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Diversity and structure of zooplankton community of the Comoé River in relation with environmental factors (Comoé National Park, Côte d'Ivoire)

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***Abstract*— The zooplankton of the Comoé River in Comoé National Park (Côte d'Ivoire, West Africa) was studied for the first time. Composition and distribution of zooplankton species were recorded at thirteen sampling stations. A total of 20 taxa belonging to 13 genera, 11 families and 4 taxonomic groups (Copepoda, Cladocera, Rotifera and other) were identified. Cladocera and Rotifera, with 40% and 35% respectively of taxonomic richness, dominate qualitatively the zooplankton community with eight and seven species. Daphnidae and Brachionidae constitute the most diverse families (3 species each), following by Cyclopidae, Chydoridae and Trichocercidae (2 species each). Copepoda was the most abundant group (58% of the total number of specimens). Four taxa dominated quantitatively zooplankton community [Thermocyclops decipiens (33%), Asplanchna brightwelli (20%), Moina micrua (12%) and copepod nauplii (21%)] and accounted for 86% of total zooplankton abundance. Canonical Correspondence Analysis (CCA) used to test relationships between environmental factors and zooplankton species showed that dissolved oxygen concentration, transparency, flow velocity and trophic level (considered through nitrate concentration) appeared as the main environmental factors controlling zooplankton composition, distribution and structure in the Comoé River (Comoé National Park).**

***Index Terms*— Comoé National Park, Comoé River, environmental factors, Zooplankton.**

I. INTRODUCTION

Zooplankton is ecologically an important group of aquatic organisms. It's one of the most important biotic components which influence the functionality of an aquatic ecosystem such as energy flow, food chain, food web and cycling of matter [1], [2]. It plays a major role in the functioning and the productivity of aquatic ecosystems through its impact on the nutrient dynamics and its key position in the food webs. Most zooplanktonic organisms have an herbivorous-detritivorous diet and exert a strong grazing impact on the phytoplanktonic biomass [2], [4]. For example, *Oithona* species are important consumers of nano-and micro-particles and may have important top down (grazing) and bottom up (nutrient recycling though excretion) effects on phytoplankton, primary production [5] and protozooplankton [6]. They also constitute one of the major food sources for larvae of commercially important species like cod, mackerel, sea bream and hake [7], [8].

Zooplankton species composition and community structure are sensitive to changes in environmental conditions, nutrient enrichment [9] and different levels of pollution [10]. Several studies have shown that zooplankton community structure is affected by multiple environmental factors including pH, temperature, nutrients, salinity, and trophic status [11], [12], [13]. Besides, the suitability of zooplankton as indicator of water quality has been demonstrated in a great variety of aquatic ecosystems [14], [15]. Reference [16] showed that eutrophication due to pollution in the urban area of Ebrie lagoon (Côte d'Ivoire) led to changes in the lagoonal zooplankton community (*Acartia clausi*, *Pseudodiaptomus hessei*, Mysids, bivalve larvae) with increasing importance of smaller organisms (*Oithona brevicornis*, *Brachionus plicatilis*).

In Côte d'Ivoire, several studies were focused on freshwater zooplankton. The most recent are those of [17] achieved in 49 agro-pastoral reservoirs of the north of Côte d'Ivoire and of [18] performed in Agneby and Bia Rivers.

The Comoé National Park is situated in the North-East of Côte d'Ivoire (Fig. 1) and is one of the vast protected areas of West Africa (1 149 150 ha). The Comoé stream and its tributaries (Bave, Iringou, Kongo) represent the main channel stretching in the Comoé National Park on 230 km. To date, zooplankton community of the Comoé River in this park remains unknown. Information on zooplankton of this park could constitute an important tool to help managers to monitor water quality, in a context of expected eutrophication provoked by increasing anthropogenic activities. In the present study, our purpose was to propose a focus on the zooplankton (composition and spatial distribution in relation to environmental variables) of the Comoé River in the Comoé National Park. This study also contributes to produce a baseline data on biodiversity of this protected area of Côte d'Ivoire.

