influence the structure of plant communities. It also influences the species composition of plant communities (Fatubarin, 1984).

A FIRE REGIME FOR WILDLIFE MANAGEMENT

Prior to the selection of a fire regime a land use policy statement is inevitable. Fire regimes (no burning, late burning and early burning) are selected for various reasons. For wildlife management a major objective is the provision of suitable habitat for the game resource. The wildlife manager aims to provide a sufficient grass cover of nutrient value. As conservationists we are also interested in the combination of other less noticeable species, such as forest duicker, requiring different more specialised habitats. Therefore, there is a need for the maintenance of a variety of habitat.

Resource use may bring difficulties, for instance, a non-burnt 2m high grass cover is not conducive to game viewing or hunting and these considerations of land use may affect the fire policy (Rogers, 1979).

Unbridled fires in vegetation, are known to have a number of adverse effects on the populations of wild animals. According to Egunjobi (1979) they are-

(1) Destruction of their habitat.
(2) Removal of food resources – mainly for herbivores.
(3) Destruction of young and eggs.
(4) Exposure to predators.

Fire is also said to affect their breeding potentials as well as the movements and distribution of wild animals in their habitat. However, the following among other, are the beneficial effects prescribed burning can have on wild animals –

(a) Prescribed fire can be used to attract animals to certain parts of their habitat. This helps to enhance game viewing in a conservation area.

(b) Fire when managed, is also a useful tool in the prevention of wild fires in conservation areas: this is done by rotational burning in blocks of land.

CHAPTER FOUR

ZOO MANAGEMENT

ZOOLOGICAL GARDENS

Whatever be the reasons behind the creation of zoos in our society, the basis of such establishments primarily is to introduce to our urban population wild animals that exist around us. Due to one reason or the other, the urban residents do no have the opportunity to visit national parks or game reserves which are generally located some kilometres away. Such introduction awakens interest and appreciation in nature, and solidifies the relation of co-existence between man and wild animals.

A zoological garden, zoo park, zoo, is a place where wild animals (both exotic and native species) and in some instances domesticated animals are exhibited in cages and enclosures for public viewing. In such establishments animals are given more intensive care that is possible in reserves and sanctuaries (Encyclopaedia Britannia, 1964). Zoos are of two types open range zoos (Enc. Brit., 1984)) and close zoos. In open zoos animals are free to move about on their own (though carnivores must be separated from herbivores) while in close zoos they are confined in cages according to their species.

The idea of zoo keeping originated in the ancient period. Then zoos and parklands were either associated with royalty or established by feudal lords for the purpose of protecting their sport excluding other people outside their immediate circle.

Parks like so many other aspects of our present civilisation originated in Asia. They existed in ancient Assyria, Persia, India and the far East, as well as Egypt, Greece and Rome (Lasdun, 1991 quoted in Falade, 1994).

The history of the Egyptian dynasties and their inscriptions indicates that even 4,000 years ago, a large variety of wild animals was kept in captivity, but the first zoological garden in respect of which there is any definite record is the one founded at the inception of the Chou dynasty about 1100 B. C. in China – named "The Intelligence Park" (Chambers Encyclopaedia, 1970).

More than 3,000 years ago, King Tiglath – Pilesser I of Assyria boasted of parks which he planted to trees brought from the countries conquered by himself. He also boasted of how he stocked the park around his palace at Assur with stags, goats, young elephants, wild oxen, allowing them to grow in captivity (Lasdun, 1991 cited in Falade, 1994).

However, modern zoo keeping may be said to have started in 1752, with the founding of the Imperial Menagerie at the Schonbrum Palace in Vienna opened to the public in 1765. In 1795, a zoo was created in the Royal Park in Madrid, 18 years later the zoological collections of the Jardin des plantes, in Paris was begun. The zoological society of London established its collection in Regent's Park in 1828, 2 years after the society was formed. By the mid 19th century, zoos were being opened all over the world (Encyclopaedia Britannica, 1984). Most long established zoos exhibit general collections of animals, but some more recently formed ones specialise in particular groups.

For instance, primates, big cats, tropical birds, or water fowl. Marine invertebrates, fishes and marine mammals are often kept in separate apartments called aquariums.

IMPORTANCE OF ZOOLOGICAL GARDENS

Recreation: Zoological gardens have long served as places of relaxation and entertainment. They provide opportunities for people to satisfy their natural curiosities in seeing

different species of animals strange to the beholders at close range. Zoo animals have always been a source of amusement to visitors due to their various displays especially when they get excited. The activities of these animals bring visitors into contact with nature with a resultant relaxing effect upon the over strained personality of the inhabitants of the urban areas.

During festive seasons, visitors troop out in multitudes visiting zoological gardens and National Parks as a form of recreation. It must be pointed out that many people do not find it easy to visit national parks due to conflict between interests, and distance from the resource centre. But the zoos which are usually nearer to the cities are easily at their disposal as avenues for recreation.

Scientific Research: The continued existence of man may well depend on the continued existence of the natural environment and the wild animals it contains. Zoos can be important centres of biological research, especially in the area of drug testing and vaccine production. These have been carried out using non-human primates.

For instance in 1966, U.S.A. alone utilised 62,783 primates consisting of new and old world species, and half a million of Rhesus monkeys during 6 peak years of polio vaccine production 10 years earlier (Harrison and Roth, 1970). Generally, zoo bred individuals are the best candidates in biological research for ease of handling.

Education: Sequel to the increased interest in natural history, zoos have acquired more definite scientific objectives as centres for the study of the animals including such aspects as comparative anatomy, pathology, reproduction and behaviour (Encyclopaedia Britannica, 1984).

In most zoos evolutionary and ecological information about the animals are attached to their cages. The zoos also serves as an efficient 'class-room' for natural resources conservation education such that people can be convinced on the need to conserve our natural heritage – wildlife, forest, etc. In other words, zoos have important roles to play in interesting and educating the public, both adults and children, in natural history and biology of wild animals. And also, in bringing to their attention the devastating effect the human species is having on other animals with which he shares the world, principally through the destruction of habitats.

From an interest in the animals and their plight should follow an interest in the efforts which are being made to save the species in greatest danger and from that, desire to participate in the efforts (Grimwood, 1965).

Preservation of gene pool: In addition to the role of zoos as wild animals sanctuaries they also serve as reserves where species that are endangered in their natural habitat can be bred in captivity (and subsequently re-introduced into the wild) over generations with a view to preserving the species. In the present century many threatened species of animals have undoubtedly been saved by breeding in captivity. For instance the wildfowl was save at the Wildfowl Trust, Slimbridge, England. Also, the European bison (or Wisent), the last wild specimen of which died in 1925 was saved in European parks and zoos (Encyclopaedia Britannica, 1984). Thus, zoos play an important role in wildlife conservation by preventing further unnatural extinction of species.

Domestication: Zoos can also contribute a lot towards the domestication of wildlife species with a view to reducing the pressure on wild populations of those species as well as

augmenting protein production. This is because zoos offer unlimited opportunities for data collection which may not be easy in the wild. Certain basic data on reproduction (especially in the area of duration and period of oestrus, gestation and incubation periods), development and changes in dentition in the young, physiological and behavioural changes during growth to maturity as well as animal diseases are more easily obtainable in zoos.

Aesthetics: Zoological gardens when well managed have aesthetic values which induce visitors to repeat their visit.

BASIC GENERAL REQUIREMENTS OF ANIMALS IN ZOOLOGICAL GARDENS

Good management of animals in captivity requires the provision of conditions similar to the beneficial factors which influence the species in the wild, and at the same time eliminate those factors which have an adverse effect on the animals. The third group of factors are neutral and have neither a beneficial nor an adverse effect on the species.

Just as we only keep healthy when provided with proper food, take exercise and keep ourselves clean, so also will animals only remain in good condition if they are given the food they normally eat, have enough room in their cages and enclosures to run about, and have their bedding changed regularly (Gwenlilian, 1957). The basic general requirements of zoo animals are:

(1) Food
(2) Accommodation
(3) Basic hygiene
(4) Mates including play companion.

