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Food web structure in a sand-dragged man-made lake of Benin, West Africa: Implications for ecosystem management

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Abstract
Knowledge on Lake food web is important to assess ecosystem structure, to depict habitat degradation, to evaluate changes in community structure and to implement sound ecosystem management. We investigated food web components, food chains and trophic levels of the man-made lake of Ahozon of Southern Benin in order to document trophic networks and ecosystem functioning. Biological data were sampled bimonthly from August 2014-October 2015, along with dietary analysis of fishes. Food web components recorded comprised detritus, macrophytes, phytoplankton, zooplankton, macroinvertebrates, fishes, frogs, varanids, turtles, snakes and bird fishers. Detrital and grazing food chains were depicted and interlinked to form the food web. Trophic levels comprised detritivores, producers (algae), herbivores, micro carnivores/omnivores, carnivores, top carnivores with fishes foraging on many trophic positions. Some interactions such as *detritus-decomposers*, *detritus-consumers, nutrients-autotrophs* and *autotrophs-consumers* were recorded and valorized the fishes and the lake. This food web study constituted documentation for fisheries management, species conservation, and sustainable exploitation of the artificial lake of Ahozon.

Keywords: Artificial Lake, *detritus-decomposers*, detritivore trophic levels, Fisheries, grazing food chains, West Africa

1. Introduction
In community ecology, food webs are interacting organism networks that describe trophic relationships and energy flows in natural and man-made ecosystems [1-3]. As feeding model, food webs depict trophic structure and productivity components such as producers, consumers, decomposers, food chains, trophic level etc., and appear to be a useful tool to evaluate ecosystem degradation, stresses and biodiversity dynamics [4-5]. Indeed, anthropogenic disturbances could lead to habitat fragmentations or losses that affect food webs structure and components [6, 7]. For example, introduction of invasive exotic fish species in a water system could lead to high competition, replacement and extinction of native species with profound changes in community structure and food web dynamics [8, 9]. Sound ecosystem restoration and biological resources management requires thorough knowledge on food webs structure [10]. Particularly in aquatic ecosystems, knowledge in food webs is crucial for habitat protection, species conservation, fisheries management and aquaculture development. Indeed, in fish ponds or man-made lake food webs, the unexploited trophic levels could be utilized to increase the fish productivity by introducing fish species foraging on these unexploited food resources.

In the Benin water bodies, notwithstanding the fisheries importance and the numerous ecological disturbances, little is known about the food webs and feeding relationships. Particularly, in the artificial lakes such as the sand-dragged man-made lake of Ahozon (South-Benin), knowledge on food webs is scanty. As reported by Gbaguidi *et al*. (2016) [11] the fish community of Lake Ahozon comprised six (6) species, *Sarotherodon galilaeus*, *Oreochromis niloticus*, *Tilapia guineensis*, the silver catfish, *Chrysichthys nigrodigitatus* (Claroteidae), the African bonytongue, *Heterotis niloticus* (Osteoglossidae), and the African catfish, *Clarias gariepinus* (Clariidae). Numerically, *S. galilaeus* and *C. nigrodigitatus* dominated Lake Ahozon and respectively made 85.21% and 11.22% of the fish community. As reported by Gbaguidi *et al*. (2016) [11], algae (52.88%) dominated the stomach of the dominant species, *S. galilaeus* whereas aquatic insects (59.9%) were the main food item consumed by *C. nigrodigitatus* in Lake Ahozon.

Due to its favorable water quality, Lake Ahozon was qualified as highly productive and having a high potential for fisheries and aquacultural valorization. However, despite their importance infisheries management, species conservation and aquacultural valorization, little is known about the trophic networks and food webs structure of the man-made lake of Ahozon. Presently, in Benin (West Africa), the sand-dragged man-made lakes are common, widespread, but mostly unexploited and the ecology not documented [12]. Knowledge on their food webs could be an important documentation for future management.

The current study aims to establish and to describe the food webs structure of the man-made lake of Ahozon (South-Benin) in order to better document the feeding structure dynamic with inferences for lake management and valorization. Specifically, the study seeks to investigate on the food web attributes such as producers, consumers, decomposers and interconnections, food chains, energy flow and pathway and trophic level with implication for fisheries management, aquaculture valorization and species conservation.