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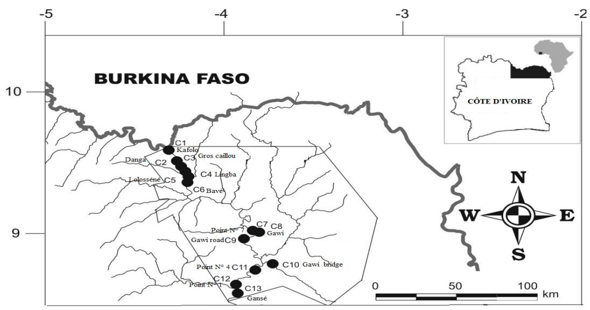


Fig. 1: Map showing the localization of sampling stations (●) in the Comoé National Park (Côte d'Ivoire, West Africa)

II. MATERIALS AND METHODS

A. Study area

Thirteen sites (C1 to C13) were sampled (Fig. 1). The north part of the park (sites C1 to C6) (Fig. 1) is characterized by savanna-type vegetation type whereas the south part (sites C7 to C13) is marked by forest-type vegetation. Besides in the north part, the average depths of the Comoe River were low and varied from 1 to 2 m while they were higher and varied between 1 and 6 m in the south part.

B. Data collection

Zooplankton and environmental variables were recorded from July to September (rainy season) in each sampling site, between 9:00 and 10:00 am. The physical and chemical parameters [flow velocity (m/s), dissolved oxygen concentration (mg/L), water temperature (°C), electrical conductivity (µs/cm), total dissolved solids or TDS (mg/L), water transparency (cm) and pH] were measured. Technical equipment comprised a propeller-driven current meter Valeport BF 008, an oximeter WTW DIGI 330 with a built in thermometer, a conductimeter WTW-LF 340, a Secchi disk and a pH-meter WTW-pH 330. The zooplankton sampling was made using a cylindro-conical net (20 µm in mesh opening size, 30 cm in mouth diameter and 1 m in length) by filtration. Seventy liters of water from each site were collected and filtered through the plankton net. Samples were immediately preserved in a mixture of river water and borax neutralized formalin at a final concentration of 5%. Besides, water samples were collected with a Niskin-bottle and preserved at 4°C for subsequent analyses of nutrients [Phosphate (PO_4^{3-}), Nitrite (NO_{2-}) and Nitrate (NO_{3-})] with a Technicon sensor III (Model AA3) auto-analyzer, according to protocols described by [19].

Zooplankton organisms were identified using the following works: [20], [21], [22], [23]. The taxa were identified and counted under a dissecting microscope. The least abundant taxa were counted on the entire sample, while the most abundant taxa were counted on subsamples made with wide bore piston Eppendorf pipettes of 1 and 5 ml. One or several subsamples were examined until numbering a minimum of 100 individual per taxa, in order to minimize sub-sampling errors and to reduce the coefficient of variation to a maximum of 10% [24].

C. Data analysis

The zooplankton community structure was described through abundance, density, Shannon diversity index (H) and Pielou's equitability index (E). The densities, expressed as number of taxa per liter (ind/L^{-1}), were calculated by dividing the number of organisms estimated in each sample by the volume of water filtered in the field.
The calculation of the Shannon diversity index was made through the formula:

$$H = -\sum_{i=1}^{i=S} p_i \times \log_2 p_i$$

where S is the total number of species and p_i the proportion of individuals in the ith species (i = 1, 2, …, S) [25].
The Pielou's equitability index (E) is :

$$E = \frac{H}{\log_2 S}$$

In which H is the Shannon diversity index and S the species richness [26].
Canonical Correspondence Analysis (CCA) was conducted by using the computer program CANOCO, version 4.5 in order to assess the relationships between water physical-chemical parameters and zooplankton species. To satisfy the assumption of normality and homogeneity of variance in data, all data were logarithmically transformed before the analyses. Kruskal-Wallis test was performed to test the effects of stations on physico-chemical parameters and zooplankton diversity and abundance. A significance level of $p < 0.05$ was considered. Analyses were carried out using the software package Statistica version 7.1

