Scholars Academic Journal of Biosciences
Abbreviated Key Title: Sch Acad J Biosci
ISSN 2347-9515 (Print) | ISSN 2321-6883 (Online)
Journal homepage: https://saspublishers.com
NLM ID:101629416

OPEN ACCESS

Animal Biology

Seasonal Distribution of Zooplankton in the Tanoe-Ehy Swamp Forest (Southeast Côte d'Ivoire): Influence of Some Abiotic Variables

Attoubé Ida MONNEY[1*], Olga Rosemonde N'Dri[1], Zéré Marius GOGBE[2], Yao Aristide KONAN[3], Mamadou BAMBA[3] and Tidiani KONE[1]

[1]Laboratory of Biodiversity and Tropical Ecology, Faculty of Environment, Jean Lorougnon Guédé University, Daloa, Côte d'Ivoire
[2]Department of Animal Biology, UFR Biological Sciences, Péléforo Gon Coulibaly University, Korhogo, Ivory Coast
[3]Laboratory of Natural Environments and Biodiversity Conservation, Faculty of Biosciences, Félix Houphouët-Boigny University, Abidjan, Côte d'Ivoire

DOI: https://doi.org/10.36347/sajb.2025.v13i12.003 | **Received:** 09.10.2025 | **Accepted:** 01.12.2025 | **Published:** 06.12.2025

***Corresponding author:** Attoubé Ida MONNEY
Laboratory of Biodiversity and Tropical Ecology, Faculty of Environment, Jean Lorougnon Guédé University, Daloa, Côte d'Ivoire

Abstract **Original Research Article**

The Tanoé-Ehy Swamp Forest (TESF), located in southeastern Ivory Coast, is the largest remaining relatively intact swamp forest in the country and is adjacent to the Aby-Tendo-Ehy lagoon complex. However, this forest is subject to various anthropogenic pressures, including poaching, logging, and land clearing for family or industrial agriculture. Therefore, information on zooplankton is essential for monitoring and managing this ecosystem. The objective of this study was to investigate the physicochemical parameters of the environment that influence the diversity and distribution of planktonic fauna in the TESF. This study was conducted monthly from March 2012 to February 2013 at three sampling stations. Twenty-eight zooplanktonic taxa (distributed among 16 families and 20 genera) were recorded in the Tanoé-Ehy Swamp Forest. Copepods constitute the most represented group (94.24%). They are followed by Rotifers (3.84%), Cladocera (1.03%), and the group of other organisms (0.89%). In all seasons, the total zooplankton is dominated by copepod nauplii (73.67–82.10%). Such seasonal nauplii dominance indicates continuous copepod reproduction within this wetland. This continuous copepod reproduction appears to be linked to the abundance of food in this habitat. The factors that strongly influence the distribution of organisms in this forest are temperature, dissolved oxygen, and depth. The majority of taxa recorded in the TESF are accidental and the presence of a lagoon taxon in this environment suggests that this forest is a refuge area for species from the adjacent Ehy lagoon. Protecting and sustainably managing this forest would help ensure the continuity of ecological exchanges and sustainably support local fishing activities.

Keywords: Zooplankton, Seasonnal distribution, environmental variables, Aby-Tendo-Ehy lagoons, TESF, Côte d'Ivoire.

Copyright © 2025 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution **4.0 International License (CC BY-NC 4.0)** which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Coastal zones, transitional spaces between land and sea, are among the most productive ecosystems on the planet [1,2]. They encompass several environments, including mangroves, lagoons, lakes, ponds, marshes, rivers, and reefs. These environments support a great diversity of flora and fauna, upon which many of their economic functions depend. The fauna of these environments is most often composed of reptiles, amphibians, mammals, fish, of molluscs, crustaceans, birds, insects, etc. [3]. These bodies of water constitute privileged places for many species of estuarine, marine or brackish water fish to carry out their feeding and reproduction functions [1,3].

The southeast of Ivory Coast is an area of intense agricultural activity (industrial plantations of bananas, pineapples, coffee, cocoa, and oil palms) where farmland has replaced natural vegetation across more than half of the land, causing significant degradation of aquatic habitats [4,5]. Furthermore, vegetation bordering lagoon environments is degraded and virtually nonexistent [4,5]. Within this region of Côte d'Ivoire lies the Tanoé-Ehy Swamp Forest, the largest remaining relatively intact swamp forest in southeastern Côte d'Ivoire, adjacent to the Aby-Tendo-Ehy lagoon complex. This ecosystem is vital for the survival of local populations. Indeed, the Tanoé-Ehy Marsh Forest serves as a nursery and feeding ground for several fish species [1]. This forest is also one of the last refuges in the world

