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Diversity and structure of zooplankton in a tropical traditional aquaculture system "Whedos" in Ouémé river high delta (Benin, West Africa)

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Abstract
The objective of this study is to assess the diversity and the abundance of zooplankton community in a tropical traditional aquaculture system "*whedos*" in the Oueme river delta. Thirty taxa were collected from the present study: Copepoda (6 taxa), Cladocerans (4 taxa), Rotifera (16 taxa) and other zooplanktonic organisms (3 taxa). Zooplankton richness observed in the *whedos* depends on type of treatment. The lowest values were registered in the control *whedos* (W_0, no treatment) (13 taxa) while the most important richness were observed in the experimental *whedos* of compensatory overeating essay (W_4 and W_5) (17-22 taxa). Zooplankton community is characterized by the Cladocerans dominance (41% of the total abundance), followed by the Rotifera (23%) and the Copepoda (20%). The most important abundances were recorded in the *whedos* of *Oreochromis niloticus* and *Clarias gariepinus* co-culture (W_1: 93.37 ind.L^{-1}; W_2: 200 ind.L^{-1}) with respectively as food the *skretting* and a local feed.

Keywords: Zooplankton diversity, traditional fish farming, *Whedos*, Oueme River, Benin

1. Introduction

Fish is sometimes the most financially affordable protein source in poor households in urban and suburban areas. It is considered as « a rich food for the poor people ». The fish has an interesting biological value and constitute an excellent source of essential amino acid. Its protein level (17-21.6%) is equivalent of cow meat (18.2-20.6%) and greater than that of poultry egg (11%) and cow whole milk (3.8%) [1]. Despite the primordial role of fish in human diet, in Benin fish consumption is very low (9.4 kg/habitant/year) versus 15 to 18 kg/habitant/year recommended by the Food and Alimentation Organization [1]. In this context, the development of fish farming appears to be the most feasible alternative. However, food, which constitutes nearly 60% of the cost of production, constitutes a major constraint to the development of this activity, particularly in the developing countries. One of the recommended solutions is the promotion of extensive fish farming systems that would enhance the trophic intake of the farming environment through the production of natural food. The current study carried out in the *whedos* (traditional fish hole) in the high delta of Oueme River (Benin, West Africa) was carried out for this purpose. *Whedos* are man-made trenches in flood plains where fish are trapped during floods and exploited during flood recession. These trenches can reach a length of 1000 meters [2].

In these artificial ecosystems, two extensive aquaculture system experiments were carried out. The first experiment was the co-culture of *Clarias gariepinus* and *Oreochromis niloticus* and the second trial consisted of the study of compensatory hyperphagia in *C. gariepinus* and *O. niloticus*. For the two experiments, the fish were fed with foods of variable quality.

The use of food in a semi-intensive ponds production system affected the natural productivity and quality of the breeding environment. Several studies have demonstrated the relationship between physico-chemical parameters, plankton production and fish yields [3, 4, 5]. Therefore, the objective of this study was to determine the extent to which the supply of an exogenous food could promote an increase in zooplankton biomass and thus provided an additional supply of food in the *whedos*.

2. Materials and Methods

2.1 Description of experiment site and sampling design

Two sites were used for this experiment in the Oueme Delta (Figure 1): Ouebossou site where a *whedo* (W_5) has been used with 12 happas for compensatory overeating essay on *Clarias gariepinus* and Ayize site where 5 *whedos* were used: one control *whedo* (W_0), three *whedos* (W_1, W_2 and W_3) for *C. gariepinus* and *Oreochromis niloticus* co-culture of essay and one *whédo* (W_4) containing 12 happas for compensatory overeating essay on *O. niloticus*. In each Co-culture *whedo*, there are three big happas of 6.25 m² in which are 1 m² small happas.

During these experiments, an imported food « *Skretting* » (45% of protein), a local aliment (made in Benin with 27% of protein) and a mixed aliment (50% imported and 50% local) were admitted for feeding the fishes respectively in the *whedos* of co-culture 1 (W_1), 2 (W_2) and 3 (W_3).

In the compensatory overeating essay *whedos* [whedos 4 (W_4) and 5 (W_5)], only commercial feed « Skretting » was used for fish feeding. Only *C. gariepinus* contained in the small happas was fed in co-culture system. No food was admitted to fishes of the control *Whedo* (W0). Water physico-chemical parameters (pH, temperature, conductivity and dissolved solid rate) were measured with HANNA multi parameter. Nutrients of water (PO_4^{3-}, NH_4^+, NO_3^-) were determined using molecular absorption spectrophotometric method with a DR 2800 spectrophotometer.

