

Ethnozoological uses of common hippopotamus (*Hippopotamus amphibius*) in Benin Republic (Western Africa)

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Hippopotamus amphibius is the 3rd largest and heaviest terrestrial mammal after elephants (*Loxodonta africana*) and white rhinos (*Ceratotherium simum*) in Africa. This investigation conducted in the Benin Republic aims to assess the local inhabitants' traditional knowledge associated with hippo in different use categories (medicinal, cultural and spiritual). Data were gathered using ethnozoological questionnaires. One hundred and fifty informants from 13 ethnic groups in Benin were randomly selected and interviewed. Chi square test was used to analyze the answers given regarding the uses categories of hippo. Principal Correspondence Analysis was used to describe traditional beliefs associated with hippo according to the ethnic groups. Results revealed seven use categories for hippo. A significant difference was observed between age groups ($\chi^2 = 27.537$; $p = 0.027$; $dF = 2$) regarding use categories. But no significant differences were found between ethnic groups ($\chi^2 = 16.437$; $p = 0.057$; $dF = 12$) for the use categories. The Principal Component Analysis revealed differences in traditional beliefs associated with hippo. For example, the male adult *Yoruba* and *Adja* regard hippo as cruel and diabolic animal. The *Fon* and old men from *Idatcha*, *Aizo*, *Mahi*, *Goun*, *Holly* and *Cotafon* ethnic groups have considered hippo as saviour, protector and fetish.

Keywords: *Hippopotamus amphibius*, Ethnozoological, Use value, Traditional belief, Benin

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Since a long time ago humans have maintained vital relationships with many wild mammals as demonstrated by wildlife paintings on rock and others representations since prehistorical time^{1,2}. Wild mammals have been used as a source of income, food and medicine, as a cultural symbol or as charms^{3,4,5}. Wildlife based on tourism is another important aspect of the human-animal relationships and contributes significantly to national incomes and is a key foreign currency earner in a number of countries^{6,7}.

Lately, several articles were published in different countries on the past and present interrelationships between human cultures and the animals in their environment^{8,9,10}. In fact, over the last decades several studies have considered that the degradation of traditional knowledge is a process which has many consequences on wildlife conservation¹¹. These studies also show that ethnozoology approach is appropriate to define ecological, sociocultural and human aspects related to wildlife conservation and

management and provides a better comprehension about the roles played by animals in a specific cultural context. Unfortunately, traditional knowledge has not been considered by the scientific community^{12,13}. Similarly, ethnobotany has been prioritised over ethnozoology in Benin. However, recently the phenomenon of zotherapy has aroused the interest of many Beninese researchers¹⁴. This study aims to improve our traditional knowledge for hippo parts use in the religious ceremonies and traditional medicine.

The hippo (*Hippopotamus amphibius*) belongs to the family of Hippopotamidae and is the 3rd largest and heaviest land mammal after elephants (*Loxodonta africana* Annon) and white rhinos (*Ceratotherium simum* Burchell) in Africa. Hippo was categorised as vulnerable on the IUCN Red List in 2006¹⁵. In Benin, hippo as a whole vitally important to the practices of traditional medicine, beliefs, customs and spirituality. However, the lack of appropriate information on species ecology, biology, threats and the interrelationships between humans and hippo constitute serious hindrances for their conservation.

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Despite its current status in the Benin Red List Book as Endangered species, the hippo (*Hippopotamus amphibius*) remains a less studied species and data are missing to implement strategic actions and tools for its sustainable conservation and to curb the threats the species is currently facing in Benin. Somehow, if early strategic actions are not implemented the conservation status of the species may change from vulnerable to endangered status and ultimately extinct in wild in Benin.

Methodology

Study area

The Republic of Benin in West Africa is situated between 6°-12.25°N and 0.40°-3°E (Fig. 1). The country is bordered by Burkina Faso and Niger to the North, the Atlantic Ocean to the South, Nigeria to the East and Togo to the West.

