INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print); 2222-5234 (Online)
Website: https://www.innspub.net
Email contact: info@innspub.net
Vol. 27, Issue: 01, p. 29-35, 2025

RESEARCH PAPER OPEN ACCESS

Length-weight relationships and condition factor of 3 species fish from Lôkpôhô dam lake (Ferkessedougou, Côte d'Ivoire)

Koné Tiéhoua[1*], Amon Yao Nicolas[1], Kouassi Koffi Dongo[1], N'Da Konan[2]

[1]*Department of Animal Biology, Formation Unit and Research of Biological Sciences, University Peleforo GON COULIBALY, Korhogo, Côte d'Ivoire*

[2]*Laboratory of Animal Biology and Cytology, Formation Unit and Research of Natural Science, University Nangui Abrogoua (former University of Abobo-Adjamé), Abidjan, Côte d'Ivoire*

Key words: Length-weight relationships, Condition factor, Lôkpôhô Dam Lake, Côte d'Ivoire

DOI: https://dx.doi.org/10.12692/ijb/27.1.29-35 Published: July 03, 2025

ABSTRACT

The length-weight relationship and condition factor are important growth indicators in fish. They provide information on the status of existing fish stocks and their evolution in an aquatic ecosystem. Studies on the length-weight relationship and condition factor of *Oreochromis niloticus*, *Brycinus nurse* and *Tilapia mariae* were carried out from September 2021 to August 2022 on the Lôkpôhô dam lake in the department of Ferkessédougou (North of Côte d'Ivoire). Fish from artisanal and commercial fishing were collected monthly in collaboration with fishermen. A total of 1610 specimens were observed including 847 specimens of *Oreochromis niloticus*, 433 specimens of *Brycinus nurse* and 330 specimens of *Tilapia mariae*. The results of the length-weight relationship give an allometry coefficient of 2.7 for *Oreochromis niloticus*, 2.86 forn *Brycinus nurse* and 2.65 for *Tilapia mariae*. The condition factors determined for *Oreochromis niloticus*, *Brycinus nurse* and *Tilapia mariae* are 2.15 ± 0.29; 1.46 ± 0.18 and 2.01 ± 0.29, respectively. The length-weight relationship showed a negative allometric ($b < 3$) for all three species. Condition factors greater than 1 show that these three species adapt well to this habitat.

***Corresponding author:** Koné Tiéhoua ✉ ktiehoua@yahoo.fr

INTRODUCTION

The information available on the demography and biology of fish populations can be used by the fisheries manager responsible for designing or implementing a development plan. This knowledge must be based on studies of population structure, growth, seasons and areas of reproduction, diets and fooding habits of the main species (FAO, 1996). The length-weight relationship and condition factor are important growth indicators of fish. The length-weight relationship provides information on the status of fish stocks and their evolution in an aquatic ecosystem (Bagenal and Tesch, 1978). It helps determine growth patterns of fish. Growth is an essential point in fish biology. It is the result of energy transformations in the aquatic ecosystem. In fisheries ecology, growth is an indicator of fish habitat quality (Searcy *et al.*, 2007). According to Oni and al., (1983), condition factor is used to characterize physiological state and physical condition of fish during their life cycle. Weight gain corresponds to better plumpness and good physiological condition of the fish. A good correlation between length and weight indicates good fish growth. De Mérona and Ecoutin (1979) indicate that growth is an essential point in fish biology. It constitutes the terminal result of energy transformations in the aquatic ecosystem and its knowledge is essential for carrying out a study of the ichthyological stocks in place and their evolution as well as the biological production of an environment. The objective of this study is to establish the length-weight relationships and condition factors (K) of *Brycinus nurse*, *Oreochromis niloticus* and *Tilapia mariae*, 3 abundant species in the Lôkpôhô dam lake in the department of Ferké (Côte d'Ivoire).

MATERIALS AND METHODS

Study area

The Lokpôhô dam lake is located 40 km from Korhogo and 10 km from Ferkessédougou (Fig. 1). It was built in 1975 by the Sugar Cane Plantation Development Company (SODESUCRE) with funding from the European Development Fund (FED). It is a secondary influx of the Bandama River.

