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Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

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Inventory of the Big Mammals of the Bay of Wali, In View of its Tourist Exploitation

Mahamadou Moustapha[1], Pierre Mbete[1], Henri Boukoulou[2], Fulbert Akouango[1], Christophe Ngokaka[1] and Joseph Vouidibio[3]
[1]Laboratoire des Productions Animales et Biodiversite,
[2]Laboratoire d'Economie et Sociologie Rurale, [3]Faculté des Sciences,
Université Marien, NGOUABI, B.P. 69, Brazzaville

Abstract: The management rational of a protected area in general, the one to vocation cynégétique in particular, must rest on merely scientific bases. Information and the key information on vegetation, fauna and the ecological functions of the protected area, must be collected progressively so that they help to make assort a coherent program of his/her/its planning. The administrators of these spaces must follow the evolution of these resources therefore regularly, and particularly to know the animal species and their movements. It is in this optics that the present survey has been undertaken in the Bay of Wali situated to the periphery of the National Park of Nouabalé Ndoki in the goal to know the quality and the quantity of big mammals that frequent it. The present survey has been achieved during three months of January 15 to April 15, 2011 to the course of which we inventoried the big mammals in and to the periphery of the Bay of Wali. According to the results of this survey, the Bay of Wali presents a very rich, containing animal diversity thirty one (31) species different from big mammals, having preferences of very determined habitat. These preferences seem to be guided by the food needs and in mineral salts, the bodily cares and the type of plant formation. The results of the present survey could contribute to the setting up of a vast program of development of the vision tourism around the Bay of Wali and his/her/its periphery.

Key words: Bay of Wali, protected area, tourism of vision, periphery

INTRODUCTION

The conservancy of forests of the Basin of Congo is so much the unique way of salute for the animal species that plant. The protected area persons responsible in general, those of the National Park of Nouabalé Ndoki in particular, execute this politics since the creation of this one in 1993.

Thus, the protection fauna, flora and the habitat are the main acticités that they lead in this vast ecosystem. In order to better fair assoir this politics, some socio - ecological studies are led on the whole of the Park including the Bay of Wali.

The Bay of Wali is situated at the periphery of the National Park of Nouabalé Ndoki. She/it constitutes one of the strategic points of restocking of the animals in water and in mineral salts. Following his/her/its natural assets, she/it became a landmark for the different cashes animal to leave of which one can consider the setting up of a project of development of the vision tourism.

The present survey aims, therefore, to know the qualitative and quantitative plan, the different species of big mammals that frequent the Bay of Wali and his/her/its vicinities.

The results of this work will probably permit to increase the potential of the sites of the écotourisme in Republic of Congo.

MATERIALS AND METHODS

Localization of the survey zone: The Bay of Wali is located at the west of the National Park of Nouabalé Ndoki, about 25 km the Boncoins villages and Bomassas (Fig. 1). One reaches there by a track that crosses a forest localized by the points following GPSS:

- 02°13.943N (entry of the forest);
- 016° 12.661 SS (beginning of the Bay.

Of oblong shape, the Bay is large of 50 meters and long of 183 meters.

His/her/its soil, covered of an algae (*Spirogyra* sp.) is drowned under bottom of clean water and very limpid whose depth adjoins 1.40 m.

Of part and others, the zone is covered with a secondary forest, a forest mono dominant (*Gilbertiodendron dewevrei*), a swampy forest and a mixed forest dominated by the Marantacéeses.

Corresponding Author: Christophe Ngokaka, Laboratoire des Productions Animales et Biodiversite, Université Marien, Ngouabi, B.P. 69 Brazzaville