Food: One of the major items in the operation of a zoo consists of the formulation, storage, preparation and distribution of nutritionally adequate food. Since, the health of the animal is closely linked with its diet, the zoo management should, as a matter of great importance, handle this item with utmost care (Akum, 1995). For carnivores supplements containing minerals and trace elements should be used in powdered form and spread on the meat.

Accommodation: The construction of cages and enclosures should be geared towards satisfying the behavioural patterns and space requirement of animals (Gwenlilian, 1957). The cage or enclosure must be properly furnished to allow the animals behave normally as an individual. In other words, the cages should provide opportunity for the animals to use their limbs as well as refuges for the animals at a height required by them. Frames should be provided for branchiation. The materials for the construction of animals houses should be selected after special investigation for ease of maintenance, naturalistic appearance, non-toxicity among other things. And the construction should be such that the animal will be within the viewing range of the visitor (young or old). However, where cage floors must be above floor level, the use of step-ups for children and short adults are desirable/helpful (Akum, 1995). Cages should also be designed in such a way that the animals can be safely handled and at the same time ensure that the animal can be humanely restrained. Also, the floor should be so made to facilitate easy cleaning.

The zoo's enclosures must:

(1) Keep the public out.

(2) Keep the animals in

(3) Provide the animal with a place in which it feels at home.
(4) Provide the public a view of the animal and how it lives and
(5) Keep predators out. For instance driver ants will kill almost any caged animal in a night unless some protection is given. This could easily be dealt with by building cages with legs and placing each leg in a tin containing water or kerosene. This prevents the ants from crossing and therefore cannot enter the cage (Gwenlilian, 1957).

Basic Hygiene: Considering transmissible agents, the first priority of management must be to protect the workers and adopt procedures which will control and eliminate infectious agents. Secondly, to care for the animals so that their health status can be improved.

Cages and outside enclosures should be regularly cleaned of faeces or droppings everyday and fresh dried grass provided as bedding whenever necessary (Gwenlilian, 1957). Cages and enclosures should be washed out periodically with a weak solution of disinfectant. It is noteworthy that there are some animals which use scents and musk to mark their territory. This produce a relatively mild odour, however, effort should be made to differentiate odours resulting from dirty enclosures or improper sanitation from such natural scent odours. The biological need of such an animal to produce odours and its use for marking territories may be effectively explained to the public in a sign near such an animal (Akum, 1995).

Heat must be available for sick and breeding animals. Small animals should be given warm bedding of cloth or dried grass and the cage taken indoors (Gwenlilian, 1957).

Lastly, new arrivals should be quarantined in rooms well separated from those holding conditioned healthy animals. At the end the quarantine period, the room should be disinfected before removing equipment, such as cages for cleaning, to another area within the zoo.

Mates: Efforts should be made to avoid keeping single individual of animals except when impossible. Mates help to reduce boredom in captivity. However, where there are several animals in the group, continual observation is very necessary so as to identify if any odd individual is being dominated and victimised.

Boredom is a great problem especially in a strong intelligent animal. Therefore, keepers should be given time to combat this with a variety of playthings (like old clothes). This could be done at peak visiting hours such that both animals and visitors get tremendous enjoyment out of the diversion, and this is surely better than seeing bored animals sitting in an empty cage.

In other to ensure that as few factors as possible are overlooked when analysing the species in relation to its wild environment, the following questions should be borne in mind.

(1) Where in the world does the species come form?
(2) In what local habitat does the animals live, and how does it use its limbs to move about in the habitat?
(3) On what does the species usually feed and how much of its time is used in searching for food?
(4) What is the normal social structure? How does this vary during the year?
(5) What are the conditions that lead to breeding?
(6) Are the youngs particularly vulnerable to any special factors?

In conclusion, it must be stated here that proper housing, hygiene and feeding; regular checks for parasites and, last but not the least well-trained animal keepers are essential factors in keeping animals in zoos.

TAXIDERMY
(MUSEUM TECHNIQUES)

Taxidermy is the science of preservation of animals or parts of animals to resemble as close as possible the (original) live animal. Collections of natural history provide a means of acquainting visitors with the park resources and most relevant collections are used with widely varying effectiveness for mass conservation education.

There are various kinds of museums. There is the war museum at Umuahia, Cultural/History Museum at Ile-Ife; Natural History Museum at Federal college of Wildlife Management among others. However, museum of natural history is the focus here. A natural history museum displays wild animal trophies and provides basic information to visitors/tourists, researchers and students about the wildlife resources in a country. Thus, providing educational instruction materials. It also serves as a laboratory for taxidermic work.

Handouts, bulletins focussing on wildlife resources should be made available in a museum.

COLLECTION OF SPECIMENS

In a standard museum of natural history, collection should show/depict the geology, geography, the environment as well as other resources of the area. Collections of animal to

be mounted depend on the accuracy of technique one employs. Specimens are collected by organised shooting.

Specific animal, age, sex, are aimed at using the knowledge of ballistics. Care is taken not to spray animal specimens with bullets in that animals covered in blood create problems during preparation of museum specimen. In fact, it is ideal to shoot only once such that only one hole is made in the skin.

Immediately an animal is shot, as much information as possible should be recorded. Information to be obtained are as stated under trophy measurement in chapter 2 of this book.

COLLECTION AND CARE OF SPECIMENS IN THE FIELD

For birds, it is best to use a shot gun of small gauge, loaded with the smallest bullet available. Birds are shot at the greatest distance at which one is sure of bringing down the bird. Immediately, the animals falls down the vent, mouth and bleeding holes should be plugged with cotton wool to prevent blood from staining the feathers and skin. Any fresh blood should be removed with a damp cloth. The colours of the eye, beak, feet and any other fleshy parts of the body should be noted. This is because parts of some animals sometimes loose their colour within short time. Always allow the body heat to dissipate as fast as possible.

Carry a bird specimen by the legs so that feathers do not get ruffled. Roll it up in a newspaper so that feathers remain clean and undamaged.

When the weather is warm and the animal is not to be skinned for several days, it should be put in a refrigerator. If it is not going to be skinned for a long time then wrap it in plastic bag or aluminium foil and put in a freezer. Birds

should never be drawn before skinning. That only soils the plumage and makes the job of skinning more difficult.

When a bird is caught alive, kill it without skin damage using –

(1) Chloroform or ether.

(2) Suffocation – grasp the body just below and behind the wings. Press firmly with your thumb on one side and your middle finger on the other. The birds air supply is thus cut off.

For small animals, collection is by shooting or trapping. However, live trap is best. The trap is better made of old lumber rather than new ones (as a camouflage). The cleanest and generally the safest way to kill an animal caught in a box trap is by drowning. In case of animals with scent glands pick the trap carefully and carry it to the nearest water. Gently but quickly immerse the trap in water to drown the animal so that the scent may not be released. If a skin has scent on it the most effective way is to wash it with tomatoes juice and then water. In warm weather, when there is danger of spoilage, small animals may be gutted on the field.

For large animals, the animals can be gutted or skinned on the field or the whole animal is taken home. Where the animal is dressed in the field, it is better to save the leg bones and skull and as much measurement as possible that would help in the preparation of the model should be obtained.

For fish, immediately it is caught, note the colours of the eyes, fins, flanks, and others. Do not degut fish on the field except when absolutely necessary. To degut, open the fish on one side and not down in the middle of the belly. Keep it in a cool and damp condition away from sunshine. In fact fins of any variety should never be allowed to dry unless when it is mounted. Loose scaled species should never be

handled with dry hands. If ice is not available wrap it in a damp cloth, paper or moss, and then cover it in layers of dry newspaper. This keeps the fish going for some hours. However, you may put a specimen in freezer for an indefinite time without damage.

For reptiles and amphibians, they should be captured alive in that they deteriorate rapidly after death. Any specimen should be collected in a thick cloth bag and put in a freezer overnight. The specimen should be thawed when one is ready to prepare it. Most frogs, and snakes especially water snakes are best hunted at night.

To obtain frogs, wade a shallow pond and shine the touch at the banks. Daze any frog sighted with the touch and grip from the front.

PREPARATION

The first thing to be done is the removal of skin. The skinning should be done in such a way that little or no fat and/or flesh is left on the skin.