2. Methods

2.1 Study area

The study habitat is Lake Ahozon located in Ouidah town in Southern Benin (Figure 1). Lake Ahozon (06°22'52"N; 002°10'34"E) is a sand-dragged artificial water body originated from the accumulation of running water in a hole created by sand- dragging activities (Gbaguidi *et al*., 2016) and covering about 0.165845 km^2 [11]. These kind of man-made lakes were mostly unmanaged, neglected and abandoned by the owners. The study area (Ouidah region) experiences a major wet season from April to July with a peak usually recorded in June, a minor wet season from mid-September to October, and two (2) dry seasons, a major one from December to March and the minor one frommid-August to mid-September Adite *et al*. (2017) [13]. Ambient temperatures varied between 25 °C and 33.6 °C, monthly evaporation ranged between 59.2-145 mm and annual rainfall averaged 1307.3 mm [13].

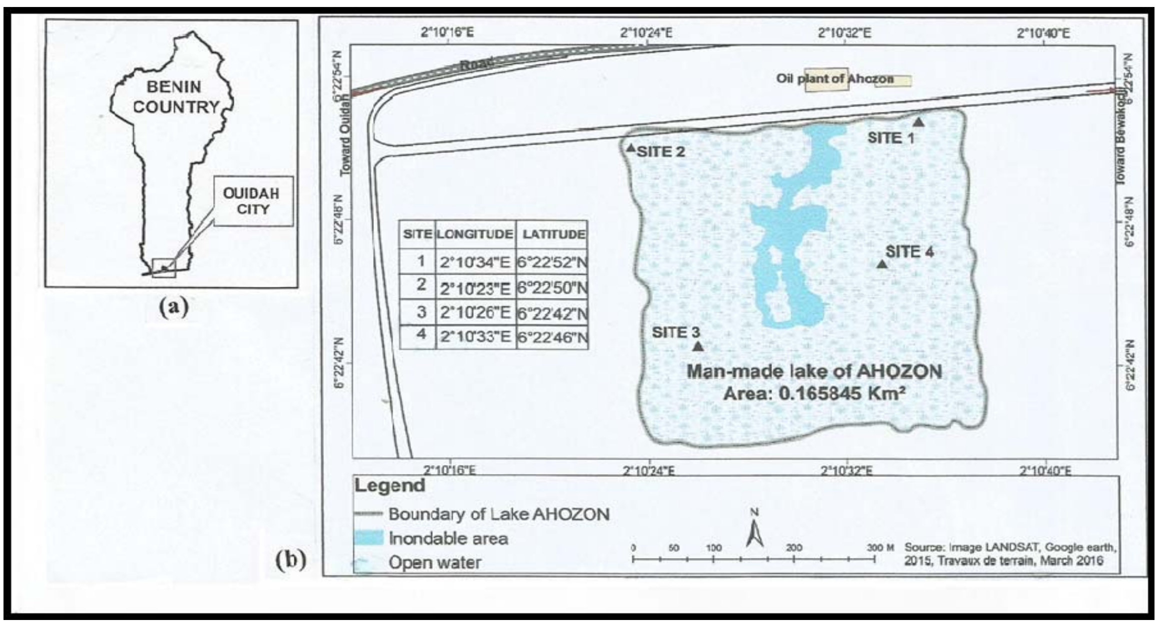

Fig 1: Map showing (a) Ouidah town, the study area, and (b) Lake Ahozon along with study sites

LakeAhozon showed depths varying between 16.2 and 240 cm and transparencies between 16.2 and 60.5 cm. Water temperatures averaged 33.25 °C and the pH ranged between 6.7 and 9.7. The conductivity ranged between50 and560 µ/cm, the dissolved oxygen concentrations between 0.73 and 11.8 mg/l and the percentage of dissolved oxygen saturation varied from 10.5 to 208.8%. Sporadic multi species fisheries occurred in the man-made lake of Ahozon that is mostly exploited by migrant fishermen.

