FEEDING ECOLOGY OF THE AFRICAN SUCKERMOUTH CATFISH *EUCHILICHTHYS GUENTHERI* (MOCHOKIDAE, SILURIFORMES) OF MALEBO POOL, CONGO RIVER (DEMOCRATIC REPUBLIC OF CONGO)

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RÉSUMÉ.— *Écologie alimentaire d'*Euchilichthys guentheri *(Mochokidés, Siluriformes) du Pool Malebo, fleuve Congo, République Démocratique du Congo*.— L'écologie alimentaire du poisson-chat *Euchilichthys guentheri* (Schilthuis, 1891) du Pool Malebo (fleuve Congo, Kinshasa, RDC) a été étudiée entre janvier 2008 et octobre 2010. Les contenus stomacaux de 243 individus ont été analysés et le régime alimentaire a été caractérisé par le calcul d'un indice alimentaire combinant les pourcentages d'occurrence, numérique et volumétrique, des proies identifiées dans ces contenus stomacaux. Cet examen a révélé que l'espèce a un régime herbivore principalement composé de périphyton (périphytophage). La présente étude n'a pas trouvé de différences statistiquement significatives du régime alimentaire en fonction de la taille des spécimens, du site d'échantillonnage et de la saison hydrologique. Les stratégies alimentaires développées par cette espèce favorisent sa coexistence avec les autres espèces de Mochokidés dans le Pool Malebo. Cette étude fournit ainsi d'utiles informations concernant l'écologie alimentaire des poissons-chats ayant la bouche en ventouse intrinsèquement liés au fleuve Congo, l'un des écosystèmes les plus menacés et les plus diversifiés du bassin du Congo.

SUMMARY.— The feeding ecology of *Euchilichthys guentheri* (Schilthuis, 1891) of Malebo Pool (Congo River, Kinshasa, DRC) was studied between January 2008 and October 2010. The stomach contents of 243 individuals were analysed and a diet was characterized by a feeding index computed by combining the occurrences, the numerical and volume percentages of the items identified in the stomach contents. The study showed that this species has an herbivorous diet mainly composed of periphyton. The study did not find any statistical differences in the diet related to the size of the specimens, the site and the hydrological season. The dietary strategies developed by this species likely contribute to its coexistence with the other Mochokidae species in Malebo Pool. The study thus provided relevant information regarding the feeding ecology of suckermouth catfishes intrinsically associated with the Congo River, one of the most threatened and biodiverse ecosystems of the Congo basin.

Malebo Pool is a wide section of the Congo River located between the Democratic Republic of the Congo (DRC) and the Republic of Congo and their two capital cities. On the DRC side, the Pool is subject to intense anthropogenic perturbations: overfishing activities leading

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to the overexploitation of the fish stocks and even to species extinctions, and degradation or even destruction of available aquatic and riverside habitats (Mbadu *et al*., 2010; Stiassny *et al*., 2011). This deteriorating situation appeals to studies on the biology and ecology of fishes in order to protect the species and suggest sustainable exploitation.

Euchilichthys guentheri (Schilthuis, 1891) is a Siluriformes fish of the African catfishes family Mochokidae that consists of nearly 200 species spread throughout the freshwaters of tropical sub-Saharan Africa and the Nile River basin (Vigliotta, 2008). It is made up of ten genera according to Ferraris (2007). Mochokids are among the fish commonly caught by fishermen in Malebo Pool. Unfortunately, the total catch data for these fishes of Malebo Pool is deficient and difficult to estimate, due to the large number of small-scale fishers and the limited capacity of national government to collect sufficient catch data.

Euchilichthys Boulenger (1900) consists of five valid species that occur in high-flow habitats in the Congo River basin, although the distinction between *Euchilichthys* and *Atopochilus* has been vague (Pellegrin, 1938; Poll, 1959, 1967). This genus is represented by *Euchilichthys guentheri* in Malebo Pool (Poll & Grosse, 1995) and constitutes an important part of the commercial catches by the traditional fishermen, especially during the dry season (pers. obs.).

Although their systematics, taxonomy and phylogenetics have been well studied (Boulenger, 1901, 1911, 1920; Poll & Gosse, 1963; Robert & Stewart, 1976; Vigliotta, 2008), the biological and ecological data concerning these fishes were surprisingly missing. Moreover, the position of *E. guentheri* in the trophic chain and its ecological niche in Malebo Pool are unknown, despite it is popular in the local markets. Its high commercial value may result in its overexploitation within Malebo Pool (Shumway *et al*., 2003; Stiassny *et al*., 2011).

According to Everhart *et al*. (1975), studies on the aspects of biology of fin fishes such as growth pattern, reproduction, nutrition are necessary as they would furnish relevant information about the formulation of fisheries management policies. The study of dietary habits based on stomach content analysis is widely used in fish ecology as an important means of investigating trophic relationship in the aquatic communities (Arendt *et al*., 2001) and in the creation of trophic models as a means of understanding complex ecosystems (Lopez-Peralta & Arcila, 2002). Furthermore, the study of a species diet constitutes a basic element for assessing its aptitude to adapt to environmental changes affecting food resources or for its suitability to domestication in fish farming (Berté *et al*., 2008). The study of the dietary habits of species like *Euchilichthys guentheri* also helps to improve knowledge about the presence, the abundance and the availability of the food resources in Malebo Pool.