Borax powder and/or DDT is added against insect attack. The borax removes oil water and helps the specimen to dry. The next thing to do is to prepare a template for the production of mould on which the skin would be mounted. Plaster of paris can be used as a casement as well as cotton wool and dry hairs. Cotton wool is however, used to line the underneath of the skin to make it smooth.

After skinning and addition of borax, the skin is stuffed and wires are passed through their appendages. The artificial body is mounted on a board using these wires. And later the body is brushed by dusting off all roughened hairs and feathers and then placed in moderate sunlight for a period of 6 days before presenting and displaying it.

MOUNTING

The knowledge of the natural history of the species helps ɜatly in mounting specimens. Different samples of the me species should feature different behaviours of the ecimen. In other words one has the free hand to select y natural posture of live animal for the specimen.

DISPLAY

There are six general themes employed in animal ıibition and presentation in museums as well as zoos, .:

Zoogeographic arrangement – here the animal specimens are displayed on the basis of their regional background irrespective of their species.

Ecological arrangement – here animal specimens are displayed according to the ecological zone in which they ɜxist.

Habitat arrangement – here arrangement is based on the habitat requirement (Arboreal, Aquatic, Terrestrial).

Behavioural arrangement – animal specimens may be displayed on the basis of their activity pattern (either as nocturnal animal or as diurnal animal).

Systematic arrangement – display of animal specimen here is geared towards visitors' attraction/satisfaction. This may mean the arrangement based on size (from smallest animal to the biggest animal specimen). It may also be according to the class of the animals concerned (reptiles, aves, mammals, Pisces and amphibians).

Mixed/Popular arrangement – for mixed arrangement animals specimen on display are just mixed together while popular display (which has almost been phased out) refers to a situation where display of animal specimens is based on special request by visitors.

CARE

Sprayed or painted specimens should be rehabilitated when they loose colour. Labels on specimens should always be kept in place. When the skin of specimens crack gum could be used to hold it in place otherwise it could be sown with thread.

NOTE: The temperature of the museum should neither be too low nor too high (medium temperature is desirable). When the temperature is too high specimens become dry and fragile.

Photographs of areas and activities (camping, anti-poaching, and so on) could also be displayed. It is desirable for a museum to have a catalogue indicating all specimens on display.

Museum specimens are better kept in glassware in that some are treated with chemicals, some are fragile and even some may be stolen. There is no specific design for a museum. It depends on space and capital available.

CHAPTER FIVE

VEGETATION SURVEY

Vegetation survey becomes imperative since it is the vegetation that supports wildlife. Thus, the existence of wild animal is dependent on the plants.

Vegetation survey shows the carrying capacity of the land area. Since all plants are not available to the animals (some are poisonous while others are beyond the reach of wild animals) vegetation survey seeks to know the quantity and quality of vegetative materials available to the animals.

Vegetation survey also probe the physical and biological characteristics affecting the existence of the vegetation.

TYPES OF VEGETATION SURVEY METHOD

There are many methods by which one can carry out an inventory of an area of land. The choice of method depend on the types of environment wherein the land is situated. Sometimes there is the need to divide the area into strata. It is also necessary to determine the gradient of the area. This is because it is essential that samples should not be taken across the gradient but along the gradient. The methods include the following methods.

(1) TOTAL COUNT – This is the total head count of all the trees available on a land area. This becomes practically impossible when a large area is involved. Thus, samples are taken which are used to extrapolate on the whole population.

(2) SAMPLING COUNTS -

(a) PLOT SAMPLING METHOD/TECHNIQUE – This is the sampling of vegetation in units of given shapes and sizes known as plots (it may be circular, triangular or rectangular). After many years of employment of the

different shapes of plots it was observed that the triangular and rectangular ones are better. The plot is usually 100m by 100m.

Samples to be taken in the plot may be randomly chosen (drawing on random numbers 1 – 100). You may pick two random numbers. The first number gives the number of metres you will walk along the edge of the plot while the second number gives the number of metres you will walk into the plot. The sample is taken at the point where the second ends. However, the choice of samples in the plot may be systematic. The samples are taken using the point centred quadrant. The species, distance to the centre of the quadrant and girth at breast height should be obtained. It should be noted that paint could be used to demarcate plots to ensure accuracy.

The calculation procedure under this method is as follows –
Find the ground total of distances of all the individual trees to the centre of the quadrant.

$$\text{Average distance/tree} = \frac{\text{Ground total of distances}}{\text{No. of individual trees sampled.}}$$

$$\text{Average area/tree} = (\text{Average distance/tree})^2$$

$$\text{Density/ha} = \frac{10{,}000}{\text{Average area/tree}}$$

Note – enough samples should, however, be taken so that the result would be representative of the area.

(b) PLOTLESS SAMPLING METHODS

Here sampling is done without such prescribed area as plot. This procedure involves reducing a whole area into one dimension point.

This method, avoids the laborious lay of plots, there is reduction in cost and result is obtained very fast.

The point centre quarter method is a plotless sampling method. All plants above one metre in height are considered while anyone below that is regarded as seedling.

This method involves the selection of transect line randomly in the area concerned and the point centre quadrant is dropped systematically, may be at every 10m along the transect.

At every sampling point the species name, distance of individual trees to the centre of the quadrant, canopy cover and girth at breast height are recorded (see Figure 5.1)

Enough samples should be taken on a transect line of not less than 3 kilometres (in a large area). Calculations – add all the distances in each sample and find the ground total of all the samples.

$$\text{Average distance/tree} = \frac{\text{Ground total of distances}}{\text{Total number of trees samples}}$$

$$\text{Average area/tree} = (\text{Average distance/tree})^2$$

$$\text{Trees/ha} = \frac{10{,}000}{\text{Average area/tree}} = \text{Tree density}$$

The relative density of species

$$\text{Equals: } \frac{\text{No. of occurrence of species}}{\text{No. of trees sampled}} \times \text{Tree density}$$

It should also be added that the trees sampled may be divided into girth classes (1-20, 20.5 – 40, 40.5 – 60cm).

The number of trees falling into each girth class is noted. This information can then be plotted on a graph. Such graphs are important in vegetation analysis.

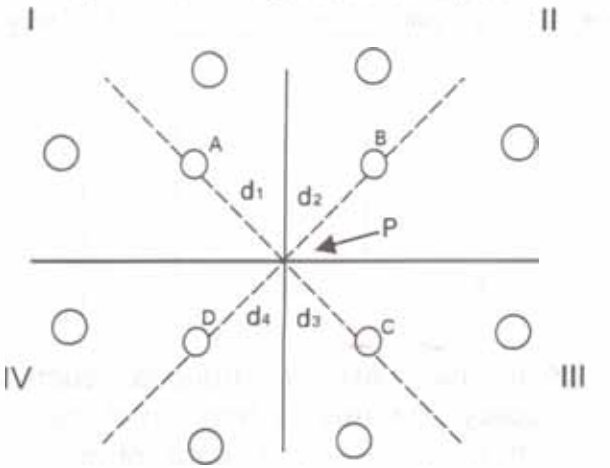


Figure 5.1 – Point Centre Quarter Method
Source: Hopkins (1974)

i, ii, iii, iv = Quadrants; P = sampling point;
Circles = trees,
Circles A, B, C, D, = nearest trees to sampling point P
d_1, d_2, d_3, d_4 = distances from nearest trees to the sampling point.

(c) LINE INTERCEPT METHOD – This is a quick method of vegetation survey. It is used for herbaceous cover evaluation. It is done using a calibrated metre tape as line transect. The tape rule (30m or 50m) is placed on a straight line. A pin or a narrow metal is dropped at intervals

(may be 3m) and any materials touched by the metal/pin is recorded on a vegetation survey sheet. A sample is shown below.

Table 5.1 VEGETATION SURVEY SHEET

Serial No	Bare ground	Litter	Perennial grass	Annual grass	Forb	Woody plant	Tree Canopy	Grazed (sign of utilisation)
1								
2								
3								
4								
5								
n								

At every point the metal is dropped, such a point is projected vertically upwards to find out if there is any tree canopy over that point. The data obtained using this method can then be used to estimate the relationship between those parameters by finding the relative percentages of each as follows:

$$\frac{\text{No of time parameter occurs}}{\text{No of samples taken}} \times \frac{100}{1}$$

(Notes: each transect line being a kilometre).