III. RESULTS

A. Environmental factors

The values of the physical and chemical parameters of the Comoé River were shown in Table I. Flow velocity ranged from 0.03 m/s at station C5 to 1.79 m/s at station C10.The values recorded for pH were less than 7 for all the sampling stations. This parameter reached its lowest value (5.57) at Site C12 and its highest value (6.99) at Site C2. Dissolved oxygen concentrations ranged from 1.05 to 3.11 mg/L with the lowest concentration at site C12 and the highest one at site C3. Conductivity varied from 44.55 µS/cm (Site C7) to 58.33 µS/cm (Site C6). Total dissolved solids (TDS) varied from 13.00 to 21.03 mg/L. The lowest water transparency (10 cm) was recorded at stations C8 and C13, while the highest (65 cm) was measured at station C3. Water temperature ranged within 23.40-32.65 °C. The minimum and maximum temperatures were measured at stations C10 and C4 respectively. The ranges of inorganic nutrients nitrite (NO2-), nitrate (NO3-) and phosphate (PO43-) were (mg/l): 0.01 (station C10) - 0.18 (C12); 1.90 (C2) - 18.00 (C10) and 0.10 (C7) - 0.86 (C3) respectively.
The variations recorded were statistically significant between the sites ($p < 0.05$), except for pH, nitrite and phosphate. Flow velocity and nitrate concentrations were significantly higher in the downstream sites (C7 - C13) than in the upstream ones (C1 - C6). On the other hand, an opposite pattern was observed for dissolved oxygen concentrations, transparency and temperature.

B. Zooplanktonic community composition

A total of 20 taxa of zooplankton were identified in the Comoé National Park. The twenty taxa belong to 13 genera, 11 families and 4 groups (Copepoda, Cladocera, Rotifera and Ostracoda) (Table II). Cladocera and Rotifera, with 40% and 35% respectively of taxonomic richness, dominate qualitatively the zooplankton community with eight and seven species.

Copepods were represented by the families Cyclopidae and Diaptomidae including respectively the species *Thermocyclops decipiens* and *T. consimilis* on the one hand, and *Thermodiaptomus yabensis* on the other hand. *Thermocyclops decipiens* presented the highest occurrence (100%). Cladocerans were represented by 8 species belonging to 5 genera and 5 families. Daphnidae presented the highest diversity with 3 species (*Ceriodaphnia affinis*, *C. cornuta*, *C. dubia*) followed by Chydoridae (2 species: *Alona monacantha* and *A. pulchella*), Sididae (1 species: *Diaphanoma excisum*) and Monidae (1 species: *Moina micrura*)

Diaphanoma excisum (100%), *Moina micrura* (77%) and *Ceriodaphnia cornuta* (69%) presented the highest occurrences. Rotifers were composed of 7 species, 6 genera and 4 families, with highest diversity in Brachionidae (3 species: *Keratella tropica*, *Brachionus angularis* and *Anuraeopsis navicula*) followed by Trichocercidae (2 species: *Trichocerca chattoni* and *T. similis*), Synchaetidae (1 species: *Polyarthra vulgaris*) and Asplanchnidae (1 species: *Asplanchna brightwelli*). The most frequent taxa of the Rotifer group (occurrence 100 %) were *Asplanchna brightwelli*.