2.2 Biological material collections

In this study, four (4) sampling sites were selected, two (2) sites in the "open water" habitat and two (2) sites in the "aquatic vegetation" habitat (Figure 1). Vegetation, plankton, macroinvertebrates and fishes were collected for this food web study. Aquatic vegetation was sampled and preserved within old news papers, and identifications were made in "Herbier National", Department of Botany, Faculty of Sciences and Technics, University of Abomey-Calavi. Phytoplankton and zooplankton were sampled with planktonic nets (Model Hydro-Bios Kiel) and were identified under compound microscope to the lowest possible taxonomic level using the identification keys of Needham [14]. Macroinvertebrates were collected with a dip net (1-mm mesh) and were identified under binocular to the lowest possible taxonomic level using the identification keys of Needham [14].

The fish assemblages of Lake Ahozon were sampled bimonthly from August 2014 to October 2015 in the aquatic vegetation and in the open water habitats using various fishing gears suchas cast net (9.80 m-diameter, 4.90 m-height, 40 mm-mesh), seine (4.15 m-length x 1.77 m-width, 3 mm-mesh), hooks (90 m-length) and experimental gill net (40 m x 1.05 m, 40 mm mesh). The fish collected were preserved for two days in 10% formalin and then removed from the formalin and preserved in 70% ethanol to facilitate the stomach content analysis.

2.3 Dietary Analysis

The fish collected were identified in the laborabory using references such as Leveque *et al*. [15] Van Thielen *et al*. [16], and Lowe McConnell [17]. Each specimen were then measured for total length (TL) and standard length (SL) to the nearest 0.1 mm with an ichtyometer, and weighed to the nearest 0.1g with an electronic balance (Philips). They were then dissected, and the digestive tract was removed and its length was measured as the distance from the distal end to the anus [18]. The stomach was then opened and its content was removed and spred on a transparent container for examination first under a binocular to identify large preys. The phytoplankton was identified by taking a sub-sample of known volume of the stomach contents and the total gross volume was estimated by water displacement using a graduated cylinder. The sub-sample is then examined under a photonic microscope. The food items were identified to the lowest possible taxonomic level using the identification key of Needham [14] for phytoplankton, zooplankton and aquatic invertebrates. After measuring the volume of each food items, their volumetric percentages were estimated for the sub-sample and then for the whole content of the stomach [18].

2.4 Data Analysis

The volumetric proportion (P_i) of each food item identified was computed using SPSS computer program [19] and following the formula:

$$P_i = \frac{(Vi)}{V_t} * 100$$

where p_i is the volumetric proportion of food item *i*in the diet, n is the number of stomachs, v*i* is the volume of the food item *i* in a single stomach, Vt is the total volume of food ingested by n stomachs.Niche breadth of each species was calculated following Simpson's niche breadth formula [20]:

$$\text{Niche breadth (NB)} = 1 \Big/ \sum_{i=1}^{n} P_i^2$$

where p_i is the proportion of food item *i* in the diet, and *n* is the total number of food items in the diet.

3. Results

3.1 Food web components

The man-made lake of Ahozon was established eleven (11) years ago, around year 2005 [11]. Though relatively "young", Lake Ahozon showed a food web that included various components (producers, consumers, decomposers) as found in natural aquatic ecosystems. One-year sampling along with stomach content analysis of the fish community revealed various components (Tables 1-6) that interacted in the food web. The food resources recorded in Lake Ahozon included detritus, macrophytes, phytoplankton, zooplankton, macroinvertebrates, fishes and other aquatic and terrestrial animals.

Detritus: At the lake bottom, detritus were unlimited resources and always available. Detrital components originated from dead plants (plankton, roots, aquatic and floating etc.), dead animals (microcrustacea, aquatic insects, mollusks, crustacean, fishes, amphibiens, reptiles, lizards, turtle, bird fishers etc.), feces and litter that were recycled and remineralized by aquatic microbial population to give a pool of dissolved nutrients that were transferred to producers[1]. In this study, detritus were intensively and directly utilized as food resources by all the fish species recorded, with proportional consumptions reaching 12.27% for *Sarotherodon galilaeus* (Cichlidae), the dominant species, 11.70% for the silver catfish, *Chrysichthys nigrodigitatus* (Claroteidae), 12.68% for the African bonytongue, *Heterotis niloticus*, 12.99% for the Nile Tilapia, *Oreochromis niloticus*, 22.20% for the cichlid, *Tilapia guineenis* and 26.80% for the African catfish, *Clarias gariepinus.* Also, detritus were preyed upon by aquatic insects, mollusks and some zooplankton [21].