(3) CANOPY COVER

This is estimated by crown diameter method. The cross diameter of the projection of a tree canopy/crown is measure using a metre tape (See Figure 5.2).

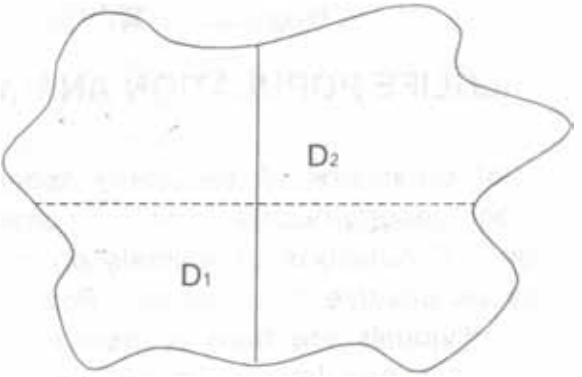


Figure 5.2 - Canopy projection at tree base

The values of the diameters are then used to estimate the crown cover using the formula

$$\text{Crown cover} = \left(\frac{D_1 + D_2}{4}\right)^2 \Pi$$

where D1 and D2 are the measured crown diameters while $\pi = 22/7$.

(4) UTILISATION OF VEGETATION

This is done using two sets of plot (10 plots of 1m x 1m in each set). One set is demarcated and fenced while the other set is demarcated and unfenced. These sets are observed at 28 days interval.

The weight of grasses in fenced plots less the weight of grass in unfenced plots gives the amount of herbage utilised by wild animals. (Note: the plots should initially be cleared of herbage).

CHAPTER SIX

WILDLIFE POPULATION ANALYSIS

A group of organisms of the same species which live together in one geographical area at the same time is called a population. Populations of animals do change and the change may be positive or negative. Populations increase when new individuals are born or new members join the group from other populations (Immigration). Populations decrease when animals or organisms die, or when they leave an area to join another population (emigration).

Therefore,

Therefore,

$$B + I = D + E$$

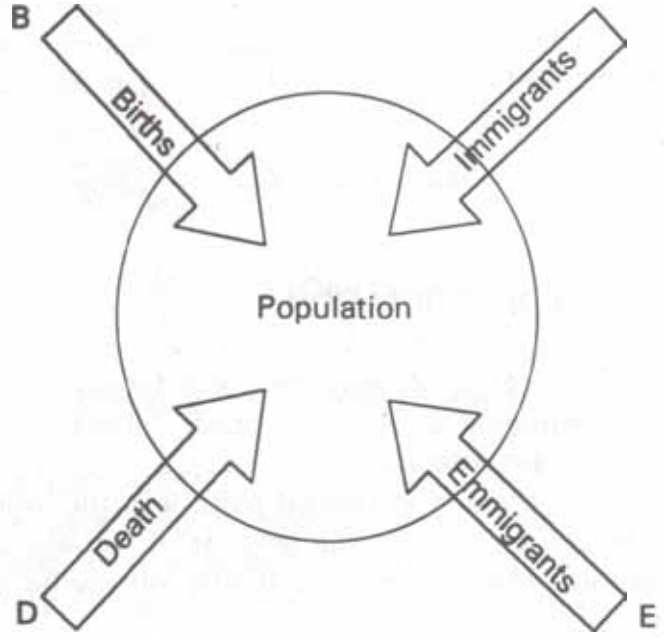


Fig. 6.1 Changes occurring in the numbers of individuals in a population

CHARACTERISTICS OF WILDLIFE POPULATIONS

The population is the basic unit of management from which we take a harvest. Every animal belongs to a population and each individual is influenced by the size and characteristics of the social grouping within that population. Changes in the characteristics of a population will affect the behaviour and internal physiology of the individual animal. In a well graded population animals expectedly will grow in number. In other situations animals may decrease in number continuously.

The population has features over and above those of the individual. It is these features that ecologists attempt to measure and describe.

The features are:

(a) Density (which changes with time)
(b) Sex and Age structure
(c) Social stratification
(d) Natality and mortality rates.
(e) Growth/decline

DENSITY AND BIOMASS: Population contains a certain number of individuals inhabiting a measurable area and consequently population has a density. And density is the number of individuals per unit area.

Density is, however, difficult to measure due to the following reasons:

(i) Wild animals are difficult to count
(ii) There is difficulty in determining the area occupied by wild animals.
(iii) Population density changes as animal die, move into or out of an area and new ones are born.
(iv) Comparisons of densities are only meaningful if the measurements are taken at approximately the same time

of the year. Thus, density must always be estimated at a particular point in time.

The foregoing shows that a population may be twice as numerous in early dry season as in late dry season. Thus, if density is to be meaningful it should be related to occupied habitat rather than mere geographical area. To be more meaningful density should be related to the quantity and quality of food, cover, water and other essentials of life.

In the comparism of population of different species the comparison of densities is useless, this is because a habitat supporting 5 elephants/km^2 cannot be compared with similar habitat supporting 25 warthog/km^2. This is because the 2 species have different weight per single individual, hence, biomass is usually substituted for density in such cases.

In other to determine biomass, the management of animal life supported per unit area must be taken into consideration. The biomass of animals supported at a particular time is known as the standing crop. This, however, is different from productivity which is the rate at which a given population produces new biomass by weight gain or reproduction over a period of time. In general the biomass which can be supported depends on the productivity and the nutritional value of the vegetation of an area.

POPULATION STRUCTURE: This is determined by the numerical relationship between the sexes and ages of the individuals within it. A rapidly expanding population will have a pyramid that is broad at the base because of high number of youngs produced annually. A stable population will have a narrower base and will taper less sharply towards the top. And a declining population will show a narrow base as its population of youngs decline.

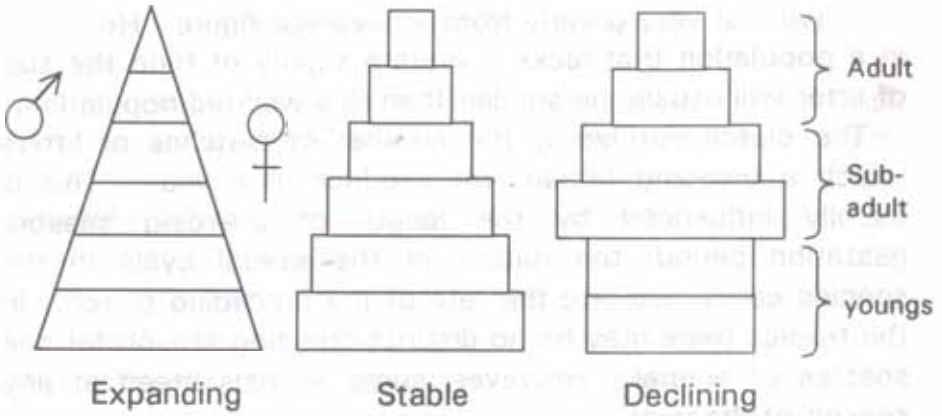


Fig. 6.2 Pyramids of stable, Declining and Expanding Populations.

Irregularities in the shape of a pyramid often indicate the occurrence in the past of unusually favourable or unfavourable years for breeding and survival.

NATALITY: Natality is the production of new individuals by a population. It is usually expressed as the number of youngs produced per unit time per breeding individual in the population. With big games, it is common to express natality rate as the number of youngs produced per a hundred breeding females per year. The rate of natality can be used to predict the fate of a population. And through this the relationship between the population and habitat could be determined.

Natality is usually influenced by size of clutch produced, number of clutches produced per year, minimum and maximum breeding, age of individuals, sex ratio and mating habits, and population density. The number of youngs produced as a result of a single breeding cycle is termed size of clutch or litter. This varies greatly among wildlife species. To an extent, clutch or litter size is a characteristic feature of a particular species. This is because the size of

litter will not vary greatly from an average figure. However, in a population that lacks adequate supply of food the size of litter will usually be smaller than in a well-fed population.

