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Ethnoichthyology: Critical analysis and perspectives

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Abstract

Ethnoichthyology is a science that deals with the relationship between humans and fish species. It is essential for the construction of new knowledge. This synthesis proposes a critical analysis of existing studies on ethnoichthyology in order to identify gaps and guide future studies. The literature search was conducted using Google scholar and Agora. Synonyms of the words fish, ethnicity, knowledge and traditional were used to identify keywords. The identified keywords were entered into the English and French search engines. The literature search identified 237 documents on Agora and 71 documents on Google scholar. The documents selected for the systematic review are 31. The nomenclature of local fish names is related to morphological, behavioural or environmental traits of the fish. Fish species are used medicinally to treat many ailments including malaria, haemorrhoids, abdominal cramps and infections. Culturally, some species are used in wedding ceremonies, funerals, sacrifices etc. Very few documents in the literature deal with the cultural, medicinal and symbolic uses of fish. This synthesis evokes the need for a study of the classification value of local fish names without forgetting the socio-cultural, medicinal and symbolic uses of fish according to ethnic groups.

Keywords: Traditional knowledge; Ethnobiology; Ethnoichthyology; Ethnic group; Fish

1. Introduction

Since the dawn of time, people around the world have used their endogenous knowledge of nature's resources to meet many needs [1, 2, 3]. This endogenous knowledge has enabled them to explain the genesis of the various elements that make up their living habitats. These elements are stories, fables, and experiences of elders, responses to problems that occurred in ancient times and have been passed down through generations. This endogenous knowledge can take on different names depending on the field to which it belongs. When it is about biology, it is called ethnobiology. Ethnobiology is a key field of study for understanding patterns among living things, ecosystem management and conservation [4]. It provides society and the scientific community with new and useful information on all aspects related to plants and animals [5, 6, 4]. To this end, despite the proven efficacy and safety of modern medicine, rural people most often owe the maintenance and restoration of their health to the empirical use of potions concocted from plants and animal organs [7, 8, 9]. Similarly, it is the active ingredients of these local plants and animal organs that are now

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synthesized and used as pharmaceuticals for the treatment of many ailments around the world [10]. In Chinese and Indian society, knowledge on traditional medicine to cure ailments and knowledge on ethnoichthyology are used in modern medicine to find solutions to many problems in their society [8]. Thus, many researchers in the fields of science are involved in learning this knowledge to invalidate, confirm or integrate it in this modern society. In ethnoichthyology, it is the knowledge of medicinal, cultic, taxonomic, symbolic and ethnographic uses of fish populations.

In Benin, each tribe has its own collection of endogenous knowledge and very few of these tribes disclose this information to their descendants. Also, if this knowledge manages to be transmitted, it is modified by word of mouth. Thus, the endogenous knowledge they hold about ichthyofauna is lost from generation to generation even though it is needed to build new knowledge [11]. This endogenous knowledge about fish species has great utility in inducing equitable co-management between wildlife and fish populations [12].

It is therefore of interest for this synthesis to carry out a systematic review of the state of knowledge on population ethnoichthyology in order to highlight the missing information that needs to be developed for a significant advance in the field of ethnoichthyology

2. Material and methods

The information collected for this synthesis was obtained from the literature search performed on the Google scholar search engine and in the online database Agora. Indeed, Google scholar is a free search engine and the databases other than Agora available in the literature require passwords that we do not possess. The keywords were identified from the synonyms of the words: fish, ethnicity, knowledge, traditional. These keywords were identified in French and in English in order to list a good collection of information available in the literature. The following words were used in English: ethnobiology, ethnoecology, ethnoichthyology, People, tribe, population, villagers, Beninese, Nigerians, Ethiopians, Kenyans, Togolese, Africans, Asians, Europeans, fish, catfish, tilapia, *Oreochromis niloticus*, *Clarias gariepinus*, *Clarias ebriensis*, traditional taxonomy, traditional knowledge, fish symbolism, beliefs. These words and synonyms allowed us to establish the following research equation: (ethnobiology, ethnoecology, ethnoichthyology) OR (people, tribe, population, villager, Beninese, Nigerian, Ethiopian, Kenyan, Togolese, African, Asian, European) AND (fish, catfish, tilapia, *Oreochromis niloticus*, *Clarias gariepinus*, *Clarias ebriensis*) AND (traditional knowledge, symbolism, beliefs). Both primary and secondary sources of information found during the literature search were considered, regardless of the time period. All documents found on the subject were consulted and downloaded as the information obtained was limited. Each document was downloaded by search engine and all documents were classified according to each search engine. Within each search engine, the documents were also sorted by document type. For example, these were essays, journal articles, reports and books and duplicate documents were removed to avoid duplicate reading. Each document was read carefully and the most relevant ones were selected. The number of documents collected per search engine and the number of documents selected were tallied. A meta-analysis was performed with excel 2007 with the collected data to illustrate the proportions of the collected documents.

