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Indigenous knowledge as a tool for Wildlife Conservation in the Dja Biosphere Reserve, Cameroon

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Abstract: **Most initiatives of wildlife conservation in Africa are geared towards the objective of integrating the riverine communities in the centre of management. In the case of Cameroon, the wildlife law does not recognise indigenous knowledge in conservation matters of wildlife; meanwhile it is very effective in this exercise. This study was initiated to carry out an inventory of indigenous knowledge available within the riverine communities surrounding the Dja Biosphere Reserve (DBR) on conservation matters. The methods of work adopted were the collection of data through questionnaires, focus group discussions and information obtained was synthesised. Data was collected in 47 villages from 4 clusters (North-South-East-West) of the DBR. In each of these clusters, questionnaires were administered to resource persons, giving a total of 120 questionnaires. A total of 16 animal species benefited sustainable management by indigenous means in the zone amongst which are 56% (9 species), 25% and 19% (2 species) which are class A, B and C respectively. About 71% of the indigenous knowledge identified appears to be effective in the sustainable management of wildlife. The indigenous knowledge was grouped into 4 categories (totems, prohibitions, chiefs' authorisation and dissemination agents). This knowledge that is more or less effective can be capitalised upon and taken into account in the texts in force which regulate hunting in order to reinforce the management of the concerned species amongst which 9 of the 16 species identified within this indigenous knowledge are classes A and 4 are of class B. The wildlife law shall be more efficient with the consideration of indigenous knowledge in the texts in force, in compatibility with the objectives of sustainable management of wildlife for which this study has permitted to identify in the DBR.**

Keywords: **Wildlife, Conservation, Indigenous knowledge, Sustainable management, Dja Reserve Biosphere, Cameroon.**

I. INTRODUCTION

The management of natural resources in developing nations is a complex task if we consider the dependency ratio of the local population on the resources and the governance of natural resources [1]. In central Africa, believes and traditional practices have always played a primordial role in the protection, conservation and management of natural resources in

occurrence with wildlife [2],[3],[4]. Until now, wildlife remains the principal source of animal protein for thousands of rural population around forests [5]. According to Auzel [6], in Central Africa, 30 to 80 % of protein consumed in the households comes from bush meat. Those around also recognise the place wildlife occupies in the rural environment notably in the socio-cultural and economic milieu. In the humid tropical forest zone, the demographic growth, increase in demand of bush meat, economic crises and poverty have made poachers principal threats that weighs on wildlife [7,[8]. With more and more remarkable reduction in this resource, it is important that measures of sustainable management be put in place.

Indigenous knowledge, in particular within the Africa context, has since been ignored and neglected in the management of natural resources [9]. Today, a number or more and more important African Governments and international development agencies have identified local indigenous knowledge as a participatory approach of the riverine population for conservation [10]. Those around the park acknowledged that the absence of this indigenous knowledge on sustainable management of wildlife policy constitutes a handicap in the management. According to Warren [9], there exist a strong relation between indigenous knowledge and development. Takoukam and Gnahoua [11] added in saying that, the interest and traditional knowledge of local communities have to be capitalised on in the elaboration and the implementation of management plan of natural resources. The Cameroon traditional society, by their report on nature has contributed in a significant manner for the protection of natural resources in the past.

In the legal dispositions, the riverine population of the forests have limited rights or responsibility. Takoukam and Gnahoua [11] have signalled with an example from Gabon that, the national forestry law recognises the customary user rights in the rural forestry domain in order to assure local populations of the optimal conditions of their existence. In Tanzania, the forestry law for example in an explicit manner permits the local population to become actors of forest management. In Cambodia, the forestry law of 2003 requires that the state knows and assures the traditional user's rights of communities living in or at the proximity of the reserve forests permanently. This type shows the necessity for a participatory sustainable management of ecosystems for the consideration of traditional practices. According to [5] Abernethy at al. (2013), traditional knowledge of wildlife management are founded on the objectives of subsistence and cultural values which are not forcefully destructive to wildlife. What is therefore the case of Cameroon? Mokuku and Mokuku [12] on the mountains of Lisotho underlined that, the same views of certain species constitutes a lucky charm; while others cause dead on those who kill them.