The aim of the present study was to define the diet of *E. guentheri* from Malebo Pool and describe the extent of its variability in relation to time, space and size of the fish in order to understand its evolution according to age of the fish. In the course of this study we understood the important role that this species plays in structuring fish assemblages and all the river community. It appears to be essential for habitat management and biodiversity conservation (Lowe-McConnell, 1979), especially in such important but threatened and fragile tropical ecosystems.

MATERIALS AND METHODS

Malebo Pool is the study area (Fig. 1). It extends from 4^{o} 05’ to 4^{o}18’ South and from 15^{o}19’ to 15^{o}32’ East, at an average altitude of 272 m. This water section ranging from the Maluku (upstream) and the Kinsuka (downstream) is approximately 35 km long and 25 km wide with a surface area of approximately 500 km^2 (Burgis & Symoens, 1987). This lake is made up of a schisto-sandy substratum of the Inkisi kind. It faces more resistant rocks at the level of Kinsuka rapids with visible rocks forming cliffs upstream. The floor substrate is muddy and sandy. During these last thirty years, the average water speed was 0.8 m/sec. The seasonal variation of the water level is about 3 m deep for the low waters in July-August and the high waters in November - December (Burgis & Symoens, 1987).

The waters of Malebo Pool are slightly mineralized, water conductivity is very low, typically between 20 and 31 $\mu S.cm^{-1}$and the pH fluctuates between 5.2 and 6.7, dissolved oxygen ranges from 7.7 $mg.l^{-1}$ and 9.1 $mg.l^{-1}$ and the water temperature lies between 17.1^{o}C and 31.5^{o}C (Burgis & Symoens, 1987).

Malebo Pool belongs to the Aw4 climatic type (Bultot & Griffits, 1971) corresponding to the hot tropical climate with daily mean temperature exceeding 18^{o}C. The maximum monthly mean temperature of the air is observed in March (26.9^{o}C) whereas the minimal monthly mean temperature is observed in July (23.3^{o}C). It undergoes a rainy season from October to May interrupted by a small dry season between February and March, and a great dry season from June to September.

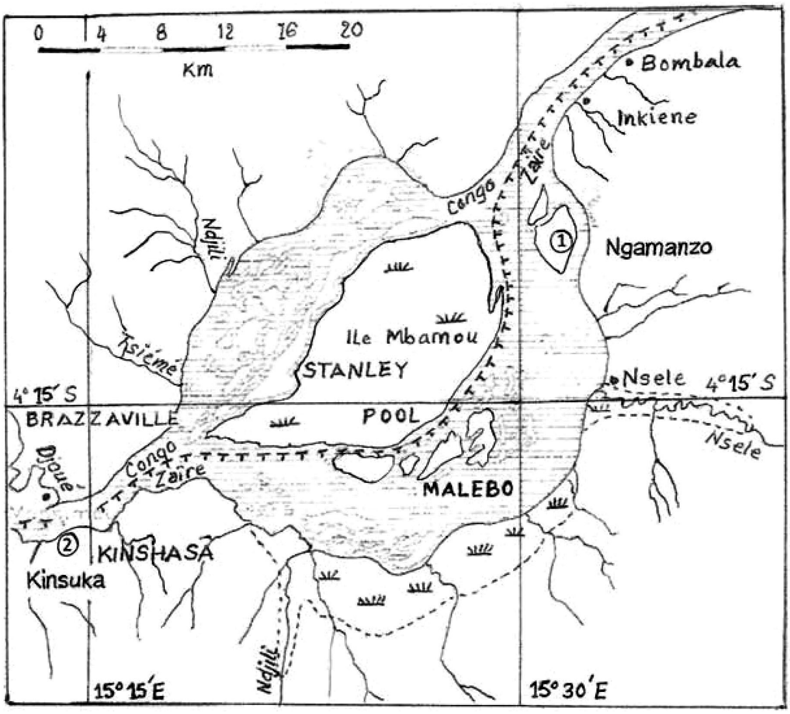

Figure 1.— Map of Malebo Pool (Modified, according to Burgis & Symoens, 1987) and location of the two study stations: Ngamanzo (1) and Kinsuka (2).

The bank is mainly covered by *Echinochloa pyramidalis* (Law) Hutch, Schult, *Ipomoea aquatica* Forsk, *Oryza bartii* and the floating vegetation is made up of *Eichornia crassipes* (Mart) Solms; *Pistia stratiotes* (L.) and *Salvinia nymphellula* (L.) invade the lake.

The periphyton is made up of Bacillariophyceae, Chlorophyta, Euglenophyta, Dinophyceae and Rhodophyta (Mbadu *et al*., 2010).

FISH SAMPLING

Between January 2008 and December 2009, and between July and December 2010, *Euchilichthys guentheri* specimens were captured each month by means of a traditional fishing method that used drifting nets of 2.5 x 800 m and 2.5 x 1000 m with 10 to 63-mm mesh size, traditional gill nets of 2.5 x 50 and 2.5 x 100 m with mesh sizes ranging from 8 to 50 mm between knots and dip nets of 1.20 x 1.50 m with 0.5 to 2-mm mesh between consecutive knots at selected fishing stations at Malebo Pool.

The drifting nets were attached to the canoe, wet and dragged in the current all the day for a 24 h duration. These drifting nets were laid the first day at 5 a.m., dragged and observed approximately 4 hours after their installation.

