Available online on 15.09.2020 at http://jddtonline.info

Journal of Drug Delivery and Therapeutics

Open Access to Pharmaceutical and Medical Research

Open Access Research Article

Zooplankton Diversity in the Bay of Tabounssou: The Case of Faban Estuary, Guinea

Pé 2 Goumou[1,2,*], Lanan Wassy Soromou[1], Mama Agnès Tea[1], Yighiwoï Koivogui[1], Mohamed Keyra[1], Hoinsoudé Segniagbeto [2]

[1] Higher Institute of Science and Veterinary Medicine (ISSMV) of Dalaba, BP: 09, Republic of Guinea

[2] University of Lomé, B.P. 1515 Lomé - Togo, Republic of Togo

ABSTRACT

On the Guinean coast, about 218 planktonic species are encountered among which, 184 species of zooplankton belonging to 60 families have been identified and copepods alone represent 63%. In the Faban estuary, fish larvae are the only group generally exploited. Fishing is carried out by men using the hawk net with small meshes. Women are the most involved in this activity, they ensure the processing and marketing of the products.

A total of twenty-seven (27) zooplankton and water samples were collected and analyzed. The various field observations and laboratory analyses revealed 21 taxa, fourteen (14) of which belonged to the Crustacean phylum, two (2) to the Chaetognathes phylum, one (1) to the Cnidaria phylum and four (4) to the Vertebrate phylum. In terms of abundance, copepods are the most represented (57%) followed by Zoes (20%) and jellyfish (10%). The zooplankton population is unevenly distributed across the stations and this distribution is governed by environmental parameters.

The analysis of water samples taken has identified variations in certain environmental parameters. In contrast to salinity, which averaged 14.23 g/l, temperature and turbidity decreased from upstream to downstream, with averages of 26.86°C and 33.47 NTU respectively, while the highest values for pH (7.92) and dissolved oxygen (6.71) were observed in September at Stations 2 and 3, respectively.

Keywords: Zooplankton Diversity, Bay of Tabounssou, environmental parameters, pH, dissolved oxygen

Article Info: Received 18 July 2020; Review Completed 24 August 2020; Accepted 31 August 2020; Available online 15 September 2020

Cite this article as:

Goumou P, Soromou LW, Tea MA, Koivogui Y, Keyra M, Segniagbeto H, Zooplankton Diversity in the Bay of Tabounssou: The Case of Faban Estuary, Guinea, Journal of Drug Delivery and Therapeutics. 2020; 10(5):223-231
http://dx.doi.org/10.22270/jddt.v10i5.4318

***Address for Correspondence:**

Pé 2 Goumou, Higher Institute of Science and Veterinary Medicine (ISSMV) of Dalaba, BP: 09, Republic of Guinea

INTRODUCTION

Ecosystems are home to a diverse set of organisms interacting with each other and with their environment. Each of these organisms, through its ecological niche and independently of its size, plays a specific role in the balance of its ecosystem, particularly in the food chain. It is recognized that the same animal can have several sources of food, and can be the prey of several animals. Thus, in aquatic environments, different food chains come together to form a trophic network in which various species of plankton are involved. In Guinea, about 218 planktonic species are encountered, among which 184 species of zooplankton belonging to 60 families have been identified and copepods alone represent 63% [1].

In estuaries, the zooplankton community is abundant and diverse. This diversification gives it a central place in the trophic chain since it is at the same time consumer, predator and prey. As such, it is the indispensable link in the food webs and energy transfers within the ecosystem. It plays a major role not only in the transfer of matter to the higher levels of the marine chain, but also in the biogeochemical cycles of the elements [2].

Beyond this central importance in the food web and water quality control, zooplankton, because of its sensitivity to certain forms of pollution and to variations in a large number of environmental factors, can be considered as an important indicator for the health of aquatic ecosystems [3].

In the Guinean estuarine areas in general and the Faban estuarine area in particular, several species of zooplankton live there because of the favourable living conditions and the availability of nutrients.