Zooplanktonic organisms were collected between 16:00 and 18:30 on 12, 19 and 26 August 2014 in 5 experiments *whedos* and a witness *whedos* (without treatment).

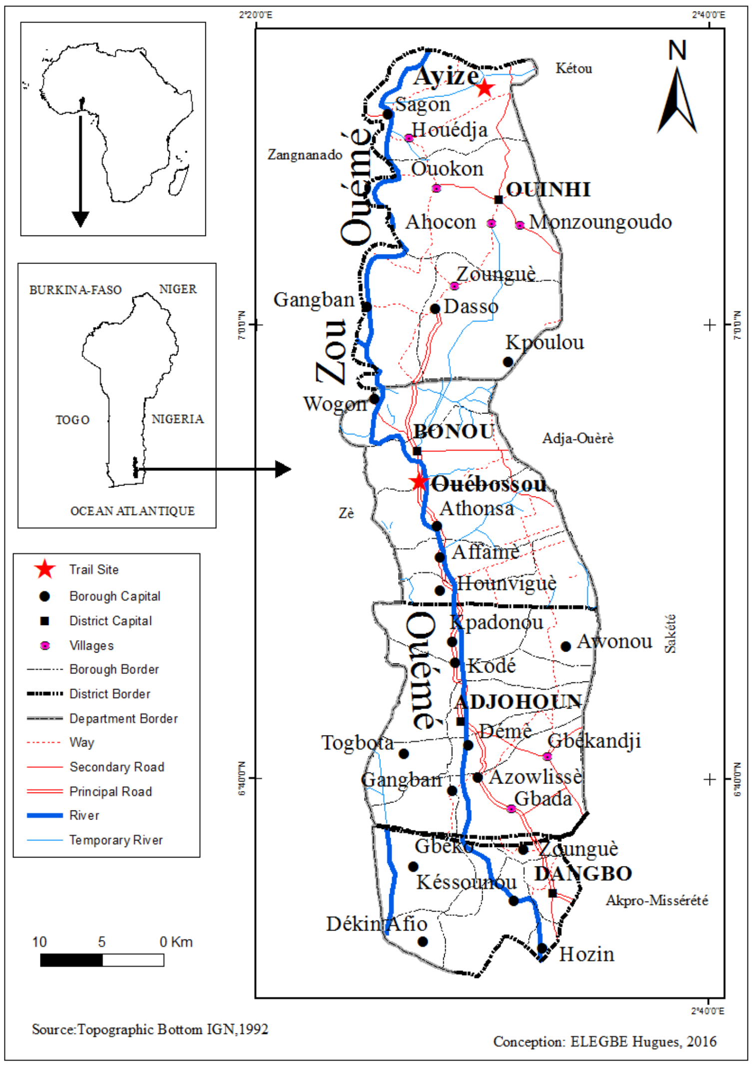

Fig 1: localization of sampling site in the Oueme river delta

At each sampling, 50 liters of water were collected in the different happas of the *whedos* and filtered on a 50 µm screen of mesh void. Samples were fixed immediately with a mixture of borax and neutralized formalin (5%). A total of 102 zooplankton samples were collected for identification.

In the laboratory, zooplankton was identified using standard keys [6-8]. Identification and numeration of Taxa were carried out in a Dollfuss vat under a Leica WILD compound binocular microscope (M3c type) with magnification 160, 250 and 400. Before identification, the *zooplankton* sample was remained to 50 or 100 ml aliquot in a graduated test-tube according to zooplankton concentration. The aliquot was homogenized through successive decanting in two beakers for sub-sampling. One or several sub-samples were analyzed until numbering a minimum of 100 individuals per taxa, in order to minimize sub sampling error and to reduce the coefficient of variation to a maximum of 10% [9]. For the least abundant taxa, (< 100 individuals), entire sample was explored. The results were converted to density (expressed as number of individuals per liter) by dividing the number of organisms obtained in each sample by the filtered water volume (100 Liters).

2.2 Data analysis

Taxonomic richness, occurrence percentage, Shannon and Equitability indices were used to determine the structure and ecological dynamics of zooplankton community in the *whedos*. The occurrence percentage (F) was calculated using the following formula: F= (Si / St) × 100, with Si: number of sample where the taxon i was captured and St: number of total samples. The occurrence percentage was used to classify taxa according to Dajoz [10]: %F ≥ 50: constant (or frequent) taxa; 25 ≤ %F < 50: secondary (or common) taxa and %F < 25: rare taxa.