STOMACH CONTENTS ANALYSIS

A total of 248 specimens were sampled at sites between Ngamanzo (139) and Kinsuka (109). 154 specimens were captured with the drifting nets, 16 with the landing nets and 78 purchased from the fishermen. Among these 248 sampled fish, 201 were collected in the dry season (June, July, August and September) and 47 in the rainy seasons. These fish were individually measured (total and standard lengths) to within one millimetre and weighed to an accuracy of 0.1 g, then dissected. The stomachs were taken, weighed and stored in pillboxes containing a five per cent formalin solution (Adite *et al*., 2005). The intestine length (IL) was measured from the pyloric small valve to the anus. The intestinal coefficient (IC) was calculated for each specimen according to the following formula (Paugy, 1994): IC= IL/SL (SL: standard length). In feeding ecology, this index gives a general indication of the diet of a given species.

Each stomach was dried up on a blotting paper, weighed and opened delicately. The 143 stomachs of *E. guentheri* were examined. The stomach contents were suspended in 10 ml of distilled water and sifted (sieve of 1000, 500 and 10 µm diameter) after addition of 1 ml of Lugol solution. Various fractions were obtained and the filtrates were examined with binocular magnifying glasses and an optical dissection microscope with a 40x magnification. Because the stomachs contents were only made up of the various fractions (particularly the mineral fraction) and the filtrates of phytoplankton, the prey-organisms were identified using Bourelly (1966, 1968, and 1970) and Compère (1991). Prey categories were sorted and counted. The total biomass of each phytoplanktonic species was estimated using the biovolume method of Vollenweider (1974) and Sournia (1978), and the equivalence relation of Iltis (1969). The average values of biovolume used in this study were drawn from Pohlmann & Friedrich (2001).

The frequency of occurrence, numerical and gravimetric and/or volumetric methods (Hynes, 1950; Ricker, 1968; Hyslop, 1980) were used in the analysis of the stomach contents. For the phytoplankton, we used the following index that takes into account the prey biovolume and makes it possible to evaluate the relative biomass of various preys. Thus, it is calculated by the following expression (Mukankomeje *et al.*, 1994):

$$\%V = \frac{n_i v_i}{\sum_{t=1}^{p} n_i v_i} \times 100$$

with *ni*: number of individuals of prey *i, vi*: biovolume of prey *i* and *nivi*: total biovolume of the *p* prey.

The relative importance of food items was expressed in the form of an Index of Relative Importance (IRI) which takes into account the numerical percentage, the weighted percentage (volumetric) and the occurrence frequency (Pinkas *et al*., 1971). This index is used to reduce the bias inherent in each one of them (Windell, 1971; Rosecchi & Nouaze, 1987). Its mathematical expression is the following:

IRI = (N + V). OF

With IRI: Index of relative importance; N (%): Percentage in number or relative abundance; V (%): Volumetric Percentage; OF (%): Occurrence Frequency.

The use of the food indices (qualitative and quantitative) made it possible to express the quantitative diet of the species. Rosecchi & Nouaze (1987) noticed that the indices of relative importance of food IRI of Pinkas *et al*. (1971) and IRA of Georges & Hadley (1979) give priority to abundant (N) and frequent (Occ) dietary items having a low weight value (P) and Marshall & Elliot (1997) described the pros and cons of each method. There is no single standard index to evaluate the diet of the fish populations.

We determined the size classes of captured fish according to the Sturge rule (Scherrer, 1984). Eight size classes of 8.77 cm of interval were defined on the basis of the Sturge rule. Because of its low strength (one specimen), the sixth class was amalgamated with the following class. Consequently, 7 size classes could be established (Tab. I).

TABLE I

Size classes of specimens of Euchilichthys guentheri *obtained by the Sturge rule and their corresponding number*

Class	Interval of class	Size	Group
1	[1.66; 10.66 [	35	1
2	[10.66; 19.66 [	13	
3	[19.66; 28.66 [	22	
4	[28.66; 37.66 [	7	2
5	[37.66; 46.66 [	8	
6	[46.66; 64.66 [	19	3
7	[64.66; 73.66]	11	

STATISTICAL ANALYSIS

The following statistical treatments were carried out using TANAGRA Software V.1.4.38:

— Analysis of ascending hierarchical classification to group together the size classes of fishes having similar diets;

— Spearman Correlation Coefficient of rows to see whether there is a relation between the diets (max. probability retained: $p = 0.05$). This was used to check the relation between the similar diets of the stations, the size classes and the hydrological seasons;

— The G-test (Zar, 1996) on the IRI proportions of the main food items was used to detect the significant differences between the station diets, the size classes and the hydrological seasons ($p < 0.05$). The χ^2 test ($p = 0.05$) on the IRI proportions of the main food groups was also carried out using STATISTICA v.6 to confirm the results of the G-test.

RESULTS

RELATION "LENGTH OF THE INTESTINAL TUBE AND STANDARD LENGTH"

For the specimens of *E. guentheri* examined, the regression equation provides a good description of the relation between the intestine length and the standard length (Fig. 2). The high value of the correlation coefficient (r) reveals a statistically significant correlation ($r = 0.89$, $p < 0.05$). The intestinal coefficients (IC) of 248 fishes analysed varied from 1.95 to 8.69 with an average of 4.08 ± 1.91.