In the Comoé National Park, zooplankton diversity varied significantly according to the sampling sites between 4 (stations C4 and C13) and 10 species (station C9) (Table II). The same is true for Shannon diversity index and Pielou's equitability index (Fig 2). Shannon index varied between 0.56 and 1.72 bit.ind-1 (mean: 1.15 bit.ind-1) with low values (0.56 to 0.74 bit.ind-1) in stations C3, C6, C8 and high values (1.5 to 1.72 bit.ind-1) in the stations C2 and C11. Pielou's equitability index varied between 0.35 and 0.79.

C. **Spatial variation in zooplankton community structure and density**

Copepods were the dominant fraction of zooplankton of the Comoé River in the Comoé National Park (61 to 97% of total abundance, average: 57.47%), except at station C3 (11%), and C4 (1%), C10 to C12 (16 to 45%), where Rotifers (station C3, 87%) and Cladocerans (45 to 87%) were more abundant (Fig. 3A). The highest abundance of total zooplankton were observed at stations C3 (4.99 ind.L^{-1}), C8 (5.94 ind.L^{-1}) and C12 (3.14 ind.L^{-1}).

The most abundant copepod taxa were *Thermocyclops decipiens* and nauplii [mean abundance of 0.74 ind.L^{-1} (57.82 %) and 0.45 ind.L^{-1} (35.59 %), respectively)]. These taxa presented the highest abundance, respectively at station C8 (4.59 ind.L^{-1}) and stations C5 and C7 (Fig. 3B). The most abundant species contributing to about 96% of Cladocerans were *Moina micrura* (relative abundance: 58.6 %; mean abundance: 0.23 ind.L^{-1}), *Ceriodaphnia cornuta* (20.37%; < 0.1 ind.L^{-1}) and *Diaphanosoma excisum* (17.2%; < 1 ind.L^{-1}) (Fig. 3C). *Moina micrura* was more abundant at stations C4, C11 and C12 (> 0.5 ind.L^{-1}) while *Ceriodaphnia cornuta* was more abundant at stations C7, C10 and C13 (0.16 to 0.44 ind.L^{-1}). *Diaphanosoma excisum* was obtained at all stations with the highest abundance (≥ 0.1 ind.L^{-1}) at stations C3-C4, C7, C11-C13 (Fig. 3C).

Rotifers were dominated by *Asplanchna brightwelli* (94%), which was more abundant at stations C3 (4.23 ind.L^{-1}) (Fig. 3D).

The spatial variations in structure and abundance recorded were significant.

As a whole, the main zooplankton species of the Comoé River in the Comoé National Park were *Thermocyclops decipiens* (33.42 % of total abundance), *Asplanchna brightwelli* (20.02%), *Moina micrura* (12.25%) and copepod nauplii (21%). Eight species (*Asplanchna brightwelli*, *Moina micrura*, *Ceriodaphnia cornuta*, *Diaphanosoma excisum*, *Thermocyclops decipiens*, *T. consimilis*, *Thermodiaptomus yabensis*, and copepod nauplii) belonging to six families (Asplanchnidae, Moinidae, Daphnidae, Sididae, Cyclopidae, Diaptomidae) were numerically dominant in the Comoe National Park (77% of the total abundance).