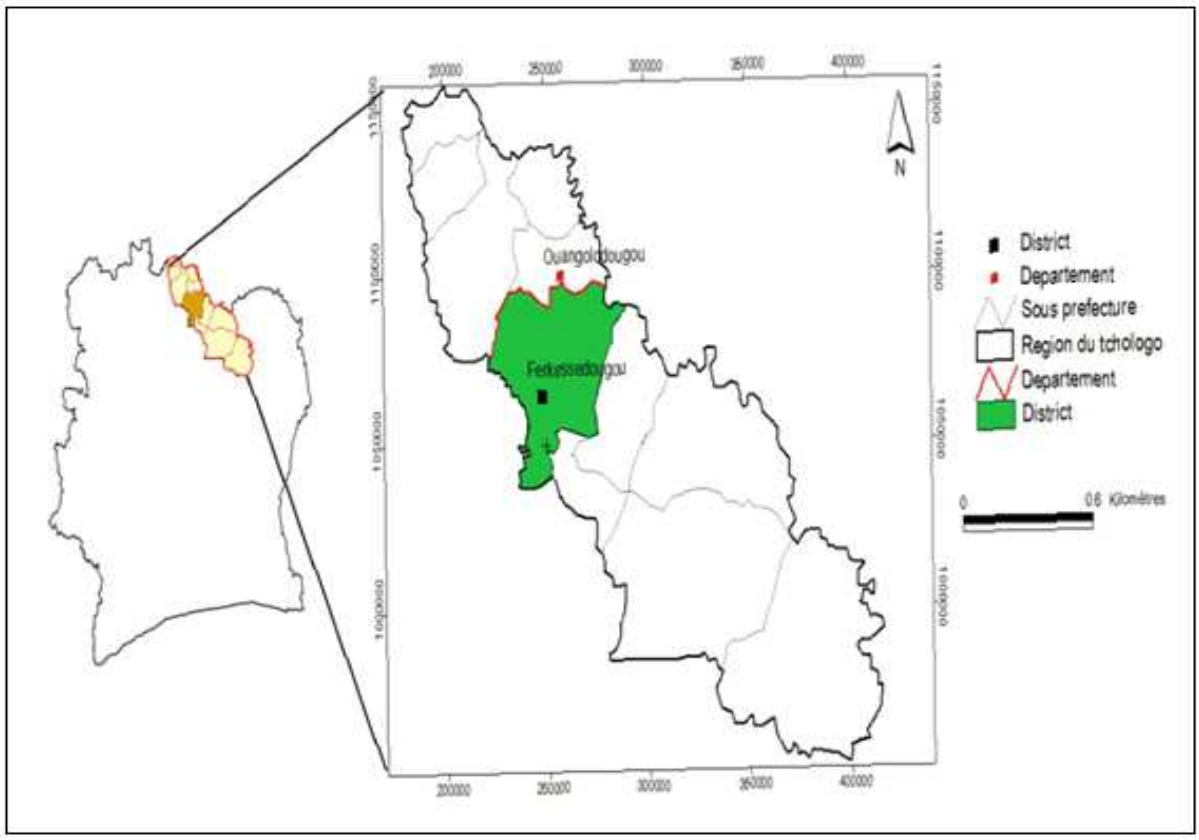

Fig. 1. Presentation of the study area (Source: Analysis of the savannah process in northern Ivory Coast by remote sensing: Case of the department of Ferkessedougou, 2016).

It irrigates the sugar cane plantations of the Lokpôhô valley and has an area of 620 ha (Coulibaly *et al.,* 2016).

Sampling

The data used for this study were collected monthly from September 2021 to August 2022. Fish from artisanal and commercial fishing were collected in collaboration with fishermen. The identification key of Lévêque and al., (1992) was used to identify the different specimens. Each specimen was weighed and measured (Lt).

Data analysis

Determination of the Length-Weight Relationship

Fish growth is analyzed using the length-weight Relationship. This relationship depends on the biological and physiological state of the fish (degree of fullness of the stomach, degree of development of the genital glands and stage of maturation) (Hatour, 2001). The length-weight relationship allows the calculation of the weight of the fish knowing the length and vice versa (Hureau, 1970). Knowledge of this relationship finds applications in fisheries biology and in the assessment of fish stocks (Coulibaly, 2003). The relationship between length and weight of fish is exponential (Le cren, 1951). This equation is as follows.

$P = a. L^b$

It can be expressed in logarithmic form.

$\log (p) = \log (a) + b \log (L)$

The allometry coefficient b generally between 2 and 4 (Layachi *et al.*, 2000) is often close to 3 (Ricker, 1980). The parameters a and b generally provide information on the variations in weight of an individual in relation to its size and can therefore be compared between two or more populations living in similar or different ecological conditions.

When b = 3; the fish has an isometric growth type (the specific density of the animal does not change)

When b > 3; allometry is majorant. (The growth of the fish is in the width direction).