for three monkey species listed on the International Union for Conservation of Nature (IUCN) Red List as critically endangered. These are Cercopithecus *diana roloway* [6], *Cercocebus atyas lunulatus* [7] and *Piliocolobus waldronae* [8]. It provides invaluable services to local populations, particularly in supplying plant-based medicines, building materials, protein resources, and materials for manufacturing various objects (fish traps, canoes) [9,10]. However, this forest is subject to various human pressures, including poaching, logging, and land clearing for family or industrial agriculture [1]. According to [11] and [12], forest destruction significantly contributes to the decline in fish catches in aquatic environments. These human pressures ultimately threaten the survival of these natural environments. To avoid jeopardizing them, it therefore seems wise to protect and manage them sustainably. To this end, it is important to understand the physicochemical and biological variables on which the exploited resources of these hydrosystems depend. Among biological variables, zooplankton fauna is known to be an essential link in the functioning of aquatic ecosystems. Zooplankton represents the most important source of protein for fry, constituting the bulk of their food [13,14]. Thus, the spatio-temporal dynamics of many aquatic organisms, particularly crustaceans and fish, depend on those of the zooplankton. Given their importance, understanding their biological diversity and the factors that determine the structure and variations of zooplankton communities is crucial. Furthermore, while numerous studies have been conducted on zooplankton fauna in Côte d'Ivoire [15,16], no information exists on zooplankton in the Tanoé-Ehy Swamp Forest.

The overall objective of this study is to determine the temporal composition of the zooplankton community in the Tanoé-Ehy Swamp Forest in relation to environmental variables.

MATERIALS AND METHODS

Study Area

The Tanoé-Ehy Swamp Forest (TESF) is a marshy area of approximately 12,000 hectares, located between the Ehy Lagoon to the west and the Tanoé River to the south and east (5°5'-5°12'N; 2°43'-2°55'W) in Ivory Coast [1] (Fig. 1). Numerous small streams originating from the Tanoé River and various tributaries feed the FMTE, which flows into the Ehy Lagoon. The amount of water it contains is linked to rainfall : the region is subject to the influence of two rainy seasons (April to July and October to November) and two dry seasons (August to September and December to March) [1].

Sampling and identification of zooplankton organisms:

Zooplankton was collected once a month from March 2012 to February 2013 between 10:00 a.m. and 3:00 p.m. at three FMTE stations (Figure 1). Six 15-liter buckets of water (for a total volume of 90 liters) were drawn from the environment and filtered through a 64 µm mesh plankton net. The collected samples were reduced using a concentrator and then collected in a pillbox containing 5% formaldehyde. Zooplankton organisms were identified using the keys of [15-18] and counted under a Leica WILD M3c binocular microscope. The results obtained were translated into taxonomic richness, occurrence (%), diversity index (Shannon & Evenness) and expressed as density (ind/m^3).

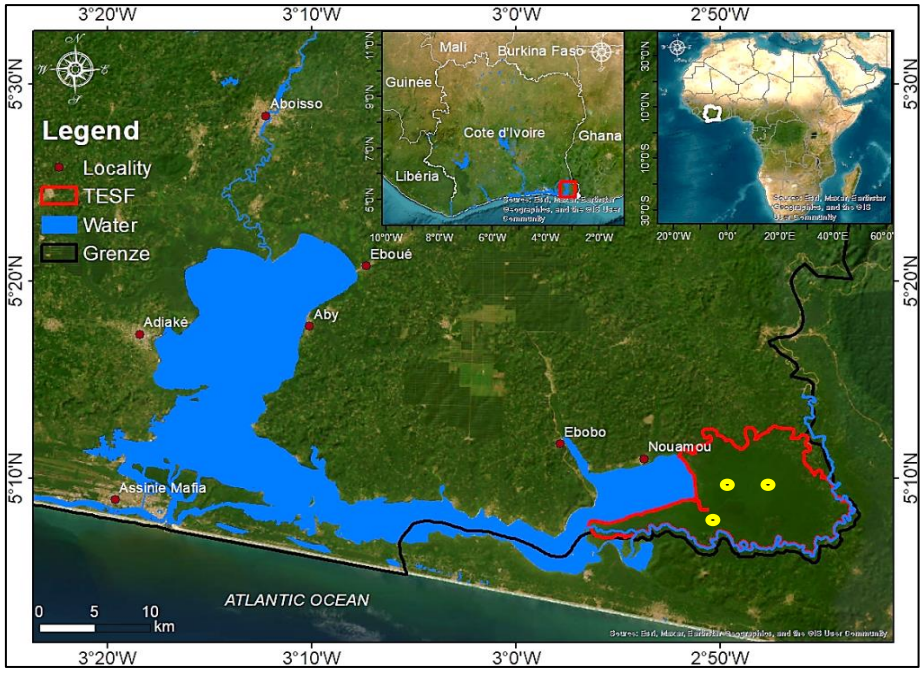

Figure 1: Overview showing the distribution of sampling stations in the Tanoe-Ehy Swamp Forest

Environmental characteristics were measured:

Water temperature (°C), pH, conductivity (µS/cm), and dissolved oxygen level (%) were measured using a Sper Scientific multiparameter meter. Water transparency (cm) was assessed using a secchi disk.

Data analysis:

Taxonomic richness and percentage of occurrence were used to determine the structure and dynamics of the zooplankton community. The percentage of occurrence (F) was obtained using the following formula: $F = (Si / St) \times 100$, where Si is the number of stations where taxon i was captured and St is the total number of stations sampled. Taxa were classified according to their percentage of occurrence based on [19] : $\%F \geq 50$: constant taxon; $25 \leq \%F < 50$: accessory taxon; and $\%F < 25$: accidental taxon. Seasonal variations in zooplankton densities were assessed using the Mann-Whitney U test. In this study, Spearman's rank correlation coefficient was applied to analyze the correlations between zooplankton and environmental variables.