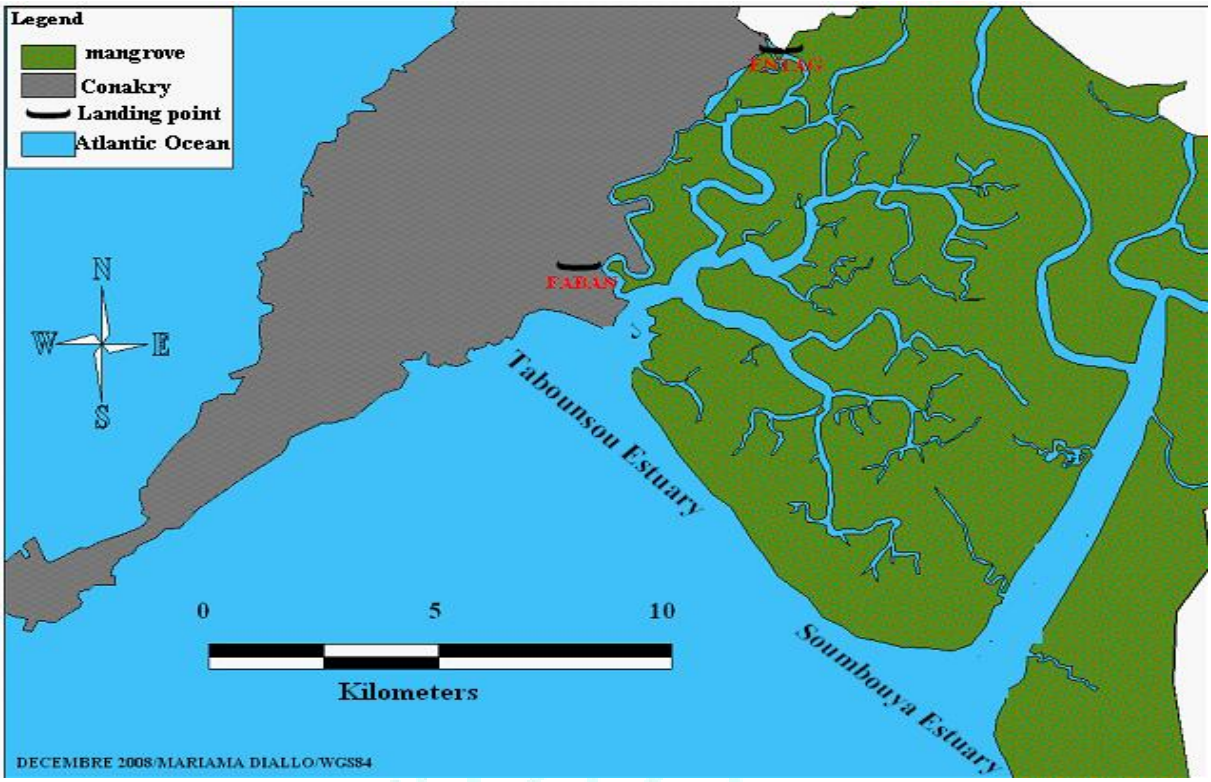
However, this ecosystem is subject to dangerous anthropogenic pressures. In Guinea, 80 to 90% of wastewater is discharged into the sea without being treated. About 80% of the pollution load of the marine and coastal environment is believed to be attributable to land-based sources and 20% to maritime activities [4]. These pressures on the environment are leading to a decrease in its biodiversity. Thus, the aim of this study is to establish a good knowledge of this ecosystem.

MATERIALS AND METHODS

Study area

The Bay of Tabounssou, called the Bay of Tabounssou by the ancient navigators of the Bofon estuary, is located south of the seafront of Conakry. It is bordered to the north by the urban commune of Coyah, to the northwest by the city of Conakry, to the south by the Atlantic Ocean, and to the southeast by the basin of the Soumbouya River.

The bay of Tabounssou is located in the east of Conakry. It lies between 9°24'-9°40' north latitude and 13°35'-13°45' west longitude. It consists mainly of the riparian populations of the Commune of Matoto and that of Coyah. They are mainly represented by the sub-suburbs.



B-METHODS

The first phase of this work was a survey of managers at the Scientific Research Center of Rogbanè-Conakry and the National Center of Fishery Sciences of Boussoura, who were asked questions using a pre-established survey forms. Each of the managers involved was asked to collaborate in order to facilitate our work in the field. These managers were asked whether previous studies had been carried out in this area and in this zone, whether the exploitation of larvae and juveniles is a formal activity. At the end of this survey, the archives were searched in order to obtain figures on the diversity of zooplankton in Tabounssou Bay. After these various surveys, we took water and zooplankton samples aboard a 45hp motorized boat during three (3) missions and at three (3) fixed stations.

Because of the shallow depth of the study area, which varied between 2 and 4 meters, zooplankton samples were collected vertically from the bottom to the surface using the zooplankton net (Hensen net) with a mesh size of 55microns and a diameter of 70 cm at the net opening. The collected samples were fixed with 5% formalin.

In parallel to the zooplankton collection, the surface water temperature was determined in situ and water samples were collected for analysis in the laboratory in order to determine certain abiotic parameters such as temperature, salinity, pH, turbidity and dissolved oxygen.