When b < 3; the fish has a growth of the minor allometry type. (The growth of the fish is in the length direction).

Student's t-test at the 5% threshold was performed to check whether the value of b deduced from the regression curves is different from 3. The coefficient of determination $\mathbf{r^2}$ was used as an indicator of the degree of correlation between length and mass.

Determination of Condition Factor (k)

The condition factor (k) reflects the fish's plumpness relative to the effect of ecological and physiological factors. This coefficient informs us about the storage of reserves necessary for gametogenesis (Fehri-Bedoui *et al.*, 2002).

$k = (P/Lt^3) \times 100$

k: condition factor

P: fish weight in g

Lt: total length of fish in cm.

RESULTS

Length-weight relationship

A total of 1610 specimens were observed including 847 specimens of *Oreochromis niloticus*, 433 specimens of *Brycinus nurse* and 330 specimens of *Tilapia mariae*. The total length of *O. niloticus* varies from 10 cm to 28 cm and its weight varies from 20 g to 403 g. The minimum total length of *Brycinus nurse* is 9.5 cm for a minimum weight of 11g. The maximum length observed is 18 cm and a maximum weight of 76 g. The minimum total length of T. mariae is 7cm and the maximum length is 18cm. Its weight is between 10g and 91g. The parameters a (Growth coefficient at origin) and b (Allometric coefficient) of the relationship linking total weight and total length of the three species are presented in Table 1. Student's t-test shows that all three species have a minor allometric growth type (b < 3). The estimated value of coefficient b is 2.7 for *Oreochromis niloticus*, 2.86 for *Brycinus nurse* and 2.65 for *Tilapia mariae*.

Table 1. Parameters of the length-weight relationship of the three species.

Species	Length (cm)			Weight (g)		a	b	Growth
	N	Min	Max	Min	Max			
Oreochromis niloticus	847	10	28	20	407	0,049	2,7	A-
Brycinus nurse	433	9,5	18	11	76	0,02	2,86	A-
Tilapia mariae	330	7	18	10	91	0,043	2,65	A-

A-: Negative allometry; N: Sample size.

The relationship between fish length and weight (Fig. 2, 3 and 4) gives a correlation coefficient R^2 which is 0.87 for *O. niloticus*, 0.84 for *B. nurse* and 0.85 for *Tilapia mariae*. There is therefore a strong correlation between the length and weight of these different species.

Table 2. Equation of length-weight regression and condition factor (k).

Species	N	Regression equation	R^2	Condition factor k	
				medium	Ecart-Type
Oreochromis niloticus	847	$P=0,049L^{2,70}$	0,87	2,15	0,29
Brycinus nurse	433	$P=0,020L^{2,86}$	0,84	1,46	0,18
Tilapia mariae	330	$P=0,043L^{2,65}$	0,85	2,01	0,29

P: Total weight; L: Total length; N: Sample size; R^2: Correlation coefficient.

Condition factor

The regression equations, correlation coefficient (R^2) and condition factor values (k) of the 3 species are reported in Table 2. The mean condition factor values are 2.15 ± 0.29 for *Oreochromis niloticus*, 1.46 ± 0.18 for *Brycinus nurse* and 2.01 ± 0.29 for *Tilapia mariae*. These results indicate that *O. niloticus* and *T. mariae* are more plump than *B. nurse*. Analysis of condition factors by season indicates little variation in values according seasons (Table 3).

DISCUSSION

The results of the length-weight relationship give a correlation coefficient close to 1 (R^2 = 0.87 for *Oreochromis niloticus*, R^2 = 0.84 for *Brycinus* nurse and R^2 = 0.85 for *Tilapia mariae*). This means that length and weight are strongly correlated for these three fish species. The allometry is therefore negative, which means that these three species of fish have faster growth in length and slow growth in thickness (growth in length is faster than growth in weight).

Table 3. Condition factor (k) of the three species according seasons.

Species	Condition factor (k)	
	Dry season	Rainy season
Oreochromis niloticus	2,16 ±0,30	2,12 ± 0,29
Brycinus nurse	1,45 ±0,20	1,45± 0,16
Tilapia mariae	1,92±0,27	2,10± 0,30

The value of b estimated for *Oreochromis niloticus* is similar to that obtained (b=2.86) by Minoungou *et al.*, (2020) in Burkina Faso in the Samandeni reservoir. Ouattara and *al* (2009), during their work on the Ayamé dam lake (Ivory Coast), obtained an allometry coefficient (b = 2.81) close to ours. This result (b = 2.74) is similar to that of Louvinguila *et al.*, (2020) on a Cichlidae of the same genus; *Oreochromis schwebischi* from the Mvassa Lagoon in the Republic of Congo. This similarity in growth of *Oreochromis niloticus* observed from one country to another could be due to the genetic performance of this species or to its high capacity for adaptation to the conditions of each environment.