RESULTS

Physico-chemical Characteristics of the Tanoé-Ehy Swamp Forest

Water temperature at the sampling sites ranged from 25 to 31.8 °C. Dissolved oxygen levels varied from 9.3 to 36.35%. pH ranged from 5.2 to 7.61. Conductivity at the sampled sites varied from 27.45 to 46.05 µS/cm. Transparency ranged from 15.5 to 41.5 cm, while depth varied from 52.5 to 197.5 cm.

The average values for temperature, pH, conductivity, and transparency were higher during the dry season, while those for dissolved oxygen levels and depth were higher during the rainy season. The differences noted are significant (Anova, $p > 0.05$) between seasons only for temperature, dissolved oxygen level and depth.

Furthermore, canopy closure rate and substrate type were also recorded at least once per season. Generally, it emerged that the substrates within the Ayenou sampling sites are predominantly composed of organic matter, including dead leaves, dead wood, roots, stems, and debris. Various plants, as well as clay and sand, were present. Canopy closure rates were estimated at 90%.

Table I: Values (mean ± standard deviation) of physicochemical parameters measured during the dry and rainy seasons in the Tanoé-Ehy Swamp Forest (Côte d'Ivoire) between March 2012 and February 2013

Saisons	Temp (°C)	O2 (%)	pH	Cond (µS/cm)	Prof (cm)	Trans (cm)
SS	28.61±2.09^a	17.11±17.11^a	6.23±0.78^a	38.77±5.00^a	75.21±22.93^a	27.57±8.68^a
SP	25.67±0.40^b	26.67±6.62^b	6.18±0.26^a	34.82±4.63^a	163.5±27.50^b	26.2±3.00^a

Within the same station, values in the same column with different letters in superscript show significant differences (ANOVA, $p<0.05$) (SS: dry season, SP: rainy season, Temp: Temperature, O2: Dissolved Oxygen, Cond: conductivity, Prof: Depth, Trans: Transparency)

Zooplankton Community

Distribution and Occurrence of Taxa

A total of 28 zooplankton taxa were recorded in the Tanoé-Ehy Swamp Forest. This community includes 10 Rotifers, 8 Copepods, 6 Cladocerans, and 4 other organisms (Table II). These 28 taxa are distributed among 16 families and 20 genera. Among these taxa, a lagoon taxon (*Pseudodiaptomus hessei*) is present.

Table II: Inventory and occurrence of zooplankton collected in the Tanoé-Ehy Swamp Forest (Côte d'Ivoire) between March 2012 and February 2013 during the dry season (DS) and the rainy season (RS)

Groups	Families	Taxa	DS	RS	P.O
Rotifers	Lecanidae	*Lecane leontina*	+	+	81.8
	Colurellidae	*Lepadella patella*		+	9.1
	Trichocercidae	*Trichocerca chattoni*		+	9.1
	Brachionidae	*Brachionus calyciflorus*	+	+	18.2
	Asplanchnidae	*Asplanchna girodi*	+	+	36.4
	Gastropodidae	*Ascomorpha* sp.	+	+	18.2
	Euchlanidae	*Euchlanis* sp.		+	9.1
		Mytilina mucronata		+	18.2
	Philodinidae	*Philodina* sp.	+	+	90.9
	Undetermined	Other rotifers		+	9.1
Copepods	Undetermined	Nauplii	+	+	90.9
		Mesocyclops sp.	+	+	90.9
	Cyclopidae	*Thermocyclops* sp.	+	+	81.8
		Apocyclops panamensis	+	+	45.5

	Diaptomidae	*Tropodiaptomus* sp.	+	+	54.5
		*Pseudodiaptomus hessei**	+		9.1
	Undetermined	Harpaticoïds	+		9.1
	Undetermined	Cyclopoids Undetermined		+	9.1
Cladocerans	Moinidae	*Moina micrura*	+	+	18.2
	Daphnidae	*Ceriodaphnia affinis*	+		9.09
	Sididae	*Diaphanosoma excisum*	+		18.2
	Bosminidae	*Bosminopsis* sp.		+	18.2
	Chydoridae	*Alona* sp.	+	+	45.5
		Chydorus sp.	+		9.1
Others	Undetermined	Ostracodes	+		18.2
	Undetermined	Arachnids larvae	+		9.1
	Chironomidae	Chironomidae larvae	+		63.6
	Undetermined	Other insect larvae	+	+	36.4
Total	16	28	21	21	

Fourteen taxa (*Lecane leontina*, *Brachionus calyciflorus*, *Asplanchna girodi*, *Philodina* sp., *Ascomorpha* sp., nauplii, *Mesocyclops* sp., *Tropodiaptomus* sp., *Thermocyclops decipiens*, *Apocyclops panamensis*, *Moina micrura*, *Alona* sp., *Chironomidae larvae* and other insect larvae) are recorded during both the dry and rainy seasons.