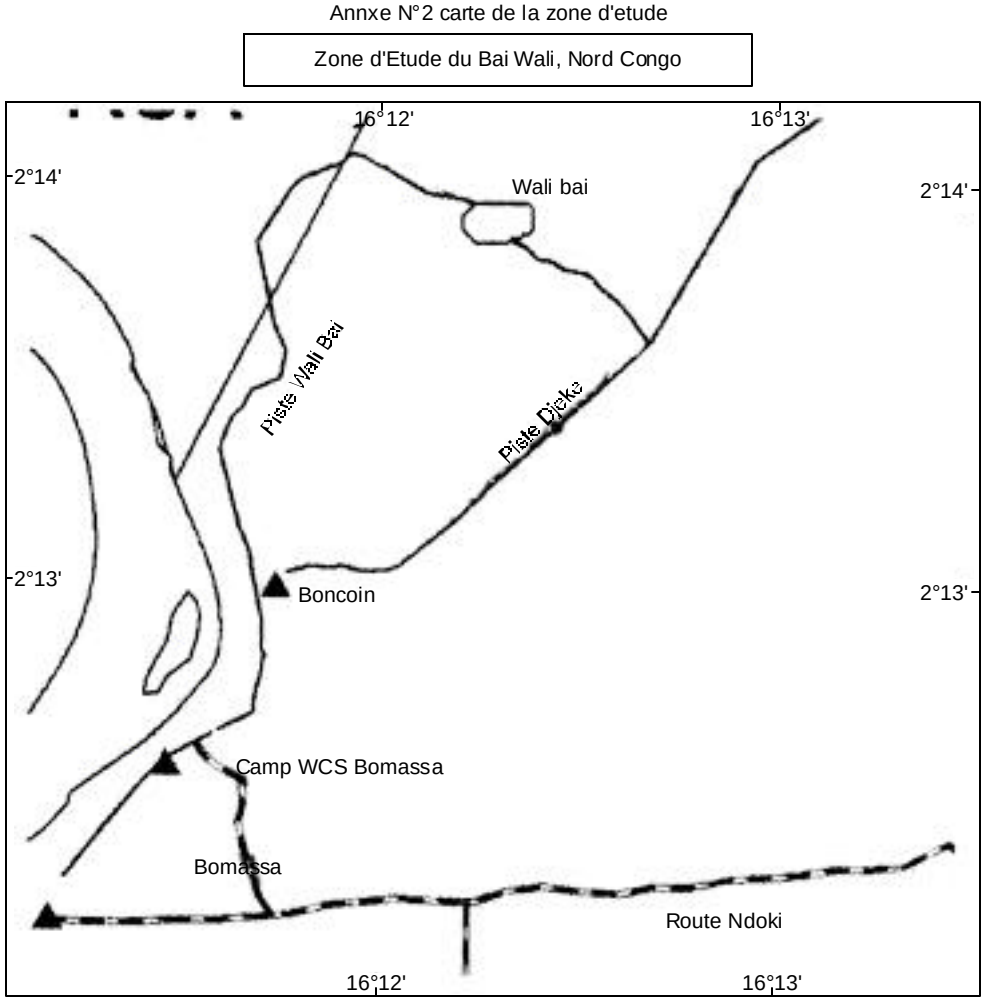

Fig. 1: Localization of the survey zone

Description of the biotic environment

Vegetation: The vegetation of the survey zone, more precisely on the course of the two tracks (Wali and Djéké) is represented by four types of formations: The Marantacée forest, the secondary forest, the swampy forest and the *Gilbertiodendron dewevrei* forest. This last belt the bay of Wali on a ray of more than 2km. However the lower stratum presents one coins wood clear, easy to penetrate and to walk. This forest is dominated by the *Gilbertiodendron dewevrei* (Limbali) with 99% of trees, followed of some cashes as the Ilomba (*Pycnanthus angolensis*), (*Manilkara koechlinii*) and other. The Marantacée forest or mixed forest represents 41%, it is composed of several cashes of trees and the different lianas. Besides his/her/its coins wood is dominated entirely by the different species of Marantacées knowledge: *Haumania dankelmaniana*, *Sarcophynium* sp, *Trachyphorynium* sp, *Megaphynium macrostachyum* and some Zingiberacéeses. *Aframomum* spp, *Palisota ambigua*, *Palisota brachytrasa*, *Costus* spp. The secondary forest represents 4%, it is around the Boncoin village on a ray of less 200 m. She/it is composed largely the secondary gases, the lianas, the bushes and of the adventitious. The swampy forest represents 2%, it edges the Wali river on a distance of at least 100 m. She/it contains a number impressive of palm Raffia in particular.