Figure 3: Sampling Station Map [**Source:** Google Earth]

Table I: Geographical coordinates of sampling stations

Stations	Depth	Geographical coordinates	
		Latitude	Longitude
Station 1	2m	9°58'003"	-13°59'513"
Station 2	2m	9°57'844"	-13°59'327"
Station 3	4m	9°57'491"	-13°59'196"

At the CERESCOR plankton laboratory, for the analysis of the samples taken and the identification of the zooplankton species encountered, we proceeded:

- The determination of biological parameters, i.e. the determination of the abundance of taxonomic groups and the determination of the specific abundance of species;

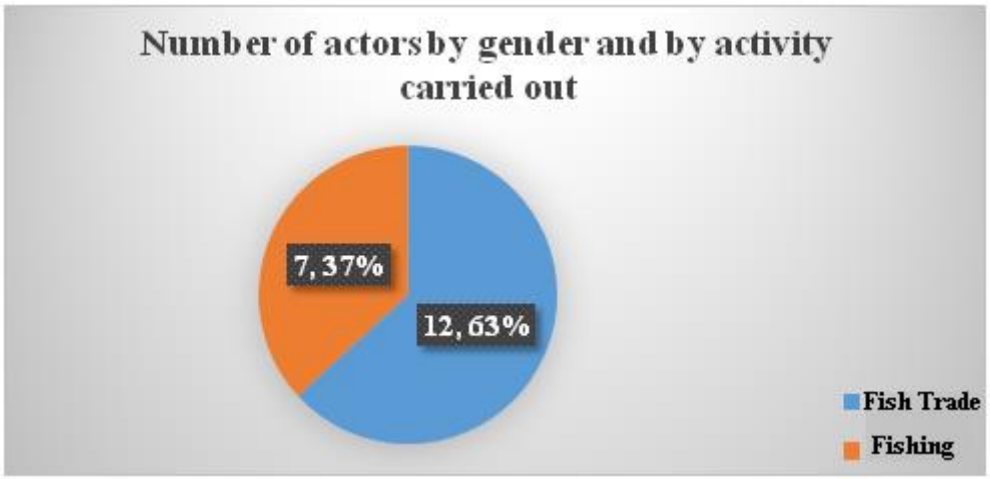
- The determination of the physical and chemical parameters of the water, i.e. temperature, pH (hydrogen potential), salinity, turbidity and dissolved oxygen.

RESULTS

The results of field surveys at the Scientific Research Center of Rogbanè-Conakry and the National Center of Fishery Sciences of Boussoura are illustrated in the tables, sectors and histograms below:

Table II: Classification by ecological groups of copepods found on the Guinean continental shelf

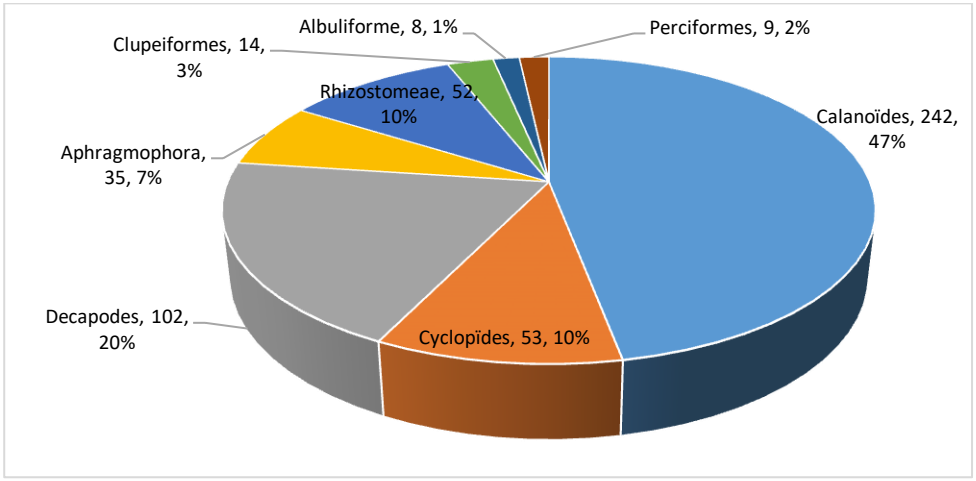
N°	Ecological Group	Scientific name	
		Gender	**Species**
1	Estuary	*Paracalanus*	*P. aculeatus*
		Nanocalanus	*N. minor*
		Calanus	*C. minor*
2	Neritic	*Paracalanus*	*P. scotti*
		Oithona	*O. simplex*
3	Semi-Nerritics	*Paracalanus*	*P. parvus*
		Centropages	*C. velificatus*
		Temora	*T. stylifera*
		Eucalanus	*E. pileatus*
			E. subtenuis
4	Oceanics	*Scolecithrix*	*S. danae*
		Euchata	*E. danae*
			E. hebes
		Rhincalanus	*R. cormitus*
			R. nosctus
		Eucalanus	*E. attenuatus*
		Pareuchaeta	*P. gracilis*



