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Study of the composition and determinism of the microalgal content in the stomach of clams (bivalvia: veneridae) of the nkam-wouri river basin in Cameroon

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Abstract
Since knowledge of clam diets is necessary for their domestication, new information is provided on the composition of the micro-algal flora in the stomach contents of Clams from the Nkam-Wouri River. 1465 Clams with different sizes were sampled in the dry season and their stomach composition in micro algal contents was investigated. The relationships between microalgal flora, size and age of clams on one hand, microalgal flora, substrate physical and chemical parameters on the other hand were assessed. A total of 27 microalgae species were identified belonging to 6 phyla, 10 classes, 16 orders, 18 families, 24 genera and 28 species. The Cyanophyceae class was the most represented (12 species or 44%) while the Chrysophyceae was the least represented (only one species or 3.70%). *Uronema elongatum* and *Oedogonium* sp were mainly consumed by Clams of different size classes (juveniles, adults and breeders in the three stations). A high quantity of organic matter (> 32mg/g) was recorded in the sediment of the three stations, which justifies the high number of Cyanophyceae (44%) and the very small number of Chrysophyceae (3.70%) enumerated in stomach contents of Clams.

**Keywords:** Composition, determinism, clams, stomach, microalgae, nkam-wouri

1. Introduction
Worldwide, nearly 6 million children under the age of five years die each year from malnutrition and food insecurity [1]. Developing countries in Africa are the most affected [2]. There is hardly meaningful quality of protein in the diet. It is therefore urgent to find practical and adequate solutions, such as the production of animal resources using the example of bivalves, more specifically Clams. The domestication and conservation of this shellfish species can be a solution to the problems of malnutrition. With a large food capacity, the Clam has a high iron (Fe) content; or 4 times more than a portion of beef liver with equal weight, phosphorus, omega 3 fatty acid, vitamin B12 (25ug per 100g), protein (15.4g and 77kcal per 100g of flesh), without forgetting their water filtration activities which make Clams excellent indicators of the quality of natural watercourses [3]. Despite all these advantages, clam farming remains an area of little interest in Cameroon [4]; its evolution is still at an embryonic stage, there is almost no scientific data on its bio-ecology. Knowledge of the zootechnical parameters of production in the Nkam-Wouri pool is essential for possible domestication and the development of a plan for the promotion and sustainable management of this resource. The totality of clams recorded on the national territory comes mainly from fishing. The latter, coupled with the demographic boom, puts pressure on this resource. A considerable drop, of 113 tonnes of clams caught, was recorded from 2005 to 2008; i.e. 240 and 127 tonnes respectively at the lower Sanaga level [5]. It therefore becomes urgent to find alternatives such as domestication in order to reduce the pressure on the stock of clams available on the Cameroonian coast. This study aims to contribute for a better understanding of the biology of clams. It is more precisely to analyze their stomach contents and determine their diets in order to deduce the factors likely to influence them in their natural habitat.

