ASSESSMENT OF CAPTIVE MANAGEMENT OF NILE CROCODILE, Crocodylus niloticus, IN THREE TOWNS OF BENUE STATE, NIGERIA

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ABSTRACT

The work assessed captive management of Nile crocodile in three towns of Benue State (Makurdi, Gboko and Katsina-Ala). A research survey was carried out in the study area with structure questionnaires and oral interviews administered to the respondents. The assessment consist of the farm size, type, the quantity and quality of feed used, the general hygiene of the farms, weight and number of crocodiles kept in each farm were noted. A total of eight farmers keeping captive Nile crocodiles were used in the study. Two were located in Makurdi two in Gboko and four from Katsina-Ala. Results showed that majority keep nile crocodile for recreation purposes (87.5%) and for economic values (62.5%). The size of enclosures of the farm was between 56 to 289m^2 while the size of their ponds ranged from 9m^2 to 100m^2. The sanitary condition in most farms was fairly clean to clean. The type feed includes beef, and frog depending on availability or in combination with other fee. The Nile crocodile are either fed once or twice a day except for the farm in Gboko (Allam Villa farm) which feeds the crocodiles four times a week. The Nile crocodile has an estimated aged of between 22 to 36 years while their weight was between 51 to 87kg. The number of crocodiles and the number of eggs were of the constraints faced in managing them in captivity. The constraints mentioned includes inadequate space (75%) and inadequate funds (62.5%). Others includes problems of water, fighting among the crocodiles, diseases and parasites. The main recommendation is putting support system in place by the government to improve captive management of the Nile crocodile for enhanced production.

Key words: Assessment, Captive management, Nile crocodile.

INTRODUCTION

The crocodiles are regarded as the largest living reptiles. Crocodiles belong to the Phyllum Chordata and the Class Reptilia. They are the largest among the principal group of reptiles called Squamata which comprised of lizards, crocodile and snakes. There are two major crocodile species based on their habitats: the Nile crocodile *(Crocodylus niloticus)* are found in the tropical regions of the world where they live near fresh water shores and the Crocodylus purosus which is believed to live in both salt and sea water environments (Hickman, 1979; Young, 1981 and Grizmeks and Scherpner, 1975). In Nigeria, crocodilians are mostly found in the Niger Delta area which is in the southern part of the country where there is a lot of crude oil prospecting. There is evidence that crocodiles face threatening and extinction future, since they live in a world dominated by humans whose increasing demand for animal protein consumption popularly referred to as bush meat and the desire to use wild animal products are always on the increase.

Crocodiles are important members of the biological species. It is not yet know what effect

their likely disappearance would have on the balance of the ecosystem. However, being carnivores, they keep the population of herbivores like wild beast and duikers in check by preying on them whenever they come for a drink of water. Crocodiles are also indicators of good healthy water body and vegetation. They lay large clutches of eggs that are fed upon by other animals including the mongoose, monitor lizards and other carnivorous animals (Britton, 2002).

This research originated from the fact that crocodile species are hardly seen in their natural habitat nowadays due to human activities including illegal hunting which has greatly reduced the population and home of the crocodiles. They are hunted for supply of skin, which is used for making shoes, handbags, belts and suitcases. Their habitat is also destroyed and used by man as farmlands in dry season farming. Also, the use of chemicals for fishing has contributed to the pollution of their habitat and they are captured for medicinal and protein needs of human. These human activities have altered the population of crocodiles which are now threatened with extinction in several parts of Nigeria. As a result, there is a need for the animal to be protected and bred in captivity. Thus, captive management will enhance the population of the species once again.

The idea of the Federal Government of Nigeria in establishing wildlife National parks game reserves and supporting zoological gardens where the endangered wildlife species are protected and kept captive for breeding to avoid extinction is stimulating. There is a need for private individuals to complement such efforts via wildlife farming. Also, the zeal with which the Government of Nigeria signed the agreement on the Convention on International Trade in Endangered Species (CITES) of which crocodiles are covered by the agreement is also very encouraging. However, illegal wildlife trade and poaching still continues in several parts of the country with impunity which have been attributed to inadequate enforcement of wildlife legislation, irregular game patrol and lack of incentives to staff in game preservation unit of National parts and game reserves, among other constraints (Inah and Onadeko, 1997). Consequently, the population of many once-abundant wild animal species in Nigeria is now very low outside the protected conservation areas and some species are endangered or at the risk of extinction in the nearest future in certain locations, unless urgent remedial actions are taken to improve upon their chances of survival and reproduction. One of the ways of achieving this increase in wildlife population is by encouraging individuals and organizations to participate in wildlife farming and captive management of some wild animal species such as crocodiles which is rare in Nigeria. This would enhance the supply of local and external meat market with more animal protein and by-products as well as create economic opportunities to improve poor people's livelihoods via more income and employment generation. This may reduce illegal hunting pressure in wildlife conservation areas.