3. Results

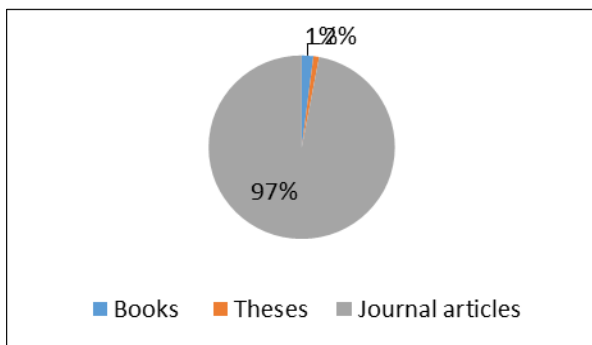


Figure 1 Percentage of documents obtained on Agora during the literature search

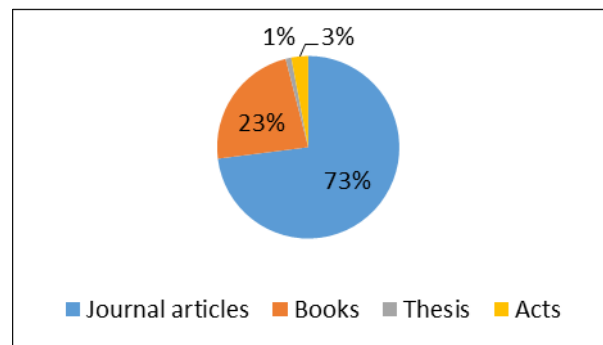


Figure 2 Percentage of documents obtained from Google scholar in the literature search

The literature search produced 237 documents on Agora, including four books (2%), two theses (1%) and 231 journal articles (97%) (Figure 1). The Google scholar search generated 71 different documents, including 52 journal articles (73%), 16 books (23%), one thesis (1%), and two reviews (3%) (Figure 2). After sorting, 31 documents dealing

specifically with the subject were counted and retained. These included 21 journal articles (67%), two theses (6%), six books (19%) and two conference proceedings (6%) (Figure 3).

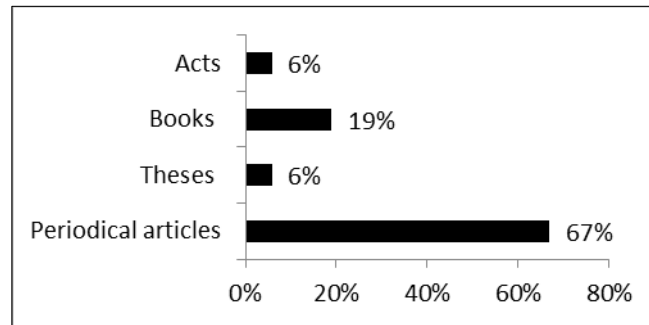


Figure 3 Number of articles identified in ethnoichthyology and selected for review

3.1 Concept of Ethnoichthyology

Aquatic ethnobiology is the study of the interrelation between humans and aquatic organisms. When it deals exclusively with fish, it is called ethnoichthyology. Ethnoichthyology is in fact a science defined as the set of endogenous knowledge that an ethnic group may have about different fish species [13, 14]. It can deal with several aspects concerning fish: the traditional nomenclature of fish species according to ethnic groups, socio-cultural and medicinal uses, and the symbolism of fish species according to tribes. Ethnoichthyology is also defined as a cumulative body of knowledge, practices and beliefs evolving through adaptive processes and transmitted from generation to generation through cultic means on the relationships of living beings (including humans) with each other and with their environment [4]. Paz and Begossi [15] defined it as a study of the perceptions that different Peoples have of fish organisms, in particular, how they classify these fish organisms. Many subdivisions arise from the concept of ethnobiology. There is ethnotaxonomy, which deals with peoples' knowledge of fish classification, and ethnofamilies, which refers to peoples' knowledge of families of fish groups [15]. There is also ethnospecificity, which refers to peoples' knowledge of fish species.