2. Material and Methods
2.1. Description of the site and the spatial device for sampling clams
The study area is located in the Department of Nkam, Littoral Region of Cameroon (Fig. 1). The Littoral region where the Nkam River is located is at the bottom of the Gulf of Guinea
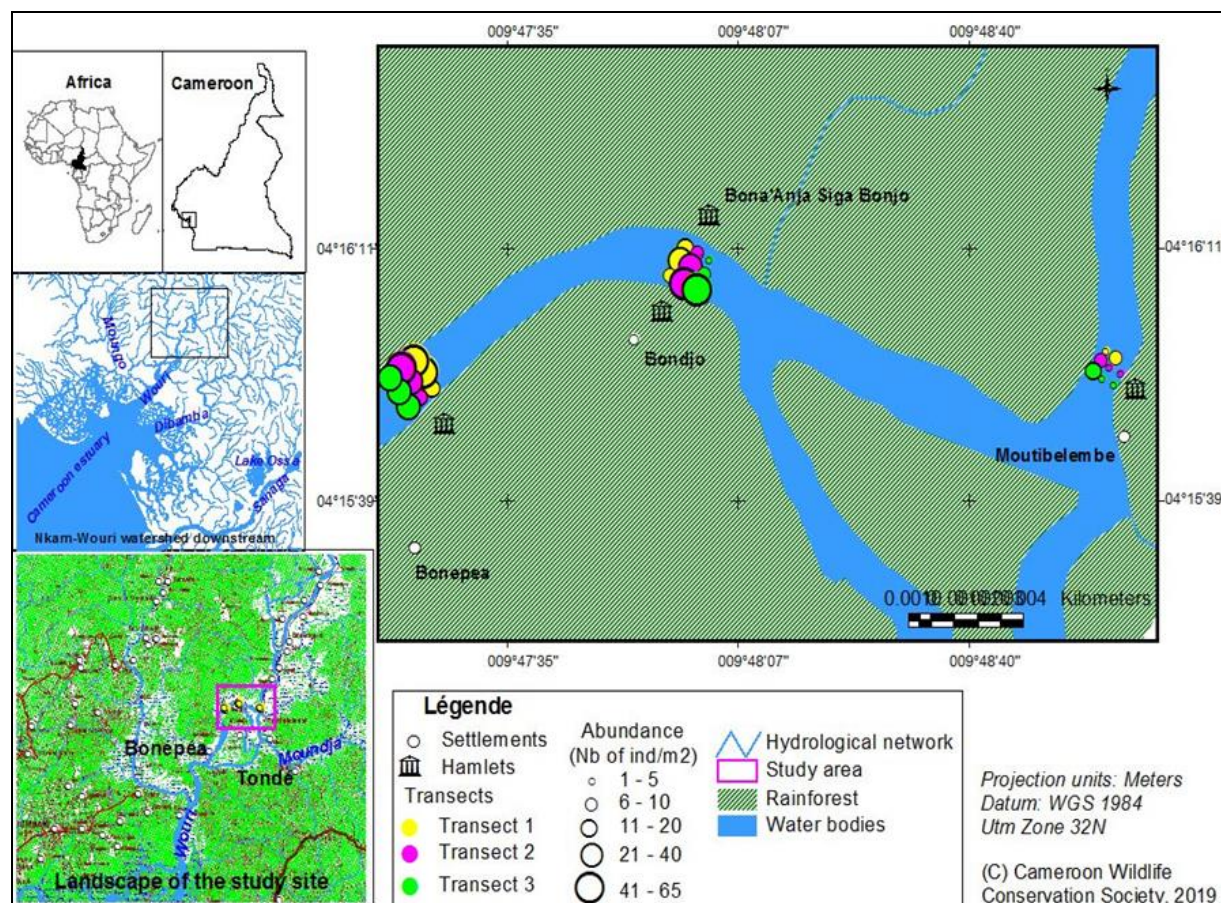
Fig 1: Localisation of the study area (Atlas Cameroun 2017, modified by Diyouke, 2019).

The climate prevailing there is equatorial of the maritime type [6]. The average monthly temperature varies between 24.8 °C from July to August and 27.7 °C in February. The precipitation shows that it is rainy, spanning 9 months. This average monthly precipitation ranges from 55mm in December to 800mm in August. The prevailing wind carries the monsoon [7]. The major part of this region has a geological cover constituted by formation of the basement essentially represented by gneiss-embredists with biotite and secondarily by anatexis, non-circumscribed and circumscribed syntectonic granites. The soils derived from these rocks are very varied: red ferralitic soils. The clams studied came from a section of the Nkam river between the localities of Moutibelembe (4 ° 15 '52.33' 'to 4 ° 16' 07.23 '' NL and from 9 ° 47 '19.90' 'to 9 ° 48 '58.52' 'LE) upstream, from Bona' Anja-Siga-Bonjo (4 ° 15 '54.80' 'to 4 ° 16' 05.87 '' LN and from 9 ° 47 '20, 29 '' at 9 ° 49 '02.25' 'LE) intermediate and Bonapea (4 ° 15' 52.55 '' at 4 ° 16 '07.30' 'LN and 9 ° 47' 20.52 '' at 9 ° 49 '04.42' 'LE) downstream.

The sampling device used for this study and the environmental variables are those shown in Figure 2. In each of the three stations (Moutibelembe, Bona'Anja-Siga-Bonjo and Bonapea), three line-transects of 100 m long each were placed perpendicular to the coast. On each line-transect, three collection points were made, i.e. nine sampling points in total per station.

Fig 2: Sampling scheme in station2; Line-transects (red) and sampling points (yellow).

2.2. Acquisition of environmental data
As Clams are benthic organisms, sampling at the bottom can considerably affect the quality of the water, in particular by resuspending a good quantity of material deposited at the

bottom. The physico-chemical parameters of the water at each station and sampling point (pH, temperature, salinity, dissolved oxygen, dissolved matter or TDS rate and conductivity) were measured in situ before any clam and sediment sampling in order to " avoid this bias in the physico-chemical analysis of water quality. These parameters were measured using a multi-parameter Hanna brand.

A volume of 500ml of water sample was taken from a sterilized bottle and then fixed with formalin at 5%. These water samples were labeled and then placed in an insulated cooler. Another 200 liters of water was taken from three randomly selected points at each station and then filtered using the plankton net. The filtrate was transferred to a 50 cl plastic bottle, then fixed with 5% formalin, labeled and stored in the insulated cooler. All these samples were transported to the Laboratory for analysis.