GENERAL PROFILE OF THE DIET

The standard length of the specimens studied varied from 1.66 to 72.8 cm. The total number of empty stomachs recorded was 33, that is, to say a vacuity coefficient (vc) of 23.1%.

The examination of the 110 stomachs containing food highlighted 60 periphytic prey organisms divided into 5 classes: Bacillariophyceae, Cyanophyta, Euglenophyceae, Chlorophyta and Rhodophyta. The presence of refuse with a mineral fraction and a category of unspecified preys was also observed (Tab. II).

In the global diet, Bacillariophyceae (IRI = 32.58%), Cyanophyta (IRI = 31.21%) and Chlorophyta (IRI = 28.29%) were the preferred food. The other food groups with an IRI lower than 10% constituted secondary food. A detailed examination of the diet indicated that *E. guentheri* food was distributed essentially between the Bacillariophyceae, Cyanophyta and Chlorophyta classes. Within these three classes, we noticed the predominance of *Oscillatoria limosa* (13.11%), *Zygnema sp*. (9.88%), *Aulacoseira sp*. (5.54%) and *Fragilaria sp*. (4.68%) as main food. The other species of periphytic preys contributed each only less than 5% to its food.

DIET ACCORDING TO THE SIZE OF THE SPECIMEN

The analysis of ascending hierarchical classification based on the occurrence of percentages calculated in each class size gave three groups (Fig. 3). The first group made up of the first three classes contains all the specimens of size lower than 28.66 cm; the second group made up of the fourth and the fifth classes contains the specimens with size ranging 28.66 to 46.65 cm; and the third group made up of the last two classes with specimens of size 46.66 to 73.66 cm. These three groups were used for the quantitative analysis of the food diet expressed in terms of IRI illustrated in figure 4.

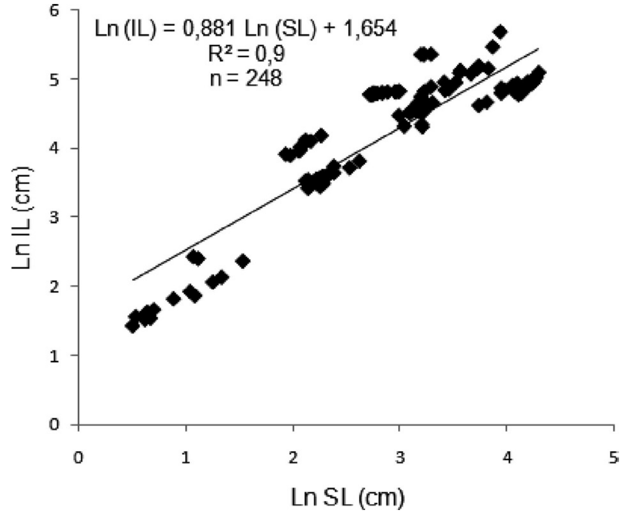

Figure 2.— Development of the intestine length according to standard length in *Euchilichthys guentheri*. Ln (Neperian logarithm); IL (Intestinal length); SL (Standard length); n = number of specimen analysed.

TABLE II

Composition of the general food diet of Euchilichthys guentheri *at Malebo Pool, Congo River (Percentage of relative Importance:%IRI; Numerical percentage:%N; Occurrence percentage:%Oc; Volumetric percentage:%Vol)*

FOOD ITEMS	%N	%Oc	%Vol	%IRI
Bacillariophyceae	**46.44**	**40.52**	**15.4**	**32.58**
Achnanthes sp.	2.27	1.76	0.00	1.01
Amphora sp.	0.06	0.2	0.00	0
Asterionelle sp.	0.2	0.35	0.07	0.02
Aulacoseira granulata	2.69	2.19	0.55	1.79
Aulacoseira spp.	6.37	2.59	2.14	5.55
Coconeis sp.	2.04	2.17	1.83	2.11
Cyclotella sp.	0.2	1.69	0.17	0.49
Cymbella sp.	1.71	2.04	0.00	0.88
Diatoma sp.	0.49	1.01	3.18	0.93
Diploneus sp.	1.81	2.02	0.00	0.92
Eunotia spp.	1.3	2.02	0.00	0.66
Fragilaria sp.	6.49	2.52	0.91	4.69
Gomphonema parvum	2.4	2.12	0.00	1.28
Gomphonema sp.	4.94	2.55	0.00	3.16
Gyrosigma sp.	0.91	1.76	0.00	0.4
Meridion sp.	0.82	1.84	0.00	0.38
Navicula spp.	2.57	1.97	1.76	2.14
Nitzschia sp.	0.35	1.06	0.05	0.11
Pinnularia sp.	1.45	1.99	0.00	0.72
Stauroneis sp.	0.51	1.39	0.00	0.2
Surirella sp.	2.71	2.17	3.28	3.26
Tabellaria sp.	1.09	1.82	1.46	1.16
Uronema sp.	2.3	1.31	0.00	0.76
Chlorophyta	**22.21**	**22.28**	**37.1**	**28.29**
Ankistrodesmus falcatus	0.18	0.4	0.03	0.02
Cladophora sp.	4.63	2.24	0.00	2.61
Oedocladium sp.	0.25	0.71	0.00	0.04
Oedogonium sp.	2.32	2.22	0.00	1.29
Pediastrum sp.	0.82	1.82	6.9	3.52
Scenedesmus sp.	2.86	2.09	1.61	2.35
Scenedesmus quadricauda	0.42	1.16	0.02	0.13
Tetraedron sp.	1.74	1.64	0.09	0.75
Spirogyra sp.	0.62	1.54	3.68	1.66
Zygnema sp.	2.9	2.19	15	9.88
Closterium sp.	2.71	1.66	5.91	3.6
Closterium moniliferum	1.24	1.46	0.87	0.78
Closterium sp.	0.87	1.34	2.45	1.12
Cosmarium sp.	0.67	1.82	0.5	0.53
Euglenophyta	**1.49**	**4.54**	**12.8**	**6.39**
Euglena sp.	0.48	1.31	3.1	1.18
Phacus sp.	0.61	2.02	9.02	4.88
Trachelomonas sp.	0.4	1.21	0.68	0.33