Fauna: The biologic potentialities of the Bay of Wali and his/her/its vicinities are varied very. She/it is one of the rare places of the forests of Central Africa where fauna remained intact. The Bay and his/her/its vicinities are populated strongly in mammals of which the Gorillas, the Chimps and especially the forest Elephants, that the origin, had motivated the creation of the National Park of Nouabalé Ndoki. Has these species himself ajoutent.les Birds, the Reptiles and fishes (Oko, 1989; Fay *et al*., 1990).

The reptiles are represented by numerous families of which the main is the family of Crocodilidé (*Osteolaemus tetraspis* or dwarf Crocodile).

Material: To really lead our survey on the land, we used the material below: one camera, a pair of twins of Pentax mark 10 x 42.50°, a card of the survey zone, a topofil with a string made of cotton, a compass, of the cards of hold of information, a roller of ribbon in red color plastic and an indelible black scorer.

Principle and method of the linear transacts: On the land, we used the method of the linear transacts. By definition, a transect is a unit of sampling that consists in parallel lines, active of an extremity of the zone of census while the other generally forming a system of grid. The big mammal inventory in the case of our survey concerned a peripheral zone of the National Park of Nouabalé-Ndoki: the Bay of Wali and his/her/its periphery. The utilized method is already the one of the linear transacts with Distance Sampling tested with success in the ecosystems of savanna. It is on foot about a sampling along a linear transect.

Indeed, a straight line named linear transect is browsed by a team who has for mission to harvest the information below: the cashes animal views, sensible or their signs (droppings, prints), the hour exact which the observation has been made; the perpendicular distance, measured between the line of march (transect) and the place where the animal (or the sign) has been seen; the type of vegetation where the animal (or the sign) is; the meteorology; the distance covered by the observer on the transect.

The first operation on the land was, strictly reserved the recognition of the course and the stratification of the zone. As for the second operation, she/it consisted to label and to mark the two tracks (Wali and Djéké) distant of 3 km each.

Has every 25 meters, one attaches a label (red ribbon in plastic carrying the precise distance of the labeled point, on the trunk of a tree of small diameter à man's height (1.20m). Next, we can normally execute our survey according to a weekly program.

Observation on the tracks of Wali and Djeke: Our information have been collected from January 15 to April 15, 2010, either during three (3) month.

The collection of the information, on the set of the two tracks makes itself every Tuesday from 7 hrs. On a total of 6 km, either 3 km for every track, we collect the information below: imprinted and droppings. We also record the cashes views as well as those sensible by deduction of their vocalizations.

Observation in the Bay of Wali: The observation in the Bay of Wali that takes place every Monday, makes itself from a watchtower constructs in border of the Bay. She/it lasts of 7 hours to 12 hrs without interruption. Provided of a pair of twins and an Observation" card ", the foreman sweeps the whole Bay.

Observations around the Bay of Wali: This observation makes itself around the Bay of Wali after the first left of the operation that be - à to say after the observations on the tracks of Wali and Djèké. She/it consists to record the tracers observed on the two strands of the Bay.

Data processing: The collected information have been interpreted with the help of the indication of abundance or kilometer numbering indication (ICK) and the ecological indication or ratio of preference of ® habitats. The indication of abundance or kilometer numbering indication corresponds the rates of meeting of a certain type of observation (droppings for example) for a given species, à numbers it of observations considered by covered kilometer.

His/her/its formula is:

$$ICK = \frac{Ni}{lj}$$

Where:

Ni = Number of observations considered for the I species;

lj = Length in kilometer of the unit of inventory considered.

With regard to the ecological indication or ration of preference of ® habitats, he/it calculate himself/itself according to the formula:

$$R = \frac{di/D}{hi/H}$$

Where:

di = Number of indications observed in the I habitat;

hi = Number of observed habitats;

D and H respectively total number of indications and total number of habitats.

RESULTS

Results of the big mammal observations on the tracks of Wali and Djeké

Direct observation results: The results of the direct observations of the big mammals on the tracks of Wali and Djeké are consigned in the Table 1. The exam of the Table 1 watch that globally one observed eleven (11) species different from big mammals of which fifteen (15) individuals out of the track of Wali and seven (7) on the one of Djeké.