After the sampling of Clams, sediment samples were then collected in each station at three levels of different depths (10cm, 20cm and 30cm) using an artisanal corer (50cm in length and 12cm in diameter) buried in the substrate manually by applying pressure to the auger head. The samples collected have been put in labeled ziplox sachets and kept in an icebox (4 °C) then transferred to the laboratory. These analyzes were conducted at the Aquafrik Laboratory in Yaoundé.

2.3. Clam collection
The collection of clams took place from December 27, 2018 to May 27, 2019, during low water periods. A harvest campaign was carried out each month, for a total of six campaigns per year. The Clams were collected on foot (December 2018 to April 2019) and snorkeling at the start of the floods (May 2019), in a 1m^2 quadrat inside each sampling point, using a collecting container of 10 liters.

2.4. Acquisition of biometric data from clams
After capture, the Clams were grouped according to the

different size classes inspired by the model of the bivalve development cycle [8]. Then, the weight of the flesh and the shell of each Clam were obtained using a scale of brand SF-400, with a sensitivity of 0.1g to 5000g. The length, height and bulge were measured using a digital caliper brand LCD-Adoric. The flesh of each clam was isolated and then stored in a 20 cl plastic jar containing 10% formalin [9]. The remaining valve streaks were counted under a binocular lens to determine the age of the Clams according to the method of [10], each streak corresponding to one year of age. In addition, other darker growth lines called increments between two streaks representing a seasonal pattern were counted.

2.5. Analysis of stomach contents of Clams
In the laboratory, the stomach contents of 975 clams were analyzed out of the 1465 clams, making 2/3 of the individuals harvested.

The stomach contents of each Clam were put in a 10ml beaker and homogenized. After stirring each beaker left standing for 24 hours, a drop of each sample was mounted between the slide and the coverslip by a dropper and then observed under a photonic microscope of the Olympus brand. Five preparations were made for each sample. The identifications were carried out directly under the microscope. Drawings and picturing were made for individuals that were difficult to identify for more details. Identification keys were being used [11, 12, 13].

The counting was carried out according to the method [25]. After determining the frequent microalgae in a sample, the enumeration of microalgae was carried out, 1 ml of the content of the bottom was removed by a micropipette and then poured into the Malassez counting slide. The Olympus photon microscope was used for the counting of individuals. The microalgae counting unit was set at 100μm as 1 individual. Colonies and coenobes were considered as 1 individual [15].

Fig 3: Sample of clams showing different classes.

2.6. Statistical analyzes
The Excel spreadsheet (2010) was used to perform the descriptive statistics (means and standard deviations) as well as the representation of the histograms. The XLSTAT 2014 software made it possible to highlight the dendrogram, to perform the Principal Component Analysis (PCA), the Factor Analysis of Correspondences (AFC). The ANOVA inferential analysis was done according to the model. The non-parametric Kruskal-Wallis test was used to make the comparisons. *: Statistically significant at P-value <0.05.

3. Results
A total of 1465 Clams were collected in the Nkam-Wouri River during the six sampling campaigns. This section presents the results obtained after the various analyses.

3.1 Qualitative analysis of the stomach content of clams removed
The analysis of stomach contents made it possible to list 6 phyla of microalgae consumed, separated into 10 classes, 16 orders, 18 families, 24 genera and 28 species. The most

represented family is that of Cyanophyceae with 12 species while Chrysophyceae constitute the less represented family, with only one species. It appears that two (2) of the phyla (Rhodophyta and Pyrrhophyta) out of the 6 that make up the classification of algae [11, 12, 13] were not represented. The taxonomic richness of the site is summarized in Figure 2 (frequency of families of microalgae) and detailed in Table I right up to a species level.
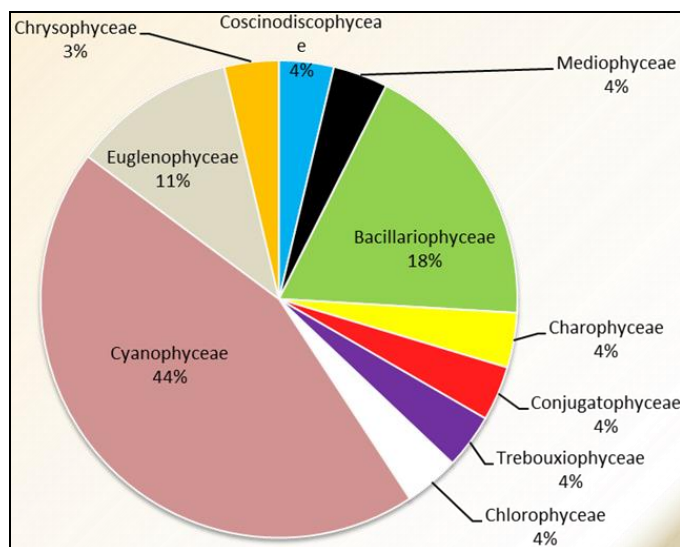
Fig 4: Frequency diagram of the different families of microalgae found in the stomach of Clams

The diagram in Figure 4 shows the composition and frequency of microalgae taxa found in the stomach of Clams. Three families (Cyanophyceae, Bacillariophyceae and Euglenophyceae) were most represented in the stomach contents of Clams, with frequencies of 44%, 18%, and 11% respectively, or a total of 73% of the representative rate occupied by these three families. The other seven (7) families (Chlorophyceae, Charophyceae, Mediophyceae, and Coscinodiscophycea) represent only 27% of the total microalgal content.