The study area is subdivided into three major climatic zones: The climate type in the southern zone is subequatorial with two rainy seasons alternating with a long dry season (December-March). The short dry season (July-August) rarely exceeds two months¹⁶. In the northern zone, it is of tropical type with one rainy season and one dry season. In the transition zone, the climate becomes sub-humid or sub-tropical with a characteristic pattern of one rainy season and one dry season¹⁶. The mean annual rainfall

varies from 900 mm in the tropical zone and can reach 1,500 mm in the subequatorial. The mean annual temperature ranges from 26 to 28 °C.

The topographical variation in the country has resulted into the diversity of habitats, flora and fauna. The plant diversity of the country is represented by more than 2807 plant species¹⁷, while the fauna diversity is represented by about more than 224 mammals¹⁸, 52 amphibians¹⁹. According to the 2013 census the total human population of the country is about 10,008,749 inhabitants²⁰.

From socio-cultural point of view, Benin presents great ethnic and cultural diversity. The dominant ethnic groups in the study area are: *Fon, Sahouè, Kota-Fon, Mina, Watchi* and *Xwla, Nagot, Yorouba and Mahi*. The dominant livelihood activity is rain-fed crop production (maize, legumes, manioc, ground nuts, amongst others) in traditional shifting cultivation systems (agroforestry systems).

Sampling

Ethnobiological surveys were based on a simple random sampling. The number (n) of the informants to be surveyed was determined using the normal approximation of the binomial distribution. Such as the Benin population size (N) is known, expression (1) is used to determine the approximate sample size (n).

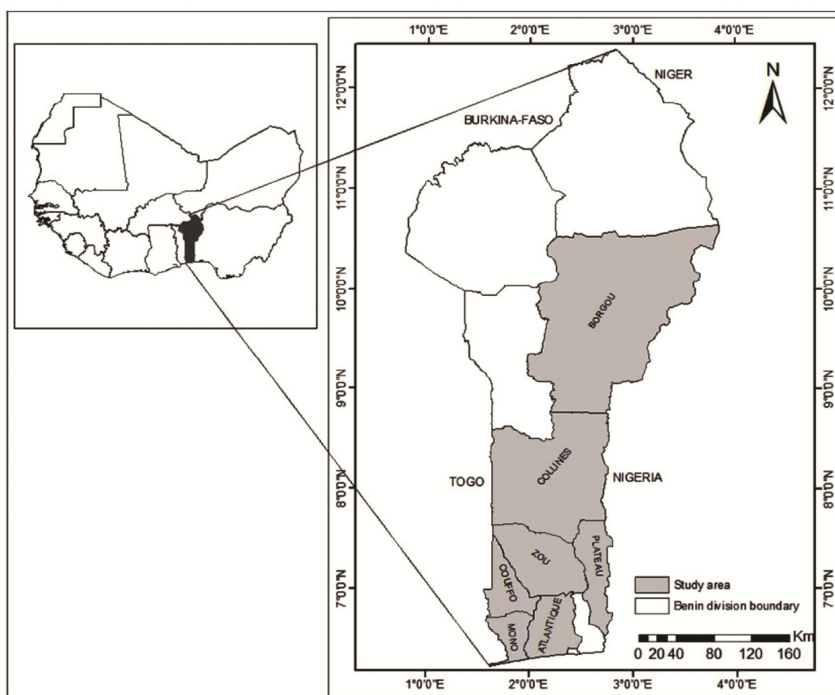


Fig. 1— Map of study area

$$n = \frac{N \cdot p(1-p)}{(N-1)(\frac{d}{z_{\alpha/2}})^2 + p(1-p)} \quad \dots(1)$$

where, n is the estimated sample size; $Z_{\alpha/2}$ value obtained from the table of standard normal distribution of $\alpha=0.05$; $Z_{\alpha/2} = 1.96$; p is the proportion of people who had knowledge hippo ($p = 0.46$; result from a preliminary survey); d is the expected error margin of any parameter to be computed from the survey, which is fixed at 0.08 and N is Benin population size ($N = 10,008,749$ inhabitants; result from RGPH4). The sample size equaled to 149.099 people and round to 150 people.