The overall aim of this study, therefore is to assess the captive management of Nile crocodile, Crocodylus niloticus in three towns of Benue State, Nigeria, namely Makurdi, Gboko and Katsina-Ala.

MATERIALS AND METHODS

Study Area

Benue State was created on the 3rd February, 1976. It was carved out of the so called Middle Belt Region. It has a land mass of 32,511 Km2. It is the seventh largest and seventh most populous State in Nigeria. It stretches between longitude 60 – 100 East and latitude 60 – 80 North (Figs. 1 and 2). The State lies mostly within the lower Benue from the South-eastern borderlands to Cross-River plains. The River Benue is the major geographical feature from which the State derive its name. The River Katsina-Ala is the most important tributary of the Benue River. The Benue and her tributaries have lowered the State high plains and deposited alluvial soil in the trough. This forms the bulk of farmland that is the pride of the State. Benue State has the greatest stretch of the river system in the country with over 100 natural ponds and lakes (Benue State Ministry of Information Makurdi). The Benue River is navigable up to Garoua in the Republic of Cameroon at the peak of the rainy seasons. There are plans by the Federal Government of Nigeria to further dredge the river for navigation and other uses.

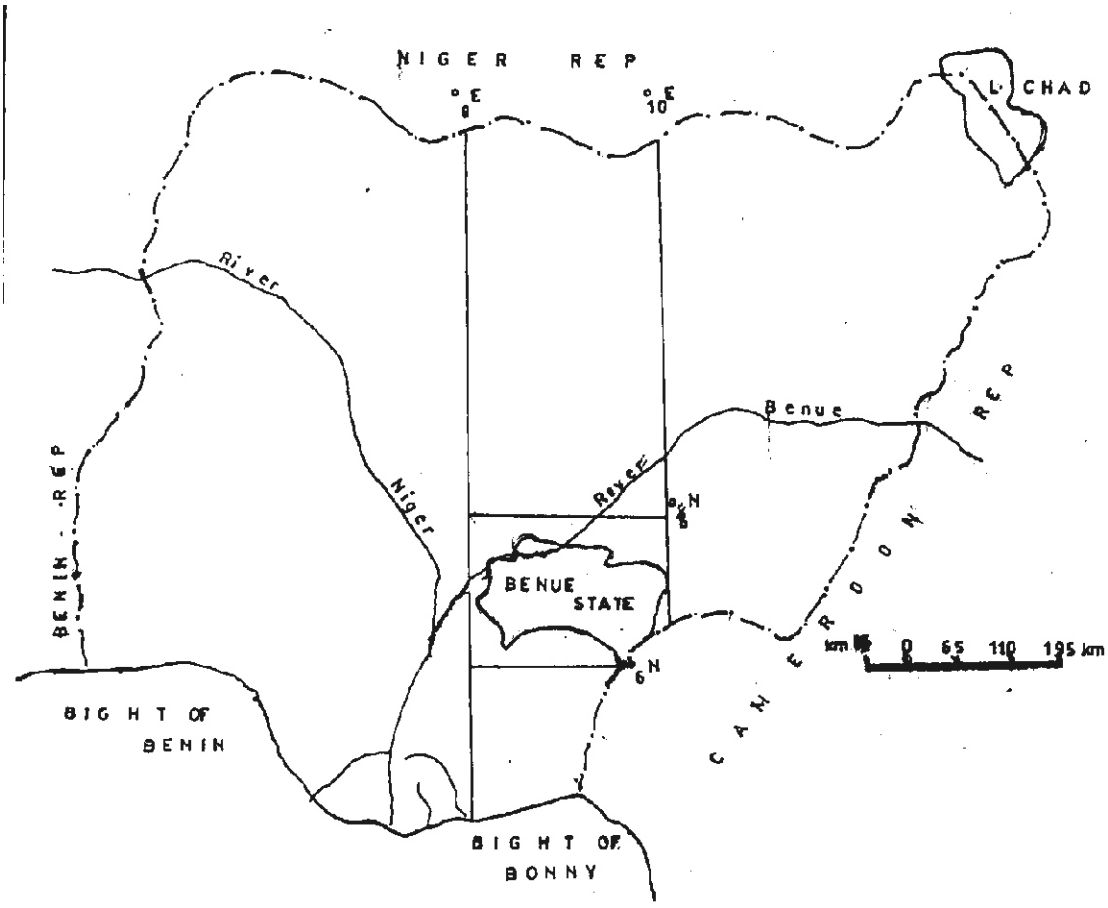
The State is located in the Southern Guinea Savanna which is a transition belt between the glassland savanna in the North and the rainforest in the South. The vegetation cover is mostly made up of giant grasses (elephant grass) and tree species like: *Vetellaria paradoxa, Parkia biglobosa, Prosopis Africana, Vitex doniana, Khaya senegalensis, etc.* Along the banks of the Benue are found hydromorphic soils, which are fertile for several crops cultivation which has earned the State a nick-name: "The food-basket-of-Nigeria".