FOOD ITEMS	%N	%Oc	%Vol	%IRI
Cyanophyta	**26.29**	**29.36**	**34.6**	**31.21**
Anabaena sp.	3.41	2.42	3.6	4.27
Anabaeopsis sp.	0.43	1.13	0.18	0.18
Chroccoccus sp.	1.36	1.39	4.39	2.00
Synechococcus sp.	1.42	1.51	0.02	0.55
Goniochloris falax	0.45	0.93	0.00	0.11
Isocystis sp.	3.21	2.17	1.13	2.36
Lyngbya sp.	1.06	1.99	0.06	0.56
Merismopedia sp.	2.08	1.89	0.13	1.05
Micrococcus sp.	1.05	1.89	3.03	1.94
Microcystis sp.	3.79	2.32	1.07	2.83
Oscillatoria sp.	3.51	2.29	19.2	13.11
Penuim sp.	0.69	1.1	0.73	0.38
Planctolyngbya sp.	1.35	1.92	0.08	0.69
Pseudanabaena sp.	1.02	1.97	0.54	0.77
Sphaerocystis sp.	0.36	0.88	0.23	0.13
Spirulina sp.	0.28	0.88	0.01	0.07
Stigoclonium sp.	0.21	0.71	0.00	0.04
Tetraspora sp.	0.36	1.11	0.13	0.14
Rhizoclonium sp.	0.27	0.91	0.00	0.06
Rhodophyta	**1.69**	**1.31**	**0.13**	**0.6**
Audouinella sp.	1.69	1.31	0.13	**0.6**
Detritus and mineral fraction	**1.86**	**1.99**	**0.00**	**0.93**

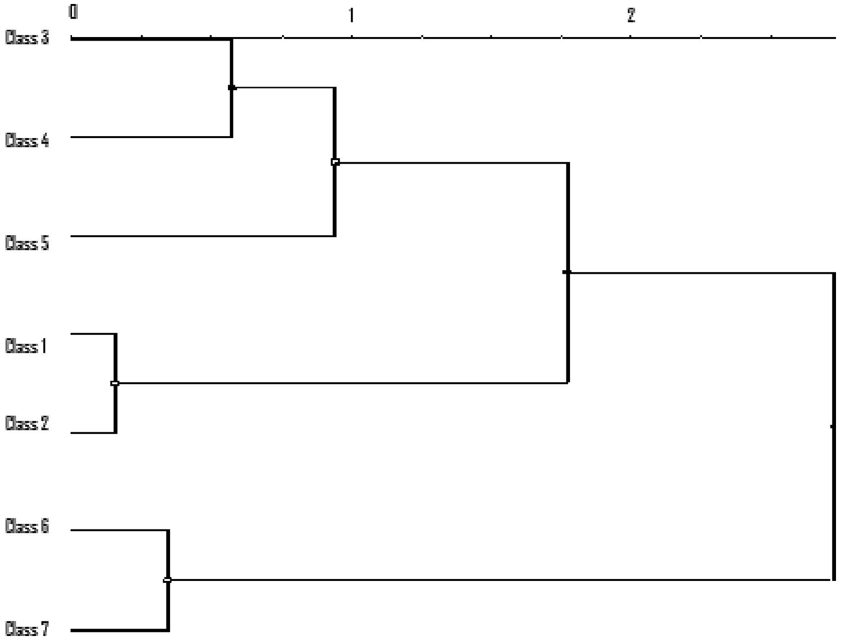

Figure 3.— Dendrogram of food similarity between the specimens of the 7 size classes of *Euchilichthys guentheri* captured at Malebo Pool during our study.

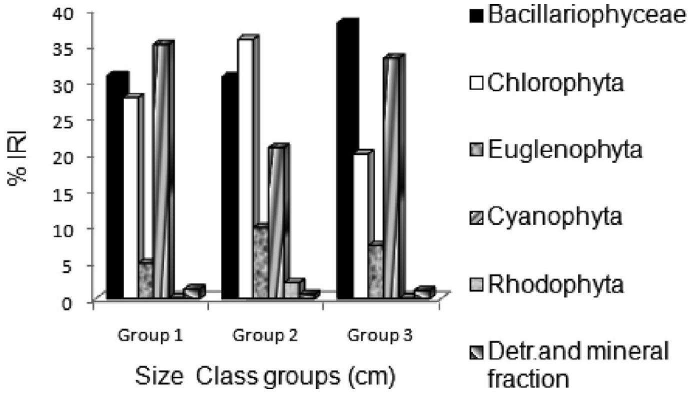

Figure 4.— Diet of captured *Euchilichthys guentheri* according to specimen size.%IRI = IRI percentage

The first group of fishes eats preferentially Cyanophyta (35.15% of the IRI), Bacillariophyceae (30.86% of the IRI) and Chlorophyta (27.80% of the IRI). The second group mostly prefers Chlorophyta (35.85% of the IRI) and Bacillariophyceae (30.71% of the IRI) and has Cyanophyta (20.8% of the IRI) as secondary food. The specimens with a big size (group 3) eat essentially Bacillariophyceae (38.14% of the IRI) and Cyanophyceae (33.27% of the IRI) and they have Chlorophyceae (20.04% of the IRI) as secondary food. The other food items represent less than 15% of the fish diet of each size group.