The clutch number is the number of clutches or litters which a breeding female will produce in a year. This is usually influenced by the length of breeding season, gestation period, the nature of the sexual cycle in the species concerned and the fate of the preceding clutch. In the tropics there may be no distinct breeding season for one species of animal. However, some animals breed at any season of the year.

Animal species with a gestation period of between 21 days and 3½ months always have capacity to breed immediately after parturition. Thus, some of them can produce as much as 3 to 6 times per annum. At another extreme the elephant has a gestation period of 22 months. If an elephant breeds immediately after parturition it could at best produce a calf in 2 years. Unfortunately, the female elephant does not breed when the youngs are nursing heavily. Some birds will not breed twice if the first clutch is successfully hatched. The number of youngs produced by a population is also dependent on the minimum and maximum breeding ages of individuals within the population.

In animal species there is a time lag between birth and maturity where reproduction is not possible while in some species (especially with respect to females) there is a certain age beyond which individuals would not be able to breed again.

If a species is monogamous an equal sex ratio would tend to favour a maximum production of young. In polygamous species the situation will be different. In such cases a distorted sex ratio with many more females than females favour a higher production of youngs per 100 breeding individuals in the population. This however, ends where the

number of males become too few to service/mate all the females.

In a sparse population of any species of animal, individuals may have difficulty in finding males and natality may thus be kept at low level. At higher densities, the difficulty of sparseness is surmounted. Thus, there is an inverse relationship between density and natality. With increasing density, pressure on food supply can develop and the health of the breeding individual will decline. This can bring about a reduced production of young. Even when food or other necessities do not become limiting social friction can develop at higher density which will inhibit breeding.

If all the factors already discussed operate in a favourable direction the natality of a population can reach a maximum. This natality rate is seldomly realised in wild animal productions except with the aid of habitat improvement techniques.

MORTALITY: The causes of death in a population are many. If all causes fail physiological breakdown through old age will cause death of the individual. The various causes of death are referred to as decimating factors. The only evidence of mortality in a population of wild animal is a decrease in the number of survivors. With large mammals, it is often possible to find the carcasses of deceased animals if scavengers are not active.

The decimating factors are predation, diseases and parasites, accidents, weather, starvation, stress and hunting.

Predation is an important decimating factor in the biotic pyramid. Most herbivores support populations of carnivores. Predator-prey relationships are affected by the relative sizes of the animal involved as well as by the

feeding habit of the predators. A generalised predator that feeds on many prey can maintain itself even under conditions in which some of its potential prey species are greatly reduced in number. On the other hand, a specialised predator that feeds on one kind of prey is closely tied in abundance to the general level of he population of this prey species. When predators are maintained at a reasonably abundant level they can in turn prevent any one kind of prey from becoming excessively numerous. The African lion is known to feed on large antelopes leaving small antelopes on which the leopard feeds. This phenomenon is termed Non-competitive life pattern in animal survival.

Most animals are subject to various kinds of diseases. Wild animals serve as host for various parasites. Commonly, there is an adjustment between the host and the disease organism or the parasite. When that balance is disturbed the death of the host may occur. If this balance is disturbed in an entire population it can result in a major epidemic.

However, this balance is usually disturbed when an individual gets weakened or injured the resultant effect is lower body resistance with eventual death.

Widespread weaknesses normally occur when most individuals in the population suffer from food shortage particularly long dry season in tropical countries or during very cold season in temperate countries. The presence of disease and parasites can thus serve as a check to prevent excessive destruction of the habitat by a host population. This is similar to how a predator can prevent a prey population from increasing to the point of habitat destruction.

Fires, drowning, highway mortality, collisions, avalanches are accidents that cause mortality in wild animals. As population increase in size and safe places in the habitat

becomes harder to find the likelihood of accidents increases. Man has introduced many modifications of the habitat through buildings, roads, fences and other artifacts. Thus, increasing sources of hazards for wild animals. Most frequently, it will be young and inexperienced members of the population that are hardest hit by accidents.

The usual effects of weather operating as a decimating factor are not severe. Weather tends to trim away a population surplus rather than to decimate severely. Excessive rain, temperature and drought affect survival.

Only in extreme situations can variations in the weather markedly bring about the impact that natural enemies have on their prey. For instance, a heavy rain occurring at an unseasonal time can cause mass drowning of young nestlings. If this is combined with cold it can cause the direct death of animals from exposure. An unusually cold spell can reduce temperature to the point where some species can no longer maintain their body temperatures. The action of weather also prevents a species with high water requirement from occupying areas with excessively dry climate. However, there are exceptions where such species can move along the edges of permanent water.

Disease organisms depend to a large extent upon the right condition, for spread, while the resistance of their host to infection and death is affected both directly, and indirectly through their food supply by the weather.

Interspecific and intraspecific competition may also depends upon the weather, since different species may have a competitive advantage over others under different conditions. Added to this competition depends on the carrying capacity of the environment, and this may vary enormously in response to changes in the weather.

Right weather conditions is necessary for effective/maximum reproduction. Reproduction may be

directly impaired or enhanced by the weather and also indirectly affected through food supply. In short, weather has effects on virtually all aspects of the population ecology of most animals.

When all other decimating factors fail to operate sufficiently (to keep the population in check) the habitat exert a final control. This is the control of food supply which will be inadequate to support an expanding population. Although this situation is not common among herbivores, it is more likely to occur among carnivores when there is shortage of food supply the animal is forced to draw on its body reserves. This result in weakened body structure to the point where normal functioning cannot continue and the animal dies.

Most frequently, however, an animal will fall victim to predation, accidents, diseases, or parasitism before actual starvation takes place. It can therefore be concluded that starvation only predispose animals to other factors that do the actual killing.

The role of stress in animal populations is still a subject for research. However, it has been found out that even with an abundant supply of food, cover, water and other essential materials, excessive numbers of these species can be detrimental to the population.

Populations that increase to high levels have undergone sudden die-off during which time the endocrine balance of the body is upset and a breakdown of the adrenal-pituitary system occurs.

The blood sugar levels also falls off and the animal dies in a state of shock. Hunting has been an important factor in the dynamics of many animal populations. Hunting (in its primitive forms as practised by people who depended on it for livelihood) is another form of predation. In its more

modern form it is a major tool of wildlife management and a principal devise for harvesting wildlife population.

Mortality in a population is either density dependent or density independent. If it is density-dependent, the amount and rate of mortality will increase in direct proportion to the population density. This clearly indicates that at higher densities not only will more individuals die but a higher percentage of the population will die. Since most wild population are relatively stable it is believed that mortality is more less density dependent.

Mortality in density-independent cases are caused by catastrophes such as forest fire, unusual weather hazards and accidents of any kind. This kind of mortality does not stabilise a wildlife population rather it results in wide and erratic fluctuations.

ANIMAL ENUMERATION

CAPTURE RECAPTURE METHODS: This is also called "tagging ratio" or Lincoln index. This method is widely used for estimating animal numbers. A certain number of individuals are captured.and marked with recognisable tags or bands. These are then released into the wild. Subsequently, a sample is taken from the population and the ratio of marked to unmarked individuals is inputted in the formulae.

$$\frac{m}{n} = \frac{M}{N}$$

where M = total number of marked individuals in the population.

N = Number of animals in the population (unknown)

m = Number of marked animals out of those recaptured

n = total number of animals recaptured

Thus,

$$N = \frac{M \times n}{m}$$

The capture recapture method is based on the following assumptions:

a) Marked ones do not loose their marks
b) Marking does not predispose individuals to predation
c) Capturing is randomly distributed.
d) Marked and unmarked ones are equally likely to be captured.
e) Marked individuals distribute themselves homogeneously with respect to the unmarked animals which had not been caught. And on subsequent occasions any marked one has the same choice of being recaptured.
f) Recapturing is done at least before marked animals die or leave the area or any immigrant enters the area.

AERIAL COUNT: This is done with the use of aircraft. Recently the remote sensing techniques and aerial photograph have been employed.