While analyzing the indications of abundance of the species, one notes that *Colobus guereza* (ICK = 0.272)

Table 1: Results of the direct observations of the big mammals on the tracks of Wali and Djeké

No	Observed species	Track of Wali	Track of Djeké	Total of observation	Indication of abundance
1	*Cephalophus dorsalis*	1	0	1	0.045
2	*Cephalophus monticola*	1	0	1	0.045
3	*Cercopithecus diane*	1	1	2	0.090
4	*Cercopithecus cephus*	2	0	2	0.090
5	*Cercopithecus neglectus*	2	0	2	0.090
6	*Cercopithecus nictitans*	2	1	3	0.136
7	*Cercopithecus pogonias*	1	1	2	0.090
8	*Colobus guereza*	5	1	6	0.272
9	*Euxerus erytropus*	0	1	1	0.045
10	*Gorilla gorilla gorilla*	0	1	1	0.045
11	*Syncerus caffer nanus*	0	1	1	0.045
Total		15	7	22	1.00

Table 2: Results of the observations indirect of the big mammals on the tracks of Wali and Djeké

		Number of indications or tracer			
No	Species	Track of Wali	Track of Djeké	Total of observation	Indication of abundance
1	*Atherurus africanus*	4	0	4	0.009
2	*Cephalophus dorsalis*	58	108	166	0.384
3	*Cephalophus monticola*	37	33	70	0.162
4	*Cephalophus sylvicultor*	2	12	14	0.032
5	*Genetta sp*	0	1	1	0.002
6	*Gorilla gorilla gorilla*	6	13	19	0.043
7	*Hyemoschus aquaticus*	5	1	6	0.013
8	*Loxodonta africana cyclotis*	36	34	70	0.0162
9	*Panthera pardus*	4	3	7	0.016
10	*Potamochoerus porcus*	2	2	4	0.009
11	*Profekis aurata*	0	1	1	0.002
12	*Syncerus caffer nanus*	23	13	36	0.083
13	*Tragelaphus euryceros*	4	27	31	0.710
14	*Viverra ou Civettictis civetta*	2	1	3	0.006
Total		183	249	432	1.000

and *Cercopithecus nictitans* (ICK = 0.136) have been seen more that all other species. One deducts some that these two species are the most abundant in the zone of survey. On the other hand, all other species views of which the indications of abundance vary between 0.045 and 0.090 were less seen.

Indirect observation results: The indirect observations in the zone of survey are based solely on the indications or tracers collected to know the prints and the big mammal droppings observed on the tracks of Wali and Djeké. The results of these observations are represented in the Table 2.

The analysis of the Table 2 shows that fourteen (14) species different big mammals let 432 tracers of which 249 on the track of Djeké and 183 on the one of Wali.

While examining the indications of abundances by species, one notes that *Cephalophus dorsalis* (ICK = 0.384, *Cephalophus monticola* (ICK = 0.162) and *Loxodonta africana cyclotis* (ICK = 0.0162) let more of tracer that the other species. One deducts some that these three species are the most abundant in the zone of survey. They are followed by two other species at knowledge: *Syncerus caffer nanus* (ICK = 0.83) and *Tragelaphus euryceros* (ICK = 0.71). The nine (9) other species let less tracers. Their indications of abundances vary between 0.002 and 0.009. One can deduct that these species are less abundant than the five (5) firsts.

Main cash abundance observed according to the habitat: We didn't harvest and analyzed the tracers that of six (6) species at knowledge: *Cephalophus dorsalis*, *Cephalophus monticola*, *Cephalophus sylvicultor*, *Syncerus caffer nanus*, *Tragelaphus euryceros* and *Loxodonta africana cyclotis*. The abundance of these species observed in the four habitats identified at knowledge: swampy forest, secondary forest, Marantacée forest and *Gilbertiodendron dewevrei* forest is estimated through the indications or tracers harvested in every habitat.