The correlation coefficient of the Spearman rows calculated from the percentages of IRI between the groups taken in pairs shows similarities of diet between groups 1 and 2 (N= 120; rs = 0.65; p = 0), groups 3 and 4 (N = 120; rs = 0.63; p = 0), and groups 2 and 3 (N= 120; rs = 0.67; p = 0).

The G-test for these three groups shows that there is no significant difference to worry between the major groups of periphyton food classes (G= 15.81; d.f. = 10; $p > 0.05$). In addition, the χ^2 test confirms non-significant difference among the prey proportions ($\chi^2 = 15.1$; $p = 0.13$).

DIET ACCORDING TO THE FISHING STATIONS

Statistically speaking, the diets of *E. guentheri* captured at the Kinsuka and Ngamanzo Stations were not different (G= 7.66; d.f. = 5; $p > 0.05$). The main food items found in the stomach contents of the specimens captured at the Kinsuka station (Fig. 5) were Chlorophyta (35.88% of the IRI) and Bacillariophyceae (29.32% of the IRI) with Cyanophyta (23.3% of the IRI) as secondary preys. The preferential food for the specimens captured at the station of Ngamanzo was Cyanophyta (37.95% of the IRI) and their secondary food was Bacillariophyceae (29.31% of the IRI) and Chlorophyceae (26.66% of the IRI). No Rhodophyta were observed in the stomach contents of fish from Ngamanzo.

The Spearman correlation coefficient of the rows carried out between the stations of Kinsuka and Ngamanzo indicates a similarity of the diets of *E. guentheri* in the two fishing stations (N = 60; rs = 0.52; $p < 0.05$). The χ^2 test shows that there is no significant variation among the stations concerning the proportions of the four preys groups ($\chi^2 = 7.1$; $p = 0.13$).

DIET VARIATION ACCORDING TO SEASON

Among the 143 analysed stomachs (115 stomachs in the dry season and 28 in the rainy season), the vacuity percentage was 16% for the two hydrological periods. The diet of *E. guentheri* did not significantly differ between the two hydrological seasons (G = 1.479; d.f. = 5; $p > 0.05$).

During the two hydrological seasons, *E. guentheri* showed a strictly periphytic diet. Sixty species of periphyton were identified in the stomach contents analysed. Among the great groups of periphytic species, Bacillariophyceae dominated numerically (46.6% in the dry season and 41.3% in the rainy season) and presented a frequency of maximum occurrence (41.9% in the dry season and 40.9% in the rainy season). The IRI (Fig. 6) shows that this group of periphyton was the preferential food in the dry season (IRI = 33.22%) as well as in the rainy season (IRI = 32.09%), with Chlorophyta and Cyanophyta as secondary food for *E. guentheri* in the dry and the rainy seasons. The Spearman correlation coefficient of rows was significant between the two seasons (N=122; rs = 0.698; p < 0.05).

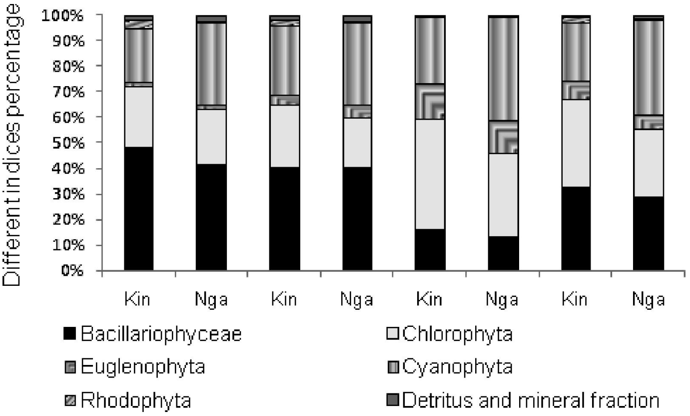

Figure 5.— Diet of *Euchilichthys guentheri* according to fishing station. Pairs of bars Kin – Nga (from left to right): Numerical Index; Occurrence Index; Volumetric Index; Percentage of Index of Relative Importance; Kin = Kinsuka and Nga = Ngamanzo.