The richest family is the Cyclopidae (3 taxa), followed by the Euchlanidae, Diaptomidae, and Chydoridae (2 taxa each). All other families are monospecific. Of the taxa observed, 7 taxa (*Lecane leontina*, *Philodina* sp., nauplii, *Mesocyclops* sp., *Thermocyclops* sp., *Tropodiaptomus* sp. and Chironomidae larvae) are constant occurrences, and 3 taxa (*Apocyclops panamensis*, *Alona* sp., and other insect larvae) are incidental. The remaining 18 taxa, with occurrences below 25%, are accidental. The taxonomic richness is 21 taxa for each season. The majority of taxa (17 taxa) recorded in the FMTE are accidental taxa.

Community Structure

Copepods constitute the most represented group (94.24%). They are followed by Rotifers (3.84%), Cladocera (1.034%), and other organisms (0.89%). The structure of the main zooplankton groups indicates that, in terms of density, Rotifers are largely dominated by *Lecane leontina* (41.88%), followed by *Philodina* sp. (31.06%) and then *Euchlanis* sp. (8.92%). Among the copepods, Nauplii (80.19%), *Thermocyclops* sp. (12.55%), and Mesocyclops sp. (5.93%) are the most abundant taxa. *Alona* sp. (57.41%), *Diaphanosoma excisum* (16.85%), and *Bosminopsis* sp. are also present. (13.81%) constitute the major taxa at the Cladocerans level. At the total zooplankton level, the most abundant taxa are Copepods nauplii (75.77%), *Thermocyclops decipiens* (11.85%), *Mesocyclops* sp. (5.60%), *Lecane leontina* (1.54%) and *Philodina* sp. (1.15%).

Seasonal variation of zooplankton population

a) Total Zooplankton

Total zooplankton density varies between 878 and 56,489 individuals/m³. The average abundance of total zooplankton is higher in the dry season (30,431 individuals/m³) than in the rainy season (12,111 individuals/m³) (Figure 2A).

However, the differences observed between seasons are not significant ($p > 0.05$). In both the dry and rainy seasons, total zooplankton density is largely dominated by copepods (96% to 89%), followed by rotifers (3% to 7%). In all seasons, total zooplankton is dominated by copepod nauplii (73.67% in the dry season versus 82.10% in the rainy season).

b) Rotifers

Rotifers have an abundance ranging from 344 to 2111 individuals/m³. The highest average abundance was observed during the rainy season (829 individuals/m³ in the rainy season versus 804 individuals/m³ in the dry season) (Figure 2B). However, the analysis of variance did not reveal a significant difference ($p > 0.05$) between the seasons.

Rotifers are dominated by *Lecane leontina* (64.48%), followed by *Philodina* sp. (25.51%) during the dry season. Conversely, during the dry season, Philodina (37.51%), *Euchlanis* sp. (19.31%), and *Lecane leontina* (19%) are the dominant taxa.

c) Copepods

At the copepod level, the density ranged from 333 to 77,378 individuals/m³. The highest average copepod density was recorded during the dry season (29,266 individuals/m³) compared to 10,826 individuals/m³ during the rainy season (Figure 2C). ANOVA comparison of densities between the dry and rainy seasons showed no significant differences ($p > 0.05$). Nauplii (76.60%) and *Thermocyclops* sp. (15.93%) were the dominant taxa during the dry season. Conversely, nauplii (91.84%) and *Mesocyclops* spp. (4.91%) dominated the copepod population.

d) Cladocerans

Cladocerans exhibited low densities throughout the sampling period, ranging from 0 to 574 individuals/m³. The highest average density was observed during the rainy season (270 individuals/m³)

and the lowest during the dry season (170 individuals/m³) (Figure 2D). However, the differences observed between seasons were not statistically significant ($p > 0.05$). In both the dry and rainy seasons, *Alona* sp. Was the dominant taxon among the cladocerans.