Considered as a principal source of natural resource that supplies the local populations, the riverine population of the DBR have great indigenous knowledge on its conservation, which can be taken advantage of to save guard the world heritage. On the contrary, most of the traditions and customs move in the same sense rather than base on the follow up of the forests [10]. But the service for conservation presently would capitalise on this knowledge if it knows and judges it effective in the expectations of conservation. Faced with this situation and in the goal to contribute to the implementation of the management plan under revision, this study focuses on the inventory of indigenous knowledge on matters of conservation of wildlife (fauna) resources around the DBR. The goal of this was to supply probable indispensable elements for a plea to be made to the Government so that this will be effectively taken in to account in the wildlife management policies of Cameroon. This project has as objectives to identify the indigenous knowledge and animal species which benefit in matters of sustainable management of wildlife.

II. MATERIALS AND METHODS

Study area:

The present study was carried out in four sectors of the DBR which was created in 1950. It constitutes the Wildlife Reserve of Dja (526 000 ha) and the peripheral zone (approximately 800 000 ha) which the global surface area is about 130 000 ha. It is situated on a horseback between the East (80%) and South (20%). It cuts across 9 Sub-Divisions of which 4 are in the Division of Upper-Nyong (Messamena, Somalomo, Mindourou and Lomié) while the other 5 are in the Division of Dja and Lobo (Bengbis, Meyomessala, Meyomessi, Djoum and Mintom). Geographically, it is located between Latitude 2°40' and 3°23' Nord and Longitude 12°25' and 13°35' East (Fig. 1). The DBR is delimited on ¾ of it perimeter by the river Dja that forms its natural boundaries. It belongs to the Southern Cameroon plateau with mean altitude of 600 m., the dominant climate type is the equatorial, with four seasons unequally partitioned. Precipitation is fairly abundant with annual mean greater than 1,500 mm. Annual mean temperatures oscillates between 23.5°C and 24.5°C with maximum in February and minimum in July. According to Letouzey [13], the forests of the Dja Reserve

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Forest (DRF) rest on schistes, micaschites and eventually melanocrates rocks towards East and all the materials producing clay soils. Vegetation is the Congolaise type of Dja to evergreen forests, belonging to the Guinea-congolaise domain [13] with a diversity of more than 270 woody trees [14].