Macrophytes and phytoplankton: In Lake Ahozon, the autotrophs (producers) included algae and macrophytes. Macrophytes and phytoplankton utilized the pool of dissolved nutrients to develop and to proliferate (Figure 2). Dominant macrophytes in Lake Ahozon were *Cyperus crassipes*, *Cyperus rotundus*, *Fuirena umbellata*, *Andropogon gayanus*, *Ludwigia perennis*, *Emilia praetermissa*, *Eleocharis complanata*, *Enydra fluctuans* and *Mariscus ligularis.* During the study period, Lake Ahozon was exempt of floating plants. Macrophytes were less ingested directly, but rather mostly consumed as detritus. Seeds originated from higher plants (phanerogam) and were directly ingested by some consumers of Lake Ahozon such the silver catfish, *C. nigrodigitatus* and the African bonytongue, *H. niloticus* that incorporated respectively in their diet about 5.51% and 4.13% of seed. The remaining felt as detritus and followed the remineralization process or germinated to constitute the new generation of macrophytes. In Lake Ahozon, algae (phytoplankton) appeared to be the potential producer with about 52 genera of blue green algae, green algae, diatoms and desmids consumed by the fishes. Among phytoplankton, dominant genera of blue-green algae were *Mycrocystis*, *Synechocystis*, *Coelosphaerium, Nostoc*, *Oscillatoria* and those of green algae were *Spirogyra, Scenedesmus, Botryoccocus, Ankistrodesmus, Crucigenia, Coelastrum, Tetraspora, Ulothrix, Binuclearia* and *Ophiocytium* [21]. Also, dominant genera of desmids included *Colacium, Closterium, Euastrum, Staurastrum, Gonatozygon, Tetmemorus, Cosmarium, Euglena, Phacus, Micractinium, Selenastrum, Peridinium* and dominant diatoms genera recorded were *Chaetoceros, Fragilaria, Stephanodiscus, Anomoeneis, Navicula, Pinnularia, Gomphonema, Cymbella, Melosira, Asterionella, Nitzschia, Cyclotella* and *Surirella.* In Lake Ahozon, except the only specimen of *C. gariepinus* that have not eaten any algae, the other five species (*S. galilaeus*, *C. nigrodigitatus*, *O. niloticus*, *H. niloticus*, *Tilapia guineensis*) incorporated about 4.97%-52.88% of phytoplankton in their diet. Also, zooplankton and mollusks foraged on phytoplankton [22].

Zooplankton: The zooplankton recorded in Lake Ahozon was dominated by rotifers such *Keratella, Brachionus, Euchlanis, Colurella, Trichocerca, Chromogaster* and *Rotaria.* Copepods included *Ectocyclops Tropocyclops*, *Arctodiaptomes, Diaptomus* and Cladocera genera recorded were *Camptocercus* and *Daphnia*. The zooplankton species were first-level consumers and fed mainly on phytoplankton [23]. In the man-made lake of Ahozon, except *C. gariepinus,* less represented in the sample, and that have not eaten any zooplankton, the other five species (*S. galilaeus*, *C. nigrodigitatus*, *O. niloticus*, *H. niloticus*, *Tilapia guineensis*) incorporated about 1.04% - 41.16% of zooplankton in their diet. Also, zooplanktons were preyed upon by aquatic insects and mollusks [7].

Macroinvertebrates: In the man-made lake of Ahozon, macroinvertebrates, mainly aquatic insects included Diptera (Ceratopogonidae, Chironomidae, Chaoboridae larvae & nymphs), Hemiptera (Corixidae), Megaloptera (Sialidae), Tricoptera (Philopotamidae larvae), Lepidoptera, Odonata and Coleoptera. Like zooplankton, macroinvertebrates were consumers at lower level and fed mainly on algae, microcrustacean and organic matters [23]. In the current study, except *C. gariepinus* all the five species remaining (*S. galilaeus*, *C. nigrodigitatus*, *O. niloticus*, *H. niloticus*, *Tilapia guineensis*) fed on aquatic insects with proportional comsumption varying between 0.63% and 59.9% of the diet. Also, a Gasteropod mollusk, *Melanoïde tubercularis* made 0.82% of the diet of *C. nigrodigitatus*.