3.2 Traditional nomenclature of local names of fish species

From the point of view of the traditional taxonomy of local names of fish species, Bahuchet [13] in *Esquisse de l'ethnoichthyologie des Yasa du Cameroun* explained the origin of the following names the names given to fish by the Yasa people of Cameroon. He revealed that the names attributed to fish in this locality come from two etymologies. On the one hand, they may be composed from the environment of the fish (the water quality, the nature of the substrate of the waters bottom where the fish live, or the width) and on the other hand, other names are attributed to the fish taking into account their coloration or their shape [16]. Begossi and Garavello [17] in their study on the ethnoichthyological notes of the fishermen of the Tocantins River analyzed the way fishermen of the Tocantins River classify fish in order to find the criteria used by these fishermen to classify the fish and to compare them with the scientific classification. They found that fishermen in the Tocantins River mainly use morphological criteria to classify fish. *Laemolyta petiti*, called *piauboca-fin* in the local language by the fishermen of the Tocantins River, is a fish with a fin-like mouth. The *Cichlasoma spectabile* is a fish called *Caraboca-de-flor* because of its flower-shaped mouth. The second criterion used in the classification of fishes is the ecological aspect. This aspect mainly refers to the type of habitat where the fish is found, such as the lake. In this locality of the Tocantins River, the pigmentation of the fish and the level of importance of the fish are other criteria taken into account in the classification of fish. Indeed, some species of fish are classified according to their colors while others are classified taking into account the level of importance of the fish species. The species of fish most consumed and sold by the inhabitants of the Tocantins River are designated by the same name throughout the area. *Prochilodus nigricans* is called *Curimata* in the whole Tocantins River area [18]. Useless fish species or those with less known names are named according to the locality. For the fishermen of the Tocantins River, some fish represent fruits and land animals. *Piau caninana* is the name given to *Leporinus affinis*. This name represents the local name of a species of snake. Similarly, Piranha manga-rosa is the name given to the fish species *Serrasalmus nattereri*. The family names involved consist of *familia do/da* followed by the name of a generic-level taxon within the family.

Paz and Begossi [15] in the study titled *ethnoichthyology of galviboa fishermen from sepetiba bay, Brazil*, presented aspects of the taxonomy of Gamboa fishermen, including the criteria used in the identification of ethnoichthyological families. Nine fish families were selected and studied through an interview with the fishermen. These fish families were the shark and ray family named, *sororoca/cavala* (mackerel), *galo* (sunfish), *mira/garoupalbadejo* (groupers), *peixe-porco* (fish fillet), *linguado* (flounder), *xarcu/carapau* (jacks), and *cobra/morcia* (eel/cod). Gamboa fishermen adopt a

hierarchical classification, including ethnospecies (terminal Berlin taxa) within ethnofamilies (generic and intermediate Berlin folk taxa). Paz and Begossi [15] demonstrated that the names of fish families are given according to morphological aspects, flesh quality and ecological relationships. For morphological aspects, criteria for species classification can be based on the existence of scales. *Peixe de couro* or *depele*, means 'absence of scales'. The absence of scales is observed for filleted fish. As regards the quality of the flesh, *peixe-porco* means 'flesh with a strong taste'. This is the name given to the species of the ray family. It is linked to the ban on fish or food taboos. Another criterion taken into account is based on reproductive biology and ecological aspects, such as the observation that some fish have a low reproduction rate, or that other fish live there, or that groupers are not present in rocky places (*peixes de pedra*). The sharks are called *peixes de pedra*. This means that they live in the open sea. The fishermen of Sepetiba Bay in Brazil name the families of fish according to their use. Thus, some fish are separated into two classes. These are fish with medicinal value, which they call net fish, and fish with ornamental value, which they call balloon fish. Another criterion to be taken into account is the price of the fish on the market. A distinction is made between high-priced fish such as lead weights and groupers and low-priced fish such as rays. Fishing practices are another criterion used by fishermen to distinguish certain fish. Indeed, shrimp baits are used by fishermen in Sepetiba Bay to catch groupers; nets and baits are used to catch sharks; the high speed of sunfish makes them difficult to catch; mackerel have a jumping behaviour. In Sepetiba Bay, the moray eel family is called *mororo* and it includes Muraenidae, Ophichthidae and Gobiidae which represent the order Anguilliformes. The first criterion used to group them together is their snake-like shape. The stage of development is another criterion for grouping the fish. *Xareu* means large and is the name given to a large fish species. *xerelete* means a medium-sized fish species, and *olhudo* means a small fish. In the family Mugilidae, *Virote* and *tainha* are also forms of the same ethnospecificity: the former is the juvenile and the latter the adult of *Mugil platanus*. Marques [19] in his study entitled *Fishermen of the State of Alagoas in Brazil*, found that the family Mugilidae was separated by two distinct ethnofamilies: *familia da tainha* and *famflia do curimii*.