One-way analysis of variance (Anova) was used to test physico-chemical parameters, taxonomic diversity and zooplankton density variation between the *whedos* in one hand and between feeding treatments on the other hand.

All calculations were performed after adequate transformation (logarithmic) of data in order to tend towards normal distributions. All steps of this method were computed using Statistica 7.1 software. Redundancy analysis (RDA) was applied to link environmental variables, zooplankton taxa and the *whedos*.

3. Results

3.1 Water physico-chemical parameters

The average values of physico-chemical parameters in *whedos waters* are summarized in table 1. All variables present a statistical significant difference (p < 0.001) between the *whedos*, with the temperature values in *whedos* 1 to 3 significantly different from those of *whedos* 4 and 5. Registered temperatures during this study vary between 26 and 28 °C. The lowest average temperature value was measured in the *whedo* 5 (W_5) while the most important values are been observed in *whedo* 4 (W_4). The pH varies between 6.26 and 7.54. The pH is relatively acid in compensatory overeating essay (*whedos* 4 and 5) (6.28 – 6.69). In contrary, in *whedos* of *Clarias gariepinus*-*Oreochromis* Co-culture (*Whedos* 1 to 3) the pH is slightly above neutral pH (7.34 – 7.54), meaning a relatively alkaline pH.

Table 1: Physico-chemical parameters in all studied experiment *Whedos* of the high delta of Oueme river (Bénin) [The same letters mean a non-significant difference between the *whedos* (p > 0,05), while different letters show a statistical significant difference (p<0,01)]

	***Whedo* Control**	***Whedo* 1**	***Whedo* 2**	***Whedo* 3**	***Whedo* 4**	***Whedo* 5**
Temperature (°C)	26.85^a	27.03 ^{a}	27.28 ^{a}	27.59 ^{a}	28.05 ^{b}	26.13 ^{b}
pH	07.24 ^{a}	07.34 ^{a}	07.54 ^{b}	07.49 ^{b}	06.69 ^{c}	06.28 ^{d}
Rate of dissolved solid (ppm)	81.55 ^{a}	71.56 ^{a}	88.13 ^{b}	88.75 ^{b}	28.13 ^{c}	52.5 ^{d}
Conductivity (µS/cm)	166.25 ^{a}	156.56 ^{a}	191,88 ^{b}	194.69 ^{b}	73.44 ^{c}	120.63 ^{d}
Orthophosphate (mg/L)	0.23 ^{a}	0.30 ^{a}	0.30 ^{a}	0.24 ^{a}	0.28 ^{a}	0.23 ^{a}
Ammonium (mg/L)	0.67 ^{a}	0.62 ^{a}	0.88 ^{a}	0.94 ^{a}	0.56 ^{a}	0.64 ^{a}
Nitrate (mg/L)	0.01	0.01 ^{a}	0.04 ^{b}	0.02 ^{c}	0.01 ^{d}	0.01 ^{e}

The rate of dissolved solid and the conductivity reveal the same tendency, with lower values in compensatory overeating essay (*whedos* 4 and 5) (respectively 28.13-52.5 ppm and 73.44-120.63 µS/cm) than those in Co-culture of *Clarias gariepinus*-*Oreochromis* (*Whedos* 1 to 3) (respectively 71.56-88.75 ppm and 156.56-194.69 µS/cm). The concentration of orthophosphate varies from 0.23 à 0.3 mg/L while that of ammonium oscillate between 0.56 and 0.94 mg/L. Nitrate concentrations vary between 0.01 and 0.04 mg/L.

3.2 Zooplankton composition and diversity

A total of 30 fresh water zooplankton taxa belonging to Copepoda (6 taxa), Cladocerans (5 taxa), Rotifera (16 taxa) and other zooplankton (3 taxa) and 16 families were identified in the *whedos* (Table 2). Copepods were represented by six taxa including two families (Cyclopidae and Diaptomidae) and six genus. Cyclopidae family presented the highest diversity (four taxa belonging to 4 genus). Cladocerans taxa (five) were belonging to 5 monospecific. Rotifera was the most diversified group recorded in the *whedos* sampled. They are represented by 16 taxa belonging to eight families and 10 genus. Brachionidae was the most diversified family, with nine species belonging to three genus (*Brachionus*, *Epiphanes* and *Keratella*). *Brachionus* presents the most important genus diversity in the *whedos* with six species, followed by *Keratella* (two taxa). Other zooplankton organisms were represented by insect larvae and ostracod. On all taxa globally obtained in this study, six (*Mesocyclops* sp., *Diaphanosoma excisum*, *Moina Micrura*, *Brachionus falcatus*, Chironomidae larvae and other insects larvae) have occurrence ≥ 50% and can be considered as most frequent taxa in the study *whedos*.