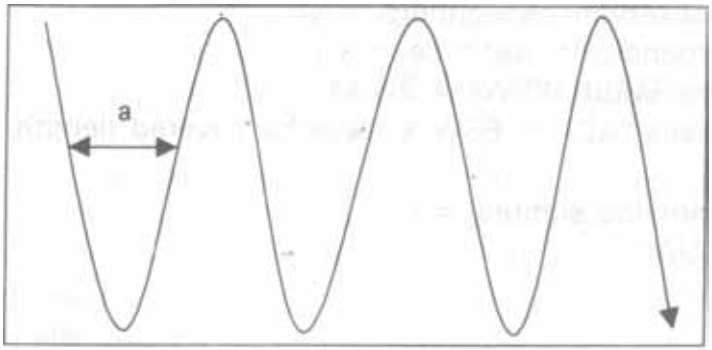
For all aerial censuring to be done the following are the requirements

(i) A crew of at least 3 men the pilot included.
(ii) An aircraft equipped with dictaphone.

The enumeration is done by scanning the areas from the aircraft and recording all the necessary information in the dictaphone. Information to be recorded includes animal number, species, colour, age, and sex.

After the exercise the dictaphone can then be replayed in the laboratory to analyse the data so recorded. The movement of the aircraft is as shown in Fig. 6.3

A = usually about 250m



a = usually about 250m

Fig. 6.3 Aircraft movement

This method is faced with a lot of constraints

(1) It is most suitable in plains

(2) The possibility of double counting is very high

(3) It is very expensive

(4) If it is done during rutting season it may lead to abortion in pregnant females.

(5) Under-estimation seems to be inherent in the method.

(6) Speed of aircraft, height above ground level, transect width and other factors such as variation of pilots, terrain, weather conditions and time of day appear to bias result.

GROUND COUNT: This method involves the use of transect lines. However, it may be done with vehicles or on foot.

A transect is selected. When moving along this transect, records are taking as animals are sighted. Notes to be taking include species of animal sighted, number, time, age, sex, activities, perpendicular distance and sighting distance.

The data gotten would then be used to estimate the density of animals sighted as follows:

Ground total of all the perpendicular distances of sightings

= x

Number of observations/sightings = y
Average perpendicular distance = x/y
Effective strip width (ESW) = 2(x/y)
Area of census (AC) = ESW x distance covered (length of transect).
Number of animals sighted = z
Density = Z/AC

NOTE:

(1) Sighting distance is the distance between the observer and the animal sighted while perpendicular distance is the distance between the animal and perpendicular to the transect line.
(2) It should be noted that sighting distance may be used in stead of perpendicular distance. However, the two should not be mixed together for calculations.
(3) Flight distance which is the distance allowed by an animal (when it is approached before racing for cover) should also be noted in the survey.

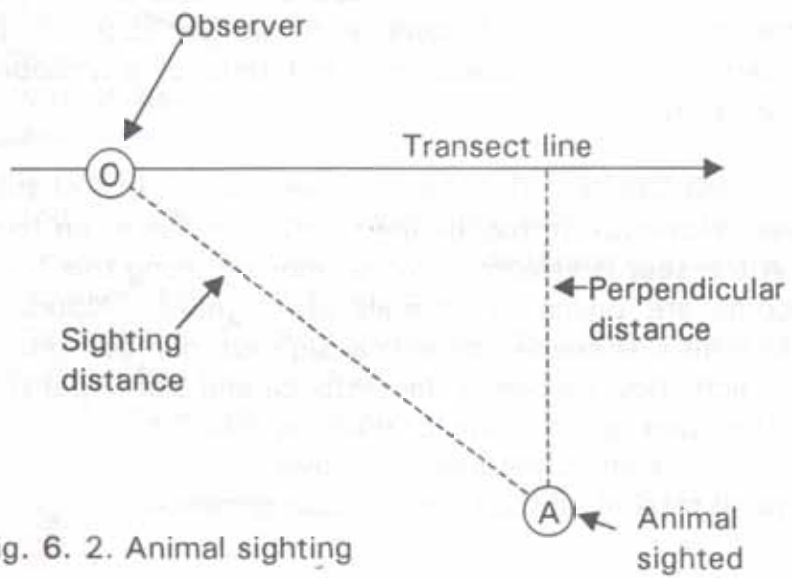


Fig. 6. 2. Animal sighting

CHAPTER SEVEN

WILDLIFE EXTENSION EDUCATION

The greatest obstacle to an intelligent wildlife management programme is the lack of clear public thinking based on sound information. There is therefore a fundamental necessity for better public information to generate support.

Any project dealing with living creatures requires time and continuity to accomplish anything. A conservation department must have a competent staff to collect accurate information on which productive programmes and harvesting regulating can be based and it must also develop a strong educational programme to acquaint the public with the basic facts on which programmes are based. A conservation department staff without a strong and well trained enforcement staff is almost hopelessly inefficient in its efforts.

FUNCTIONS OF EDUCATION STAFF

1. To get people (especially the rural dwellers) into a frame of mind and attitude conducive to acceptance of conservation ideas.
2. To educate the general public on the importance of wildlife as a basic natural resource.
3. To carry out extension courses to reach directly both the young and adult population inhabiting the land.
4. To disseminate the facts on which regulations and limitations of the harvest of wild animals are based.
5. To secure public assistance and support in applying knowledge of methods of improving and conserving the habitat.

6. To train technicians and teachers in wildlife field.
7. To disseminate constantly enough information to the field staff to allow them to present programmes intelligently and accurately.
8. To disseminate to the rural dwellers results of relevant research and to carry their problems back to research organisation. For instance, relevant information on wild animal domestication should be given to the rural populace in that this is expected to reduce hunting pressure on wild populations of animals concerned.

LOCAL LEADERS IN WILDLIFE EXTENSION WORK

The two basic functions of local leaders (King, Emirs situational leaders) in wildlife extension service are:

a. To bring about local support for extension activities.
b. To increase the amount of extension teaching that can be done.

No local extension officer can do the job expected of him all alone. He needs assistance and assistants. No doubt there is need for a large number of workers to reach a large number of populace. The only way out is to utilize local leaders. In order to do this, the extension worker needs to known how to do this, he needs to known how to identify leaders, how to develop and use them, and how to best use them in moving the extension programme forward (William *et al,* 1984).

IMPORTANCE OF LEADERSHIP IN EXTENSION WORK

The following are the reasons why the community leaders in extension work is very important.

1. New practices are more readily accepted by rural dwellers when and if their leaders adopt them.

2. The extension worker has greater contact with the rural people trough the use of local leaders. Thus, he is in a better position to know their needs and interests.
3. When the local leader are effectively involved, there will be less disruption of the programme.
4. It provides an enabling enviroment to fulfil the basic principle of extension of involving people in the process to help themselves. The leader can help explain the programme to the people better than the agent in some cases.
5. Using community leaders assist the extension agent reach many more individuals.
6. Leaders defend village work against unfair criticisms and help bring about more favourable attitude toward extension work (Williams *et al,* 1984).

LIMITATION TO THE USE OF LOCAL LEADERS

1. Local leaders may give wrong interpretation to the programme thus bringing the credibility of the agent to question.
2. They may introduce their own opinion and value judgement to the programme.
3. They may not be good teachers and will therefore not be as effective in selling the programme to the people.
4. They may find it difficult to spare the required amount of time to receive adequate training that will enable them to be effective in the programme.
5. Location and training of leaders takes much of the time of an extension worker.
6. Local leaders may seize the opportunity to acquire prestige and personal gain within the community without contributing much to the effectiveness of the extension agents (Williams *et al,* 1984).

RESEARCH IN THE WILDLIFE MANAGEMENT

The accurate importance of wildlife research is the gathering of accurate data. However, the research must be adequately planned, carefully executed, and closely checked before the information is accepted as a basis for operation.

The results of any study may suggest modification of existing management method or may indicate the necessity for the development of new techniques and procedures. In either case the development of new techniques and procedures or new techniques is a fundamental part of research responsibility.

Research should neither be seen as a definite job that can be accurately scheduled and completed at a specific time nor an eternal process of data and information accumulation on the same problem.