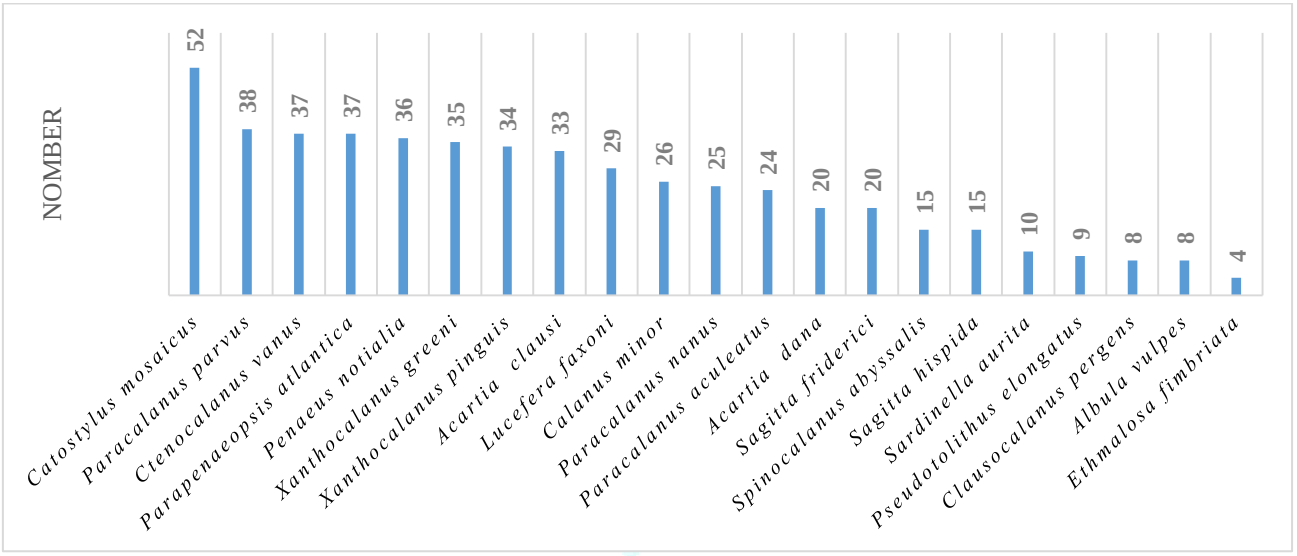
Sectoral 1: Breakdown of actors by gender and by activities performed

Table III: Inventory of zooplankton species found in the Estuary of Faban

Order	Family	Scientific names	Number of individuals per month			Total
			sept	**oct**	**nov**	
Calanoids	*Paracalanidae*	*Paracalanus aculeatus*	14	4	6	24
		Paracalanus parvus	8	19	11	38
		Paracalanus nanus	14	5	6	25
	Calanidae	*Calanus minor*	7	8	11	26
	Pseudocalanidae	*Ctenocalanus vanus*	18	5	14	37
		Clausocalanus pergens	3	5	0	8
		Spinocalanus abyssalis	9	0	6	15
	PHaenidae	*Xanthocalanus greeni*	18	4	13	35
		Xanthocalanus pinguis	18	9	7	34
Cyclopids	*Acartiidae*	*Acartia dana*	8	9	3	20
		Acartia clausi	18	10	5	33
Decapods	*Penaeidae*	*Penaeus notialia*	24	5	7	36
		Parapenaeopsis atlantica	17	10	10	37
	Luciferidae	*Lucefer faxoni*	6	11	12	29
Aphragmophora	*Sagitiidae*	*Sagitta hispida*	4	3	8	15
		Sagitta friderici	7	9	4	20
Rhizostomeae	*Catostylidae*	*Catostylus mosaicus*	5	18	29	52
Clupeiformes	*Clupeidae*	*Ethmalosa fimbriata*	4	0	0	4
		Sardinella aurita	3	4	3	10
Albuliforme	*Albulidae*	*Albula vulpes*	2	0	6	8
Perciforme	*Sciaenidae*	*Pseudotolithus elongatus*	3	3	3	9
	Taxonomic diversity		**210**	**141**	**164**	**515**