Table 1: Taxonomy of the identified microalgae in the stomach content of clams

Phylum	Class	Order	Family	Genus	Species
Bacillariophyta	Coscinodiscophyceae	Coscinodiscales	Coscinodiscaceae	*Coscinodiscus*	*Coscinodiscus* sp.
	Mediophyceae	Stephanodiscales	Stephanodiscaceae	*Cyclotella*	*C. ocellata*
	Bacillariophyceae	Cymbellales	Cymbellaceae	*Cymbella*	*C. naviculiformis*
		Cymbellales	Cymbellaceae	*Cymbella*	*Cymbella* sp.
		Fragilariales	Fragilariaceae	*Fragilaria*	*F. capucina*
		Naviculales	Naviculaceae	*Navicula*	*N. nivalis*
		Naviculales	Pinnulariaceae	*Pinnularia*	*P. gibba*
Charophyta	Charophyceae	Charales	Characeae	*Chara*	*Chara* sp.
	Conjugatophyceae	Desmidiales	Gonatozygaceae	*Gonatozygon*	*G. monotaenium*
Chlorophyta	Trebouxiophyceae	Chlorellales	Chlorellaceae	*Actinastrum*	*Actinastrum* sp.
	Chlorophyceae	Oedogoniales	Oedogoniaceae	*Oedogonium*	*Oedogonium sp.*
		Chaetophorales	Uronemataceae	*Uronema*	*U. monotaenium*
Cyanophyta	Cyanophyceae	Nostocales	Aphanizomenonaceae	*Aphanizomenon*	*A. flosaquae*
		Synechococcales	Merismopediaceae	*Aphanocapsa*	*A. holsatica*
		Synechococcales	Merismopediaceae	*Aphanocapsa*	*A.littoralis*
		Nostocales	Rivulariaceae	*Calothrix*	*Calothrix* sp.
		Oscillatoriales	Oscillatoriaceae	*Lyngbya*	*Lyngbya* sp.
		Synechococcales	Merismopediaceae	*Merismopedia*	*Merismopedia* sp.
		Chrococcales	Microcystaceae	*Microcystis*	*M. aeruginosa*
		Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria* sp.
		Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*O. subsalsa*
		Oscillatoriales	Oscillatoriaceae	*Phormidium*	*Phormidium* sp.
		Nostocales	Aphanizomenonaceae	*Raphidiopsis*	*R. curvata*
		Nostocales	Rivulariaceae	*Rivularia*	*R. aquatica*
Euglenozoa	Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*E. mutabilis*
		Euglenales	Euglenaceae	*Euglena*	*E. viridis*
		Euglenales	Euglenaceae	*Trachelomonas*	*T. hispida*
Ochrophyta	Chrysophyceae	Chromulinales	Dinobryaceae	*Dinobryon*	*Dinobryon* sp.

Figure 5 shows the micro algal abundance of phyla according to the stations. Station 3 recorded a maximum abundance of 53.52% compared to the other 2 stations (32.40% and 14.09%). The phyla Cyanophyta and Chlorophyta were the most abundant whatever the station considered while the phylum Ochrophyta was the least represented.
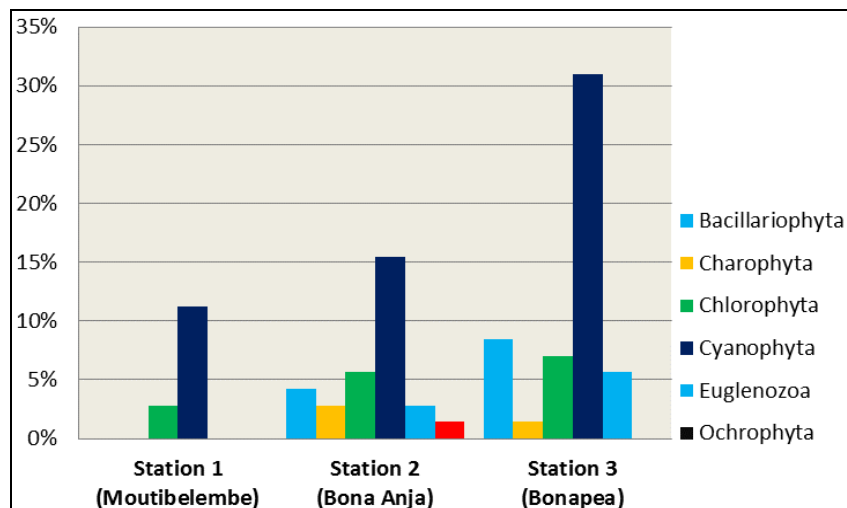
Fig 5: Microalgal abundance of phyla per stations.