The tracers of these six (6) species are consigned in the Table 3. The exam of the Table 3 rises that no trace has been harvested in the swampy forest. The tracers of two cashes at knowledge *Cephalophus dorsalis* and *Loxodonta africana cyclotis* has been harvested in three

Table 3: Main cash abundance observed according to the habitat

No	Observed species	Type of habitats	Number of tracer observed	Percentage	Indication of abundance
1	*Cephalophus dorsalis*	Swampy forest	0	0.00	
		Secondary forest	2	1.20	
		Marantacée forest	96	57.70	2.3
		Gilbertiodendron forest	68	40.95	
2	*Cephalophus monticola*	Swampy forest	0	0.00	
		Secondary forest	0	0.00	
		Marantacée forest	38	53.00	0.9
		Gilbertiodendron forest	32	45.00	
3	*Cephalophus sylvicultor*	Swampy forest	0	0.00	
		Secondary forest	0	0.00	
		Marantacée forest	10	68.42	0.1
		Gilbertiodendron forest	4	28.56	
4	*Syncerus caffer nanus*	Swampy forest	0	0.00	
		Secondary forest	0	0.00	
		Marantacée forest	7	17.94	0.5
		Gilbertiodendron forest	32	81.94	
5	*Tragelaphus euryceros*	Swampy forest	0	0.00	
		Secondary forest	0	0.00	0.4
		Marantacée forest	6	19.34	
		Gilbertiodendron forest	25	80.64	
6	*Loxodonta africana cyclotis*	Swampy forest	0	0.00	
		Secondary forest	2	2.85	
		Marantacée forest	40	57.13	2.2
		Gilbertiodendron forest	28	39.99	

formations that are: secondary forest, Marantacée forest and *Gilbertiodendron dewevrei* forest. On the other hand, the tracers of the four (4) other species: *Cephalophus monticola*, *Cephalophus sylvicultor*, *Syncerus caffer nanus* and *Tragelaphus euryceros* are solely present in the Marantacée forest and the *Gilbertiodendron dewevrei* forest.

The exam of the tracers in every habitat raises that the habitat preferred of the *Cephalophuses dorsalis*, *Cephalophus monticola* and *Cephalophus sylvicultor* is the Marantacée forest with respectively of the percentages of abundance indication of: 57.7%, 53%, and 68.40% against 40.95%, 45% and 28.56% for the *Gilbertiodendron dewevrei* forest.

Syncerus caffer nanus and *Tragelaphus euryceros* prefer the *Gilbertiodendron dewevrei* forest with percentages of 81.94% and 80.64% against 17.94% and 19.34% for the Marantacée forest.

Finally, the habitat preferred of *Loxodonta africana cyclotis* is the Marantacée forest (57.13% against 39.99% for the *Gilbertiodendron dewevrei* forest. 2.85% only for the secondary forest.

Situation of the mammalian big others on the tracks of Wali and Djeké:

***Pan troglodytes* (Chimp à lucid face):** In the setting of our survey, no sign of Chimp has been recorded on the tracks of Wali and Djeké.

***Gorilla gorilla gorilla* (Gorilla of plain of the west):** On along the tracks of Wali and Djeké, the tracers of Gorilla have been observed ten nine (19) time of which six (6) in Marantacées forest and thirteen (13) time in à *Gilbertiodendron dewevrei* forest.

***Panthera pardus* (Leopard):** The tracers of the Leopard have been observed seven (7) times of which four (4) in Marantacées forest and three (3) in *Gilbertiodendron dewevrei* forest.

Results of the direct observations of the big mammals in the Bay of Wali: The results of the direct observations of the big mammals in the Bay of Wali are consigned in the Table 4.

The exam of the Table 4 shows that nine (9) species have been seen in the Bay of Wali. Among these species, *Syncerus caffer nanus* was the more view (n = 97). This species was followed by *Colobus guereza* (n = 20) and finally *Colobus badius* (n = 8). On the other hand, the six (6) other species that had been seen one or three (3) times are not only frequent the Bay of Wali.

Results of the big mammal observations around the Bay of Wali: The results around the Bay of Wali consisted to record the tracers along the strands of the Bay. This supplementary survey looked for to detect and to confirm the animal species that come early the Bay the morning or the after noon before the arrival and the departure of the observers; during the night or during the week notably the dead days that be - to say non retained for the observations. The famous Table 5 the observed species tracers.