Makurdi town, which is the State capital and a Local Government headquarter is strategically situated on River Benue at the point of convergence of rail and road routes. The total land area of the Local Government is 3,993.3 Km^2 with vegetation of that of Guinea Savanna. The soil nature varies from sandy to loamy soil in some parts of the Local Government.

Gboko town is also strategically located and it is the headquarter of Gboko Local Government Area. It has a land mass of 4,493 Km^2 and the town serves as the traditional headquarter of the Tiv speaking people. The traditional head of the Tiv people, Tor Tiv, is based in this town. A good network of trunk A roads link the town with other Local Government Areas of the State and other parts of the country.

Katsina-Ala town is also strategically located along River Katsina-Ala. This town serve as the headquarter of Katsina-Ala Local Government Area. The Local Government has a land mass of 4,544 Km^2 and the vegetation is that of Guinea Savanna. A prominent feature in the area is the Lake Aketa located in Katsina- Ala town which normally host the annual fishing festival.

The major wild animals commonly found in these three Local Government Areas are monkey (*Cercopithecus ascanius)*, Hedgehog (*Atelerix albiventris),* Squirrel (*Xerus erythropus)*, Rabbit (*Poelagus ascanius),* Fox *(Canis simensis)*, Antelope (*Neotragus pgymacus),* Crocodile (*Crocodylus niloticus),* and Grasscutter (*Thyonomys swinderianus*).