Sectoral 2: Abundances by taxonomic groups

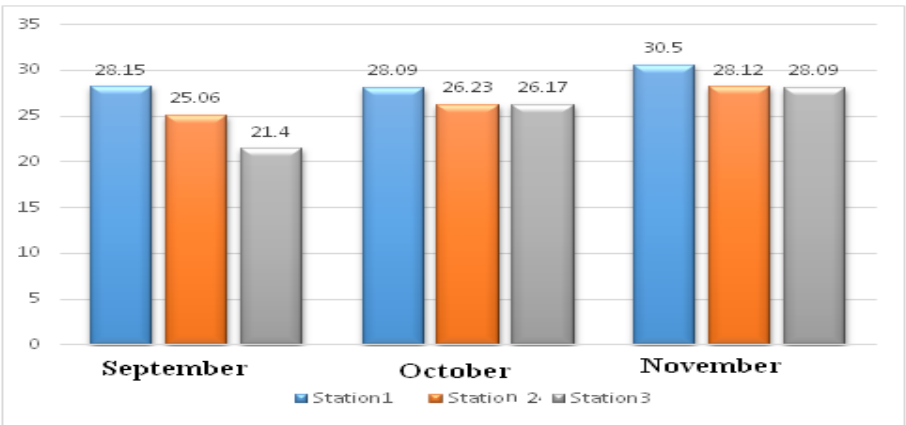


Histogram 1: Abundance of zooplankton species found in the three (3) Stations

a- Determination of physical and chemical parameters

❖ **The temperature**

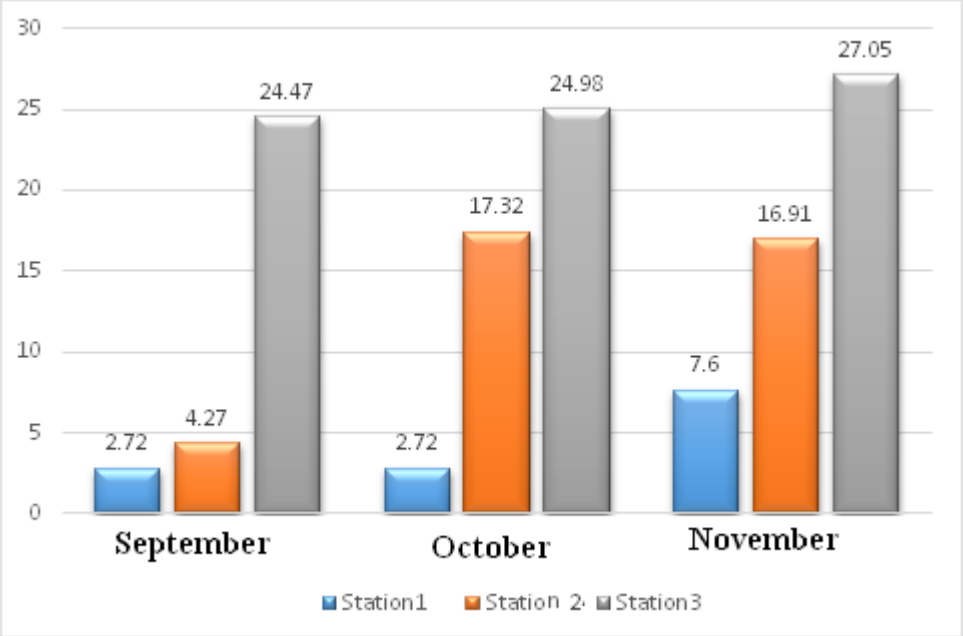
Water temperature is an important factor in aquatic life. Its variation depends on both coastal and freshwater temperatures and its cycle is determined by the ratio of marine and river influences. However, the temperature can be altered by local conditions and by water discharges. There is an enormous variety of temperature adaptations in plankton species, ranging from psychrophiles to thermophiles adapted to warm temperatures by allowing species differentiation according to latitudinal and vertical temperature gradients, conditions their distribution and diversity [5]. During our investigations, the values obtained are presented in the histogram 2.



Histogram 2: Spatial and temporal temperature variation

❖ **Salinity**

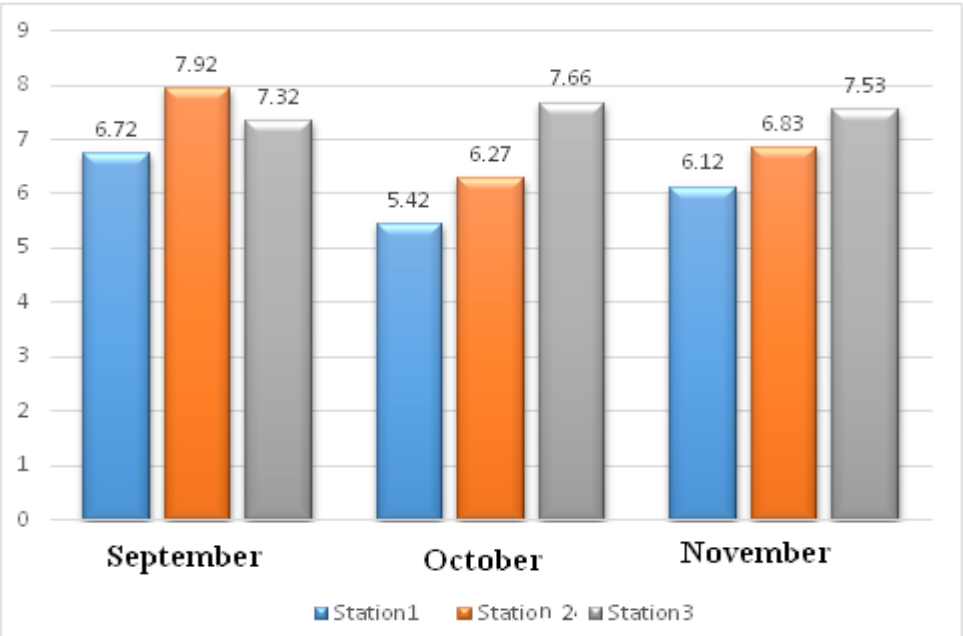
The average salinity of the oceans is 35g/l and generally remains between 30g/l and 40g/l. Salinity is a determining factor in the distribution of zooplankton communities, they are relatively abundant and diverse as long as the salinity does not exceed 70‰ [6]**(P. S. DIOUF, A. DIALLO, (1987).** The values found are presented on histogram 3.