In contrast, Olurin and Aderibigbe (2006) reported positive allometric growth (b = 3.10) for Oreochromis niloticus in a fish farm in Nigeria, Ogun State.

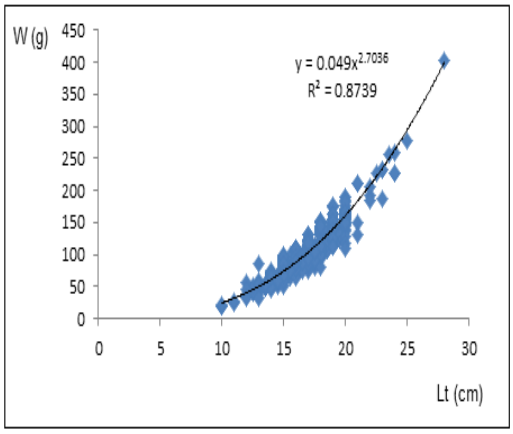

Fig. 2. Length-weight relationship of *Oreochromis niloticus*.

These results could suggest that O. niloticus is in a better state of physiological "well-being" in this fish environment. According to Legendre and Ecoutin, (1996) this result could be explained by the fact that in an experimental environment, there is no predation or competition and this makes the living conditions of the fish generally optimal compared to their natural living conditions. The allometry coefficient (b= 2.86) of *Brycinus nurse* observed during this study is similar to that (b= 2.95) determined by Minoungou *et al.*, (2020) in the Samandeni reservoir in Burkina Faso. The result of the work carried out by Konan *et al.*, (2007) in the rivers of the South-East of Ivory Coast gave a value of b (3.086) higher than that obtained in the present study.

The same results are obtained by the Fisheries Management project in the South-West of Burkina Faso (GPSO, 1995) on *Brycinus nurse* (b = 3.53) and also by Abobi *et al.*, (2013) in the lower reaches of the White Volta in Ghana (b = 3.07). The low value of the allometric coefficient (b) of B. nurse in the Lôkpôhô dam lake could be explained by its proximity to the plantations and factories of SUCAF-CI (Sucrerie Africaine - Côte d'Ivoire). The allometry coefficient resulting from the length-weight relationship of Tilapia mariae (b= 2.65) is lower than that determined by Konan *et al.* (2007) in the rivers of the South-East of Côte d'Ivoire (b= 3.09). This result could suggest that living conditions in Lake Lokpôhô are less good than in the rivers of the South-East of Côte d'Ivoire. According to Hossain *et al.*, (2006), the value of (b) could be influenced by the growth phase, stomach contents and level of gonad development. The results of the present study are similar to those of Minoungou *et al.*, (2020) from the Samandeni reservoir in Burkina Faso on a related Cichlidae, *Coptodon zillii* (b= 2.91). The condition factors determined in *Oreochromis niloticus*, *Brycinus nurse* and *Tilapia mariae* are 2.15 ± 0.29; 1.46 ± 0.18 and 2.01 ± 0.29, respectively.

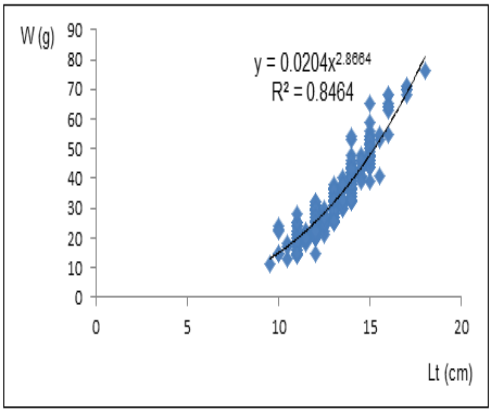

Fig. 3. Length-weight relationship of *Brycinus nurse*.

These three fish species are in an environment where living conditions are acceptable because Alhassan and al. (2015) consider that a condition factor k less than 1 suggests that the fish are in poor conditions. These results could be explained by the fact that a given individual can have a more or less high weight depending on numerous factors, the main ones being the individual's own morphology, the state of fattening, the sexual stage of the gonads, the own density, and the state of fullness of the digestive tract (Freon, 1976). The analysis of the condition factor as a function of the season shows that the maximum value of the coefficient k is recorded in the dry season for *O. niloticus*. The low value of the condition factor in the rainy season could be justified by the fact that the species could experience difficulties in obtaining food in this season because of the increasing water level.