Doffana [20] in Ethiopia did the same by explaining the origin of the names of the fishes in Lake Zeway in *Zay* language. *Tilapia zilli* is called *Adisie*. This means a newly arrived species. The locals look exotic. This fish species is also called *Afrika* by the migrants of this tribe. They perceive this species as an African fish. *Clarias gariepinus* is called *ambaza*. This local name means black. This name was given not only because of its black coloration but also because of its ugliness and hostility towards the tilapia which is the endemic fish species of the locality. *Barbus* sp. is called *Aba Samuel* because it is native to Lake Aba Samuel.

In Benin, Djidohokpin et al. [21] interviewed fishermen in *Tovè* locality on ethnoichthyological issues of fishes in the *Tovè* River. They noted that the name *Hotoun* attributed to *Parachana obscura* is due to its snake-like morphology. *C. gariepinus* is named *Asson* and this name is due to its resemblance to the cat. *Brycinus longipinus* is locally called *Agontcha*. This name is related to the shape of its dorsal fin. *Labeo senegalensis* is called *Adahoué*. This name was given to it because of the numerous galls that cover its mouth. The name *Djan* attributed to *Chrysichtys auratus* is linked to the shape of its head. *Zegbin* is the name given to *Malapterus electricus*. This name was given because of the presence of electrical organs on this fish. *Synodontis schall* is called *Gloe*. This name was given because of the presence of a shield on the body. *Sarotherodon melanotheron* is called *Wè*. This name was given because of the presence of black spots on the operculum. *Houa* is the local name of *Heterotis niloticus*. It was given to it because it has the habit of hiding under marshy vegetation. *Hepsetus odoe* is called *Kaka-adou*. This name is related to the noise it makes when it is caught.

Jones et al [22] highlighted the knowledge of traditional nomenclature of the First Nation of British Columbia. Two peoples were considered: the *Haida* and the *Tsimshian*. Among the *Haida*, fish nomenclature appears to be complicated by dialectal differences and the lack of a standard phonology and dictionary. For example, the coho salmon that is caught during the month of November is named *Gaayda dahlgyang*, which means needle fish in the belly of the coho. This name was given to it because of its exclusively plant-based diet. It is an herbivorous fish that only appears at this time of the year. Another species of coho salmon is found in the waters between January and February. It is called *ts iing k iiga*, which means sharp tooth. The *Haida* believe that this is a metamorphosis of the coho salmon after it has completed its round and returned to freshwater, changing its diet to carnivorous. *Squalus acanthias* is called *K'aaxada* which means dogfish. This name is given to all species resembling this shark. This shark is called in *Haida* dialect: dogfish. The black-eyed perch *Cymatogaster aggregata* is called *gaadaa* which means white. This name was given to it because of its appearance. The black cod *Anoplopoma fibria* is called *skil*. This local name was given to it because of the name *skil* that researcher James Swan gave in 1905 to the samples of this fish that he bought from *Haida* fishermen. *Opiodon elongatus* means *sgaagaay* in the *Haida* language, which means the shaman's dance. The shaman's dance is the way the shaman shakes his head while performing a dance. This species of fish also shakes its head when it is caught. In the *Tsimshian* dialect, the *Sebastes melanops* is called *gaax*. This name is composed of the adjective bass and the black colour of the fish, meaning black bass. *Anoplopoma fibria* is called sand fish. *Oncorhynchus nerka* is called blue-black salmon or sockeye salmon.