Histogram 3: Spatial and temporal variation of salinity

❖ **Hydrogen potential (pH)**

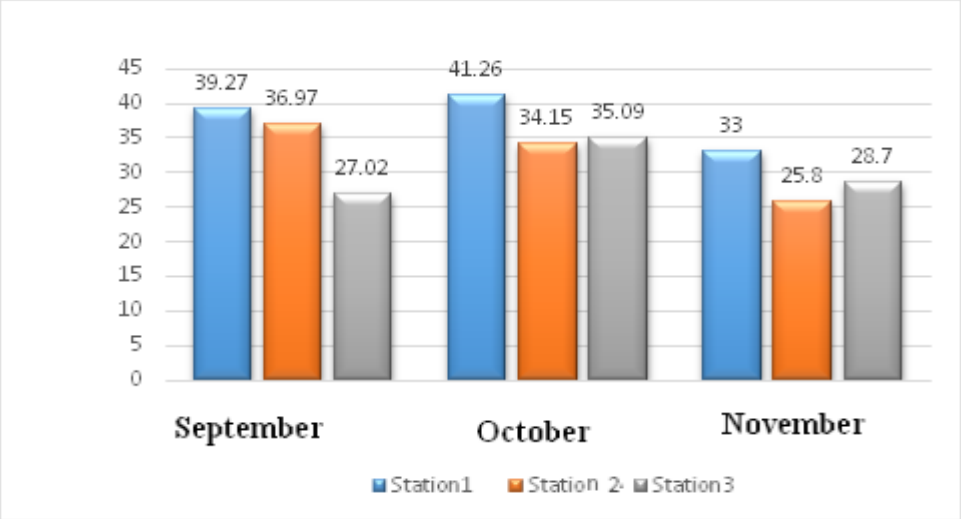
The hydrogen potential (pH) is one of the very essential environmental parameters in the distribution of aquatic organisms. It is the characteristic of the acidity of sea water. The pH strongly influences the mechanism of chemical and biological reactions in water. In natural waters, pH values are between 6 and 8.5 and decrease in the presence of high levels of organic matter and increase in periods of low water, when evaporation is important [7] (**Derwich, E.et al., 2010**). The pH values found in the analyses are shown in histogram 4.



Histogram 4: Spatial and Temporal Variation of pH

❖ **Turbidity**

Cloudy water is water that contains mineral particles (clay, silica, silt), suspended plant and animal organic matter. Waters with very high turbidity are surface waters. The values found during our investigations are presented in histogram 5.

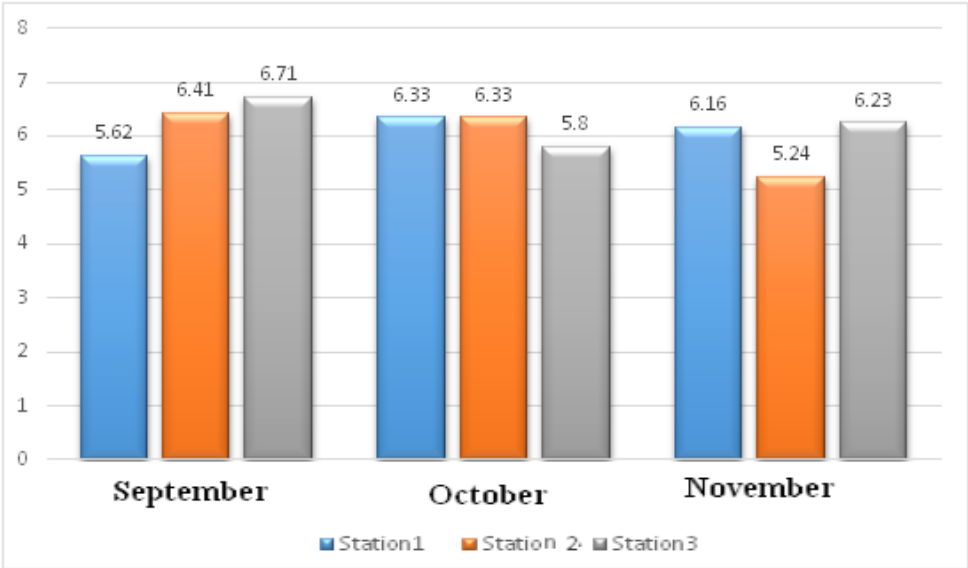


Histogram 5: Spatial and temporal variation of turbidity

❖ **Dissolved oxygen**

Oxygen is one of the most useful parameters for water and is an excellent indicator of its quality. It is one of the parameters most sensitive to pollution. Its value gives us information about the degree of pollution and therefore the degree of self-purification of water.