Fishes and trophic guilds: The ichtyofauna of Lake Ahozon comprised six species, three tilapiine cichlids including the freshwater tilapia, *S. galilaeus*, the Nile Tilapia, *O. niloticus* and *T. guineensis*; the silver catfish *C. nigrodigitatus* (Claroteidae), the African bonytongue, *H. niloticus* (Osteoglossidae), and the African catfish, *C. gariepinus* (Clariidae) (Gbaguidi *et al*., 2016) [11]. *Sarotherodon galilaeus* is the dominant species in Lake Ahozon and made 85.21% of the fish community. In Lake Ahozon, though not carnivore, *H. niloticus* and *C. nigrodigitatus* incorporated respectively, 3.51% and 2.38% of fish scales in their diet. Likewise, in Lake Ahozon, *C. gariepinus*, an intermediate carnivore foraged mainly on *S. galilaeus* larvae that represented 65.10% of the stomach contents.As an intermediate carnivore, *C. gariepinus* could also forage on larvae of all the five species. As results, except *C. gariepinus* that was numerically less represented, *S. galilaeus*, *C. nigrodigitatus*, *O. niloticus*, *H. niloticus*, and *T. guineensis* foraged on sand particules, detritus, algae, microcrustacea and aquatic insects, but with variable proportional consumptions [22].

Examining trophic guilds among Lake Ahozon fishes, species such as *S. galilaeus*, *O. niloticus* and *T. guineensis* were algivore-detritivore and consequently mainly fed on algae and detritus [22]. They incorporated algae in their diet for about 52.88%, 68.14% and 13.23% respectively, and proportional consumption of detritus reached 12.27%, 12.99% and 22.20% respectively. Also, in Lake Ahozon, fishes such as *C. nigrodigitatus* and *H. niloticus* were omnivore-microcarnivore and mainly fed on aggregated aquatic insects and microcrustacea that represented 60.13% and 49.06%, respectively. Also, detritus ingested by *Chrysichthys* and *Heterotis* were 9.18% and 12.68%, respectively, and seeds consumed were 5.51% and 4.13%, respectively. The African catfish, *C. gariepinus* was less represented, but is omnivore – carnivore and fed mostly on small fishes from Lake Ahozon.

Other aquatic and terrestrial animals: Ecological survey around Lake Ahozon revealed the presence ofcarnivore or microcarnivore such as frogs, lizard (varanid), reptiles (python, aquatic snakes, turtles). Also, some top carnivore such bird fishers (kingfishers, marsh hawk) were recorded in Lake Ahozon environment and fed mainly on fishes.

Table 1: Volumetric and occurrence percentages (%) of food resources consumed by *Sarotherodon galilaeus* (N=1189) from the artificial lake of Ahozon (South-Benin).

Food resource categories	Volumetric percentage (%)	Occurrence (Number)	Percentage occurrence (%)
Algae	52.88	1022	85.95
Microcrustacae	2.03	158	13.89
protozoans	7.68	502	42.22
Aquatic insects	0.63	75	6.31
crustaceans	0.15	8	0.67
Detritus	12.27	826	69.47
Sand particules	23.95	860	72.33
Unidentified preys	0.41	81	6.81

Table 2: Volumetric and occurrence percentages (%) of food resources consumed by *Oreochromis niloticus* (N=29) from the artificial lake of Ahozon (South-Benin).

Food resource categories	Volumetric percentage (%)	Occurrence (Number)	Percentage occurrence (%)
Algae	68.14	24	80
Microcrustacae	3.79	5	16.67
Aquatic insects	1.84	2	6.67
Detritus	12.99	13	43.33
Sand particules	4.33	8	26.67
Unidentified preys	8.91	13	43.33

Table 3: Volumetric and occurrence percentages (%) of food resources consumed by *Tilapia guineensis* (N=19) from the artificial lake of Ahozon (South-Benin).