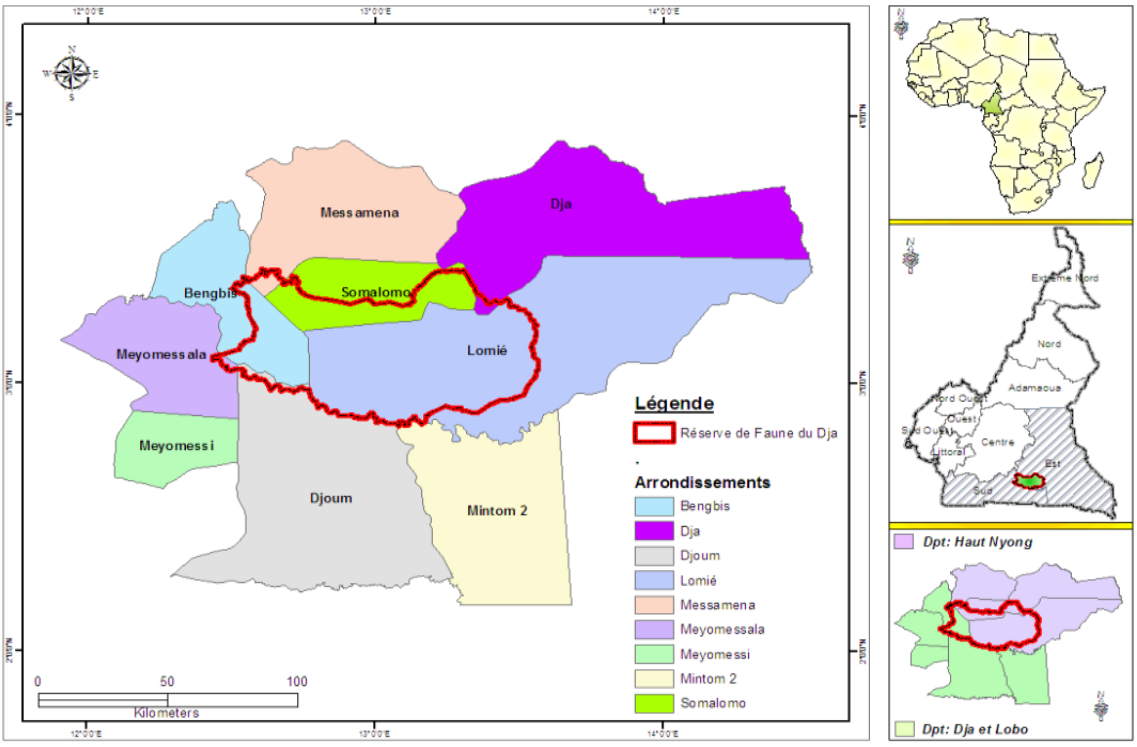

Fig 1: Adminitartive location of the wildlife Reserve of Dja.

The information relative to fauna carry essentially mammals, birds and fish presenting a diversity of 109 mammals repartion in to 10 Orders and 34 families, 360 species of birds and 62 species of fish in the DBR [15]. Looking at the texts that regulate wildlife in Cameroon, many of these species are categorised in class A (species prohibited from hunting, thus benefiting integral protection); class B (species which are hunted uppon authorisation); and class C (species exploited). Although according to White and Weghe (2008), many species that are found presenting a threaten status were; for example: the Elephant (*Loxodonta cyclotis*), the gorilla (*Gorilla gorilla*) and Chimpanzee (*Pan troglodytes*), *colobus satanas, Arctocebus aueus.* Traditional agriculture and hunting remain the principal activities of subsistence and food supply in the zone.

Field survey:

Survey was realised in four clusters in the DBR (Fig 2). In each cluster, atleast a tenth of villages were surveyed giving a total of 47 villages. Choice of villages was orientated towards a more dense human population in terms of demography as follows:

- 13 villages in the Southern cluster: Bii; Zo'otou II, Zoebefam, Nkolmboula, Mintom, Avobongon, Zootu I, Mbouna, Mikon-messeng, Mandoung, Djoum, Messing and Yen;
- 13 villages in Eastern cluster: Lomie, Poutepoum, Minbale, Ekom, Djila, Jackposten, kassalafam, Balipe, Abakoum, Abakoum, Mintoum, Biba II and Nomedjoh;
- 11 villages in the Northern cluster: Somalomo, Nemeyong I, Ndengue, Malen I, Londjap, Ekom, Nkoue, Ngoyla, Maleuleu, Ettou, and Djolempoum; and
- 10 villages in the Western cluster: Meyomessala, Nkldja, Nkoulaze, Nkougoulou, Makas, Nybizot, nsimalen, Nkolembemb.