Zooplankton taxon richness varies according to *whedos* (Table 2). The lowest taxonomic richness (13 taxa) was recorded in the control *whedos* (W_0). In contrary, the most important richness (22 taxa) was obtained in the *whedo* 5 (W_5) treated with « *skretting* » in the compensatory overeating experiment with *Clarias gariepinus*. Let's notice that in the *whedos* of co-culture experiment (W_1,

Table 2: Composition of zooplankton population obtained in the studied *whedos* through the experiments of co-culture of *Oreochromis niloticus* and *Clarias gariepinus* and compensatory overeating essay on the two species.

	Families	**Taxa**	**W_0**	**W_1**	**W_2**	**W_3**	**W_4**	**W_5**	**% Occurrence**
Copepoda	Cyclopidae	*Thermocyclops* sp.		+	+	+	+	+	32
		Mesocyclops sp.	+	+	+	+	+	+	84
		Halycyclops sp.	+					+	16
		Ectocyclops sp.	+						4
	Diaptomidae	*Thermodiaptomus* sp.				+	+		8
	unidentified	*Nauplii*		+	+		+	+	40
Cladocerans	Sididae	*Diaphanosoma excisum*	+	+	+	+		+	56
	Bosminidae	*Bosmina longirostris*		+				+	12
	Daphnidae	*Ceriodaphnia cornuta*	+	+	+			+	16
	Moinidae	*Moina micrura*	+	+	+	+	+	+	52
	Chydoridae	*Chydorus* sp.		+			+	+	12
		Brachionus angularis		+	+	+	+		24

Rotifera	Brachionidae	*Brachionus calyciflorus*			+	+		+	12
		Brachionus caudatus		+	+	+		+	44
		Brachionus falcatus		+		+		+	56
		Brachionus plicatilis	+	+	+	+	+		44
		Brachionus brevispinus						+	4
		Epiphanes clavulata					+		4
		Keratella tropica						+	4
		Keratella sp.			+		+		8
	Testudinellidae	*Hexarthra* sp.						+	4
	Trichocercidae	*Trichocerca* spp.	+				+		8
	Conochiloïdae	*Chonochilus* sp.						+	4
	Philodinidae	*Rotaria* sp.				+			8
	Asplanchnidae	*Asplanchna* sp.				+	+	+	20
	Euchlanidae	*Collulera* sp.	+	+	+	+		+	32
	Lecanidae	*Lecane* spp.	+	+			+	+	32
Others	Chironomidae	Larva of Chironomidae	+	+	+	+	+	+	64
	unidentified	Other insect larvae	+	+	+	+	+	+	68
	unidentified	Ostracodes	+	+	+	+	+	+	36
Total	16	30	13	17	15	16	16	22	-

W_2 and W_3) and compensatory overeating essay experiment with *Oreochromis niloticus* (W_4) the taxonomic richness are approximately equal (15 to 17 taxa).

Shannon and Equitability indices also varied according to *whedos* and experiences. The lowest values were obtained in *whedos* 1 (W_1) (respectively 1.24 ind/bit and 0.41) and 2 (W_2) (respectively 1.63 ind/bit and 0.60) while the highest Shannon and Equitability indices were recorded in control *whedos* (W_0) and in *whedos* 3 to 5 (W_3 to W_5) (respectively 1.94-2.08 ind/bit and 0.63-0.81). On the average, highest Shannon and Equitability indices were recorded in the control *whedos* (respectively 2.08 ind/bit and 0.81) and in compensatory overeating essay (respectively 1.99 ind/bit and 0.68).

3.3 Quantitative analysis

3.3.1 Zooplankton Structure and variation according to the whedos and the treatments

The zooplankton observed in the *whedos* is, on average, marked by Cladocerans dominance (41% of the total abundance), and followed by Rotifera (23%), Copepoda (20%) and other organisms (5%). This general tendency (Cladocerans dominance) was also observed in the *whedo* of co-culture with *skretting* treatment (W_1) and local aliment (W_2). Nevertheless, in control *whedo* (W_0), in co-culture *whedo* with composed aliment treatment (W_3) and in the *whedo of* compensatory overeating essay on *Oreochromis niloticus* with *skretting* (W_4), the zooplankton population was dominated by the Rotifera (41-49%). In contrast, in the *whedo* of compensatory overeating essay on *Clarias gariepinus* (W_5), the zooplankton population was marked by Copepoda dominance (54%).