Food resource categories	Volumetric percentage (%)	Occurrence (Number)	Percentage occurrence (%)
Algae	13.23	12	41.38
Microcrustacae	14.50	17	58.62
Aquatic insects	25.41	16	55.17
Detritus	22.20	22	75.86
Sand particules	21.05	19	65.52
Unidentified preys	3.61	6	20.69

Table 4: Volumetric and occurrence percentages (%) of food resources consumed by *Chrysichthys nigrodigitatus* (N=1020) from the artificial lake of Ahozon (South-Benin).

Food resource categories	Volumetric percentage (%)	Occurrence (Number)	Percentage occurrence (%)
Algae	4.97	131	12.84
Microcrustacae	1.04	46	4.51
Aquatic insects	59.9	622	60.98
Mollusks	0.82	21	2.06
Fish scales	2.38	33	3.24
Seeds	5.51	133	13.04
Detritus	9.18	340	33.33
Sand particules	11.76	460	45.10
Unidentified preys	4.44	142	13.92

Table 5: Volumetric and occurrence percentages (%) of food resources consumed by *Heterotis niloticus* (N=21) from the artificial lake of Ahozon (South-Benin).

Food resource categories	Volumetric percentage (%)	Occurrence (Number)	Percentage occurrence (%)
Algae	16.39	19	90.48
Microcrustacae	41.16	21	100
Aquatic insects	7.90	10	47.62
Fish scales	3.51	1	4.76
Seeds	4.13	2	9.52
Detritus	12.68	14	66.67
Sand particules	19.97	17	80.95
Unidentified preys	2.25	8	38.10

Table 6: Volumetric and occurrence percentages (%) of food resources consumed by *Clarias gariepinus* (N=1) from the artificial lake of Ahozon (South-Benin)

Food resource categories	Volumetric percentage (%)	Occurrence (Number)	Percentage occurrence (%)
S. galilaeus larvae	65.10	1	100
Detritus	26.80	1	100
Sand particules	8.10	1	100

3.2 Food chains: grazing versus detrital

In an ecological community, a food chain is the sequence of food energy transfers or energy pathways from one prey to another [1]. In the artificial lake of Ahozon, the feeding ecology analysis of the ichtyofaunal community revealed the existence of various food chains that interlinked to generate a food web. The schematic representation of Lake Ahozon food web (Figure 2) comprised both detrital food chains starting with detritus, and grazing food chains starting with algae. Exemples of food chains from Lake Ahozon food web were: (Detritus→*Tilapia*→*Clarias*→Reptiles→Bird fishers), (Detritus→*Clarias*→Reptiles→Bird fishers), (Phytoplankton→*Sarotherodon* →*Clarias*→Reptiles→Bird fishers), (Phytoplankton →Zooplankton→Aquatic insects→*Chrysichthys*→Reptiles→ Bird fishers) etc.