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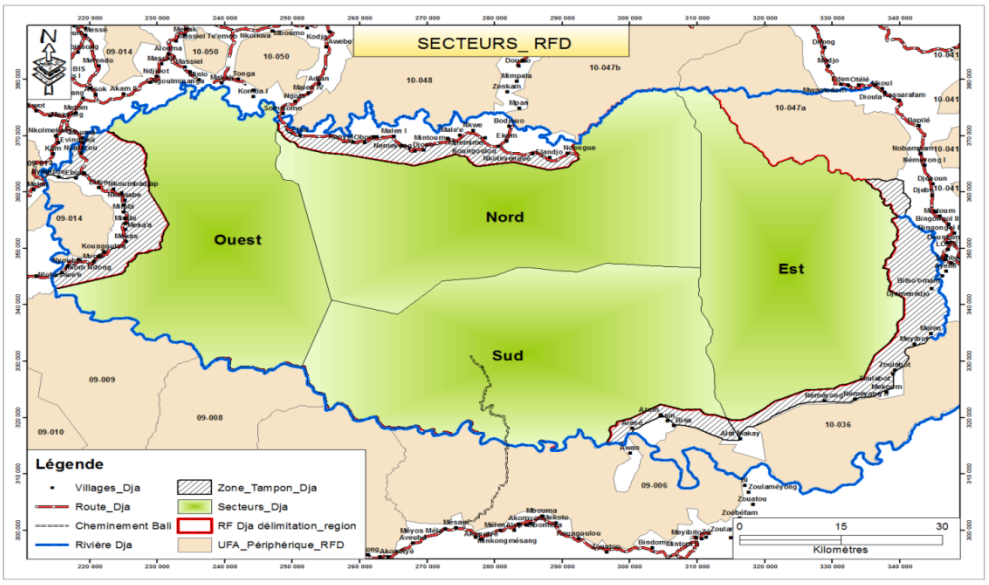

Fig 2: Distribution of villages around the clusters of the wildlife Reserve of Dja

In these villages, geographical coordinates were taken, two to three resource persons were interviewed, the choice of the resource person was based essentially on age (old), activity (hunting), longivity in the village (native) and knowledge of traditional management of wildlife. In each cluster, 30 resource persons constituted of riverine population and chiefs of the village were interviewed with questionannaires making a total of 120 persons interviewed. For each survey, semi structured and structured questionnaires were concieved and administered in a manner to collect information on the indigenous knowledge in matters of wildlife management, the species which benefits this indigenous knowledge, the effectiveness of this knowledge viewing nowadays, etc.

With the use of Classes of protection (A, B and C; such as recognised by the wildlife law of Cameroon) to classify species identified, the level of protection and effectiveness of the knowledge were stratified into 3 classes such as: “good”, “ more or less good”, and “bad” for the level of protection and “ not effective”, “acceptable”, good” and bad for the level of protection and “not effective”, “acceptable” and “effective” for the effectiveness of the knowledge in the conservation of the species.

It is good to note that, interest was not only given to resource persons but also to the entire village through focus group discussion; where most of the villagers were given the possibility to understand and have advantage to answer questions asked. This permitted the investigator to obtain maximun information from the interactions and discussions (Figure 3). Also, information was recorded on recorders in audio in certain circumstances solicited and extracted later.

Fig 3: Focus group discussions with the Baka peasants in Djila village in the Eastern cluster (on the right) and Mkam village in the Western cluster (on the left).

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Data encoding:

All the data was encoded in the data base MsExcel. The Qgis software was used to materialise the riverine villages surrounding the DBR on the map with the aid of geographical coordinates collected on the field.

III. RESULTS

Inventory of wildlife (fauna) species benefiting indigenous protection

A total of 16 animal species partitioned in to 8 Orders were signalled by the riverine as benefiting protection/ sustainable management from indigenous knowledge. Out of these species, 25% are from the Order of Squamata and 19% from the Order of Primates (Table I).

On the view point of animal protection classes in Cameroon, 56% (9 species) are from class A, 25% (4 species) from class B and 13 % (2 species) from class C. Sixty-three per cent (63%) of these species have a level of protection "good" contrary to 37% that have a protection level of "more or less good"; no level of protection "bad" was identified for this species. In the point of view of effectiveness of indigenous knowledge on the species, 71% of species were "effective" in sustainable management; 25% species is "acceptable" and only those of 4% "not effective".

TABLE I: LIST OF 16 SPECIES THAT BENEFIT CONSERVATION OR SUSTAINABLE MANAGEMENT BY THE INDIGENOUS KNOWLEDGE AROUND THE DJA BIOPHERE RESERVE. 0= not effective; 1= acceptable; 2 = effective.