Total zooplankton abundance also varies according to the *whedos* (Figure 2). The lowest densities were recorded in the control *whedo* (W_0) (10.28 ind.L^{-1}), on *O. niloticus* and *C. gariepinus* co-culture *whédo* with composed aliment feeding (50% of *skretting* and 50% of local aliment) (W_3; 23.57 ind.L^{-1}) and in *Clarias gariepinus* (W_4; 16.02 ind.L^{-1}) and *Oreochromis niloticus* (W_5; 20.69 ind.L^{-1}) compensatory overeating essay *whedos* with *skretting* aliment. In contrast, the highest abundances was obtained in *O. niloticus* and *C. gariepinus* co-culture *whedos* (W_1: 93.37 ind.L^{-1}; W_2: 200 ind.L^{-1}) with respectively *skretting* and local aliment using. On the average, highest abundance was recorded in *whedos* of co-culture the experience (94 ind.L^{-1}) while lowest abundances were observed in the control *whedos* (10 ind.L^{-1}) and in the compensatory overeating essay (16 ind.L^{-1}).

Five taxa constitute the main taxa (91% of the total abundance): *Diaphanosoma excisum* (37.24% of the total abundance; average density 22.60 ind.L^{-1}), *Mesocyclops* sp., (18.64%; 11.31 ind.L^{-1}), *Brachionus plicatilis* (18%; 10.73 ind.L^{-1}), insects larvae (14.38%; 8.73 ind.L^{-1}) and *Moina micrura* (3.35%; 2,03 ind.L^{-1}). Cladocera abundance was marked by *D. excisum* dominance (91.34%), followed by *M. micrura* (8.21%) (Figure 2). *D. excisum* showed the most important densities in the *whedos* 1 (W_1; 69 ind.L^{-1}) and 2 (W_2; 91 ind.L^{-1}) while *M. micrura* was observed with the highest density only in *whedo* 2 (W_2; 7 ind.L^{-1}). Rotifera was mainly constituted *B. plicatilis* (83%) which is obtained with the highest density in the *whedo* 2 (W_2; 49 ind.L^{-1}). *Mesocyclops* sp. was the main copepod species (91%) and was recorded with highest densities in *whedos* 1 (W_1; 21 ind.L^{-1}) and 2 (W_2; 32 ind.L^{-1}). Insects larvae was obtained with most important densities in *whedo* 2 (W_2; 38 ind.L^{-1}).

These analysis reveal that the supply of local aliment in *whedo* 2 (W_2) during *Oreochromis niloticus* and *Clarias gariepinus* co-culture experience favoured zooplankton community development mainly *Mesocyclops* sp., *D. excisum*, *B. plicatilis* and insects larvae. In *whédo* 1 (W_1), *skretting* addition during *O. niloticus* and *C. gariepinus* co-culture, induces an important development of *Mesocyclops* sp. and *D. excisum*. Co-culture experiences favoured an important development of *Mesocyclops* sp. (average: 18 ind.L^{-1}), *D. excisum* (44 ind.L^{-1}), *B. plicatilis* (20 ind.L^{-1}) and insects larva (14 ind.L^{-1}). In the control, *whedos* and in the *whedos* of compensatory overeating essay, each of these three taxa presents an abundance $\leq$ 5 ind.L^{-1}.

3.3.2 Correlation zooplankton, environmental variables and studied *whedos*

The CCA results reveal that correlation between environmental factors and zooplankton taxa are mainly explained by the two first axis (57.3% of total variance), with 44.5% for the first axis (λ: 0.232). The five main zooplankton taxa obtained in this study (91% of total abundance) are under the influence of various environmental variables. *Diaphanosoma excisum* (37.24% of total abundance) and *Mesocyclops* sp. (18.64%) was significantly and positively correlated with conductivity; dissolved solids rate (TDS) and oxygen. *Brachionus plicatilis* (17.68%), insect larvae (14.38%) and *Moina micrura* (3.34%) are positively influenced by the pH and the nutrients (ammonium, nitrate and phosphate).