Table 4: Results of the direct observations of the big mammals in the Bay of Wali

No	Species	Seen	Vocalization	Total	Indication of abundance
1	*Cercocebus albigena*	0	1	1	0.007
2	*Cercopithecus neglectus*	0	3	3	0.021
3	*Cercopithecus nictitans*	0	3	3	0.021
4	*Colobus badius*	7	1	8	0.065
5	*Colobus guereza*	17	3	20	0.162
6	*Gorilla gorilla gorilla*	0	2	2	0.016
7	*Lutra maculicolis*	2	0	2	0.016
8	*Pan troglodytes*	0	3	3	0.021
9	*Syncerus caffer caffer*	97	0	97	0.788
Total		123	16	139	1.000

Table 5: Different types of tracer of the big mammals around the Bay of Wali

No	Identified species	Imprinted	Droppings	Total	Indication of abundance
1	*Atilax paludinosus*	3	0	3	0.009
2	*Cephalophus dorsalis*	25	2	27	0.081
3	*Cephalophus monticola*	13	0	13	0.039
4	*Cephalophus nigrifrons*	2	0	0	0.006
5	*Colobus guereza*	1	0	1	0.003
6	*Herpestes naso*	3	0	0	0.009
7	*Herpestes sanguineus*	1	0	1	0.003
8	*Hyemoschus aquaticus*	5	0	5	0.015
9	*Loxodonta africana cyclotis*	46	4	50	0.150
10	*Pan troglodytes*	1	0	1	0.003
11	*Panthera pardus*	3	0	3	0.009
12	*Potamochoerus porcus*	3	0	3	0.009
13	*Profelis aurata*	2	0	2	0.006
14	*Syncerus caffer nanus*	114	33	147	0.442
15	*Tragelaphus euryceros*	71	0	71	0.213
Total		293	39	332	1.000

The exam of the Table 5 raises that except the observed species directly in the Bay, there are other species that frequent the Bay during the days and hours closed of the survey.

Thus, we identified twelve (12) species. It is about of: *Atilax paludinosus*, *Cephalophus dorsalis*, *Cephalophus monticola*, *Cephalophus nigrifron*, *Herpester noso*, *Herpester sanguineus*, *Hyemoshus aquaticus*, *Loxodonta africana cyclotis*, *Panthera pardus*, *Potamochoerus porcus*, *Profelis aurata* and *Tragelaphus euryceros*.

Besides the presence nearly regular of the *Syncerus caffer nanus* around the Bay, the other cash frequency in this middle shows its tropic importance in the life of the animal cashes of this part of the National Park of Nouabalé Ndoki.

DISCUSSION

The results of the inventory that we did in the Bay of Wali and his/her/its periphery indicate thirty one (31) species different from big mammals, what reveals the wealth faunique of this zone.

These results confirm the previous works notably those of Oko, 1989; Fay, 1993 on the big mammal diversity in the North part of Congo in general and in our zone of survey in particular.

The company raised of the big mammals in this zone seems closely linked at least four factors knowledge: the food needs and in mineral salts, the bodily cares and the type of plant formation.

The look of this hypothesis, he/it is question to bring a particular attention on some charismatic species observed in order to confirm or to invalidate the advanced hypothesis.

***Loxodonta africana cyclotis* (forest Elephant):** Our results of inventory of *Loxodonta africana cyclotis* confirm the works of (Fay, 1993) on the abundance of the forest Elephants in this zone. Indeed, the previous studies led the periphery of the National Park of Nouabalé Ndoki on the densities of the forest Elephants, raised the existence of a strong density of this species. Otherwise, these works had established the relation between this concentration and the remoteness of the villages. Indeed, (Fay, 1993) cities by (Moukassa and Madzou, 1998), had noted that the density of the forest Elephants increases with the remoteness of the village. Our works seem to confirm this result.

While analyzing the Table 2, even though the difference is not meaningful, one notes that one saw more tracers of Elephants on the track of Wali that is more distant of the Boncoin village that on the one of Djeké situated close to the village.