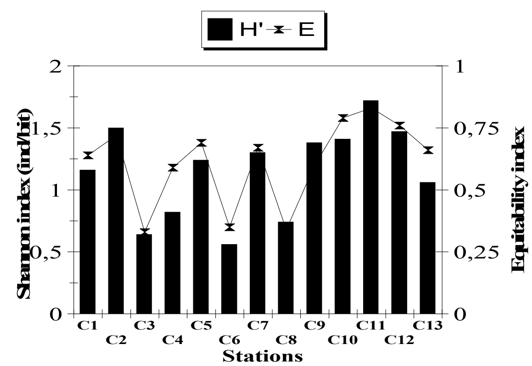
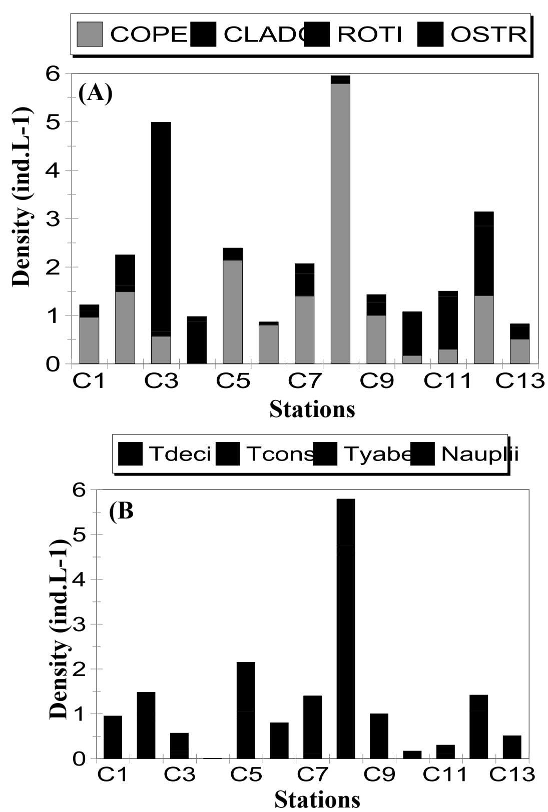
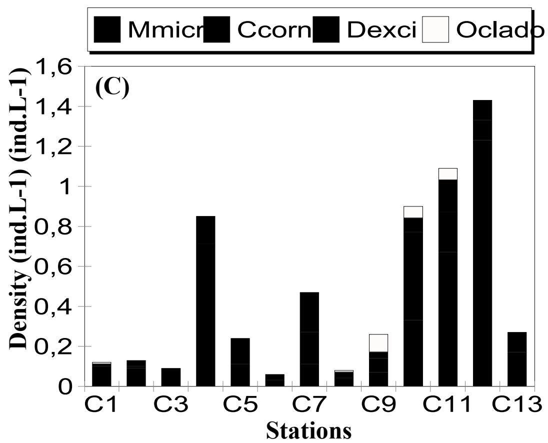


Fig. 2: Variation of Shannon index (H') and equitability index (E) for zooplankton community in the Comoé National Park (Côte d'Ivoire, West Africa).





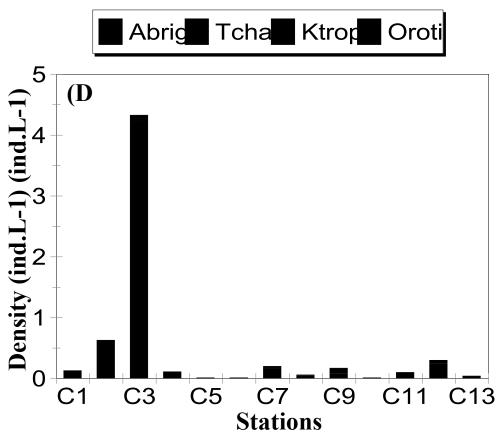


Fig. 3: Spatial variation of cumulative density of zooplankton groups (A) and density of the main species of Copepods (B), Cladocerans (C) and Rotifers (D) sampled in the Comoé National Park. (COPE : Copepods, CLADO : Cladocerans, ROTI : Rotifers and OSTR : Otracod, Tdeci : *Thermocyclops decipiens*, Tcons : *Thermocyclops consimilis*, Tyabe : *Thermodiaptomus yabensis*, Mmicr : *Moina micrura*, Ccorn : *Ceriodaphnia cornuta*, Dexci : *Diaphanosoma excisum*, Oclado : Other cladocerans, Abrig : *Asplanchna brightwelli*, Tchat : *Trichocerca chattoni*, Ktrop : *Keratella tropica*, Oroti : Other rotifers.