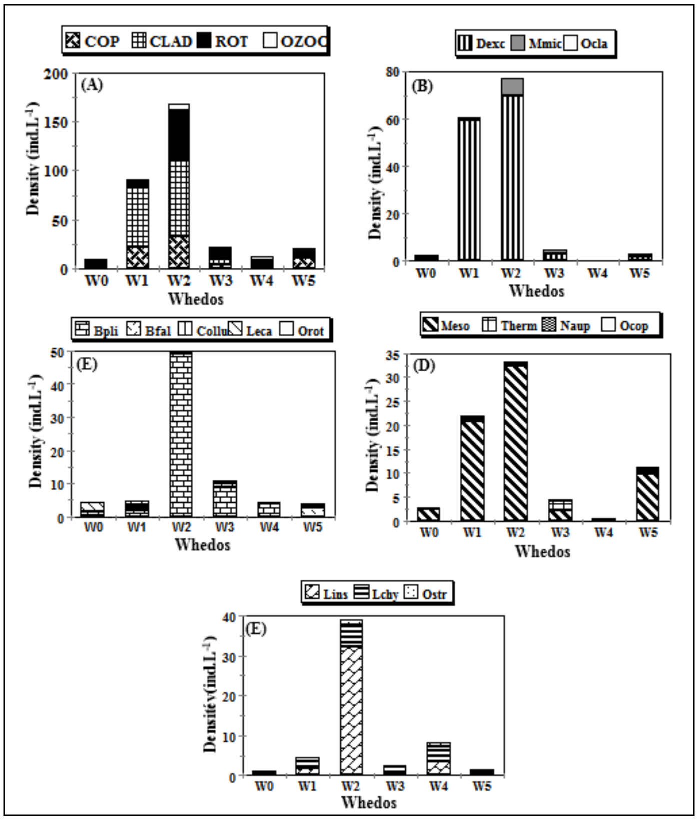

Fig 2 : Densities of total zooplankton (A) and the main taxa of Cladocerans (B)**,** Rotifera (C), Copepoda (D) and other organisms (E) in experimental *Whedos*. [ROT : Rotifera, COP: Copepoda, CLA : Cladocerans, OZOO : Other zooplankton, Dexc : *Diaphanosoma excisum,* Mmic : *Moina micrura*, Ocla : Other Cladocerans, Leca : *Lecane* spp., Bpli : *Brachionus plicatilis*, Bfal : *Brachionus falcatus*, Collu : *Collulera* sp., OROT : other Rotifera, Meso : *Mesocyclops* sp., Therm : *Thermocyclops* sp., Naup : Nauplii of Copepods, Ocop : Other Copepods, Lins : Insects larvae, Lchi : Larvae of Chironomidae, Ostr : Ostracoda.