Source: MINISTRY OF LAND AND SURVEY MAKURDI

Fig. 1: Map of Nigeria Showing Benue State

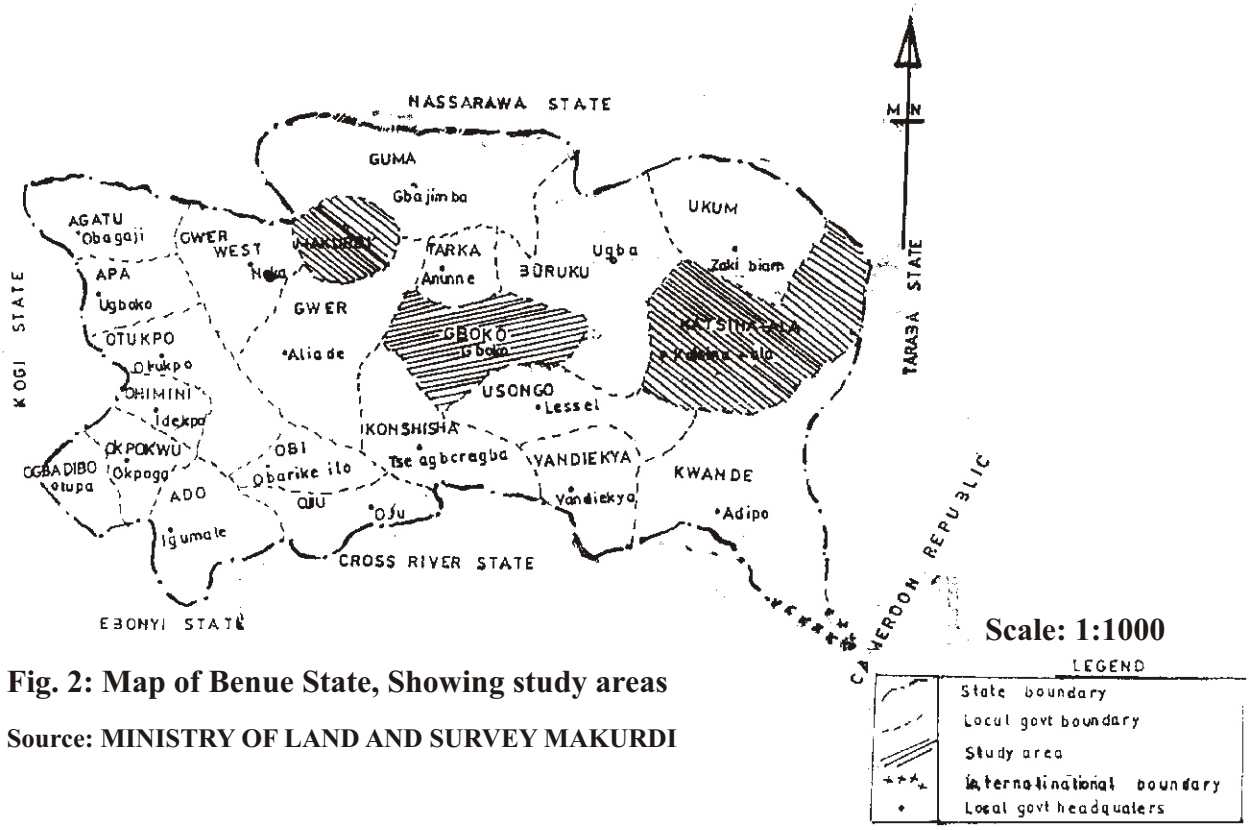


Fig. 2: Map of Benue State, Showing study areas

Source: MINISTRY OF LAND AND SURVEY MAKURDI

Human Population and Socio-economic Activities

The study areas are made up of rural settlements and few commercial centers. The areas are dominated by farmlands meaning that a high proportion of their land is intensively put under agricultural practices. Agriculture forms the basis of the economy since the people are predominantly farmers. The farm produce found in commercial quantity include: yam (*Discorea alata*), cassava (*Manihot esculenta)*, rice (*Oryza sativa)*, and fruit trees such as mangoes (*Mangifera indica),* Citrus spp. Such as oranges; pear and banana. The Local Government also accommodates other tribes from Nigeria. They include: Hause, Igbo and Yoruba who are mainly traders. In the areas, most of the young people engage in commercial motorcycle and teaching.

Methodology

Structured questionnaires and oral interviews were administered on two respondents (the only crocodile farmers) each from both Makurdi and Gboko towns. In Katsina-Ala town, questionnaires were distributed and oral interviews were also held with four respondents who were the only crocodile farmers in the study area. This was followed by the field assessment of the crocodile farms during which the farm size, feed ration, water source, general hygiene of the farms and animals welfare, weight and number were noted among others. The names and locations of the sampled crocodile farms are listed in Table 1.

Table 1: Names and locations of sampled crocodile farms.

S/No	Name of Establishment	Location/ Town
1	Government House, Makurdi	Makurdi
2	Benue State University Zoological Garden	Makurdi
3	Retired Air Marshal Allam Villa	Gboko
4	Retired Col. Viashima Gawa Villa	Gboko
5	College of Education	Katsina-Ala
6	Juladaco Hospital	Katsina-Ala
7	Government Model College	Katsina-Ala
8	Camp Bethel Motel	Katsina-Ala

Source: Field Survey, 2005.

Method of data analysis

The data were analyzed using frequency counts and percentages. A simple correlation analysis to determine the relationship between feed ration and average weight and feed ration to reproduction was done.

RESULT

Purpose of Nile crocodile farming in the study area.

Table 2 present the purpose of Nile crocodile farming in the eight locations in the study area. A mixed response of the farmers showed that 87% and 62% of them farm crocodile for recreational and economic values, respectively. Only a few of them keep the animal for meeting animal protein requirement (37%) and as pet (25%).

Table 2: The purpose of Nile crocodile farming in the study area.