3.2 Quantitative analysis of stomach contents according to the size of the Clams

Table 2 below shows the number of microalgae individuals per milliliter, obtained by manual counting. We note that a total of 3210 microalgae were counted: 2010 (62.62%), 950 (29.60%) and 250 (7.78%) microalgae were identified respectively in stations 3; 2 and 1. In general, the average density of microalgae was higher in Clams of size class 6 (80-100mm), i.e. 1240 microalgae

Table 2: Mean densities of microalgae obtained in the stomach contents of Clams in different stations

Stations	Size class (cm)	1 [5-30[	2 [30-40[	3 [40-50[	4 [50-60[	5 [60 -80[	6 [80 -100[	Total par Station
1 Moutibelembe		40	180	0	20	10	0	250
2 Bona Anja	Micro Algues/ml	260	130	180	80	110	190	950
3 Bonapea		0	120	240	350	250	1050	2010
Total/classe		300	430	420	450	370	1240	3210

3.3. Correspondence factorial analysis between sizes of clams and the stomach contents at all stations
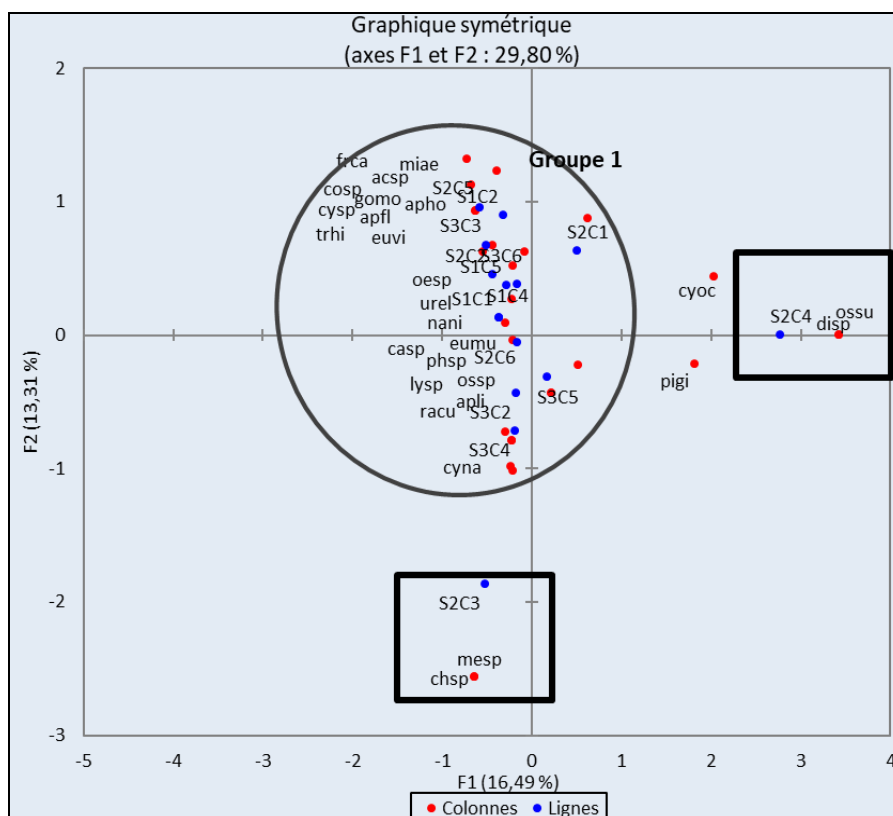

Fig 6: Factorial correspondence analysis of between the clam size classes at the different sites and the stomach contents. The blue dots represent the different size classes of Clams from the stations studied and the red dots the microalgal stomach contents. Abbreviations:

Acsp=*Actinastrum* sp., *Cosp= Coscinodiscus* sp., *Cyoc=Cyclotella ocellata, Cyna =Cymbella naviculiformis, Cysp=Cymbella* sp., *Frca=Fragilaria capucina, Nani=Navicula nivalis, Pigi=Pinnularia gibba, Chsp=Chara* sp., *Gomo=Gonatozygon monotaenium, Acsp=Actinastrum* sp., *Oesp=Oedogonium* sp., *Apfl=Aphanizomenon flosaquae, Apho=Aphanocapsa holsatica, Apli=Aphanocapsa littoralis, Casp=Calothrix sp, Lysp= Lyngbya* sp., *Mesp=Merismopedia* sp., *Miae=Microcystis aeruginosa, Ossp=Oscillatoria sp., Ossu=Oscillatoria subsalsa, Phsp=Phormidium* sp., *Racu=Raphidiopsis curvata, Urel=Uronema elongatum, Eumu= Euglena mutabilis, Euvi= Euglena viridis, Trhi=Trachelomonas hispida, Disp = Dinobryon* sp.