CHAPTER EIGHT

FOOD-HABIT ANALYSIS

Food habit studies provide useful data for management of animal species. It also sometimes provides information for law enforcement purposes.

Food habit analysis include both field and laboratory work. This is because results obtained in the laboratory may be inadequately interpreted in the absence of field work. Adequate numbers of samples must, however be collected to show local, seasonal, or annual changes in diets. Samples should, however, be collected for a minimum of two years.

Food and feeding habits of wild animals may be studied using the following methods:

1. VISUAL OBSERVATION: This is the commonest method of the study of ungulates, the observer stays away watching the animal (from a hide) as it feeds or drinks.

Animals have the habit of visiting water holes during the dry season. Observation of food habits or behaviour are thus better taken at water holes especially during the dry season. Record is taken of the plant being eaten, the part of the plant taken and the number of bites per minute.

The plant specimens are then collected and pressed in herbarium. They are further identified in the laboratory. It is also possible to make visual observation of the animals (with the use of binoculars) at places other than water holes especially when driving around in game reserves and national parks.

2. MOUTH CONTENT METHOD: This method has the advantage that foods would not have been broken down by digestion. Since the sample represent only a mouthful, a large number of samples may be required to obtain a

considerable picture of the diet. However, the limited amount of such samples may be used in conjunction with other methods for more accurate information.

3. FAECAL ANALYSIS: A knowledge of the food consumed by an animal can be gained from study of its droppings. This is based on the fact that fragments of nearly all foods pass through the digestive system of animals without being digested.

Although the study of droppings can shed light on the food habit of most animals it is especially applicable to carnivores. The structure and colour patterns of hairs and/or feathers vary with a different prey species and can easily be identified under a low power microscope. The guard hairs (coarse body hairs) are the most identifiable of the hairs.

In the case of faecal analysis, raw faeces (fresh) of the animals are obtained and preserved in a bottle, normally with 10% alcohol. The animal species responsible must be dentified. In case the animal is not found on the spot the footprint should be identified. In carrying out laboratory analysis, slides of the epidermis of plant materials found in the faeces are prepared. This will then be compared with epidermal slides of major (dominant) plants found in that habitat.

In studies involving both carnivorous and herbivorous species, interpretations is often complicated due to the fact that indigestible fragments are more likely to occur in some food species than in others. Thus, distorting the result. Moreover, fragment identification is complex and often requires the attention of a specialist.

Droppings of animals could be planted in a prepared soil medium and seeds of plant materials taken will germinate. The soil to be used has to be heated at 124°C for 24 hours to make it completely seed free. The planting pots box(es)

should be covered by mosquitoes proof wire net to prevent contamination from outside. A control box is usually provided to check if there is any contamination.

4. RUMEN (STOMACH) ANALYSIS: This is another method used to study food habits of herbivores. Here the animal is shot while feeding and food materials are collected from oesophagus, stomach and intestine. The plant materials from the different parts of the digestive system are then identified.

5. MECHANICAL ANALYSIS: This is possible especially with elephant droppings. The digestion of food in the elephant is not thorough. And as such it is possible to easily identify seeds, epidermis, and broken stems (twigs) in droppings of elephant. I have personally sighted intact seeds in the droppings of Baboons in Old Oyo National, Sepeteri, Nigeria.

6. OBSERVATION OF TAMED ANIMALS: This involves young captured and consequently tamed animals. The owner has the opportunity of watching the animal as it feeds. Therefore, he would be able to take proper record of food items taken.

CHAPTER NINE

ECOTOURISM

SCOPE OF ECOTOURISM

Tourism, as defined by the Longman Dictionary of Contemporary English, is the practise of travelling for pleasure (especially during holidays) and the business of providing holidays, tours etc. for tourist. According to the definition given by two Swiss Professors of Economics, Hunziker and Kraft which was subsequently adopted by Association of Scientific Experts in Tourism (AIEST).

Tourism is the sum total of the phenomena and relationships arising from the travel and stay of non-residents, in so far as they do not lead to permanent residence and are not connected with any earning activity (Kehinde, 1993).

Going by the various definitions by individuals and various organisations five main features of tourism have been identified, viz:

a. Tourism is motivated by the movement of people as well as their stay in various destinations;
b. The two key elements in tourism are journey to the destination and the stay including activities at that destination;
c. Both the journey and the stay take place out of the tourists normal place of residence and work;
d. The movement of a tourist to a place is temporary and short-termed in character as the tourist is expected to return to his original place of residence; and
e. Destinations are visited for purposes quite different from taking up appointments or residence within the places visited (Kehinde, 1993).

However, while there are various definitions of 'tourism' world-wide, the affiliate of the United Nations serving as a global forum for tourism policy and issues, is working to standardise tourism policy and issues, is working to standardise tourism terminology and classifications throughout the world. Such standardisation will permit comparisons across studies, encourage accumulation of knowledge about tourism activities, and assist those beginning to study tourism in defining their terms (Frechtling, 1996).

Some of the world Tourism Organisation definitions as cited in Frechtling (1995) are as follows:
The visitor is the functional unit in the UN/WTO structure and is defined as any person travelling a place other than that of his her usual environment for less than 12 months and whose main purpose of trip is other than exercise of an activity renumerated from within the place visited.

Tourism comprises the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes.

Tourists are visitors who stay at least one night in a collective or private accommodation in a place visited.

The same-day visitor is a visitor who does not spend the night in a collective or private accommodation in the place visited. This includes cruise passengers who disembark in a country but spend their nights on board ship.

Tourism expenditure is the total consumption and expenditure made by a visitor or on behalf of a visitor for and during his or her trip and stay at a destination.

The tourism industry is the set of enterprises, establishments and other organisations one of whose principal activities is to provide good and/or services to tourists.

In addition tot he above definitions, Frechtling (1996), defined tourism demand which is yet to be officially defined by WTO as a measure of visitors use of a good service.

Tourism constitute the largest single item in world trade, although it is composed of many separate elements, viz, transport by air, sea, land, catering services, accommodations, and entertainment for visitors, the manufacture and sale of thousands of items, from souvenirs to jet aircraft (Encyclopaedia Americana, 1974).

It is often called an invisible export in that many nations realise large amount in foreign exchange currency by effectively encouraging foreign visitors to travel inside their countries. And it accounts for 6% of all the "export" in the world (Encyclopaedia Americana, 1974).

CLASSIFICATION

Smith (1977), classified tourism into five categories, viz.:

(a) Enthnic tourism,
(b) Cultural tourism,
(c) Historical tourism,
(d) Environmental tourism and
(e) Recreational tourism

Wildlife management is an environmental based pursuit providing opportunities for natural and environmental attractions for tourists world-wide.

The Longman Dictionary of Contemporary English defines recreation as a form of amusement, or a way of spending free time. It is identified that there is mutual relationship between the three concepts – wildlife management, Tourism and Recreation.

While recreation is an act of occupying oneself in past time pleasures, tourism initiates the move to achieve such a goal. Finally, wildlife management sites (Zoological gardens, game

reserves, national parks, etc.) provide grounds for the eventual attainment of the goals.