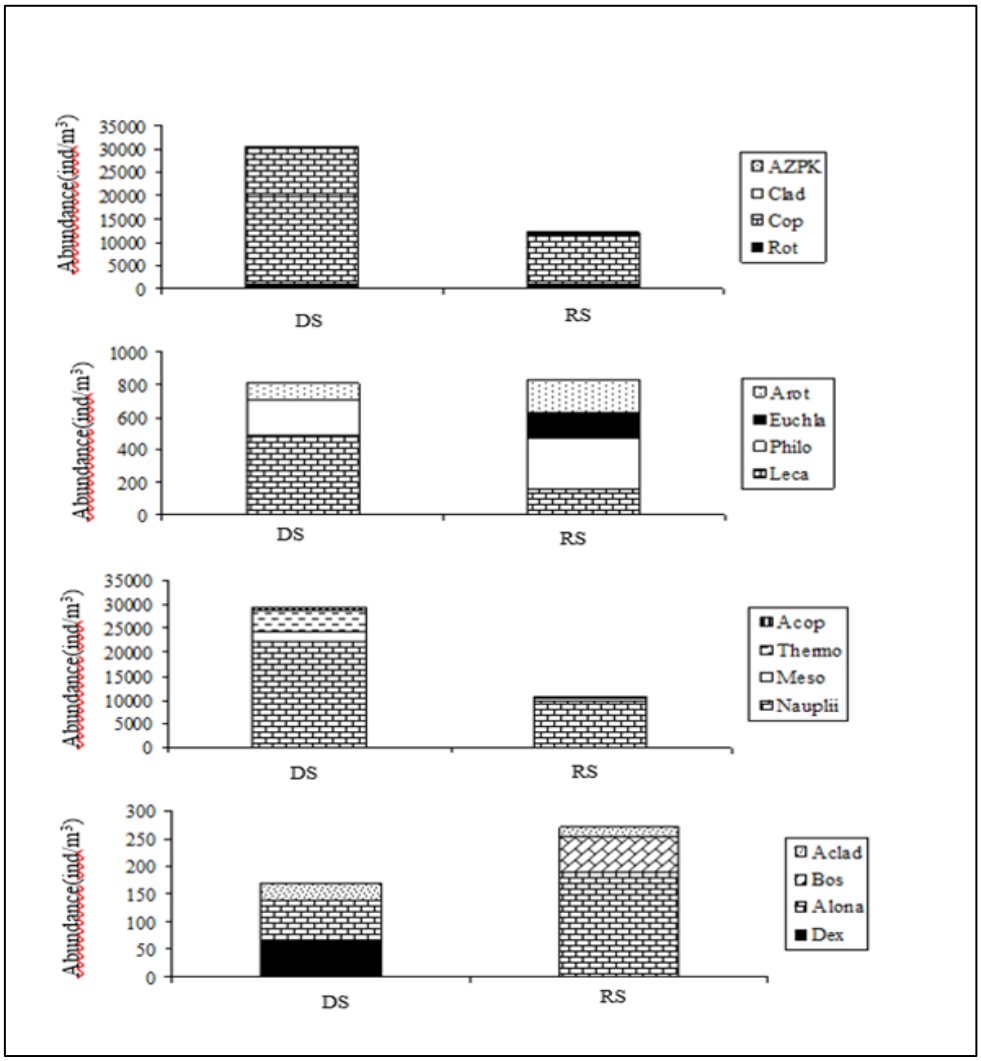

Figure 2: Seasonal variations in the abundance of total zooplankton (A) and the main taxa of the zooplankton groups [Rotifers (B), Copepods (C), Cladocera (D)] sampled at Ayenou (Côte d'Ivoire) from March 2012 to February 2013 (Rot: Rotifers, Cop: Copepods, Clad: Cladocerans, Azpk: other zooplankton, Arot: other Rotifers, Euchla: Euchlanis sp., Philo: *Philodina* sp., Leca: *Lecane leontina*, Acop: other Copepods, Thermo: *Thermocyclops* sp., Meso: *Mesocyclops* spp., Aclad: *other Cladocera*, Bos: *Bosminopsis* sp., Dex: *Diaphonosoma excisum*).

Influence of environmental factors on Zooplankton Community distribution

The correlations between environmental variables and the different zooplankton groups show that Conductivity, pH, and transparency are negatively correlated with all zooplankton groups, while depth, temperature and oxygen are positively correlated with these organisms. (Table V). The variables that strongly influence the distribution of zooplanktonic organisms in the FMTE are temperature, dissolved oxygen, and depth.

Table III: Spearman's rank correlation between zooplankton groups and environmental variables.

Taxons	Cond (µS/cm)	Temp (^{O}C)	DO (%)	pH	Trans (cm)	Depth (m)
Rotifers	-0.024	0.77	0.68	-0.23	- 0.22	0.84
Cladocerans	-0.12	-0.58	0.72	-0.16	- 0.37	0.63
Copepods	-0.61	0.67	0.54	- 0.25	0.623	0.89
Others	-0.05	0.29	0.43	- 0.33	- 0.45	0.58

DISCUSSION

In the Tanoé-Ehy Swamp Forest, temperatures ranging from 25 to 31.8 °C. This temperature range is higher than that obtained by [20] in Taï National Park (20.9 to 25.7 °C) and by [21] in the Bandama River (21.6 °C to 28 °C), but similar to the temperature range

recorded by [22] in the Gambia River in Nioloko Koba National Park in Senegal (24.9 to 31.3 °C). This high temperature in the rivers and the Tanoé-Ehy Swamp Forest is likely linked to the low canopy cover (less than 50% in most of the study stations). In southeastern Ivory Coast, forest areas are increasingly being destroyed to make way for agricultural production. As a result, in the absence of vegetation cover, sunlight reaches the surface of waterways directly, causing a rise in the surrounding temperature.

The average dissolved oxygen levels obtained in this study (9.3% to 36.35% in TESF) are significantly lower than those found in other aquatic environments. For example, oxygen saturation levels of 60% to 110% have been recorded in the Boubô River [21] and the Bandama River [23] (Ivory Coast). The low dissolved oxygen levels observed in this environment are largely attributed to the decomposition of abundant organic matter in this hydrosystem. This decomposition by bacteria leads to the depletion of dissolved oxygen.