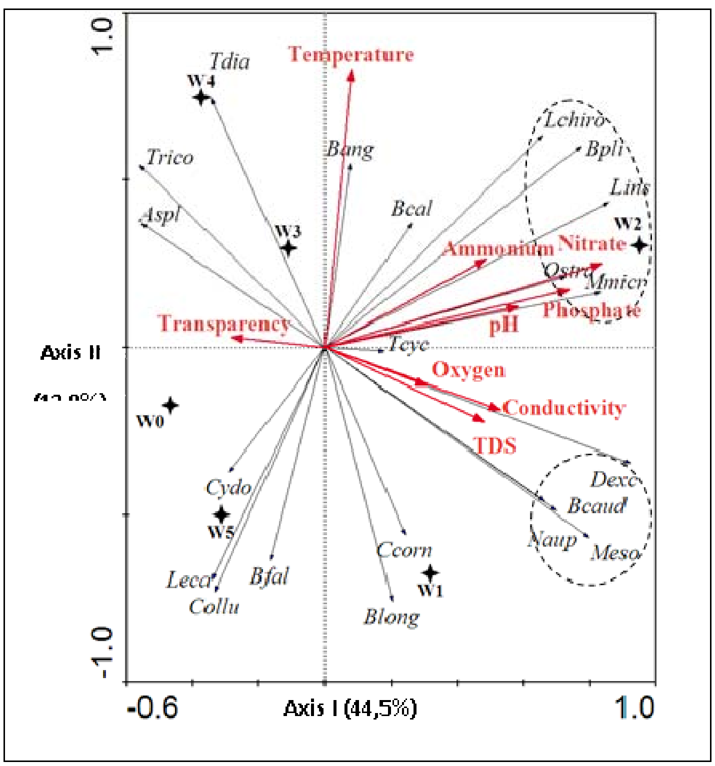

Fig 3: Triple projection graph (triplot) of canonic analysis showing the two first axis of zooplankton taxa ordination, environmental variable (red arrow) and experimental studied *Whedos*. [Dexc : *Diaphanosoma excisum,* Mmic : *Moina micrura*, Ccorn : *Ceriodaphina cornuta*, Leca : *Lecane* spp., Bpli : *Brachionus plicatilis*, Bfal : *Brachionus falcatus*, Bcaud : *Brachionus caudatus*, Bcal : *Brachionus calyciflorus*, Bang : *Brachionus angularis*, Trico : *Trichocerca* sp., Aspl : *Asplanchna* sp., Collu : Collulera sp., Meso : *Mesocyclops* sp., Tcyc: *Thermocyclops* sp., Tdiap : *Termodiaptomus* sp., Naup : Nauplii Copepods, Ocop : other Copepods, Lins : Insect larvae, Lchi : Larvae of Chironomidae, Ostr : Ostracoda

4. Discussion

A total of 30 taxa were identified in the *whedos* of the region of high delta Oueme River in Benin through this study. This taxonomic richness was comparable to with the one obtained in other lakes and dam such as Azili lake in Benin (36 taxa) [11], agro-pastoral dams in the north of Côte d'Ivoire (30 taxa) [12], Loumbila lake in Burkina Faso [13] and the lake of Prado dam in Colombia (26 taxa) [14]. Nevertheless, taxa diversity in present study is relatively lower in comparison to the taxonomic richness obtained in the hydroelectric dams Ayame I (48 taxa) [15] and Buyo [16] in Côte d'Ivoire, in the lake Ehoma in Nigeria (67 species) [17], in the lakes Parque Atalaia (75 taxa) and Souza Lima (106 taxa) in Brazil [18]. This taxonomic richness variation could be related to many other factors of which, (1) water physico-chemical characteristics, (2) hydrosystems area (123 to 167 m^2 in the present study versus 200 to 92 000 ha for the other hydrosystems) and the versant field area, (3) sampling effort (3 sampling in less than a month with 102 examined against 2 to 18 month sampling during other studies), (4) the mesh of sampling instruments (50 µm in the current study against 38 to 150 µm in mentioned investigations) and (5) the level of taxa identification.

Indeed, spread aquatic ecosystems offer various micro-habitats capables of sheltering a great diversity of species [19]. According to Daget and Iltis [20] in Albaret [21], there are a correlation between the surface of aquatic ecosystems versant field studied and the number of species living therein.

The analysis of zooplankton population composition in the *whedos* shows that, in quality level, Rotifera constitutes the most diversified group (16 taxa belonging to 8 families and 10 genus). Besides, the Brachiomidae represent the most diversified family, with 9 species and 3 genus while the *Brachionus* presents the most representative diversity (6 species), followed by *Keratella* gender (2 taxa). Zooplankton composition in *whedos* presents the same tendency as the one observed in the lake Azili in Benin by Houssou *et al.* [11] (30 rotifera taxa belonged to 13 families and 18 genus in a taxonomic richness of 36 taxa; Brachionidae dominance : 8 species and 3 genus with *Brachionus* presenting the most important diversity (5 taxa)). The results of this study marked by quality the dominance of rotifera, Brachionidae and *Brachionus* are similar to those reported by other authors in the hydroelectric dams and fresh water reserves in tropical zone : as the lakes Buyo [16] and Ayame I [15] in Côte d'Ivoire, the lakes Souza Lima and Parque Atalaia in Brazil [17], the municipal lake of Yaoundé in Cameroon [21], agro-pastoral reserves in the north Côte d'Ivoire [12], the lake of Loumbila in Burkina Faso [13], the lake Ehoma in Nigeria [17], prado reserve in Colombia [14] and the Reserve Jurumirim at Sâo Paulo (Brazil) [23]. Many hypothesis can generally explain the qualitative preeminence of rotifera, Brachionidae and *Brachionus* in the *whedos*. One of the hypothesis could be that the *whedos* become eutrophic with the supply of (« *skretting* », local aliment and composed aliment). This could explain the low oxygen concentration recorded during the study (< 5 mg/L, average: 3.62 mg/L). Besides, it is broadly admitted that of Brachionidae family and the genus *Brachionus* taxa are majorly and regularly met in eutrophics tropical waters [24]. Moreover, some species of the Brachionidae family show a great tolerance to eutrophication that they are associated hyper-eutrophics waters and are considered like good bio-indicators of eutrophication. They are *Brachionus angularis*, *B. calyciflorus*, *B. havanaensis*, *Filinia opoliensis*, *Keratella cochlearis*, *K. tropica* and *Epiphanes macrourus* [25-27].