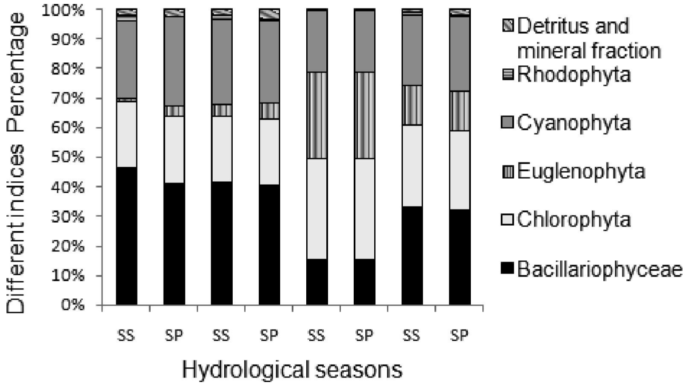

Figure 6.— Diet of *Euchilichthys guentheri* according to hydrological season. Pairs of bars SS – SP (from left to right): Numerical Index; Occurrence Index; Volumetric Index; Percentage of Index of Relative Importance; SS = dry season SP = rainy season.

DISCUSSION

To the best of our knowledge, this is the first study of the feeding ecology of a species of sucker-mouthed mochokid, of *Euchilichthys* in the Congo basin in general, and at Malebo Pool in particular.

The relative length of the intestine (IL/SL) is related to the kind of food taken by vertebrates in general (Grassé & Devillers, 1965) and fishes in particular (Fryer & Iles, 1972; Kramer & Bryant, 1995a, 1995b; Paugy, 1994). These studies have shown that the intestine is relatively longer among the herbivorous species, shorter among the carnivorous and of intermediate length among the omnivorous. The intestinal coefficients (IC) defined to characterize the various food groups of the fish species are generally overlapping (Kouamélan, 1999; Fryer & Iles, 1972; Paugy, 1994; Al-Hussaini, 1974) but Kramer & Bryant (1995b) working on size classes of about 20 species in Central America found non-overlapping distributions within the various classifications. Our results tally with the works of Fryer & Iles (1972), Paugy (1994) and Kramer & Bryant (1995a, 1995b) in the sense that they indicate that *E. guentheri* has a relatively long intestine ($1.95 \leq IC \leq 8.69$).

Just as in the earlier studies (Paugy, 1994; Fryer & Iles, 1972), the intestinal coefficient obtained in the present study for *E. guentheri* is included in the microphytophagous trophic group (1.95 - 8.69). However, the relative length of the intestine gives just a general indication of the diet of a given species, and analysis of the stomach contents is the best approach to characterize the specific diet of each species.

The analysis of the diet of *E. guentheri* shows that this species has a strictly periphytophagous diet. It is a scraper fish with cup-shaped inferior mouth and many loose monocuspid teeth to scrape pebbles for periphyton in running waters. Consequently, the species can be regarded as a primary consumer because of the presence of a diversity of periphytic taxa in its diet. In addition, the permanent presence of refuse and sediments in the stomach contents of the studied specimens seems closely related to their adaptation to the benthic zone.

Some authors (e.g., Lauzanne, 1988; Lévêque, 1994) have stressed that all Mochokidae, except *Brachysynodontis* and *Hemisynodontis* species, are secondary consumers (*invertivorous*). Lévêque (1994) indicated that among fishes there is a positive correlation between the diet types, the shape of the body and the trophic apparatus - the shape, size and position of the mouth and teeth of the predators. The ichthyophagous species, for example, are characterized by an elongated and flexible body, a broad mouth in terminal or dorsal position, with very powerful teeth that enable them to capture their prey (Lévêque, 1997). Cichlidae are included in the filterers group and have a generally flat body (Rosen, 1982) and a trophic apparatus with specialized anatomical structures (Anargyros, 1992; Fryer & Iles, 1972). In addition, in his work on the 11 species of Cichlidae of Lake Tanganyika, Mbomba (1985) showed that *Petrochromis polyodon,* a species having tricuspid teeth, is a grazer of unicellular periphyton on rocks and vegetation. After simulation, the method of *E. guentheri* for grazing periphyton resembles a lot that of *P. polyodon* and other species of the sucker-mouthed Neotropical Loricarioidea in America (Van Wassenbergh *et al*., 2009; Adrians *et al*., 2008; Geerinckx *et al*., 2007) with the only difference that the studied species has monocuspid mandibular teeth with elongated base, truncated crowns and a hook (pers. obs.). These teeth having great flexibility are adapted to exploit the algae on a broad range of rock surfaces like *P. polyodon* and other Neotropical Loricarids.

Benthophagous species have in general a small mouth, in inferior, sub-inferior or terminal position, with very reduced and weaker teeth (Kouamélan, 1999). In the Mochokidae group, *E. guentheri* and other mochokid suckermouths genera (*Chiloglanis* and *Atopochilus*) seem to be the fishes with particular trophic apparatus and diet different from those of the other species of the mochokid group. *E. guentheri* has a suction cup-shaped mouth, upper and lower jaws with many mobile teeth with elongated base and truncated crown, an elongated body, a very long intestine well differentiated from stomach at the pylorus level. These anatomical structures would explain its adaptation to rapids and its particular trophic specialization which enables it to avoid competition with the other species of the Mochokidae family.

Our results showed that Bacillariophyceae, Cyanophyta and Chlorophyta play a major role in the diet of the studied species. This study also showed a great diversity of periphytic species in the stomachs of a Mochokidae species, thus showing the particularity of the diet of the latter within the group. It is the first dietary study of a sucker-mouthed mochokid. Lauzanne (1988) indicates that, except the *Brachysynodontis* and *Hemisynodontis* which remain microphagous filterers, the other genera of mochokid exploit the benthic invertebrates, various vegetable and animal remains, especially of insect larvae and mollusks, but also oligochetes, ostracodes, terrestrial insects and even those having large scales.