The average pH is acidic at 6.23 in the Tanoé-Ehy Swamp Forest during the dry season, compared to 6.18 during the rainy season. These values are low compared to those reported by [23] and [24]. Several processes can influence water pH. The most important are (1) the balance of photosynthesis and respiration reactions, (2) the presence in the water of organic acids with weak acidic functional groups, and (3) water originating from the watershed [25, 26, 27]. Furthermore, an increase in carbonic acid concentration due to dominant mineralization of organic matter can lead to a decrease in pH [28], as is likely the case in the Tanoé-Ehy Swamp Forest. According to [28], pH variations that support the development and protection of aquatic life should be between 6 and 9 [27]. Outside this range, organisms could experience stress that would compromise some of their vital functions.

Twenty-eight zooplankton taxa were obtained from the Tanoé-Ehy Swamp Forest (TMSF). The zooplankton of the TMSF is comparable to that observed in lake Chad in Chad [29], lake Guiers in Senegal [30], and the Aiba Reservoir in Nigeria [31]. The zooplankton community is dominated by copepods in terms of abundance (94.24%). Such dominance has already been observed in the Aiba Reservoir in Nigeria [31], where copepods accounted for 85.86% of the total abundance. The total zooplankton is dominated by copepod nauplii in both the dry and rainy seasons (73.67% in the dry season versus 82.10% in the rainy season). The dominance of nauplii in all seasons indicates continuous copepod reproduction [32]. According to [33], year-round or seasonal copepod reproduction depends on the rhythm and abundance of food resources as well as temperature. Thus, the Tanoé-Ehy Marsh Forest appears to be a favorable environment for the reproduction of these organisms. *Thermocyclops* sp. and *Mesocyclops* sp. (constant taxa) are the most abundant taxa. The high abundance of cyclopids in the streams is linked to cyanobacterial blooms [34]. Furthermore, analysis of stomach contents of species of the genus *Thermocyclops* by [35] showed that these species ingest a high percentage of organic debris in addition to the consumption of Cyanophyceae (mainly Microcystis). Furthermore, the substrates of the Tanoé-Ehy Marsh Forest, being predominantly composed of organic matter, would favor the abundance of copepods, and in particular the abundance of *Thermocyclops* sp. It is well known that zooplankton, and copepods in particular, play a crucial role in nutrition, maintaining the growth and survival of invertebrates [36] and fish [14]. Indeed, copepods, which are the main secondary producers in aquatic ecosystems, transfer energy flows from primary producers. Towards higher levels in the food chain, such as zooplankton-feeding fish [37]. According to [38], in the natural environment, food availability is one of the most important environmental factors affecting animal survival. [1] also noted the presence of 33 fish species, including 6 species with estuarine and/or marine affinities and 27 exclusively freshwater species, in the Tanoé-Ehy Marsh Forest. Among these species, 10 are sedentary. Such continuous reproduction of copepods within the TESF would therefore provide fish with a permanent food source. This could explain the importance of this body of water as a preferred feeding and nursery site for numerous fish species, as reported by [1].

The predominance of accidental taxa (17 taxa) observed in the TESF reflects the non-permanent nature of the majority of species recorded in this environment. These taxa are not typical elements of the local fauna but likely originate from the adjacent Aby-Tendo-Ehy Lagoon System. Their presence could be explained by the fact that the TESF may serve as a refuge or breeding ground for lagoon species, especially since a lagoon species (*Pseudodiaptomus hessei*) has been recorded in this forest.

The factors influencing zooplankton distribution in this forest are temperature, dissolved oxygen, and depth. Temperature appears to be a determining factor for zooplankton development. Indeed, moderate temperature increases stimulate the metabolism and reproductive rate of planktonic organisms [39]. In tropical marshes, temperatures between 25 and 30 °C promote the proliferation of rotifers and copepods by accelerating reproductive cycles and increasing the availability of phytoplankton, the main food source. In the Tanoé-Ehy context, this positive correlation likely reflects an intensification of biological productivity in warmer areas, particularly during the dry season, when photosynthesis is enhanced. Dissolved oxygen, also positively correlated, reflects the quality of the environment and the level of water aeration. Sufficient oxygen levels promote the survival and reproduction of hypoxia-sensitive planktonic organisms [40]. In the Tanoé-Ehy marshes, the presence

of dense vegetation cover and areas of high aquatic photosynthesis (macrophytes and phytoplankton) increases oxygen availability, creating optimal conditions for zooplankton development. These observations are consistent with those of [41] in the wetlands of southeastern Côte d'Ivoire, where a positive correlation between oxygen and zooplankton density was also demonstrated.

Depth also has a positive influence on zooplankton, contributing to greater thermal and chemical stability in the water column. Deeper areas offer refuge from abrupt variations in temperature and turbidity, thus allowing the coexistence of a greater number of taxa [42]. In the TESF, these deeper areas are likely less exposed to disturbances. Mechanical processes (wind, eddies) and sedimentation ensure better retention of planktonic organisms and a more favorable environment for their reproduction.