3.3 Cultural use of fish species

With regard to cultic uses of fish. Orilogbon and Adewole [8] reviewed the knowledge on ethnoichthyology and its applications in Nigeria. They interviewed fishermen, fetishists and traditional practitioners on the socio-cultural uses of fish. They noted that clariids and the species *Malapterus electricus* were the most commonly used for cultic purposes. Indeed, braised *Clarias* sp. is used for inductions, funerals, yam festivals, weddings and to gain respect from elders. When used alive, *Clarias* sp. is used for money and love ceremonies. In combination with plants, it is used for inanimate objects and to pronounce incantations. *Heterotis niloticus* is used alive in marriage ceremonies. *Parachanna obscura* is used alive to attract good fortune. The dorsal part of *P. obscura* is used in the *malokun* festival. When *P. obscura* is used whole, it is used to kill a man. *Xiphias gladius* is used whole to induce an erythema on the skin which can lead to the death of the subject after seven days.

3.4 Use of fish species in traditional medicine

In terms of medicinal uses, in Europe, the Spanish use the blood, bile, oil and flesh of the eel fish to treat alcoholism, obesity, mental disorders and infant mortality. The bile of the carp, bones and swim bladder are used to treat lumbago and skin rashes. The head, flesh and liver of catfish are used to correct skin, intestinal and throat problems [23] Cyprinidae are used for pregnancy testing by pregnant women [24].

In Africa, the Zay people use *Barbus* sp. oil to treat abdominal cramps and to cure eye ailments. Consumption of fish eyeballs increases the intelligence level of the consumers. A concoction of fish relieves heart, chest pain and indigestion. Fish consumption cures psychiatric and pediatric problems. It helps compensate for blood loss in women after childbirth and improves skin tone [20]. In Nigeria, Orilogbon and Adewole [8] reported that dried and topped *Clarias* spp is used to correct infertility in men. When braised, it is used to treat malaria, hemorrhoids, yellow fever and infections. When *Malapterurus electricus* is fully braised, it treats congestion, cerebral cortex dysfunction, cancer. It is consumed fresh by pregnant women to correct problems of underdevelopment of the fetus. *Heterobranchus* spp. is dried and braised to solve gonorrhoea problems. Braised head of *Oreochromis niloticus* is consumed to solve insomnia problems. Oishi [24] in the ethnoecological study and ethnomedical use among the *Bakwele* of Cameroon revealed that in Cameroon, the *Bakwele* people use *Synodontis* sp to treat cough and asthma. The fish species *Calamoichthys calabaricus* is used by young ladies to quickly get pregnant after a first delivery. The fish species *Malapterus electricus* is used to enhance the development of the fetus during the fetal period, resulting in a strong and robust child. The *Bakwele* people use the fish species *Phago* sp belonging to the family Citharinidae to treat sexual weakness. The pectoral spine of *Malapterus electricus* is used by men in combination with medicinal plants to increase fighting strength during fights. *Synodontis* sp. is used to cure eye irritations. Among the *Bakwele*, the spines on the fins of the fish *Tetraodon mbu* are removed and poured into water in order to kill whoever drinks the water. In Benin, in the Ouémé region, Djidohokpin [21] noted that only two fish species are used for medicinal purposes: *Parachanna obscura* and *Malapterus electricus*.

3.5 Endogenous and symbolic beliefs about fish species

From the point of view of the taboo related to fish species, in the *Zay* culture, the first fish caught by a fisherman must necessarily be eaten by the fisherman himself because the fisherman's future will depend on how he treats that fish. Another belief states that whoever catches a blind fish is blessed by God. A blind fish is a generous fish. That is, the fisherman who caught it will always catch this type of fish. So, to catch this type of generous fish, the fisherman must catch one or two fish, braise them at the water's edge and then eat them and burn the bone until it becomes ashes and put his hands on the ashes and pray. In this way, he will resume fishing with vigor, a powerful spirit and great motivation. Oishi [24] outlined the taboos of poisons regarding pregnant women and young mothers (Table 1).

In Benin *mami wata* and in Senegal *mame coumba bang* are deities to whom one must submit and ensure their good grace in order to have access to fishing grounds and fish. According to a Senegalese fisherman, the fish live in the water with the shepherd of the fish called *munu*. This shepherd is their protector. Thus, before any fishing activity, an offering is made to the shepherd and the latter makes the fishing very fruitful. In the absence of offering, fishermen were pursued by curses [25].