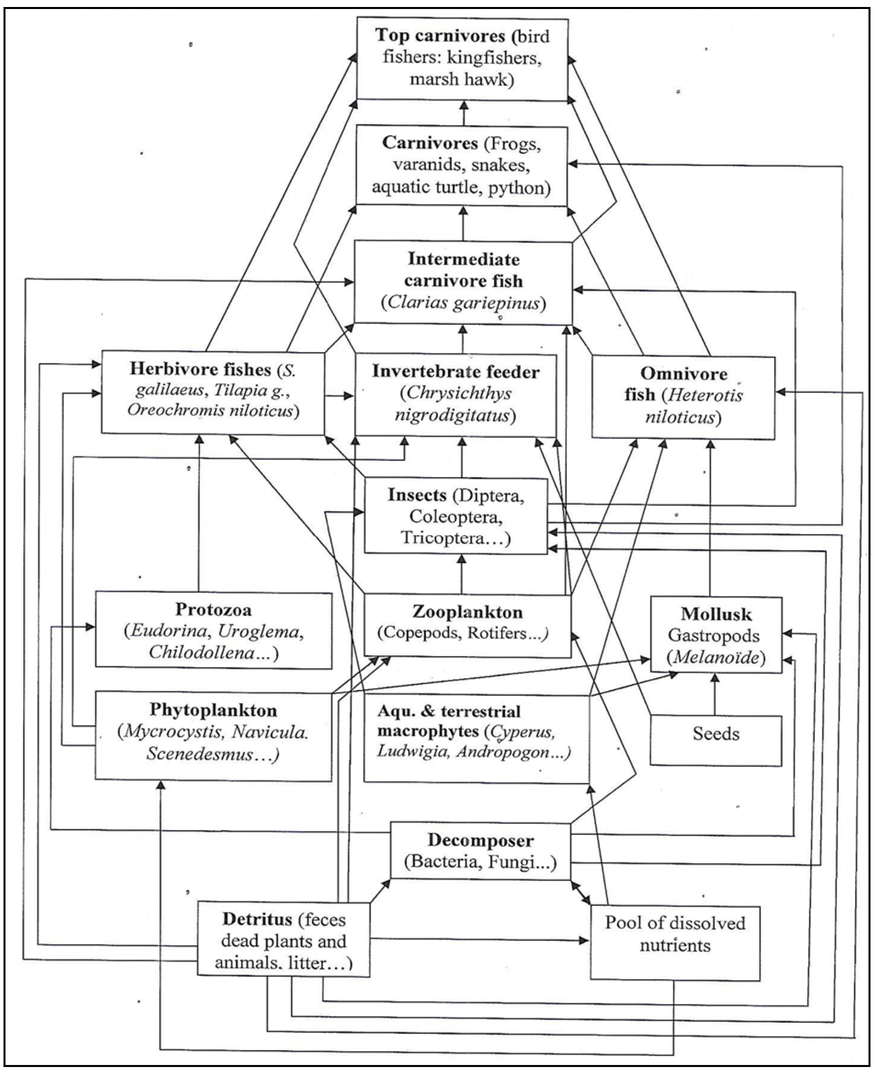

Fig 2: Schematic representation of Lake Ahozon food web in Southern Benin

3.3 Trophic levels

A trophic level referred to each step in food chain. In Lake Ahozon food web, five (5) major trophic levels of different importance were depicted. The first trophic level (TL) belongs to producers (phytoplankton); the second TL belongs to herbivores (*Sarotherodon, Oreochromis, Tilapia*) that represented the first level consumer; the third TL belongs to microcarnivore / insectivore/intermediate carnivores (*Chrysichthys, Clarias*) representing the second level consumer. The fourth TL or third level consumer belongs to canivores (frogs, snakes, varanids, aquatic turtles), followed by the fourth level consumer that belongs to the top carnivores (bird fishers). In Lake Ahozon, because most of the food web organisms displayed an opportunistic food habit and showed a large niche breadth (NB), they were able to forage on many trophic levels [21-22]. As example, the silver catfish *Chrysichthys*, with a maximum niche breadth NB=8.35, foraged simultaneously on detritus, algae and insect trophic level.

4. Discussion and Conclusion

Notwithstanding its "young" age and the lack of connections with other aquatic ecosystems, the man-made lake of Ahozon showed a food web comprising various components such as producers (algae, macrophytes, seeds, detritus), consumers (microcrustacea, insects, mollusks, fishes, frogs, varanids, turtles, snakes, bird fishers) and decomposers (bacteria, fungi) as found in various natural and artificial water bodies[21] (Tables 1-6). These major components generated food chains that interacted and interlinked to form Lake Ahozon food web (Figure2). These findings agreed with those reported by Gbaguidi *et al.* [11] in the sand-dragged artificial lake of Bewacodji (Southern Benin) established in the same geographic area, without connections with adjacent coastal ecosystems, and showing similar food web components. Nevertheless, Lake Bewacodji was covered of floating plants, *Nimphea* spp mainly, that reduced photosynthesis and primary production [24]. In contrast with Lake Ahozon, the artificial lake of SUCUBE, located in the Center region of Benin and connected to Oueme River, was more diversified with about 24 fish species belonging tovarious trophic guilds [25]. As reported by Winemiller (1990) [26] and Smith (1992) [1], geographic space, ecosystems features, seasons, hydrological regimes, spawning seasonalities and habitat disturbances are the major causes of the variation of food web structure.