During our analyses, its recorded values are marked on histogram 6.



Histogram 6: Spatial and temporal variation of dissolved oxygen

Table IV: Water quality as a function of physical and chemical parameters in estuary areas in the rainy season

Abiotic parameters	**Average**	**WHO standards (1976)**	**Appréciation**
Temperature (°c)	26,87	26 à 30	Good
Salinity (g/l)	14,23	3,5 à 35	Good
pH	6,87	6,5 à 8,5	Good
Turbidity (NTU)	33,47	0,4 à 4	Wrong
Dissolved oxygen (mg/l)	6,09	5 à 8	Good

DISCUSSION

The Guinean coastline is an area of very varied biological diversity; about 218 planktonic species encountered, 184 species of zooplankton belonging to 60 families have been identified and copepods alone account for 63% [1].

Of the 19 actors surveyed, 12 were fish merchants, i.e. 63%, and 7 were fishermen, i.e. 37%. This low number of fishermen is due on the one hand to the fact that the exploitation of juvenile fish is a less profitable activity to interest a large number of professional fishermen, and on the other hand to the fact that a single fisherman can supply 2 or 3 fish wholesalers. These results are in line with those of Faro N. et al. (2005) [8] who point out that in the exploitation of larvae and juveniles, women are the most involved.

The inventory of zooplankton species at the stations revealed a very diverse population. A total of 515 individuals from 8 orders, 12 families and 21 species were identified in the three (3) stations. September was the richest month with a percentage of 39.81%. The observation of this richness confirms the data previously obtained by Adandedjan D. et al. (2017) [9] according to which the qualitative and quantitative increase of zooplankton in a coastal zone takes place during the rainy season. This fact is remarkable in the July-September period.

The copepods represented by the Calanoid and Cyclopid groups are the most numerous (57.28% of the total number of individuals) followed by zoes represented by decapods (19.51%). These results are consistent with the work of Diouf PS. and A. Diallo, (1987) [6] who maintain that in an estuary, copepods are the most numerous with a frequency that varies between 23.75% and 58.27% relayed by zoes 18.11%.

Dominance of the species Catostylus mosaicus as a representative of jellyfish is very remarkable (52 individuals) followed by *Paracalanus parvus* (38 individuals) and *Ctenocalanus vanus* (37). The species of *Ethmalosa fimbriata* presented the smallest number of individuals (4). These results are contrary to those who indicate that jellyfish in terms of species are poorly represented in an estuary [6].

The temperature value decreases from upstream to downstream (coastal to offshore). This variation is influenced by: the depth of the water, the degree of sunshine but also by river water supplies. During our investigations, its value varied between 21.4°C and 30.5°C and peaked in november at station 1, while its lowest value was found at station 3 in September (21.4°C). These results are consistent with those of Pezennec, O. (1999)[10] which indicates that, hydrologically, Guinean waters remain warm year-round and are close to the ambient temperature of the area. It should be noted that it is a result of its tropical climate.

Salinity, unlike seawater temperature, increases from the coast to the open sea. Its value ranges from 2.72g/l to 27.05g/l with an average of 14.23g/l. The lowest salinity was observed in September (2.72g/l) at Station 1 and the highest salinity in November (27.05g/l) at Station 3. This would be justified by the significant freshwater inflow from the mainland and heavy rainfall.

These results are consistent with those found by Pezennec, O. (1999) [10] who argues that salinity in Guinea varies seasonally ranging from 2‰ in the rainy season (July to August), at the mouths to 34 g/l in the dry season. Rainfall is the main driver of such variations. In the Guinean estuarine environment, the salinity rate always remains below 35 g/l and varies from 27.3 g/l to 0 g/l less than 20 km from the mouths [11].

The pH values vary from station to station but also from period to period. The values recorded in the Faban Estuary during our research ranged from 5.42 to 7.92. The lowest value of 5.42 was recorded in October (at station 1), which could be due to its proximity to the coast and anthropogenic sources of pollutants. Unlike the months of October and November, we note that in September, the pH value dropped from station 2 to station 3, which could be justified by the presence of engine oils at this location at the time of our sampling.