CONCLUSION

Twenty-eight zooplankton taxa (distributed among 16 families and 20 genera) were recorded in the Tanoé-Ehy Swamp Forest. Copepods constitute the most represented group (94.24%). They are followed by rotifers (3.84%), cladocerans (1.03%), and other organisms (0.89%). In all seasons, the total zooplankton is dominated by copepod nauplii (73.67–82.10%). The average abundance of total zooplankton is higher in the dry season (30,431 individuals/m³) than in the rainy season (12,111 individuals/m³). Factors that strongly influence the distribution of zooplankton are temperature, dissolved oxygen, and depth. The majority of taxa recorded in the TESF are accidental and the presence of a lagoon taxon in this environment suggests that this forest is a refuge area for species from the adjacent Aby-Tendo-Ehy lagoon System.

REFERENCES

1. Konan Y.A., 2014. Diversity of the fish fauna and bioecological characteristics of Thysochromis ansorgii (Boulenger, 1901) and Steindachner, 1894 in the Tanoé-Ehy swamp forest (Côte d'Ivoire). Doctoral thesis, Félix Houphouët Boigny University, Côte d'Ivoire, 172 p.
2. Cicin-Sain B., Knecht R.W. & Fish G.W., 1995. Growth capacity for integrated coastal management since UNCED : an international perspective. *Ocean Coastal Management*, 29 (1-3): 93-123.
3. FAO, 1994. Mangrove forest management guidelines. *FAO Forestry Paper*, 117 : 320 p.
4. Hauhouot C., 2004. Anthropogenic pressures on the natural environments of southeastern Ivory Coast. *International Journal of Tropical Geology and Ecology*, 28 (1-2): 68-82.
5. Seu-Anoï N.M., Ouattara A., Koné Y.J.M. & Gourène G., 2011. Seasonal distribution of phytoplankton in the Aby lagoon system, Ivory Coast, West Africa. *African Journal of Aquatic Science*, 36 (3): 321-330.
6. Linnaeus C. (1758). Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio decima, reformata. Holmiae, 824 pp.
7. Audebert J. B. (1797). Natural History of Monkeys, Painted from Nature / Natural History of Monkeys and Lemurs. Folio, 178 p
8. Kerr R. (1792). The Animal Kingdom, or Zoological System of the Celebrated Sir Charles Linnaeus ; Class I. Mammalia. Edinburgh : William Creech. 400 p.
9. Koné I., Béné J-C. K., N'Guessan A.K., Bitty A.E., Koffi A.D., Akpatou K.B. & Gonedelébi S., 2008. A plea for the preservation of the Tanoé Swamp Forest (Southeast Côte d'Ivoire), a site of exceptional conservation value in West Africa and the world. *RASAPCI*, Abidjan, 25 p.
10. Zadou D. A., Koné I., Mouroufié V. K., Adou Yao C. Y., Gleanou E. K., Kablan Y. A., Coulibaly D. & Ibo J. G., 2011. Conservation value of the Tanoé-Ehy Swamp Forest (Southeast Côte d'Ivoire): socio-anthropological dimension. *Tropical Conservation Science*, 4 (4): 373-385.
11. Durantel D., Garces A., Moras H. & Pillet F., 2003. Evaluation of the impact of forestry activities on water quality. *Report of the International Office for Water*, 14 p.
12. Koné T., Teugels G.G., N'douba V., Gooré Bi G. & Kouamelan E.P., 2003. First data on the inventory and distribution of the fish fauna of a small West African coastal basin : the Gô River (Côte d'Ivoire). *Cybium*, 27 (2): 101-106.
13. Piasecki W., Goodwin A.E., Eiras J.C. & Nowak B.F., 2004. Importance of Copepoda in freshwater aquaculture. *Zoological Studies*, 43 (2): 193-205.
14. Brassard D., 2009. Long-term variability of Cladocerans in boreal forest lakes subjected to natural and anthropogenic disturbances. Master's thesis, Université du Québec, Canada, 42 p.
15. Ouattara I.N., Ouattara A., Koné T., N'douba V. & Gourène G., 2007. Distribution of zooplankton along two small West African coastal basins (Bia and Agnébi ; Côte d'Ivoire). *Agronomie Africaine*, 19 (2): 197-210.
16. Etilé N.R., Kouassi A.M., Aka M.N., Pagano M., N'douba V. & Kouassi N.J., 2009. Spatio-temporal variations of zooplankton abundance and composition in a West African tropical coastal lagoon (Grand-Lahou, Côte d'Ivoire). *Hydrobiologia*, 624 : 171-189.
17. 15. De Mannuel J., 2000. The rotifers of Spanish reservoirs : ecological, systemic and zoogeographical remarks. *Liinnetica*, 19 :91-167.
18. Dussart B.H. & Defaye D, 2001. Introduction to the Copepoda (2nd ed.) Guides to the Identification of the Microinvertebrates of the Continental Waters of the World, 16 : 1-344.
19. Sharma S, 2010. Micro-faunal diversity of Cladocerans (Crustacea : Branchiopoda : Cladocera)