As for the endogenous beliefs related to fish species, in Europe, freshwater fishes are represented as symbols in the coat of arms of many villages, towns and provinces and particularly in those regions of Europe that have been enriched by fishing. For this purpose, Germans and Russians represent on their coat of arms salmon, eel, lamprey, pike, barbel.

In Africa, the catfish is considered a protector and when it dies, it is buried in the same way as humans by the Burkinabe. In Egypt, the *Lates niloticus* is the animal form of the goddess *Neth* in Egyptian mythology. This species of fish is respected in Egypt and sacred by mummification at death. The lepidote fish *Barbus* sp. is used to communicate with the

spirit world. It is the spirit of water. From the point of view of fish symbolism, the lepidote fish *Barbus* sp. is linked in Egyptian belief to the god Osiris. In fact, in mythology, this species ate the genitals of the god Osiris and to be punished, it was thrown into the Nile, which became its exclusive habitat. *Barbus* sp. is represented in bronze by a scaled fish sculpture with a dorsal fin, a pelvic fin, a ventral fin and a ring fin.

Table 1 Taboos on some fish species in the Bakwele culture of Cameroon [24]

Fish species	Families	Prohibited	Consequences
<i>Campylomormyrus</i> sp.	Mormyridae	Consumption of the head by the parents of a future newborn	The mouth of the newborn becomes long
<i>Momyrus macrodon</i>	Mormyridae	Fish consumption by the parents of an expectant newborn	The newborn will hiccup
<i>Auchenoglanis</i> sp.	Bagridae	Fish consumption by the parents of an expectant newborn	The newborn will be born with spots on the body
<i>Xenomystus nigri</i>	Notopteridae	Fish consumption by the parents of an expectant newborn	The newborn will have a cough and a stomach ache
<i>Tetraodon mbu</i>	Tetraodontidae	Trampling of fish by a pregnant woman	The delivery will be very difficult
<i>Ichthyborus besse</i> ; <i>I. quadrilineatus</i>	Citharinidae	Consumption of the head by the parents of a future newborn	The future newborn will have protruding eyes
<i>Ctenopoma ocellatum</i> ; <i>C. oxyrhynchum</i>	Anabantidae	Consumption by parents and cousins	The newborn will keep saying shock, shock, shock or kuroc, kuroc, kuroc.
<i>Heterotis niloticus</i>	Osteoglossidae	Fish consumption by the parents of an expectant newborn	The newborn will be born with a long mouth
<i>Channallabes</i> sp.	Clariidae	Fish consumption by parents of a future newborn	The newborn will be born with a deformed face and a large square on the jaw
<i>Heterobranchus longifilis</i>	Clariidae	Use by parents of newborns or children	The newborn or the children will suffer from respiratory distress or will have a hollow on the forehead like the fish
<i>Petrocephalus catostroma</i> ; <i>P. christyi</i> ; <i>Marcusenius senegalensis</i>	Mormyridae	Fish consumption by parents of a future newborn	Neonatal respiratory distress and rapid death
<i>Auchenoglanis occidentalis</i>	Bagridae	The parents of a newborn child must not consume or kill.	The newborn will breathe like a wild pig
<i>Synodontis acanthomias</i>	Mochokidae	Fish consumption by the parents of a future newborn	The baby will cry like a fish
<i>Labeo lineatus</i> ; <i>L. cyclorhynchus</i> ; <i>L. longipinis</i>	Cyprinidae	Consumption by parents of a newborn	The baby will have many rashes around the mouth
<i>Calamoichthys calabaricus</i>	Polypteridae	Consumption by a young lady	Delayed menstruation

In Burkina Faso and Mali, the fish was represented in bronze at the end of a hairpin of about 13.8 cm.

In Mali, the "*mamiwata*", considered to be the mermaid of the waters, is represented by a woman with long hair whose lower body, from the hip to the feet, is shaped like a fish tail.