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APPENDIX

MAMMALS OF WEST AFRICA (A CHECKLIST)

ORDER	FAMILY	SCIENTIFIC NAMES	COMMON NAMES
TUBULIDENTATA	Orycteropodidae	*Orycteropus affer* (Pallas, 1766)	Aardvark
PROBOSCIDEA	Elephantidae	*Loxondonta africana* (Blumenbach, 1797)	African Elephant
HYRACOIDEA	Procaviidae	*Procavia ruficeps* (Hemprich and Enhrenberg, 1832)	(Western) Rock hyrax
		Dendrohyrax dorsalis	(Western) Tree hyrax
SIRENIA		*Trichechus Senegalensis*	West African manatee
PERISSODACTYLA	Rhinocerotidae	*Diceros biconis* (Linnaeus, 1758)	Black rhinoceros
ARTIODACTYLA	Suidae	*Potamochoerus porcus* (Linnaeus, 1758)	Red river hog
		Phacochoerus aethiopicus (Pallas, 1766)	Warthog
		Hylochoerus meinertzhgeni (Thomas, 1904)	Giant forest hog
ARTIODACTYLA	Hippopotamidae	*Hippopotamus amphibius* (Linnaeus, 1758)	Hippopotamus

	Choeropsis Liberiensis (Morton, 1849)	Pigmy Hippopotamus
Tragulidae	*Hyemoschus aquaticus* (Ogilby, 1841)	Water Chevotain
Giraffidae	*Giraffa Camelopardalis* (Linnaeus, 1758)	Giraffe
Bovidae (Sub-family Tragelaphinae)	*Tragelaphus Scriptus* (Pallas, 1766)	Bush buck
	T. Spekei	Sitatunga
	Taurotragus derbianus	Derby eland
	Boorcercus euryceros	Bongo
Sub-family Bovinae	*Syncerus caffer* (Sparrman, 1979)	African buffalo
(Sub-family Cephalophinae)	*Cephalophus Doriae*	Striped duiker
	Cellophalophus Sylvicultor	Yellow-backed duiker
	C. jentinki	Jentink's duiker
	C. maxwelli	Maxwell's duiker
	C. monticola	Blue duiker
	C. niger	Black duiker

	C. nigrifrons	Black fronted duiker
	C. rufilatus	Red.flanked duiker
	C. callipygus	Peter's duiker
	C. ogilbyi	Ogiliby's duiker
	C. dorsalis	Bay duiker
	C. leucogaster	White-bellied duiker
	Sylivicapra grimmia	Crowned duiker
Bovidae (sub-family Reduncinnae)	*Kobus defassa*	Waterbuck, Defassa Waterbuck
	Adenota kob	Kob
	Redunca redunca	Reed buck
	R. fulvorufula	Mountain Reedbuck
(Sub-family Hippotraginae)	*Hippotragus equinus*	Roan antelope
	Oryx dammah	Scimitar-horned oryx
	Addax nasomaculatus	Addax
Sub-family Alcelaphinae)	*Damaliscus Korrigum*	Korrigum
	Alcelaphus Buselaphus	Hartebeest, Western hartebeest

	(Sub-family Neotraginae)	*Oreotragus oreotragus*	Klipspringer
		Neotragus pygmaeus	Royal antelope
		N. batesi	Bates' dwarf antelope
		Ourebia ourebi	Oribi
		Gazella dama	Dama gazelle Addra gazelle
		G. dorcas	Dorcas gazelle
		G. rufifrons	Red-fronted gazelle
	(Sub-family Caprinae)	*Ammotragus lervia*	Barbay Sheep
CARNIVORA	Canidae	*Lycaon pictus* (Temminck, 1820)	Hunting dog
		Canis aureus	Common jackal
		Canis adustus (Sundevall, 1846)	Side stripped jackal
		Vulpes reuppelli	Rüpel's fox
		V. pallida	Pale fox
		Fennecus zerda	Fennec fox
	Mustellidae	*Ictonys striatus*	Zorilla
		Poecilictis libyca	Libyan striped Weasel
		Mellivora capensis	Ratel, Honey Badger

	Lutra maculicollis	Spotted-necked otter
	Aonyx capensis (Schinz, 1821)	(Cape) Clawless otter
	Paraonyx microdon	Cameroon otter
Viverridae	*Viverra civetta* (Schreber, 1778)	African civet
	Genetta bini (Rosvear, 1974)	Benin Genet
	G. Poensis (Waterhouse 1838)	Forest Genet
	Nandinia binotata (Gray, 1830)	Two-spotted palm civet
	Atilax paludinosus	Marsh mongoose
Hyaenidae	*Crocuta crocuta* (Erxleber, 1777)	Spotted hyaena
	Hyaena hyaena	Stripped hyaena
Felidae	*Felis libyca* (Foster, 1780)	African wild cat
	F. Margarita	Sand cat
	F. Serval (Schreber, 1776)	Serval
	F. aurata	African golden cat
	Panthera leo (Linnaeus, 1758)	Lion
	Panthera pardus (Linnaeus, 1758)	Leopard
	Acinonys jubatus	Cheetah

		Geneta maculata	Forest genet
		G. tigrina	Blotched genet
		Pseudogenetta villiersi	Pseudogenet
		Herpestes sanguineus	Slender mongoose
		H. ichneumon	Egyptian mongoose
		Mongos gambianus	Gambian mongooose
		Ichneumia albicauda	White-tailed mongoose
		Crossarchus obsurus	Kusimanse mongoose
RODENTA	Anomaluridae	*Anomalurus beecrofti* (Fraser, 1852)	Beecroft's flying squirrel
	Sciuridae	*Helliosciurus gambianus* (Ogilby, 1822)	Gambian sun squirrel
	Cricetidae	*Cricetomys gambianus* (Waterhouse, 1840)	Gambian giant rat
	Muridae	*Rattus rattus* (Linnaeus, 1758)	Black rat
	Muscaradimidae	*Graphinrus murinus* (Desmarest, 1822)	Common African Dormouse
	Dipodidae	*Jaculus jaculus* (Linnaeus, 1758)	Lesser Egyptian Jerboa

Hystricidae	*Hystrix cristata* (Linnaeus, 1758)	Crested porcupine
	Atherurus africanus (Gray, 1842)	Brush tailed porcupine
Thryonomidae	*Thryonomys swinderianus* (Temmick, 1827)	Greater cane rat, Grass cutter
Bathyergidae	*Cryptomys ochraceocinereus* (Henglin, 1864)	Ochre mole rat
Leopridae	*Lepus capensis*	African hare
	L. crawshayi (de Winton 1899)	Crawshay's hare
Lorisidae	*Arctocebus calabarensis* (Smith, 1860)	Angwantibo
Galagidae	*Galagoides demidovii* (Fischer, 1809)	Dwarf galago
	Galago senegalensis	Senegal galago
Cercopithecidae	*Papio anubis* (J. B. Fisher, 1829)	Anubis baboon
	Cercopithecus mona (Schreber, 1775)	Mona monkey Fine boy
	C. nictitans (Linnaeus, 1776)	White-nose monkey Spot-nose monkey
	C. tantalus (Ogilby, 1841)	Tantalus monkey
	C. aethiops	Green monkey
	C. diana	Diana monkey

		Erythrocebus patas	Red patas monkey
		Colobus polykomos	Black colobus
		C. badius	Red colobus
	Pongidae	*Pan troglodytes* (Blumenbach, 1779)	Chimpanzee
		Gorilla gorilla (Savage and Wyman, 1847)	Gorilla
PHOLIDOTA	Manidae	*Manis tricuspis* (Rafinesque, 1847)	Tree pangolin, White-bellied pangolin
		M. longicaudata	Long-tailed pangolin
		M. gigantea	Giant pangolin
INSECTIVORA	Tenredicae	*Potamogele velax* (Duchain, 1860)	Giant otter-shrew
	Erinaceidae	*Erinaceus albiventris* (Wagner, 1841)	Fair toed Hedge hog
	Soricidae	*Crocidura flavescense* (I. Geoffory, 1827)	African Giant shrew
CHIROPTERA	Pteropodidae	*Eidolon helvun (Kerr, 1792)*	Straw coloured fruit bat.
		Epomops franqueti (Tomes, 1860)	Franquet's fruit bat
	Nycteridae	*Nyecteris arge* (Thomas, 1903)	Bate's slit faces bat
		N. hispdia (Schreber, 1775)	Hairy slit faced bat.

Emballonuridae	*Taphozous mauritianus* (E. Geoffroy 1818)	Mauritian tomb bat
Rhinopomatidae	*Rhinopoma microphyllum* (Brunnich, 1782)	Larger mouse tailed bat
Megadaermatidae	*Lavia frons* (E. Geoffroy, 1810)	Yellow winged bat
Rhinolophidae	*Rhinolophus fumigabus* (Rüppel, 1842)	Abyssia horse-shoe bat
Hipposideridae	*Hipposideros ruber* (Noack, 1893)	Noack's african leaf nosed bat
Vespertillionidae	*Pipistrellus nanus* (Peters, 1852)	Banana bat
Molossidae	*Tadarida nigeriae* (Thomas, 1913)	Nigerian free-tailed bat.

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