D. Relationships between zooplankton taxa and environmental factors

The CCA showed the overall relationships between species distribution and environmental variables (Fig. 5). The first factorial plan (axes I-II) CCA explained 45.6% of the variance, of which 25.2% attributed to the first axis and 20.4% to the second one. The axis I showed a discrimination between the northern stations (C1 to C7) and the southern ones (C8 to C13). The first group was positively and significantly correlated (after Monte Carlo test) to dissolved oxygen concentration and water transparency. Zooplankton species associated to these stations were *Thermocyclops consimilis*, *Ceriodaphnia dubia*, Copepod nauplii, Ostracods, *Allona pulchella*, *Trichocerca similis, Polyarthra vulgaris* and *Asplanchna brightwelli*. The southern stations were mainly correlated (positively and significantly) to flow velocity and nitrate. Zooplankton species associated to these stations were *Thermodiaptomus yabensis, Thermocyclops decipiens*, *Ceriodaphnia cornuta*, *C. affinis*, *Moina micrura*, *Alona monacantha*, *Diaphanosoma excisum*, *Keratella tropica* and *Trichocerca chattoni.*

IV. DISCUSSION

A total of 20 zooplanktonic taxa belonging to 13 genera, 11 families and 4 taxonomic groups (Copepoda, Cladocera, Rotifera and other zooplankton) were recorded in the Comoé National Park with qualitative dominance of Cladocera and Rotifera (40% and 35% respectively of taxonomic richness, with eight and seven species). Zooplankton taxa collected in the Comoé River in this park is similar to the zooplankton community already reported in some tropical freshwater ecosystems in Côte d'Ivoire [27], [17], [18] or in other West African countries such as Burkina Faso [28], Mali [29], Senegal [30], and Nigeria [31], [32]. They are also common in South American countries [33], [1], [34], [35]. This taxonomic richness (20 taxa) is relatively low compared to zooplankton diversity in some freshwater ecosystems of Côte d'Ivoire such as Bia and Agnebi Rivers (respectively 64 and 30 taxa) [18], of Mali such as Selingue Reservoir (31 taxa) [29], of Senegal such as Lake Guier (39 taxa) [30] and of Nigeria such as Okhuo River (51 taxa) [31] and Ikpa River (53 taxa) [36]. In contrast, zooplankton richness of the Comoé River in the Comoe National Park is relatively higher than richness reported by [32] in the Sombreiro River (17 taxa) in Nigeria. The difference between the zooplankton richness in this study and others may be attributed to the natural conditions of water bodies and time of sampling. Reference [32] reported that distributions of zooplankton vary from place to place and year to year due to the dynamic nature of aquatic systems.

Our study showed, in the Comoé National Park, the greater diversity of Cladocera and Rotifera with eight and seven species respectively. Qualitative dominance of Rotifers is a characteristic of tropical freshwater environment zooplankton as observed by [18] in Bia and Agnebi Rivers (Côte d'Ivoire), [37] in Ovia River (Benin city, Nigeria), [35] in Jesumira River (Brazil). In contrast, in Sombreiro River (Nigeria), Copepoda and Cladocera presented high diversity (29% of total diversity each) [32].