Class of protection	Order/taxon	Species	Common names	Level of protection	Effectiveness
Class A	Carnivora	*Panthera pardus*	Leopard or Panther	good	2
	Proboscidea	*Loxodonta cyclotis*	Elephant	good	2
	Primates	*Gorilla gorilla*	Gorilla	good	2
	Primates	*Pan troglodytes*	Chimpanzee	good	2
	Pholidota	*Manis* spp.	Pangolin	More or less good	1
	Primates	*Colobe guereza*	Magistrate Colombus	good	2
	Squamata	*Boa* spp.	Snake (boa)	More or less good	2
	Squamata	*Coronella* spp.	Smooth snake	More or less good	0
	Squamata	*Ophiophagus hannah*	Cobra	good	2
Class B	Cetartiodactyla	*Cephalophus sylvicultor*	Yellow backed Duiker	good	2
	Cetartiodactyla	*Syncerus caffer*	Buffalo	More or less good	1
	Testudines	*Testudo* spp.	Forest Tortoise	More or less good	1
	Squamata	*Bitis gabonica*	Gabon Viper	More or less good	1
Class C	*Rodentia*	*Atherurus africanus*	African brush-tailed porcupine	good	2
	Rodentia	*Myosciurus* spp.	Squirrels	good	2
	Carnivora	*Aonys congicus*	Congo clawless Otter	good	2

III.2. Indigenous knowledge of conservation matters or sustainable management of wildlife around Dja Biosphere Reserve

Out of 120 resource persons interviewed, 71% recognised the existence of at least one indigenous knowledge on conservation of wildlife around the DBR. The indigenous knowledge identified has been grouped in to 4 large categories (Table II):

Category 1 concerns the totem species: This survey revealed the identity of at least one species considered a totem which has as a duty to protect the village, a compound, a family or an individual. This is for example a Panther or Leopard in the villages of Bii, Djaposten, Djiola, etc.; the snake boa constrictor in the village of Bapile (Eastern cluster); Chimpanzee in the villages of Nkongoulou (western cluster) and Ndengue (Northern cluster); Gorilla in the village of Nemeyong I and Malen I (Northern cluster). This mystic-magical power and human protector confide to these species a

status of integral protection in the costumes and traditions of the people. They represent certain individuals initiated in this cultural rite that gives them some spiritual superiority over the other members of the society, who strongly influence the society by their decisions. They are people who incarnate in these animals. The modus operandi of these totems is to watch over the entrance and outlets of the villages in the nights, defend the interests and the integrity of the villages in case of mystical attacks by sorcerers. Also, killing any totem animals is a very high risk since their extermination is translated by the dead of the initiated who used them and the disappearance of the culture of the people thus; letting lives expose to all sort of mystical attacks.

Category 2 concerns the prohibited/forbidden: the prohibited can be divided in to 4 types according to the nature of prohibition.

Consumption prohibition (all): the prohibition that concerns both men and women prevents the consumption of certain animals which are responsible for the transmission of certain diseases and / or cause physiological dysfunctions on those who consume them. For example the case of yellow backed duiker that provoke haemophilia. According to the population, the women who eat shall bleed seriously during their menstruation period. We noted also the case of Leopard/Panther that gives anger to those who eat them. The smooth snake and buffalo are responsible for the transmission of syphilis to the descendants of those who have "weak blood" and eat them. The consumption of the beef of Congo clawless Otter is forbidden for men of reproductive age and to pregnant women. In the village of Pouhempoum I (Eastern cluster), women just from delivering do not eat porcupine. In the same village, pregnant women are not to eat pangolin and Clawless Otter. Magistrate colombus is also prohibited uniquely for pregnant women in the village of Djaposten (Eastern cluster). In the Northern Cluster, touching a dead or life magistrate colombus attracts misfortunes in your life.

Prohibition from eating by adolescents: it was a customary right although nowadays it has significantly reduced or even disappeared in certain villages, in fact, adolescents (boys and girls) were not to consume or eat meat of pangolin, colobus, viper, tortoise etc. which were uniquely preserved for the "old or initiated". The disappearance of this prohibition according to many youths was explained that, it was from egoism of the old who wanted to confiscate these resource of high quality to them; thus has to be neglected by the youths.