Data collection

Ethnozoological surveys were conducted during the period from November 2015 to January 2016. Structured interviews using questionnaires were carried out with 150 informants. Respondents were randomly selected according to ethnic groups. The sample size was proportional to the socio-linguistic group size in Benin.

The key questions that were addressed to the respondents concerned: (i) use categories (curse/blessing, food, poison, protection against evil influences, religious ceremonies, traditional medicine and witchcraft). Respondents were requested to provide a score for each use category. The scoring scale ranged from 1 to 3 (1= low importance of the use, 2 = average importance of the use and 3 = high importance of the use), (ii) animal parts having medicinal properties, (iii) the ailments cured by animal parts and how the medicines were prepared and administered.

Data analysis

The different uses reported by the respondents (detailed uses) were grouped into the following general categories of use: traditional medicine, food, poison, protection against evil influences, bad witchery, religious ceremonies, curse/blessing. Citation frequency were calculated to estimate the cultural importance of hippo:

Citation frequency

The citation frequency of use categories (CF) from hippo was evaluated through the response rate according to the formula (2):

$$CF = \frac{N_i}{N} \times 100 \quad (2)$$

N_i : the number of respondents who responded positively to use of hippo for specific use categories; N : the total number of respondents.

CF = 0 indicates that the hippo part is not used in this category;

CF = 100 when this use category was indicated by all respondents.

Chi-square test was performed to evaluate the association of the response rate to ethnic groups and informant's age.

Traditional beliefs associated with common hippopotamus

The respondents were categorised according to ethnic group and age into six subgroups of young men (M1) and young women (F1) 35 yrs, adult men (M2) and adult women (F2) about > 35 yrs old to 55 yrs, old men (M3) and old women (F3) > 55 yrs. Thus, we constituted 78 subgroups (13 ethnic groups \times 6 subgroups). The percentage of positive responses for each modality of the variables related to traditional beliefs associated with hippo was determined for each of the 78 subgroups. Principal Component Analysis (PCA) was performed on the data using FactoMineR package in R.

Results

Uses categories of common hippopotamus

Common hippopotamus parts were determined to be used for different purposes. The respondents indicated some of the uses as religious ceremonies (84.67 %), traditional medicine (79.33 %), protection against evil influence (70.67 %), tourism (38 % of informants) and food (20.67 %). Other use categories such as witchcraft, curse/blessing and utilisation as a poison were seldom mentioned by the informants (Fig. 2). A significant difference existed between age groups ($\chi^2 = 27.537$; $p = 0.027$; $dF = 2$) regarding hippo use categories. In fact, 100 % of the old men mentioned the use of hippopotamus parts in bad witchcraft, curse/blessing and utilisation as poison while just 1 % of young men mentioned these use categories. No significant differences were found between ethnic groups ($\chi^2 = 16.437$; $p = 0.057$; $dF = 12$) for the use categories.

Hippo parts use in each use categories

From the ethnozoologic interviews, it was established that 15 body parts of hippo were used in the various use categories. The tongue, bone, skull, lips, tail, ears, bile and genital organs are key

zootherapeutic parts derived from hippo which are used in traditional medicine. These body parts of hippo are also the constitutive elements of fetishes (religious ceremonies) and occult practices (poison, curse/blessing, bad witchery and protection against evil influences). As shown in Table 1, many parts of the hippo body were used for treatment of diseases such as rheumatism, measles and possessed or haunted people.