in rice field ecosystems of Meghalaya. *Records of Zoological Survey of India*, 110, 35-45.
20. Kotov A.A., Jeong H.G. & Lee W., 2012. Cladocera (Crustacea : Branchiopoda) of the southeast of the Korean Peninsula, with twenty new records for Korea. *Zootaxa*, 3368 : 50–90.
21. Dajoz R., 2000. Précis d'écologie, 7th edition, Dunod, Paris, 615 pp.
22. Kamelan T.M., 2014. Fish population of some hydrosystems in the Taï region (Côte d'Ivoire). Doctoral thesis, Félix Houphouët-Boigny University, Côte d'Ivoire, 212 pp.
23. N'Zi G.K., Gooré B.G., Kouamélan E.P., Koné T., N'Douba V. & Ollevier F., 2008. Influence of environmental factors on the spatial distribution of shrimp in a small West African basin—the Boubo River—Côte d'Ivoire. *Tropicultura*, 26 (1): 17–23.
24. Reichard M., 2008. Microhabitat use by fishes in the middle course of the River Gambia in the Niokolo Koba National Park, Senegal : a unique example of an undisturbed West African assemblage. *Journal of Fish Biology*, 72 : 1815–1824.
25. Aboua B.R.D., 2012. Development of a fish biotic integrity index for the preservation of biodiversity in the Bandama River. Doctoral thesis, Félix Houphouët-Boigny University, Côte d'Ivoire, 227 p.
26. Berté S., 2009. Biology and ecology of Distichodus rostratus (Günther, 1864) in a specific hydrosystem in Côte d'Ivoire. Doctoral thesis, University of Cocody, Côte d'Ivoire, 180 p.
27. Groleau A., Harrault L., Viollier E., Gaillard A., Pepe M. & Benedetti M., 2008. Temporal variability of pH and the CO2-Carbonate system in the Seine River in Paris. *Piren-Seine Annual Report*, 17 p.
28. Bertrin V., Vandenhende M., Laplace-Treyture C. & Dutartre A., 2009. Ecological assessment of the aquatic environments of the Palais de Molua : Project for a National Nature Reserve of the Hourtin Dunes and Marshes. Cemagref Bordeaux, Networks, Purification and Water Quality Research Unit. Final report, 98 p.
29. CRE, 2009a. pH. Fact sheet. *Laurentians Regional Environment Council*, 3 p.
30. CRE, 2009b. Conductivity. Fact sheet. *Laurentian Regional Environment Council*, 3 p.
31. Saint-Jean L., 1983. The zooplankton. *Monographiae Biologicae*, 53: 199-232.
32. Ka S., 2006. Zooplankton communities of two tropical lakes (Lake Guiers and Dakar Bongo Reservoir, Senegal): relationships with environmental factors, phytoplankton, and cyanobacterial blooms. PhD thesis, Aix-Marseille University, France, 212 p.
33. Akindele O.E. & Olutona O.G., 2014. Water Physicochemistry and Zooplankton Fauna of Aiba Reservoir Headwater Streams, Iwo, Nigeria, 11 p.
34. Mageed A.M., 2006. Spatio-temporal variations of zooplankton community in the hypersaline lagoon of Bardawil, North Sinai, Egypt. *Egyptian of the Aquatic Research*, 32: 168–183.
35. Dussart B.H., 1980. Copepods. In : Durand J.R. & Lévêque C. (Eds): Aquatic Flora and Fauna of Sahelian-Sudanian Africa, Volume I. ORSTOM, Paris : 333–356.
36. Sampaio E.V. & Lopez C.M., 2000. Zooplankton community composition and some limnological aspects of an oxbow lake of the Paraopeba river, Sao Francisco River Basin, Minas Gerais, Brazil. *Brazilian Archives of Biology and Technology*, 43(3): 285-293.
37. Rietzler A.C. & Espindola E.L.G., 1998. Microcystis as a food source for Copepods in a subtropical eutrophic reservoir. *Verhandlungen des Internationalen Verein Limnologie*, 26: 2001-2005.
38. Levinsen H. & Nielsen T.G., 2002. The trophic role of marine pelagic and heterotrophic dinoflagellates in Arctic and temperate coastal ecosystems : a cross-latitude comparison. *Limnology and Oceanography*, 47(2): 427-439.
39. Banse K., 1995. Zooplankton : Pivotal role in the control of ocean production. *Journal of Marine Science* 52: 265-277.
40. Millot S. & Bégout M.L., 2009. Individual fish rhythm directs group feeding : a case study with juvenile sea bass (Dicentrarchus labrax) under self-demand feeding conditions. *Aquatic Living Resources*, 22: 363-370.
41. Wetzel R.G. (2001). Limnology : Lake and River Ecosystems. *Academic Press, San Diego*, 1006 pp.
42. Margaleff R, 1983. Limnologia. *Omega*, Barcelona. 1010 p.
43. Kouamé A.A., Jaboyedoff M., Goula Bi Tie A., Derron M.H., Kouamé K.J. & Meier C. (2019). Assessment of the Potential Pollution of the Abidjan Unconfined Aquifer by Hydrocarbons. *Geosciences*, 9(2), 60.
44. Sommer U., Adrian R., de Senerpont Domis L., Elser J.J., Gaedke U., Ibelings B., Jeppesen E., Lürling M., Molinero J.C., Mooij W.M., van Donk E. & Winder M. (2012). Beyond the plankton ecology group (PEG) model : Mechanisms driving plankton succession. *Annual Review of Ecology, Evolution, and Systematics*, 43, 429-448.