The waters of the Faban Estuary are heavily disturbed. This high turbidity is not only the consequence of the shallow depth of the area, the nature of the soil that makes up the watershed, the state of the plant cover but also of the drainage of runoff and watercourses or, the mixing of water masses by waves, the organisms that live and tidal movements. Our results are in agreement with the work of Diané, L. et al. (2005) [12] on Sangaréah Bay in which he argues that the high turbidity of the waters is recorded during the rainy season and can be explained by the important contribution of solid particles resulting from the leaching of soils in the watershed caused by rainfall due to deforestation and soil degradation.

The dissolved oxygen (DO) concentration also varies from one station to another. During our investigations, its highest value was found in September (6.71). In order to assess water quality, we compared the mean value found for each parameter during the three (3) samplings to the standards given by the World Health Organization.

The mean turbidity value found does not comply with the standard, which is the result of the muddy nature of the bottom, the nature of the soil forming the catchment area and the intensity of the fluvial inputs into the estuary.

Unlike the latter, the averages of temperature, salinity, pH, and dissolved oxygen are in accordance with World Health Organization standards. This conformity allows us to deduce that the waters of the Faban estuary are still of good quality, which would justify the great biological diversity of the area. These ideas are in line with those of Diouf PS et al, (1987) [6] who conclude that at present, the waters of an estuary are favorable for the development of zooplanktonic organisms through the coexistence of different water masses (coastal and oceanic) despite the pressure on living and non-living resources.

CONCLUSION

The present work, whose interest stems from the lack of information on plankton on the Guinean shelf in its coastal part, has made it possible to study zooplankton, a food base for many marine organisms, including some commercial fish. The research has made it possible to study the taxonomic composition, spatial and temporal dynamics of the qualitative and quantitative characteristics of the organisms, as well as the laws governing the distribution of these organisms in relation to certain environmental factors. The results show that:

- The waters of the Faban estuary are favorable to the development of zooplanktonic organisms through the coexistence of different bodies of water (coastal and oceanic) despite the pressure on living and non-living resources;
- The physical and chemical parameters of Faban waters vary from one station to another, favoring the regulation of the distribution of zooplanktonic organisms;
- The maximum amount of zooplankton is obtained during the rainy season thanks to the supply of nutrient-rich streams.

REFERENCES

1- Domain F, Chavance P, Diallo A. . Coastal fisheries in Guinea: resources and exploitation - IRD / CNSHB, 2000; 2 13, rue La Fayette- 754 80 Paris Cedex 10.
2- Banse K. Zooplankton: Pivotal role in the control of ocean production: I. Biomass and production. *ICES Journal of Marine Science* 1995; 52(3-4) 265–277, https://doi.org/10.1016/1054-3139(95)80043-3
3- Ouedraogo I, Oueda A, Gneme A, Sirima D, Zongo F, Guenda W, Kabre GB. Spatial distribution and influence of some physico-chemical factors on Zooplankton in two urban reservoirs (Ouagadougou, Burkina Faso). 2015
4- Guinee/PNUE. National Report on the Marine and Coastal Environment, November 2006.
5- Demory D. Impact of temperature on phytoplankton and its interactions with viruses. 2017; Available at https://tel.archives-ouvertes.fr/tel-01653093/document. Accessed 12/08/2018. Pp 194.
6- DIOUF PS, DIALLO A. Spatial and temporal variations of zooplankton in a hyperhaline estuary: Casamance. Rev. Hycfrobiol. hop. 1987; 20 (3-4):257-269.
7- Derwich E, Benaabidate L, Zian A, Sadki O, Belghity D.. Physico-chemical characterization of the waters of the alluvial groundwater of upper Sebou downstream of its confluence with OUED FES. Larhyss J. 2010; 08:101-112 **7.**
8- Faro N, Diallo O, Diallo MM. Evaluation of the socio-economic contribution of fisheries to Gross Domestic Product and rural development, 2005; version 3 (in french)
9- Adandedjan D, Makponse E, Hinvi LC, Laleye P. Preliminary data on the diversity of zooplankton in Lake Nokoué (South Benin), J. Appl. Biosci. 2017; 115:11476 - 11489. (French version)
10- Pezennec O. Environnement hydro-climatique de la Guinée. In: Domain F. et al. (éds),– La pêche côtière en Guinée : ressources et exploitation. IRD édition, Paris, Collection colloques et séminaire, 1999; 7-27.
11- Pandaré, D, Tamoïkine, MY. Study of ichthyo plankton in coastal and estuarine waters bordered by mangroves in Guinea and Senegal. In: Mangrove dynamics and use in southern river countries (du Sénégal à la Sierra Leone). Marie Christine, Cormier Salem, ORSTOM, 1994.
12- Diané I, F Doumbouya, ML Bamy. Influence des activités anthropiques sur le fonctionnement hydrodyna.mique de a Baie de Sangaréyah (Dubréka/Guinée) Ministère de la pêche et de l' economie maritime, 2006.