The results indicated that Lake Ahozon food web included detrital food chains starting with detritus and grazing food chains beginning with algae and macrophytes. According to Smith [1], in detrital food chains, detritus (dead plants and animals, litter) were broken down by bacteria, a process involving the conversion of organic nutrients to inorganic matters. The pool of dissolved nutrients obtained was then transferred to producers, phytoplankton and macrophytes [23]. Also, in Lake Ahozon, detritus were directly consumed by all fish species inventoried, the freshwater tilapia *S. galilaeus*, the Nile tilapia *O. niloticus*, *T. guineensis*, the silver catfish, *C. nigrodigitatus*, the African bonytongue *H. niloticus* and the African catfish *Clarias gariepinus.* Previous studies in the Sô River-Lake Hlan [27] aquatic system, Lake Nokoue and Toho-Todougba lagoon [28] of Southern Benin showed that detritus were the major components and starting point of most food chains. In particular, in Southern Benin, detritus are the base of primary and fish productions in traditional fish ponds called "whedo" [29]. As reported by DeAngelis (1989) [5], the food webs based on detritus are more important than those based on autotrophic production because of the huge amont of detritus that can make available a high quantity of nutrients in the ecosystems. The different interactions recorded, namely, *detritus-decomposers* that release the nutrients (nitrate, ammonium, phosphate, sulphate) in the ecosystem[5], *nutrients-autotrophs* in which nutrients were transferred to producers, and *detritus-consumers* in which detritus were directly utilized by the consumers, made possible these utilizations and valorizations of detrital materials.

Grazing food chains started with macrophytes and algae (phytoplankton), and appeared to be one of the most representative energy pathways in Lake Ahozon food web. Algae were prominent in the open-water habitat which dominated the artificial lake of Ahozon [1]. Indeed, because the open-water habitat was exempt of floating plants, solar light exposure was maximal and thus, enhancing photosynthesis activities and algae production [30]. A case of grazing food chain depicted in Lake Ahozon food web is that phytoplankton was consumed by zooplankton which was preyed upon by aquatic insects which become food for fishes, mainly *Chrysichthys* that were preyed upon by carnivores (reptiles) and top carnivores (bird fishers) (Figure 2). Like detrital energy pathways, obvious interactions recorded were those of *Autotrophs-Consumers* mainly *Autotrophs-Herbivores* (phytoplankton-zooplankton, phytoplankton–*Sarotherodon* etc…) and those *Herbivores-Carnivores* (example: *Sarotherodon* – Bird fishers). Nevertheless, in Lake Ahozon, the *Herbivores-Carnivores* interaction was relatively weak because of the quasi-absence of predatory fish species in the lake system.

Though artificial and isolated from adjacent coastal waters, Lake Ahozon comprised trophic levels (TL) (Producers / phytoplankton, Herbivore, Microcarnivore / Omnivore, Carnivore, Top carnivore) nearly similar to those of natural aquatic ecosystems, but with moderate trophic networks. Winemiller (1996) [23] reported comparable trophic levels in the Upper Zambezi River (Western Zambia) and in the Brazos River (USA) food webs. However, in contrast with Lake Ahozon, these two rivers exhibited high fish species richnesses that comprised top carnivores fishes such alligator gar (*Lepisosteus* spp.) and catfish (*Ictalurus punctatus*) in the Brazos River food web, and *Hepsetus*, *Hydrocynus*, *Clarias* in the Zambezi food web along with a high number of food chains and a dense trophic networks. In the artificial lake of Ahozon, detritivore and herbivore trophic positions dominated the food web and constituted a case of valorization of this artificial water body [31]. In Lake Ahozon, the study indicated that for most organisms of the food web, because of their wide niche breadthn foraged simultaneously on several trophic levels. It was the case of the tilapiine cichlid *S. galilaeus*, a consumer and dominant fish species that fed simultaneously on detritus TL and algae TL. Likewise, the silver catfish, *C. nigrodigitatus* and the African catfish *C. gariepinus* also consumers, fed on detritivore, herbivore (phytoplankton), insectivore and piscivore trophic levels (Figure 2). Except for piscivore trophic position, the African bonytongue, *H. niloticus*, an omnivore, explore the same trophic levels as *C. nigrodigitatus* (Figure2). This preliminary study of Lake Ahozon food web gives insight on trophic relationships and constituted documentation for fisheries management, species conservation, and for detecting ecosystem stresses [31]. Sustainable exploitation of Lake Ahozon requires protection of spawning and nursing grounds, and a periodic ecological follow up.

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