The first two axes of the factorial correspondence analysis (CFA) express 29.80% of the total variance. With this CFA, all of the clam size classes studied fell into three main groups according to their stomach contents. Group 1 in the center, with clams of size classes 4 and 6, which express strong correlations with microalgae of the genus *Cymbella* sp, *Pinnularia* and *Oscillatoria* sp. In fact, the CFA highlights 3 groups, the first of which represents (S1C1 = station1-class of size 1, S1C2 = station 1-class of size 2, S1C3, S1C4, S1C5, S1C6, S2C1, S2C2, S2C5, S2C6, S3C1, S3C2, S3C3, S3C4 S3C5 S3C6) 88.9% of the sample set with the exception of

group 2 (S2C4) and group 3 (S2C3) which are minority isolated entities (11.11% of the set of samples). The central position occupied by the Clams of the group (1), surrounded by algae species (Acsp, Cosp, Cyna...) distributed randomly (Figure 6) reflect the fact that these Clams share a good number of species in common. For example, *Uronema elongatum* and *Oedogonium* sp. mostly listed in the stomachs of juveniles, adults and spawners of the three stations.

3.4. Analysis of similarities of stomach contents of the different classes in the various stations
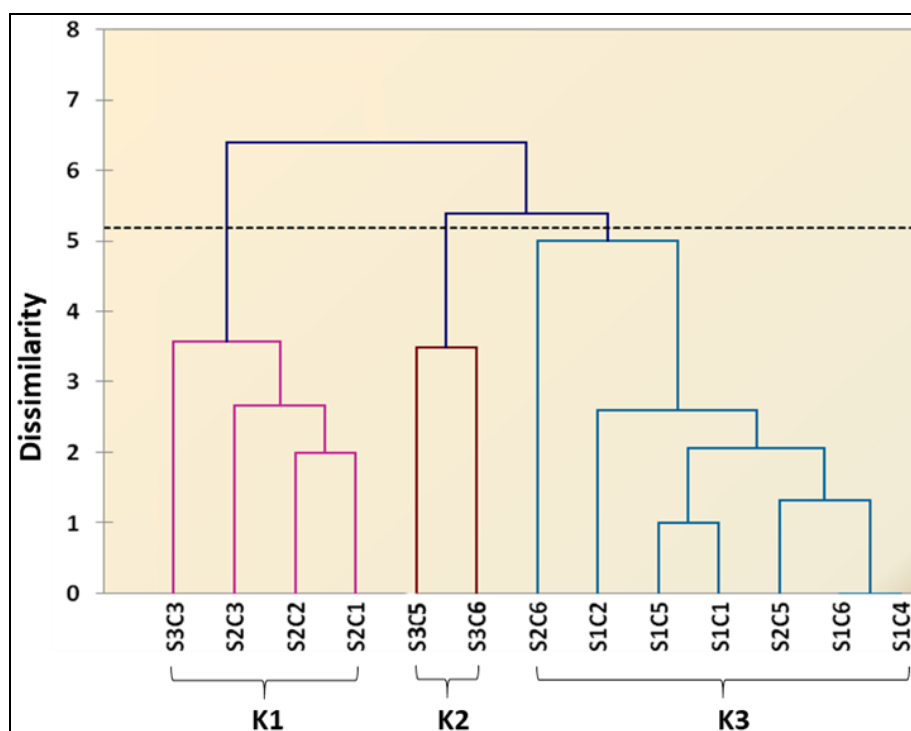
Fig 7: Dendrogram of the Ascending Hierarchical Classification (CAH) of all the clam size classes of the stations according to the microalgae found in the stomach.

It appears from the dendrogram (Fig7) that, three (3) large groups of clam size classes (k1, k2 and k3) are clearly distinguished by their stomach contents. The group k1 consists of Clams from sites 2 and 3 of classes C1 (5-30mm), C2 (30-40mm) and C3 (40-50); whose stomach contents are rich in microalgae of *Raphidiopsis curvata, Euglena viridis and Cymbella* species. sp. It shows a similar diet of Clams of the same class in these 2 nearby sites. The group k2 consists essentially of clams from station 3 of size classes C5 (60-80mm) and C6 (80-100mm) whose stomach contents are more similar to each other than with those of all the other clam classes. These size classes of the group K2 consume the microalgae *Euglena mutabilis, Navicula nivalis* and *Cymbella*

naviculiformis more. Finally, the k3 group is made up of Clams from sites 1 and 2, of all classes except class C3, whose stomach contents are rich in microalgae, mainly *Uronema elongatum, Oscillatoria* sp and *Navicula nivalis*. However, the dendrogram shows that there is a close, albeit weak, link between Clams of similar size classes (they are closer to each other than to the rest of the whole).