Traditional beliefs associated with common hippopotamus

The Principal Component Analysis revealed three categories of beliefs about hippos. The first three axes explained 66.71 % of the observed variation. Table 2 presents the correlation coefficients between the traditional beliefs associated with common

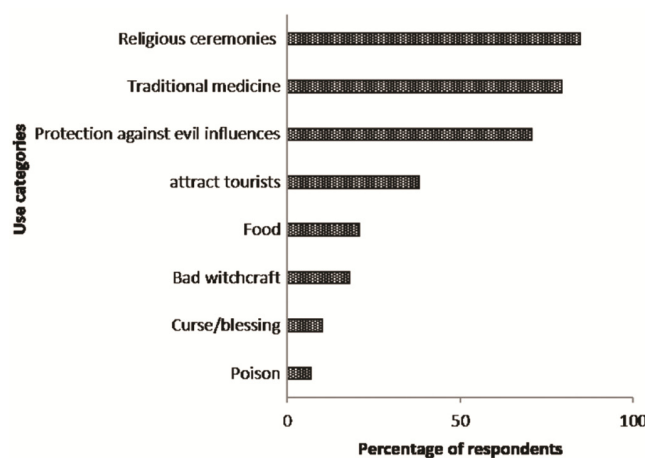


Fig. 2 — Percentage of response of informants in different use categories

Legend: *Adja, Aizo, Bariba, Cotafon, Fon, Goun, Holly, Idatcha, Mahi, Mina, Nago, Oueme, Yoruba* represent the surveyed ethnic groups. Letters M1, M2, M3 after each ethnic group represent respectively young, adult and older man whereas F1, F2, F3 after each ethnic group represent respectively young, adult and older woman.

hippopotamus and these three PCA axes. The correlation of the Principal Components to each variable category suggests that PC1 reflected Spiritual beliefs; PC2 the traditional story that narrates a common belief or explains some natural phenomenon but unsubstantiated and PC3 hippos-human relations. Fig. 3 displays the projection of the different ethnic subgroups and traditional beliefs associated with common hippopotamus in the system axes 1 & 2. Table 2 and Fig. 3 show that the male adult *Yoruba* and *Adja* (*Yoruba* M2 & *Adja* M2) consider hippos as cruel and diabolic animals. The *Fon* and old men from *Idatcha, Aizo, Mahi, Goun, Holly* and *Cotafon* ethnic groups have considered the hippo as a saviour, protector and fetish.

Discussion

Uses categories of common hippopotamus

Zootherapeutics is an important element of the cultural inheritance. A large proportion of African populations uses wild animals to treat diseases²¹. In

Table 2 — Correlations between traditional beliefs associated with hippos in Benin for the first 3 Principal Component (PC) axes

Traditional beliefs associated with hippos	Principal Component (PC)		
	PC1 Spirituality	PC2 Myth	PC3 Sociability
Protector	0.87	0.13	-0.01
Savior	0.59	0.42	-0.40
Fetish	0.87	0.08	-0.08
Not aggressive animal	-0.06	-0.47	-0.69
Cruel animals	-0.05	0.41	0.55
Pregnant women shouldn't see	0.19	-0.56	0.43
Devil	0.13	0.74	0.08
Not laugh at hippo	-0.37	0.58	0.40
Ordinary people shouldn't kill hippo	0.74	-0.29	-0.06

Table 1 — Hippo parts use in traditional medicine and their preparation and utilisation

Hippo parts	Diseases cured	Preparation and utilisation
Feaces	measles	Add feaces to water used to wash the child's body
	Getting rid of devils	Burnt feaces
Bones	Rheumatism	Put Bones + bark of <i>Borassus aethiopum</i> in water, then wash the body with the mixture
	Possessed or haunted people	Burning and inhaling the smoke
Lips + Tongue	Mental disorder	Hippo bone Burnt + <i>Rauvolfia vomitoria</i> root, then inhale the smoke
	Give speech power to king	Only high initiates know this preparation
Tooth	Give sexual power to men	Grind into powder with <i>Aframomum melegueta</i> + <i>Gardenia nitida</i> root, then lap up the powder

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