Zooplankton community of the Comoé River was marked by numerical dominance of Copepods (61 to 97% of total abundance, average: 57.47%), followed by Rotifers and Cladocerans (mean: 21% each). The main zooplankton species were *Thermocyclops decipiens* (33.42%), copepod nauplii (21%), *Asplanchna brightwelli* (20.02%) and *Moina micrura* (12.25%). The predominance of these species could be explained by multiple environmental factors including flow velocity, dissolved oxygen concentration and trophic status of water (considered through the concentration of nutrients, the turbidity and the transparency) in the Comoé national park. Indeed, *Thermocyclops decipiens* was observed in all sampling stations and presented highest abundance at station C8 (4.59 ind.L^{-1}) characterized by low dissolved oxygen concentration (1.29 mg.L^{-1}) and transparency (10 cm). *Thermocyclops decipiens*, *Diaphanosoma excisum, Asplanchna* sp. and other several taxa such as *Ceriodaphnia* spp., *Moina micrura*, *Bosmina* spp., *Brachionus angularis*, *B. calyciflorus*, *Filinia opoliensis*, *Keratella cochlearis*, *K. tropica*, *Epiphanes macrourus*, etc. were often associated with hypertrophic water [38], [39], [15], [40]. Eutrophication is the result of the fact that, during the wet season, water arriving in the Comoé River water in the park drives a great quantity of dissolved or suspended organic and inorganic matters. These organic and inorganic wastes are mineralized in the receiving water bodies and the resulting nutritive elements stimulate phytoplankton production [41]. According to [42], decomposition process of organic matter and phytoplankton utilize oxygen, therefore reducing the minimum dissolved oxygen and pH and leading eutrophication (cited in [43]). Low pH might also be attributed to pollution generated outside park boundaries.

According to [38], predominance of *Thermocyclops decipiens* in eutrophic conditions is due to its capacity to ingest a high percentage of organic detritus besides consumption of colonies of Cyanophyceae (mainly *Microcystis*). Some species were often associated with hypertrophic water, but it's also reported that eutrophication provokes changes in zooplankton community structure. A lot of zooplanktonic species disappear because of phytoplankton bloom linked to eutrophication and the inhibitions generated by the toxicity of some algae [44], [45]. According to [46], the eutrophication is followed by changes in primary producers composition which in turn, lead to changes in zooplankton community. Eutrophication also affects zooplankton by the hypoxia that it produces in bottom waters. The hypoxia (i) disrupts vertical migrations [46] which is a strategy for some zooplankton organisms to avoid predation by abundant visual predators such as fish and invertebrate [47], [48]); (ii) reduces the development, the growth, the reproduction rate and the eggs viability [46]. Eutrophication structuring action on zooplankton

In addition, the zooplankton community composition and structure are also affected by biological interactions like predation and competition for food resources [49], [50], [33]; by food quality and quantity [30], the size of food particles [51], [52], [53]; by the reproductive strategies and the life cycles of the zooplanktonic organisms [54].

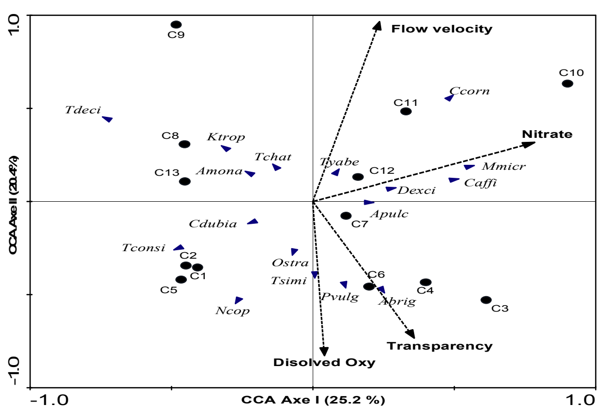


Fig. 4: CCA diagram correlation among environmental variables and species sampled in Comoé River from July to September. Tdeci : *Thermocyclops decipiens*, Tcons : *Thermocyclops consimilis*, Tyabe : *Thermodiaptomus yabensis*, Mmicr : *Moina micrura*, Ccorn : *Ceriodaphnia cornuta*, Dexci : *Diaphanosoma excisum*, Ncop : Copepod nauplii, Caffi : *Ceriodaphnia affinis*, Amona : *Alona monacantha*, Cdubia : *Ceriodaphnia dubia*, Apulc : *Alona pulchella*, Abrig : *Asplanchna brightwelli*, Tchat : *Trichocerca chattoni*, Ktrop : *Keratella tropica*, Tsimi : *Trichocerca similis*, Pvulg : *Polyarthra vulgaris*, Anavi : *Anuraeopsis navicula*, Bang : *Brachionus angularis*, Ostra : Ostracods.