S/N	Study locations	Purpose			
		Economic value	Protein requirement	Recreation	pet
1.	College of education (L_1)	+	-	+	-
2.	Gov't. Model College (L_2)	+	-	+	-
3.	Camp Bethel Motel (L_3)	+	+	+	-
4.	Juladaco Hospital (L_4)	+	+	+	-
5.	B.S.U. Zoo. Garden (L_5)	-	-	-	-
6.	Government House (L_6)	-	-	+	-
7.	Allam Villa (L_7)	-	-	+	-
8.	Viashima Gawa (L_8)	+	+	+	+

Legen: + = applicable, - = not applicable, L= location\

Source: Field survey, 2005.

Estimated dimension of farms in the study area and their sanitary conditions

The estimated dimensions of each farm in the study areas and the sanitary conditions are presented in Table 3. The total farmland enclosure ranged from 289m^2 in Benue State University Zoological Garden to 56m^2 in Allam Villa. Also, the size of the ponds from 100m^2 in B.S.U. Zoological Garden to 9m^2 in Allam Villa while the land area of the farms ranged from 64m^2 in Juladaco Hospital located in Katsina-Ala to 20m^2 Allam Villa Gboko. The result is indicating that there is increasing interest in keeping the Nile crocodile in the study area but several constrains may be the limiting factors. The sanitary conditions of the farms was rated as clean in four locations, moderately clean in one farm and fairly clean in three other farms.

Table 3: Estimated dimension of farms in the study area and their sanitary conditions

Study locations	Size of enclosures (m^2)	Size of pond (m^2)	Size of land area (m^2)	Sanitary conditions
L_1	81	16	25	Clean
L_2	182	35	56	Clean
L_3	110	48	12	Fairly clean
L_4	180	28	64	Fairly clean
L_5	289	100	49	Clean
L_6	126	21	42	Clean
L_7	56	9	20	Moderately clean
L_8	143	36	35	Fairly clean

Source: Field survey, 2005

Information on Feeds and Feeding of Nile Crocodiles

Given in Table 4: is the type of feed and their amount that are rationed to Nile Crocodiles in captivity in the eight locations studied. Feed type included beef, frogs, lizards, chicken, fresh fish and cartilaginous bones (also called biscuit bones). Most of farms utilize beef more than any other type of feed. They also utilize fresh fish as a source of protein to the crocodiles while biscuit bones and frogs are used depending on the availability. During rainy seasons, frogs are harvested from stagnant waters where they breed in abundance. However, there is a need for the crocodile farmers to have breeding ponds for frog multiplication if they are to sustain the crocodile farms. The amount of the feed ranged from 1.0 to 3.0kg for beef, 0.5 to 1.0kg for frogs, 0.5 to 2.0kg for fresh fish. At a meal, any of the available feed is offered to the crocodile or alternatively a combination of this feed is also offered for a given meal.

Table 4: The amount and type of feed given to crocodile per meal in captivity

Study locations	Types of feed and amount						
	Beef (Kg)	Frogs (Kg)	Lizards (Kg)	Chicken (Kg)	Fresh fish Kg)	Biscuit bone (Kg)	Total (Kg)
L_1	2.0	1.0	-	-	-	-	3.0
L_2	2.0	-	-	2.0	-	1.0	5.0
L_3	1.0	1.0	-	-	1.5	1.0	4.5
L_4	1.0	1.0	0.5	-	2.0	2.0	6.5
L_5	1.5	0.5	-	-	1.5	-	3.5
L_6	3.0	-	-	1.0	-	-	4.0
L_7	-	1.0	1.0	-	-	0.5	2.5
L_8	1.0	-	0.5	1.0	0.5	-	3.0

Source: Field survey, 2005

Feeding Frequency of Nile Crocodile in the Study Area

The number of times the crocodiles are fed either per day or for a week is presented in Table 5. Most of the farmers feed their crocodiles once a day while the others feed them twice a day. They feed the crocodiles early in the morning (for those feeding once a day) or morning and late afternoon (for those feeding twice a day). For those feeding their crocodiles once a day it translates to 7 times in a week while those feeding twice, it translates to 14 times in a week.

In Allam Villa Gboko farm (L_7), they feed the crocodile just times a week depending on when the feed is available.