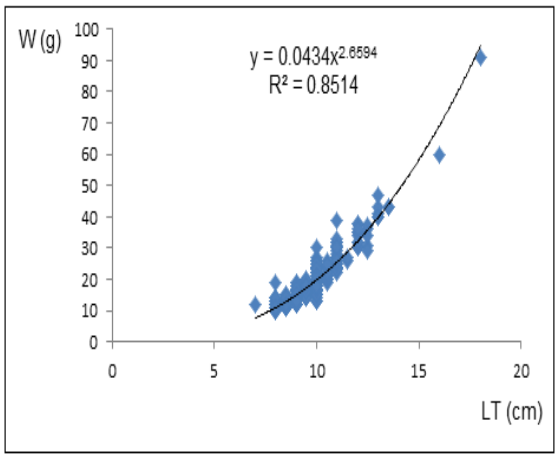

Fig. 4. Length-weight relationship of *Tilapia mariae*.

B. nurse has a (k) that does not vary with season and this could be explained by the fact that the variation of the season has no impact on the condition factor of the species. The minimum value of k recorded for *T. mariae* during the dry season can be explained by the decrease in food during this season.

CONCLUSION

This study based on the length-weight relationship and the condition factor of three species of fish from the Lôkpôhô dam lakes provides the first basic information on these parameters in this small dam in the north of Ivory Coast. The study of growth parameters shows an allometry coefficient less than 3 in the three species. The condition coefficient greater than 1 show that these three species adapt well to this habitat and to the physicochemical and biological conditions necessary for their development.

ACKNOWLEDGEMENTS

The authors thank all the fishermen of the Lokpôhô dam lake for their collaboration. We would like to particularly thank Mr. Angoran who is an agent of the Ferkessédougou fisheries directorate for his help with data collection.

REFERENCES

Freon P. 1976. Relations tailles-poids, facteurs de condition et indices de maturité sexuelle: Rappels bibliographiques, interprétations, remarques et applications. Centre de Recherches Océanographiques de Dakar Thiaroye **8,** 114-171.

Alhassan EH, Akongyuure DN, Asumang F. 2015. Determination of Morphometric Relationship and Condition Factors of Four Cichlids from Golinga Reservoir in Northern Region of Ghana. Journal of Biological Science **15(3),** 201-206.

Hossain MY, Ahmed ZF, Leunda PM, Jasmine S, Oscoz J, Miranda R, Ohtomi J. 2006. Condition, length-weight and length-length relationships of the Asian striped catfish *Mystus vittatus* (Bloch, 1794) (Siluriformes: Bagridae) in the Mathabhanga River, Southwestern Bangladesh. Journal of Applied Ichthyology **22,** 304-307.

Abobi SM, Ekau W. 2013. Length-Weight Relationships and Condition Factors of *Alestes Baremoze*, *Brycinus Nurse* and *Schilbe Intermedius* from the Lower Reaches of White Volta River (Yapei), Ghana. International Journal of Fisheries and Aquaculture **5(6),** 152-165.

GPSO (Projet Gestion des Pêches dans le Sud-Ouest). 1995. Enquêtes Halieutiques sur les Six Retenues: Tounoura, Comoé, Douna, Tiéfora, Lemouroudougou et Navrikpê. Situation et Recommandations. GOPA-COFAD: Bad Homburg.

Konan KF, Ouattara A, Ouattara M, Gourène G. 2007. Weight–length relationship of 57 fish species of the coastal rivers in South–Eastern of Ivory Coast. Croatian Journal of Fisheries **65(2),** 49- 60.

Legendre M, Ecoutin JM. 1996. Aspects de la stratégie de reproduction de Sarotherodon melanotheron: comparaison entre une population naturelle (Lagune Ebrié, Côte d'Ivoire) et différentes populations d'élevage. In : Pullin R. S. V, Ed: Lazard J, LEGENDRE M, Amon Kothias JB, Pauly D, Lhomme-Binudin C. Le troisième symposium international sur le tilapia en aquaculture, Makati City : ICLARM, 360-374.