Several authors (Mukankomeje, 1992; Lévêque, 1997; Frederich *et al.*, 2008) showed that the majority of fish species eat plankton at least during a stage of their life. As such, the diet would evolve from an initial uniform planktivorous stage in young fishes to a definitive herbivorous, carnivorous or omnivorous stage in adults (Frederich *et al.* 2008).

Concerning the diet variation according to the size, the *Euchilichthys* specimens of small size preferentially consume Chlorophyta and Bacillariophyceae. Those of intermediate size eat Bacillariophyceae and Chlorophyta as well as Cyanophyta. The diet of the adult specimens is composed of Cyanophyta and Bacillariophyceae. This shows that these fish eat the same prey types as they grow. Thus, they are specialized in the exploitation of periphytic algae. This mode of trophic specialization was also observed by Mbomba (1985) who noticed that several species of Cichlidae, grazers of periphytic algae in the littoral rocks of Lake Tanganyika, eat the same type of food from juvenile to adult, the only difference being that young eat predominantly Chlorophyta whereas adults consume more Cyanophyta.

It should nevertheless be stressed that major variations were observed in the proportional importance of the principal algal groups among the defined size classes. Specimens of large size consume mainly Cyanophyta (IRI = 39.34%) whereas the predominant source of food for the young is Chlorophyta (IRI = 40.41%). Bacillariophyceae constitute the basic food of the specimens of fish in all size classes. We think that this difference may be due to the different distribution of size classes among microhabitats in the studied sites, as well as to their mode of food exploitation. Considering that Malebo Pool is an ecosystem that annually undergoes significant changes of water level and other environmental parameters, such as physical chemistry and chlorophyll “a” concentrations, the species should have a range of varied dietary items in relation to all these variations.

The absence of animal preys confirms the thesis according to which the studied species is a periphytophagous fish that feeds on attached algae on rocky substrate and deadwood laid in waters, but also having structural adaptations linking a sucker mouth to living in strong currents and having a scraping feeding behaviour like the Neotropical Loricariidae (Adrians, 2003; Diogo *et al*., 2000).

E. guentheri specimens exhibit similar diets both at Kinsuka and Ngamanzo Stations. The IRIs of the great group of periphytic preys show almost identical proportions and a significant Spearman correlation coefficient. *E. guentheri* was thus found to have a periphytophageous diet at two fishing stations in Malebo Pool in contrast to the diet of other genera of the Mochokidae family (Lauzanne, 1988; Diomande *et al*., 2001; Lalèye *et al*., 2006; Diomande *et al*., 2009). Lauzanne (1988) highlighted the planktivorous tendency of *Brachysynodontis bantensoda* and *Hemisynodontis membranaceus* in the lakes, and omnivorous tendency when they live in the rivers. Lauzanne (1988) indicates also that the *Synodontis* have a diet which varies according to the biotope, but yet these species have an eclectic food tendency.

Although *E. guentheri* presents the same trophic spectrum at the two stations, it does not exploit food in the same proportion in the two areas. The numerical percentage, the occurrence frequency as well as the relative importance of food items differ somewhat between the stations. This result might be explained by the fact that these areas are ecologically different. The rocky substrate which characterizes the Kinsuka Station creates very complex microhabitats which promote the maintenance of a diversity of periphytic preys. In addition, other ecological factors can influence the distribution, abundance and diversity of the prey species in the area. Among these factors, we may mention the productivity and diversity of the habitat, the width, size and depth of the river, current velocity, the type of substrate and vegetation. Therefore, Malebo Pool constitutes a complex ecosystem which has diversified microhabitats. For the moment, it is not possible to elucidate the factors which are involved in the distribution, abundance and diversity of periphytic preys at the two fishing stations.

It is established that a tropical environment and the availability of food for fish can vary considerably in quantity and quality according to seasons (Wootton, 1990). Thus Mbadu *et al.* (2010a) revealed that among the *Distichodus* species (*D. affinis*, *D. antonni* and *D. lussoso*), at

Malebo Pool on Congo River, the preferential food is made up of the macrophytes in the dry season whereas in the rainy season the periphyton has a high occurrence frequency. In contrast, the diet of *E. guentheri* is largely uniform throughout the year (Spearman correlation coefficient of the rows: rs = 0.698; $p < 0.05$ and G-test: G = 1.479; d.f. = 5; $p > 0.05$) in the waters of Malebo Pool. The benthic habits of this species may be relevant since the decrease of water level during the dry season affects only marginal areas, and does not seem to greatly affect the availability of periphytic food.

The study shows the relative stability of the river conditions at the level of the Malebo Pool. Because the number of stomachs analysed in the rainy season was lower than in the dry season, conclusions about the species diet during the rainy season are limited. This situation is due to the frequency of *Euchilichthys guentheri* seasonal appearances but also to the fishing techniques used for the sampling of these benthic fish in the deep waters of Malebo Pool.

From the current results, it may be concluded that the feeding ecology of *E. guentheri* in Malebo pool is probably similar to those of the other genera of suckermouth catfishes in Africa and in Neotropical ecosystems. The trophic features of this species show that it is an herbivore which evolved a scraping feeding behaviour that allowed it to specialize on periphytic preys.

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