Prohibition of hunting certain animals: in the culture of the Baka people of Djiola village (Eastern cluster), primates are considered as human ancestors (by the resemblance, behaviour and physiology vis-à-vis man); for that, their hunting or their consumption is strictly forbidden. Other villagers who are more instrumental and enlightened declare that these animals transmit even human disease when eaten and manipulated, and make more effort to avoid contacts with primates. A hunter declared that chimpanzees go as far as begging hunters who want to shoot them with arms using human gests and you need to be heartless to execute the animal at that time.

Category 3 concerns an authorization from the chief of the village for to execute hunting

The population thinks that the forest that surrounds them is their property and they have the right of control over its exploitation. This is the reason why many communities have their territories well demarcated and any trespass by a member of another neighbouring community becomes a violation of customary law. To preserve the resources of their forests, in the goal to ensure sustainable management, it was noted that many traditional chiefs have the powers to bless and curse hunting festivals. It is a customary right exercised by the chiefs of the villages who have the power to authorise or refuse the entry into the forest of their territories to hunt. So, if someone stubbornly goes hunting without the authorisation of the chief, he returns empty handed. This knowledge has no specificity vis-à-vis certain species and benefits all the biodiversity of the concerned forests. When an accord is given by the chief of the village to a hunting festival, he blesses it and it becomes fruitful.

Category 4 concerns the species considered as agent of plant dispersal (dissemination): the populations are aware that many plant species exist thanks to the presence of animals that plant them in their forests. They recognise that the disappearance of certain animals triggers the extinction of certain plant species to an extent that, presently more interests is laid on their check (alimentation, medicines and source of revenue, etc.). We have for example the elephant, gorilla, chimpanzee, duikers which according to indigenous knowledge has to be conserved since they are agents of zoochory. Even though, certain species are often hunted, the riverine population recognise the national wildlife law that protects the animals.

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TABLE II: RECAPITULATION OF INDIGENOUS KNOWLEDGE IN MATTERS OF CONSERVATION OF WILDLIFE BIODIVERSITY OF THE RIVERINE PEOPLE AROUND THE DJA RESERVE BIOSPHERE

Categories of indigenous knowledge		Wildlife (fauna) concerned	Description of the knowledge/ reasons/ justifications according to the riverine	Effectiveness of the knowledge in conservation or sustainable management	Villages concerned	Observations
Totems		Panther, elephant, boa snake, gorilla, chimpanzee, pangolin, otter and cobra	Animals considered as protectors of individuals or as precise ancestors of the village. The totem animals vary from one village to another.	Very effective since the riverine of the villages do not hunt the totem species.	Quasi-total	Species hunted only by strangers or new comers
Prohibition/ forbidden	For consumption (all)	Yellow backed duiker, panther, buffalo, viper and magistrate colombus	These are animals that transmit disease and cause physiological dysfunctions in certain persons who consumed.	Remains effective since riverine are afraid to eat and attract sickness	Quasi- total	Those who hunt for example panther are poachers and doing that for skin trafficking.
	Eaten by adolescents (boys and girls)	pangolin, magistrate colombus, viper, tortoise, etc.	Even though this knowledge has seriously reduced, there are species which are reserved uniquely for the «old » or "initiated". Youths and women do not have to eat their meat.	Not more effective since it's not more applicable by the concerns	villages of Eastern cluster, Maleuleu (Northern cluster)	Youths gave an account that it was a practice of the « old » who wanted to be the only ones eating good bush meat.
	Hunter	primates	Are our ancestors, we do not eat them. For the riverine of Ekom, they are our grand-parents who guard the village	effective	Baka of Djila (eastern cluster), Ekom (Northern cluster)	According to them, they cannot eat these animals which resembles man.
Authorisation from chiefs of the villages		No distinction	It is the chief of the village who authorises/bless the entry in to the forest with the goal of hunting even if the authorisation is obtained from the state; if not the hunting will net be successful.	efficace	Nsimalen (antenne Ouest) ; Baka of the Eastern cluster	To be promoted in other clusters.
Agents of plants dispersal (dissemination)		Elephant, squirrel, gorilla, chimpanzee etc.	These species benefits particular traditional protection from the riverine, they assure the dissemination of grains.	More or less effective.	Most essentially in the Northern cluster	To be promoted in other clusters.
Other minor indigenous knowledge		No distinction	- Allow the animals fall in a trap when they are very small or when it is a totem. - Hunted by traditional methods (spears, stones, traps, etc.)	More or less effective.	-	Specific to certain riverine and none to the villages