3.5. Number of microalgae ingested according to the age of the clams
The number of microalgae ingested according to the age of the Clams is presented in Table 3.

Table 3: Number of microalgae ingested per individual according to the size class of the Clams

Average number of micro algae consumed	100	140	144	148	150	414
Size classes (cm)	[5-30 [	[30-40 [	[40-50 [	[50-60 [	[60-80 [	[80-100 [

From Table 3, it emerges that the oldest clams tend to consume more phytoplankton than the least old. For an equal proportion of sample analyzed 1 ml, we note that the Clams of the first class consumed on average 100 micro algae each, that of the second class (140 micro algae), third (144 micro algae), fourth (148 micro algae), fifth (150 micro algae) and last class (414 micro algae). The consumption of micro algae is proportional to the size of the Clam.

3.6. Influence of sediment and physico-chemistry of water on the diet of clams
The stomach contents of Clams containing water, has sediments and physico-chemical compounds from their diet as shown in Table 4.

Table 4: Result of particle size analysis, MOT, TOC, PH, of the sediment in each

Parameters	Station 1(%)	Station 2(%)	Station 3(%)	H	P-value
MOT mg/g per sediment	$32,33 \pm 0,37$	$35,83 \pm 0,25$	$36,16 \pm 0,11$	6,713	0,0349*
PH	$8,28 \pm 0,18$	$6,60 \pm 0,02$	$7,78 \pm 0,03$	7,200	0,0273*
Total phosphorus (in mg of PTD-P.L^{-1})	$15,66 \pm 0,57$	$11,33 \pm 0,57$	$15,33 \pm 0,57$	6,054	0,0485*
Total carbon (in mg of COT.L^{-1})	$147,00 \pm 1,00$	$122,66 \pm 0,57$	$74,33 \pm 0,57$	7,322	0,0257*
Clay	$8,70 \pm 0,26$	$6,67 \pm 0,02$	$8,58 \pm 0,04$	5,600	0,060
Fine silt	$61,30 \pm 0,01$	$57,27 \pm 0,63$	$66,86 \pm 0,63$	7,322	0,0257*
Coarse silt	$18,76 \pm 0,05$	$16,76 \pm 0,45$	$15,99 \pm 0,12$	7,261	0,0265*
Fine sands	$11,16 \pm 0,05$	$14,33 \pm 0,15$	$7,43 \pm 0,15$	7,261	0,0265*
Coarse sand	$0,26 \pm 0,46$	$5,43 \pm 0,15$	$1,56 \pm 0,05$	7,322	0,0257*

The data are presented in the form of mean ± standard deviation (SD). The non-parametric Kruskal-Wallis test was used to make the comparisons. *: Statistically significant at *P*-value <0.05.

The sediment is mainly composed of fine silts whatever the station considered. The mean percentage proportions being 61.30 ±0.01%, 57.27 ±0.63%, and 66.86 ±0.63% respectively for stations 1, 2 and 3. These data indicate that the muddy medium is rich in organic matter, characteristic of the presence of microalgae (Charophytes). There are significant differences between the three stations (P-value<0.05) whatever the parameter studied, except for the clay percentages of which no significant difference was observed between the three stations (P-value>0, 05).

4. Discussion
The present study identified 28 species of freshwater microalgae belonging to 10 classes and 6 phyla. This result is close to that reported by [16] where he reported the presence of 39 species, 9 classes, and 5 phyla in the fresh waters of Cotonou in Benin. Also, the great diversity of species mainly made up of phytoplankton agrees with that found by [17] "Clams feed mainly on phytoplankton necessary for their growth". Cyanophyceae are the most represented (12 species, or 44%), followed by Bacillariophyceae, (with 7 species or 18%) and the other 8 classes only had 4 species each, or 38%). These results are different from those obtained by [18] who had worked on the diversity of phytoplankton for nutritional selectivity by *Galatea paradoxa* from the lower delta of Sanaga, Cameroon, this can be explained by the fact that the work was carried out in two rivers located in two different micro climates.

Factor Analysis of Correspondence of clam size classes and ingested microalgae has shown that there is a direct link between the different clam size classes and the taxa of algae they consume. The stomach contents are therefore almost identical to all the sizes of Clams from site 1 and 3. The inertia value obtained from the FCA (29.80% inertia) is less than 1. However, the more this inertia value is less than 1, the lower the intensity of the relationship between the clam size classes (juveniles, adults, breeders) and the type of algae consumed. The Independence P-value test 0.99>0.05 allows us to affirm that the null hypothesis H0 (that is, the rows and columns of the table are independent), thus suggesting that it there is no real link between the size of the Clam and the phytoplankton it consumes.