Table 5: Feeding frequency of Nile Crocodile in the study area

Study locations	Feeding Frequency	
	Daily	Weekly
L_1	1	7
L_2	2	14
L_3	2	14
L_4	2	14
L_5	1	7
L_6	1	7
L_7	-	4
L_8	1	7

Source: field survey, 2005

Estimated age and Weight (Kg) of Nile Crocodile Reared in Captivity

Table 6. Showed the estimated age and weight of Nile crocodile at each location in the study areas. The age of the Nile crocodiles ranged from 36years in Juladaco Hospital, Katsina Ala to 22 years in Benue State University Zoological Garden, Makurdi. The weight of the Nile crocodile ranged from 87Kg in Camp Bethel Motel, Katsina Ala to 51Kg in Government House, Makurdi and Allam Villa Gboko farms. In relation to the age, the weights of the crocodiles are quite low. The amount of feed needs to be increased to meet the growth need of the crocodiles.

Table 6: Estimated age (years) and weight (Kg) of Nile crocodiles in captivity

Study locations	Age (year)	Weight (Kg)
L_1	33	61
L_2	27	83
L_3	29	87
L_4	36	79
L_5	22	56
L_6	34	51
L_7	34	51
L_8	28	63

Source: Field survey, 2005

Number of each sexes and the reproductive age of adult Nile crocodiles in captivity

Presented in Table 7. is the number of each sexes (male and female) of Nile crocodiles and the reproductive age of the adults. The total number of male adults 17 and 33 for female adult crocodiles. For the young crocodiles, the total numbers of males were 10 and 6 for females in all the eight farms studied. The adult crocodiles reached their reproductive ages within 6years in Government Model College, Katsina Ala and 8year in Juladaco Hospital, Katsina-Ala. The number of eggs that

were laid by the crocodiles at the time of the research ranged from 23 in Juladaco Hospital, Katsina Ala to 36 in Government Model College, Katsina Ala.

Table 7: Number of sexes and the reproductive age of adult Nile crocodiles kept in captivity

Study locations	Reproductive age (years)	Number of male (adults)	Number of female (adults)	Number of male (young)	Number of female (young)	Number of eggs
L_1	-	3	3	-	-	-
L_2	6	3	2	5	3	36
L_3	6	1	5	3	2	27
L_4	8	1	5	2	1	32
L_5	-	3	8	-	-	-
L_6	-	3	4	-	-	-
L_7	-	1	1	-	-	-
L_8	-	2	5	-	-	-
Total		17	33	10	6	86

Source: Field survey, 2005

Constraints of Nile crocodile Management in captivity in the study areas

Table 8. showed the constraints faced in managing Nile crocodile in captivity at each location in the study areas, Majority of the farmers mentioned that inadequate space (75%) and inadequate funds (62.5%) were their constraints in raising Nile crocodiles in captivity, other constraints include problem of water (37.5%), fighting among the crocodiles (25%), disease and parasites 25%) etc.

DISCUSSION

Crocodiles are important elements of the biota they live and we do not yet know what effect their disappearance would have on the balance of nature (Grizmeks, *et al.,* 1975). They explained that apart from ones species found in brackish and sea water, crocodiles live near water shores in the warmer regions of the world. Crocodiles serve as source of raw materials where their skin are exported and used for shoes, belts, handbags, etc. production due to high demand for skin trade (Young. 1981). Chikoko (2000), Young (1981), Hickman (1979) and Grizmeks and Scherpner (1975) are of the view that crocodiles serves as source of protein popularly known as bush meat. A major area of concern about the bush meat trade and debate and work on the "Bush meat Crisis", as it has become known, relates to the role the trade is believed to play in threatening rare and endangered forest species. The impact of the bushment trade on endangered species was raised by the UK Government Department of Environment, Food and Rural Affairs (UK, DEFRA) within CITES in April 2000 (Brown and Hunter, 2000). The UK Government (DEFRA) paper presented at the 11th CITES Conference of parties (Cop. II, Nairobi, 2000) concluded that the international component of the bushmeat trade is small but potentially important and that the harvesting of endangered species (species under Appendix 1) for domestic use must be regulated at national level (Brown and Hunter, 2000; Bowen-Jones and pendry, 1999). Efforts to halt and reverse the decline in bushmeat have tended to be driven by conservation. To date, efforts to tackle

the trade have been concentrated in West and Central, reflecting the rate at which forest and bushmeat resources are being degraded and the priority attached to tackling these issues by those Governments and donors. Initiatives have included efforts to promote cross border collaboration, strengthen the policy and regulatory framework, improve enforcement, support community based forest management, work with timber companies, substitute for bushmeat as a food source, change hunter incentives and explore domestication of bushmeat wild animal species.