However, so in the case of the works of (Fay, 1993) the concentration of the forest Elephants is bound the remoteness of the villages, in our case, this

concentration seems to be influenced by the type of plant formation (Table 3). Indeed, the exam of the Table 3 shows that if the Elephant is present in three types of forests: secondary, Marantacée and *Gilbertiodendron dewevrei* one observed it more in the Marantacée forest. The previous study results, the type of plant formation come to be added therefore in the choice of the habitat preferred of the Elephant. But, in a case as in the other, this choice is quite dictated by factors different.

In the case of the works of (Fay, 1993) one thinks that the forest Elephants move away of the villages to occupy the habitats where they feel in security, that be - to say the zones where there are not any named traps mines locally.

Indeed, each knows that the forest Elephants are the big devastating of the cultures of the villagers. To remedy there, these put all ways of traps in order to move away them of their cultures. It is not therefore a luck that the Elephants move away of the villages and concentrates in these habitats.

In the case of our works, the concentration of the forest Elephants in the Marantacée forest justifies itself by the abundance of food that one finds in this plant formation. Indeed, the Marantacée forest is a dense, shaggy forest where develop himself all ways of vegetations of which eat the forest Elephants. It is not the case of the *Gilbertiodendron dewevrei* forest whose undergrowth is naked, without fodder.

The Bovidéses: The rate of meeting of the Bovidéses à knowledge: *Cephalophus dorsalis, Cephalophus monticola* and *Syncerus caffer nanus* is very weak (Table 1). On the other hand, their indications of abundance are raised very on the tracks (Table 2). Two reasons seem to justify this situation.

The first is that some species are less active the day, on the other hand they are more active the night. It is the case of *Cephalophus sylvicultor* that spends his/her/its days to sleep and becomes very active since the fall of the night. Such a species won't be seen the day.

The second reason seems to be bound it political of a good management in the withdrawal of the game instituted the periphery of the National Park of Nouabalé Ndoki by the driver of this protected area, notably the interdiction of the pose of traps cables.

The analysis retailed of the Table 1 and 2 raises that the *Cephalophus* kind is very abundant in the zone of survey with the exception of *Cephalophus sylvicultor*.

Tragelahus euryceros is very rare in direct observation. It appears us like an evidence because this animal is very discreet and he escapes himself/itself of it since the least alert. It is not therefore astonishing that he/it prefers the *Gilbertiodendron dewevrei* forest where the danger is easily audible because of the undergrowth that is very clear.

***Syncerus caffer nanus*:** This presents very impressive result species even though the rate of meeting on the tracks was weak. On the other hand, the indication of abundance of the tracers in the Bay and around the present Bay a very elevated rate.

These preferences of *Syncerus caffer nanus* explains themselves on the one hand by the fact that this species likes to sprawl in the mud in order to eliminate some interferences as the ticks, the fleas. Then, she/it takes her/its sunbath. One can affirm therefore that it is for bodily cares that this frequent species regularly the Bay of Wali. On the other hand, the rays of the sun that cross the tablecloth of water of the shallow Bay, facilitate the numerous algae development of which she/it eats. Finally, the water of the Bay is rich in mineral salts. *Syncerus caffer nanus* can satisfy its needs therefore in mineral salts without browsing long distances.

All these united assets make that this species stays there more frequently in and around the Bay of Wali.

Conclusion and perspectives: The Bay of Wali is situated at the periphery of the National Park of Nouabalé Ndoki, one of the biggest areas protected from Congo. Our survey to consist to inventory the big mammals who frequent this strategic zone and to classify them according to their ecological dog houses. The results confirmed the presence of several species of big mammals and their preferences for very determined habitats.

These preferences seem to be guided by the food needs and in mineral salts, the bodily cares as well as the type of plant formation.

So *Cephalophus dorsalis*, *Cephalophus monticola*, *Cephalophus sylvicultor* and *Loxodonta africana cyclotis* prefers the forest Marantacée, *Tragelaphus euryceros* adores the forest *Gilbertiodendron dewevrei* whereas *Syncerus caffer nanus* prefers the baths in full Bay of Wali.

This survey that had the merit to inventory the big mammals of the periphery of the National Park of Nouabalé Ndoki, debit to be completed by detailed works structural on the daily and seasonal big mammal visits in and the periphery of the Bay of Wali in order to offer an exploitable tourist bouquet in all season.

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