4. Discussion

4.1 Concept of Ethnoichthyology

Ethnoichthyology is perceived as the study of the relationship between humans and fish. However, not all researchers who have conducted ethnoichthyological studies have this same understanding. Indeed, García-Quijano [26] states that this science is not limited to the relationship between humans and fish, but to the relationship between humans and all aquatic metazoans, namely crustaceans, echinoderms, mollusks, cetaceans, birds and fish with cartilaginous and bony skeletons. For him, humans interact not only with fish but with all aquatic vertebrates and invertebrates. Therefore, restricting the concept of ethnoichthyology to fish is not an exhaustive definition. To this end, García-Quijano [26] subdivides aquatic ethnobiology into two sciences. The one that studies the relations of humans with aquatic animals and is called ethnoichthyology and the one that studies the relations of humans with aquatic plants and algae and is called ethnophycology. But if we limit ourselves to this one definition, what would we say about ethnozoology, which is nothing but the study of the relations between human and animals in general. Thus, the definition of the word ethnozoology contradicts that of García-Quijano [26], who groups all aquatic animals under the term ethnoichthyology. Regarding the formation of the word ethnoichthyology, it comes from the combination of two words namely: ethno meaning ethnicity, people, population, humans and ichthyo meaning fish. Thus, ethnoichthyology is obviously a science that studies the relationship between people and fish. Therefore, the definition proposed by García-Quijano [26] must be more precise and change the name according to the phylum, class or order of the aquatic animal considered. While it is accepted by all other researchers that ethnoichthyology records the relationship between humans and fish, the same cannot be said for the type of relationship it may have with fish. Indeed, for many researchers, it is only about endogenous knowledge about fish, fish ecology, distribution... [14, 27]. Berkers et al. [28] point out that this knowledge is an accumulation of notions, practices and beliefs that evolve through processes of adaptation and are transmitted through generations. Bahuchet [13] elaborated on this type of relationship by noting that ethnoichthyology records not only human knowledge about fish but also human valuation of these animals. For him, this knowledge that humans have about fishes must necessarily be applied as people use them in their technical activities. Orilogbon and Adewolá [8] add that ethnoichthyology is the use of fish by Indigenous Peoples for their immediate needs (food and traditional medicine). The notion of utilization is evident from these definitions. Given these observations, a more comprehensive definition of ethnoichthyology would specify that it is the science that studies endogenous human knowledge of fish species and the application of that knowledge by humans.

4.2 Traditional nomenclature of local names of fish species

Regarding the traditional nomenclature of fish species, Palomares and Pauly [29] stated that local names assigned to fish species by fishermen, regardless of the type of dialect, give an indication of the fish's body shape, colour, habitat, behaviour and/or ecology. This statement seems to be correct because the majority of the names given to fish by the people are related to an event or aspect related to the fish species. However, it should be noted that these names assigned to fish are not necessarily related to a particular trait of the fish or its habitat as Palomares and Pauly [29] thought. Indeed, Jones et al. [22] reported that the black cod *Anoplopoma fibria* is named *skil* by the *Haida* people and that this local name was given to it because of the name *skil* that researcher James Swan in 1905 gave to samples of this fish that he purchased from fishermen. Thus, not all fish names have a theoretical basis in tradition and thus the same name can be given to all species of fish in the same family. For example, the name *ambaza* assigned to *C. gariepinus* in the *Zay* language is used to refer to many species of catfish. Similarly, one species may have two local names. This shows that the nomenclature of fish names is not always structured within ethnic groups. Begossi and Garavello [17] pointed out that the rare and small species of fish encountered in the Tocantins River are not known to fishermen because they do not recognize them and therefore have no classification criteria. However, it is obligatory to note that some fishes are well known by fishermen, but have not been classified in any ethnofamily. Among them, we have *Hipocampus punctulatus* called *cavalo do mar* which means sea horse, *Euthynnus alleteratus* called bonito and *Oligoplites saliens* designated by *guaivira* [15]. Bahuchet [13] considers that there is clearly a well-defined structure. Among the *Yasa* of Cameroon, for example, similar fish species are designated by simple and indecomposable names. In contrast, different species are grouped together and referred to by the name of the most abundant fish species. Oishi [24] also proved that the *Bakwele* ethnic groups of Cameroon divided the fishes into two groups. Fish with scales called *besu ε kpapa* and fish without scales *besu ε djεε*. These remarks show the importance of studying the classificatory value of local names of fish in each tribe. Similarly, Djidohokpin et al. [21] did not explain the etymology of the names or their theoretical basis.