The farming of wildlife species outside forest areas, or 'game ranching', is an established and growing industry on private ranches in southern and easter Africa. For example, in Nigeria the farming of giant care rat (*Thryonomys swinderianus)* had met with some degree of success. Furthermore, this study assesses the domestication of crocodiles in Benue State. So also in North is the more intensive management of ostriches, parrots, and some antelopes is being considered or is already established.

From the study, the purpose of domesticating crocodiles for recreation may not unconnected with the fact that watching these reptiles in their artificial habitat is quite enjoying and appealing to many naturalists. Also, in the study areas, crocodile skin is utilized by Chiefs (traditional rulers) as mark of dignity/royalty and therefore, it is a popular trophy in Benue State. Crocodile meat is socially acceptable as food in the study area. This agrees with the view of Grizmeks and Scherpner (1972) that crocodile serve as source of protein popularly known as bushmeat. Presently, the dimension of some of the Nile crocodile enclosures and the size of ponds are quite inadequate for the current populations of the animals. As an absolute, Harkewicz (1995) recommended that the enclosures' width should be about 3 to 4 times the animal's total length, but larger sizes are preferred. For a pair of Nile crocodile, a minimum land area required would be 3 times the animals' Snount Vent (SVL) as width and 4times its length. This is reflected on the health and breeding ability of the Nile crocodiles. This inadequate pond size results in restlessness, retarded growth and body weight loss of the crocodiles

The calculated correlation coefficient to average weight was 0.72. This indicates that there is a relationship between feeding and weight gain. So an increase in feed given to the crocodiles will most likely result in body weight gain, if other environmental factors like weather, adequate space, available clean water etc. are favourable. There is a need to relate the feeding of the crocodiles based on their number in the pond. So also, there is a positive correlation between feeding and reproduction (r=0.63). This also means feeding will increase the reproduction rate of the animals.

Six out of eight locations have never called a veterinary doctor to their farms to attend to the animals. The farmers claimed that the Nile crocodiles generally have high resistance to diseases and therefore they do not need frequent medical care. In Juladaco Hospital, Katsina Ala, there was an incident in 2002 when som of the crocodiles were inactive and refused eating. The attention of a veterinary doctor was called in. they were treated for lack of appetite as a result of worm infestation. They were basically de-wormed. Similarly, in Government House, Makurdi, one of the crocodiles showed sign of discoloration on the

belly and lower part of the body, a veterinary doctor who examined them diagnosed fungal infection and effectively treated the animals. All the respondents in the eight locations agreed that minor injuries sustained as a result of the animals fighting normally heal without medical care. None of the respondents admitted vaccinating their crocodiles since the inception of the farm. The mortality result showed that in year 2001, three crocodiles died in Allam Villa Gboko and 6 hatchlings in Camp Bethel Motel in 2003. This is as against 2 death in 2004 at College of Education, Katsina Ala. Reasons for death include inadequate feeding (25%) and food competition (65%). Normally, hatchlings are supposed to be provided minimal amount of water in shallow trough. In some locations (Government Model College, Katsina Ala, Camp Bethel, Katsina Ala and Juladaco Hospital, Katsina Ala), hatchlings were left to start life in the big ponds. So also, they were supposed to be given minced food in a dish, but they are fed large lump of feed like adults

In conclusion, it is possible to domesticate Nile crocodile in captivity, however, it is essential to meet their needs just as close to those in the natural habitat. In their review of bushmeat literature, Bowen-Jones *et al* (2001) concluded that several authors have advocated for captive breeding of game species as a possible way to satisfy local demand without compromising the wild stock. This has obvious attractions where bushmeat fetches high prices and captive breeding should in theory reduce demand for wild-caught specimens. On the other hand, there is evidence that the major species with potential for domestication have long since been discovered, there are doubts as to whether the targeted wild species have (or can be bred as to develop in captivity) the behavioural and reproductive patterns conducive to domestication. The concept of raising wild animals in captivity is well intentioned but there must be adequate biological basis Nile crocodiles in this case met those entire biological bases and can grow and perpetuate in captivity. Thus Nile crocodile is recommended for farming by individuals, corporate organizations and non-governmental bodies for enhancing income and meat supply as well as employment generation. This would improve livelihood of the poor people and tackle unemployment problem reasonably.

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