CONCLUSION

Twenty taxa were indentified for the first time in the Comoé River in the Comoé National Park. This constitutes a precious database for future assessments, since the park is listed as a world heritage site in danger

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Table I: Physical and chemical parameters of Comoé River in the Comoé National Park: Fvel. : Flow velocity; O2: Dissolved oxygen concentration; Cond.: Conductivity; TDS: Total dissolved solids; Transp.: Transparency; Temp: temperature; NO2- : Nitrite; NO3- : Nitrate; PO_4^{3-} : Phosphate.

Stations	FVel. (m/s)	pH	O_2 (mg/l)	Cond. (µS/cm)	TDS (mg/l)	Transp. (cm)	Temp. (°C)	NO_2^- (mg/l)	NO_3^- (mg/l)	PO_4^{3-} (mg/l)
C1	0.05	6.17	2.36	55.41	18.00	25.00	30.05	0.08	2.12	0.15
C2	0.04	6.99	2.27	53.46	18.50	22.50	30.85	0.12	1.90	0.14
C3	0.06	6.56	3.11	48.22	15.41	65.00	32.00	0.12	4.36	0.86
C4	0.08	6.95	2.78	57.56	21.00	55.00	32.65	0.05	3.14	0.14
C5	0.03	6.71	2.77	45.59	13.17	30.00	31.05	0.09	2.70	0.35
C6	0.04	6.53	2.57	58.33	21.03	45.00	30.80	0.13	2.98	0.41
C7	1.54	5.84	1.18	44.55	13.00	14.50	26.55	0.17	5.45	0.10
C8	1.37	6.58	1.29	48.39	14.50	10.00	28.80	0.06	5.45	0.11
C9	1.56	6.61	1.29	54.45	18.50	12.50	27.60	0.05	5.10	0.15
C10	1.79	5.86	1.15	54.80	18.50	10.50	23.40	0.01	18.00	0.42
C11	1.75	6.17	1.23	47.80	15.32	12.50	28.05	0.15	9.60	0.17
C12	1.60	5.57	1.05	57.22	20.06	12.50	27.30	0.18	6.73	0.19
C13	1.60	6.84	1.33	47.76	15.18	10.00	28.35	0.07	5.03	0.17

Table II: Zooplankton taxa collected in the Comoé River in the Comoé National Park from July to September; +: species presence.

Groups	Families	Taxa	Stations												
			C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
Copepoda	Cyclopidae	*Thermocyclops decipiens*	+	+	+	+	+	+	+	+	+	+	+	+	+
		Thermocyclops consimilis		+	+		+				+				
	Diaptomidae	*Thermodiaptomus yabensis*		+						+			+	+	
	undetermined	Nauplii	+	+	+		+	+	+	+			+		
Cladocera	Chydoridae	*Alona monacantha*									+				
		Alona pulchella											+		
	Bosminidae	*Bosmina longirostris*								+					
	Daphnidae	*Ceriodaphnia affinis*										+			
		Ceriodaphnia cornuta		+				+	+	+	+	+	+	+	+
		Ceriodaphnia dubia	+								+				
	Sididae	*Diaphanosoma excisum*	+	+	+	+	+	+	+	+	+	+	+	+	+
	Monidae	*Moina micrura*	+	+	+	+	+		+		+	+	+	+	
Rotifera	Brachionidae	*Keratella tropica*									+				+
		Brachionus angularis								+					
		Anuraeopsis navicula								+					
	Synchaetidae	*Polyarthra vulgaris*			+										
	Trichocercidae	*Trichocerca chattoni*			+						+			+	
		Trichocerca similis							+						
	Asplanchnidae	*Asplanchna brightwelli*	+	+	+	+	+	+	+	+	+	+	+	+	+
Other	undetermined	Ostracods						+					+		+
04	11	20	6	8	8	4	6	6	7	9	10	7	9	8	4