Nahoua IO, Iftime A, Mester LE. 2009**.** âge et croissance de deux espèces de cichlidae (Pisces): *oreochromis niloticus* (Linnaeus, 1758) et *sarotherodon melanotheron* rüppell, 1852 du lac de barrage d'ayamé (côte d'ivoire, afrique de l'ouest)**.** Travaux du muséum national d'histoire naturelle **3,** 313–324.

Hélène DLT, Goma-Tchimbakala1 AIZJ, Lérège BM, Honest FPN, Victor M. 2020. Effets saisonniers sur les relations poids-longueurs et coefficients de condition pour 16 espèces de poissons de la Lagune Mvassa, basse Guinée, République du Congo. Journal of Animal & Plant Sciences **44(1),** 7540-7552.

Olurin KB, Aderibigbe OA. 2006. Length-weight relationship and condition factor of pond reared juvenile Oreochromis niloticus. World journal of Zoology **1(2),** 82-85.

Minoungou M, Ouedraogo R, Da N , Oueda A. 2020. Relation longueur-poids et facteur de condition de sept espèces de poisson du réservoir de Samandeni avant son ouverture à la pêche (Burkina Faso). Journal of Applied Biosciences **151,** 15559-15572.

Ricker WE. 1980. Calcul et interprétation des statistiques biologiques des populations de poissons. Bulletins de l'office des recherches sur les pêcheries du Canada, 191F, Ottawa, 379-392.

Coulibaly L. 2016. Analyse du processus de savanisation du nord de la Côte d'Ivoire par télédétection: Département de Ferkessédougou; Laboratoire Géosciences et Environnement-UFR SGE-Université Nangui Abrogoua, 136-138.

Mérona DB, Ecoutin JM. 1979. La croissance des poissons d'eau douce africains. Revue bibliographique et essai de généralisation. Office de la recherche scientifique et technique outre· mer hydrobiologistes orstom, 24, Rue Bayard, 75008 Paris, France. 139 p.

Bagenal TB, Tesh FW. 1978. Age and growth. In: Methods for assessment of fish production in fresh waters. Ed Bagenal TB, Blackwell Scientific Publications, London, Oxford Edition, 101-136.

Oni SK, Olayemi JY, Adegboye JD. 1983. Comparative physiology of three ecologycally distinct freshwater fishes, *Alestes nurse*, *Synodontis schall* Broch and *Tilapia zillii*, Journal of Fisheries Biologie, **22,** 105-409.

Searcy SP, Eggleston DB, Hare JA. 2007. Is growth a reliable indicator of habitat quality and essential fish habitat for a juvenile estuarine fish. Canadian Journal of Fisheries and Aquatique Science **64,** 681-691.

FAO. 1996. Etat de connaissances sur les pêcheries continentales ivoiriennes. Rapport de projet, p.135.

Lévêque C, Paguy D, Teugels GG. 1992. Faune des poissons d'eaux douces et saumâtres de l'Afrique de l'ouest. Tome II. Faune tropicale, XXVIII, MRAC–Tervuren/ORSTOM–Paris, 385–902.

Hatour A. 2001. Relation taille poids des captures de thon rouge (*Thunnus thynnus*) en Tunisie. Institut National des Science et Technologie De La Mer Tunisie, 1-8.

Hureau JC. 1970. Biologie comparée de quelques poissons antarctiques (Nototheniidae). Bulletin de l'Institut Océanographique de Monaco **1931,** 1 - 244.

Coulibaly ND. 2003. Relation taille-poids de 11 espèces de poissons du Burkina Faso. *In:* Fish Biodiversity: Local Studies as Basis for Global Inferences; Palomares, MLD, Samb B, Diouf T. Vakily JM, Pauly, D; Ed. ACP-EU Fisheries Research Initiative **14,** 20-22.

Layachi M, Melhaoui M, Abdallah S, Ramdani M. 2000. Contribution à l'aide de la reproduction et de la croissance du Rouget-barbet de la vase (*Mullus barbates* L., 1758) de la zone littorale méditerranéenne de Nador (Maroc). Bulletin de l'Institut scientifique de Rabbat, section De La Vie **29,** 43-51.

Le Cren ED. 1951. The length weight relationship and seasonal cycle in gonad weigth and condition in the Perch (*P. fluvitilis*). Journal of Animal Ecology **20 (2),** 201-219.

Ferri- Bedoui R, Gharbi H, El Abed A. 2002. Période de reproduction et maturité sexuelle de *Liza aurata* (Poisson Mugilidae) des cotes Est et Sud tunisiennes. Bulletin de l'Institut National des sciences Et Technologies De La mer **29,** 11-15.