According to Badsi *et al.* [28], the rotifera dominance in freshwater aquatic ecosystems could be assigned to the fact that it is opportunist organisms that ingest bacteria and organic detritus dominating in eutrophics areas aquatic ecosystem. Another hypothesis that might explain the rotifera qualitative dominance in this study is the predation which is a factor operating on the structure of zooplankton community composition in aquatic areas through the selection of prey. Therefore, zooplankton consumer (as *Clarias gariepinus*) exert a selection on the taxa and/or the individuals of big size, leading finally in the long term a community dominated by the zooplankton of small size [29, 30, 31] such as the rotifera. Besides, their dominance in the lakes and in fresh water reserves can be assigned to the fact that those zooplanktonic organisms are opportunist, with a short life cycle and have a great tolerance to various environmental conditions [29].

Fourteen genus previously observed in the lake Azilli (Benin), fed whith water from Oueme river (*Anuraeopsis*, *Cephalodella*, *Filinia, Habrotrocha*, *Hexarthra*, *Lepadella*, *Lindia*, *Proales*, *Polyarthra*, *Pompholyx*, *testudinella*, *Acartia*, *Afrocyclops* and *Daphnia*) [11] were not observed in the present study. The absence of zooplankton organisms taxa, generally found in tropical fresh water reserves [12, 13, 15, 16] can be explained by the smallness of our sampling effort: three sampling in one month (only one season). Besides, taxa of the genus *Thermocyclops*, *Halycyclops*, *Ectocyclops*, *Thermodiaptomus*, *Diaphanosoma*, *Ceriodaphnia*, *Chydorus*, *Epiphanes* and *Chonochilus* obtained in the present study are not mentioned by Houssou *et al.* [11]. This shows that in Benin, precisely in the high delta of Oueme River, the inventory of zooplanktonic population must be continued.

The quantitative analysis of zooplankton community obtained in the present study shows that the highest abundances were recorded in the *whedos* of *Oreochromis niloticus* - *Clarias gariepinus* co-culture (W_1 : 93.37 ind.L^{-1}; W_2 : 200 ind.L^{-1}) where used aliments are respectively *Skretting* local aliment made in Benin (45% of protein). In those *whedos*, a proliferation of a *Mesocyclops* sp. (21-32 ind.L^{-1}), *Diaphanosoma excisum* (60-70 ind.L^{-1}), *Brachionus plicatilis* (49 ind.L^{-1}) and insect larvae (32 ind.L^{-1}) was observed. In the other *whedos* : control *whedos* (W_0), *whedos* of co-culture with composed aliment (W_3) and the *whedos* of compensatory overeating essay (W_4 and W_5) with *skretting* aliment, the abundances of zooplankton are relatively low (10-23 ind.L^{-1}). This proliferation of *Mesocyclops* sp., *D. excisum* et *B. plicatilis* mainly in the *whedos* 1 (W_1) and 2 (W_2) can be in relation with eutrophic statute of the areas. Indeed, cladoceran *Diaphanosoma* spp. and *Moina micrura*, rotifera *Brachionus* spp. were considered to be taxa with great tolerance to eutrophication and could be associated with hyper-eutrophic waters [32-34]. The quantitative analysis of the data showed that on the average, the abundance of zooplankton community in the co-culture *whedos* (94 ind.L^{-1}) was higher than that of control *whedos* (10 ind.L^{-1}) and compensatory overeating essay (16 ind.L^{-1}). The same trend was observed with abundance of *Mesocyclops* sp., *D. excisum*, *B. plicatilis* and insect larvae.

5. Conclusion

This study allowed to inventory the zooplankton population in *whedos*. In the co-culture trials of tilapia *Oreochromis niloticus* and catfish *Clarias gariepinus* on the one hand and compensatory hyperphagia on the other, 30 taxa divided into 4 major groups (Rotifera, Copepoda, Cladocerans And other organisms) were obtained. This study revealed that the use of food (commercial food as a local food) in *whedos* led to a significant proliferation of zooplankton. In addition to the insect larvae inventoried, the zooplankton communities listed belong to the genus *Mesocyclops sp*., *Diaphanosoma excisum*, *Brachionus plicatilis* and insect larvae.

6. References

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