The dominance of the *Uronema elongatum* and *Oedogonium* sp species corresponds to the result obtained by [19] who noted the abundance of the latter in the Batika (Yabassi) and Tongo'o bassa (Douala) rivers in Cameroon. Geographically these sites belong to the same hydrographic basin and there is communication of waters between the Batika river and the Nkam river. In addition, the Ascending Hierarchical Classification (ACH) noted an inter-class variability of 0.88. This low value means that the clams of the different size classes are not far apart, on the contrary they have a very close food preference. While the intra-class variability (2.30) is close to the total variability 3.17. This means that the Clams within the same size class have a diet which is not necessarily identical. This observation is similar to that of [20], who during a test found that the Clams (larvae) of the same species ate the same type of phytoplankton but of different size, the largest (330-405µm) fed of algae from 15 to 25µm and the smallest (185-260µm) of algae of size <5µm. He suggests that these results are certainly due to the anatomy (the size of the mouth and the esophagus) or energy requirements which increase with the size of the Clam.

There is a direct positive correlation between the age and the feeding behavior of the Clams with regard to the quantity of algae consumed. The older the clam, the more it consumes phytoplankton, and the higher the weight of its flesh and shell. The largest 16-year-old Clam was caught in Bonapea (Station 3). It had a length of 96 mm, a Weight of flesh of 18g while the smallest 1year old Clam caught at Bona Anja (Station 2) had a length of 9 mm and a weight of Flesh <0.1g. According to [20], who during a test found that the Clams (larvae) of the same species fed on phytoplankton of different size, the largest (330-405µm) fed on algae of 15 to 25µm and the smallest (185-260µm) algae size <5µm.

Concerning the influence of the sediment on the diet of the Clam, the analysis of the particle size distribution shows that the sediment of the three stations has a silty texture made up of more than 50% of fine silts (61.31% in S1, 56, 83% in S2, and 66.5% in S3) and less than 10% of clays. This type of substrate is favorable for the growth of Clams [21]. According to [22], the finer the particles of the sediments, the better the Clams (*M.mercenaria*) grew in this environment. However, with too large a proportion of fine particles (clay), the growth

of clams reduces [22]. A high quantity of organic matter from the sediment of the three stations was also revealed. (Or 32.5 mg/g at S1, 35.6mg/g at S2 and 36.1mg/g at S3). According to [23] these environments are characterized by the predominance of Cyanophyceae and Euglenophyceae where they live in waters rich in nutrients (eutrophic environment). This justifies the high number enumerated (Cyanophyceae, 44%) and (Euglénophycées, 11%). While the absence of Rhodophyceae, Xanthophycees, Rhodophyceae or the very reduced number of Chrysophyceae (3.70%) which according to Iltis (1980) [15] are species characteristic of oligotrophic aquatic environments (pure waters) confirms our results. Bonapea recorded the highest number of clams catches (726 Clams) and the highest number of inventoried species (2010 phytoplankton/ml) certainly due to its geographical position, physicochemical parameters but also the influence of the sediment (a MOT, TDS and fine silt level of 36.1mg/g of dry sediment, 33.11mg/Let 66.5% respectively). Another favorable aspect for the nutrition of Clams is the pH of the sediment which varies from 6 to 8, all stations considered, which corresponds to the optimum pH of [24]

5. Conclusion
The present study made it possible to list 27 species, belonging to 6 phyla, 10 classes, and 23 genera. Cyanophyceae such as *Uronema elongatum* and Chlorophyceae such as *Oedogonium* sp have been identified as the algae preferentially consumed by Clams from the three stations, independent of their sizes. The Factorial Correspondence Analysis (FCA) which aimed to show the relationship between clams of different sizes (juveniles, adults and breeders) and the type of microscopic algae (phytoplankton) consumed has shown that there is no real differences regarding the kind of algae consumed by them. In fact, these Clams share a good number of species in common. For example, the species *Uronema elongatum* and *Oedogonium* sp have been mainly listed in the stomachs of juveniles, adults and spawners of the three stations. However, the results from the dendrogram show that there is a close, although weak, link between Clams of similar size classes compared to the others. This observation is certainly due to the anatomy (the size of the mouth and the esophagus) or energy requirements which increase with the size of the Clam. For an equal proportion of sample analyzed from each individual, we note that the Clams consumed respectively from the first to the sixth class 100, 140, 144, 148, 150 and 414 micro algae each during the capture period thus indicating individual average daily consumption. The grain analysis (granulometry) shows that the sediment has a silty texture (>50% fine silts and less than 10% clay) and an organic matter content >32mg/g dry sediment all stations combined. This high content of nutrients explains the high abundance of Cyanophyceae and Euglenophyceae identified in the stomach content of Clams. Sediment therefore has a direct influence on the diet of Clams.

6. Acknowledgements

7. References
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