They mainly relied on the literal explanation of the names assigned to the fish. This does not underline the quality of this study. Indeed, anyone who speaks the *Fon* dialect of Benin can literally transcribe into French the fish names mentioned by these researchers. Furthermore, the explanation given for the nomenclature of the fish names seems incomprehensible and illogical. According to these authors, the *Hotoun* attributed to *Parachana obscura* is due to its snake-like morphology. But the snake in *Fon* is called *Dan* and this name does not appear in the name *Hotun*. In the same way, these authors affirm that the name *Djan* attributed to *Chrysichtys auratus* is linked to the shape of its head. But the head is called "Ta" and it does not appear in the name *Djan* given to this fish species either. Thus, if the phenotypic traits reported by these researchers do not appear in the etymology of the names given to certain fish species, there is certainly an important fact in the history of these fishes that should exist and would not have been reported by these researchers. However, it is essential that a researcher interested in the traditional taxonomy of the fish species of a given People necessarily masters the dialect of that People, as many subtleties may be missed, not to mention the risk of misinterpreting the information gathered. Furthermore, these authors note that the *Fon* dialect is spoken in *Tovè*. This is not true. Indeed, even if there are *Fon* ethnic groups in some parts of the commune of Adjohoun in the department of Ouémé, the *Wémè* language remains the most widely spoken, regardless of the region of the department, even if this language tends to be closer to the *Fon* dialect. Moreover, in Benin, despite the great specific wealth of the Ouémé, only ten species are known from the point of view of traditional taxonomy. Thus, the traditional taxonomy of 237 fish species is still unknown.

4.3 Cultural use of fish species

From the point of view of socio-cultural uses, only one study dealing in detail with this aspect was identified. This shows once again that the socio-cultural uses of fish are a taboo subject. However, they must be revealed in the perspective of safeguarding the endogenous knowledge of the Peoples and the advancement of science.

4.4 Use of fish species in traditional medicine

In traditional medicine, fish species used in the healing of diseases are not chosen randomly. The species of fish valued in endogenous medicine are identified from their morphological aspects or from their behaviours that are close to the disease to be treated. To this end, *Synodontis* sp is a species of fish that emits noises similar to a person coughing when fished in the natural environment. Hence it is used by the Bakwele to treat coughs and asthma. Similarly, *Phago* sp. is a species of fish used to treat sexual weakness because of its very strong and elongated body. Furthermore, the medicinal uses reported in the literature have identified the species of fish used in traditional medicine, highlighted the body parts of the fish used in the treatment of diseases as well as the form in which the fish is consumed. But no information is provided on the dosage and mode of application. In addition, in Benin, there are 246 ethnic groups and each of these ethnic groups has its own endogenous knowledge on fish species and especially in the healing of diseases. People disappear through generations with their endogenous knowledge without leaving any information for scientific progress.

4.5 Endogenous and symbolic beliefs about fish species

From a symbolic point of view, there is very little documentation in the literature. The few that have been identified do not explain in depth the basis of the existing information. Nevertheless, in African cultures, many species of fish are venerated, respected and represented by divinatory symbols. Fish are also valued by Ifa priests for idol worship, spiritual rites [8]. This information is very sensitive and is not easily passed on by people. Most of the endogenous information is given in parables. Thus, though understanding the dialect of the ethnicity under consideration, extra effort necessarily has to be made by the researcher for the understanding and interpretation of these parables. Thus, research on ethnobiology should be undertaken in many ethnic groups in Africa and specifically in the Republic of Benin to reveal the endogenous knowledge. The symbolic aspect of fish should take into account not only traditional religions but also Christian religions. Each symbolic representation is linked to a particular belief. The belief aspects should be explained in detail. A study on the fish species revered by local people should be conducted and these species should be identified and protected for conservation.

5. Conclusion

The nomenclature of local fish names varies between ethnic groups. They use different criteria to classify fish, but there are some universal aspects to the classification processes. Fish can be grouped according to their morphology, behaviour, environment, stage of development, use, value, feeding habits or fishing practices. Not all names given to fishes necessarily have a meaning in the tradition. Fish species are used medicinally to treat many ailments, including malaria, haemorrhoids, abdominal cramps and infections, but there is no record of the dosage or method of application. Culturally, some species are used in wedding ceremonies, funerals and sacrifices. Very few documents in the literature

deal with the cultic and symbolic uses of fish. Most of the documents found deal with the habitat, size and diet of fish, but also with fishing methods, taste and food value, and medicinal use. It is therefore necessary to deepen the research in this field in order to valorize the knowledge for the socio-cultural and economic development of the Peoples.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors of this article declare there are no conflicts of interest in connection with this paper.

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