IV. DISCUSSION

The one who owns access rights for long duration in the forest is traditionally known as key contributor to the principles of sustainable management of forest resources [11]. In fact, the riverine population possessed indigenous knowledge which positive impact in conservation is very effective [12],[16]. Our survey has permitted us to reveal that hunting practice in DBR is regulated by social prohibitions within a well organised and hierarchical society. Contrarily, concrete cases of these rules and customs regulate exploitation and use of natural resources [11]. This explains the fact why in many villages certain animal species remain venerated until present; this is so that hunters and consumers remain prohibited and severely censured by families entirely through ethnics and tribes; and also the fact that all strangers and even autochthones would have obtained authorisation from chiefs to organise a hunting festival. All transgressions of these rules were considered by all as act to undermine part of traditional custodies, gods of the forest and of the waters. All persons having violated those prohibitions are exposed to sanctions approved by the society like forced labour for the damage cause on nature (offer a cock, ram etc.) to acquit the matter.

Nguifo and Talla [10] recognised that the elimination of the law of many local traditional practices or indigenous knowledge constitutes an important break in the management of wildlife. These authors signalled for example the case of elephants killed yearil in the community of Baka for rituals. According to them it is a ritual and the hunters who kill the animal are considered very important in the community. When we look at article 78(2) of the wildlife law N°94/01 of 20 January 1994, this species is a class A therefore, integrally protected and cannot, in any case, be killed. Contrary, in certain cases the capitalisation on certain knowledge shall be an asset in conservation [11].

Meanwhile, many species benefit conservation by traditional means [12]; it is the case for example of species considered as totems, forbidden from eating or when protected for their role of plants dissemination. It is for example the case of Eastern cluster where the Baka communities affirmed for not hunting or eating gorillas for the simple reason that they are often considered as their ancestors because of the resemblance to human. We also noted the case of totem; species in the view of our survey were essentially class A species and which are considered by the riverine like protectors of individuals or the village thus, can never be hunted by the autochthones. Let us therefore take note according to the testimonies of chiefs of the villages and the respondents that, totem species to an extent despite their protection by traditional knowledge, still face the same threats because of poaching exercised by strangers in the zone. According to Mokuku and Mokuku [12] in mountainous zones of Losotho, certain animal species such as the spotted skaapsteke snake, cobra, black crow etc. are traditionally protected since just seeing them gives you good luck. For this reason, you can find job and have money. This same author underlined also the case of certain birds thus, killing those triggers the dead of him or her who killed them.

V. CONCLUSION

Meanwhile, it is good to note that the riverine population of the DBR dispose of indigenous knowledge whose effectiveness in the management of wildlife resources is not to be demonstrated again. The Cameroonian law regulating hunting shall thus be more effective if the government identifies these local practices and indigenous knowledge compatible with the objectives of sustainable management of fauna in the goal of integrating it in the wildlife legislation in force. So, the modality to exercise will then preview the orientation of these indigenous knowledge instead of formal prohibition exercise effected by the riverine and related to the fauna conscious of the fact that it is not easy to modify a law, it shall be wished that at a local level, this knowledge should be taken into consideration in the planning process of the management of protected areas. Implicate them in strategies of protection of biodiversity constitutes an asset of responsibility of the population in conservation policies in Cameroon.

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