Original Research Article

Length-Weight Relationship and condition factor of twenty fish species in Ebrie lagoon (Aghien-Potou sectors Abidjan, Côte d'Ivoire)

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ABSTRACT

Aims: This study investigated Length-weight relationships and condition factors of fish species in Ebrie lagoon (Aghien-Potou sector, Côte d'Ivoire)

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Place and Duration of Study: Ebrie lagoon (Aghien-potou sector) from april 2019 to march 2020.

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Methodology: study was conducted during 3 to 4 days continuously in ebrie Lagoon (Aghien-Potou Sector). Furthermore, monthly fish samples were collected from commercial landings at random using gillnets, cast nets, traps, hooks and beach seines.

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Results: All Length-weight regressions were highly significant with the coefficient of determination (r^2) ranging from 0.61 in *Schilbe mandibularis* to 0.90 in *Monodactylus sebae* and *Chrysichthys maurus*. An isometric growth was observed for most of species except three of them namely *Ethmalosa fimbriata*, *Pseudotolithus elongatus*, and *polydactylus quadrifilis*. The k values varied from 0.19±0.001 in *S. melanotheron* to 6.10±0.3 in *Monodactylus sebae.* The values of b and k denote that the Ebrie lagoon could provide a favourable environment and suitable habitat for the growth of those fish species.

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Conclusion: The study provides basic information on length-weight parameters for twenty major fish species collected from Ebrie lagoon (Aghien-Potou sector). Three species namely *Ethmalosa fimbriata*, *Pseudotolithus elongatus* and *Polydactylus quadrifilis* exhibited a trend of positive growth whereas seventeen fish species showed isometric growth. The condition factor k was superior to 1 for 75% of the fish species and inferior to 1 for 25 % of the fish species. These growth trends denote that the lagoon could provide a favourable environment and suitable habitat for the growth of those fish species.

Keywords: Length-weight relationship, condition factor, Fish, lagoon, Côte d'Ivoire, West

1. INTRODUCTION

Fish is an important source of food because of it richness in protein, minerals, vitamins and the cholesterol low level. The length-weight relationship studies are widely applied in fisheries management as they provide information on stock condition [1]. Indeed, length-weight relationship is commonly used in fisheries assessment to convert length measures into weight and to ascertain the growth characteristics related to those variables [2]. The condition factor could reflect the physiological state of a fish which is influenced by both intrinsic (gonadal development, organic reserves, presence or absence of food in the gut) and extrinsic (food availability, environmental variability) factors [3]. Moreover, the condition factor estimates the general well-being of the individual and is frequently used in several cases such as the comparison of two more co-specific populations living in similar or different conditions of food or density; the observation of increase or decrease in feeding activity or population changes possibly due to modification in food resources. At last, the determination of the period and duration of gonadal maturation. Despite the usefulness of both length-weight relationship and the condition factor in fisheries management little is known about the length-weight relationship and condition factor of fish species in Ebrie lagoon (Aghien-Potou sector). The purpose of the present study was to provide basic information on the length -weight relationship parameters of twenty fish species in Aghien-Potou sector caught by artisanal fisheries and assess the condition factor for each species.

2. MATERIAL AND METHODS

2.1. Study area

The Ebrie lagoon system with an area of 566 km², extends in the east on 125 km along the littoral of Côte d'Ivoire between 340-450w. It comprises the ebrié lagoon itself (523 km²) and the Aghien-Potou lagoon system (43 km²). Located between 515-527 n and 343-356 w, the Aghien-Potou lagoon system extends on 72 km from perimeter and 32 km length from the median axis [4] (figure 1). In Potou lagoon, the influence of the intrusion salt works is sensitive in dry season (from january to may), while remaining moderate (< 9), and the water being soft from may to december [5].

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The climate of the study zone is an equatorial type characterized by four seasons including one high dry season from december to march, a high rainy season from april to july, a small dry season from august to september and a small rainy season from october to november. It is a zone where interannual precipitations rank above 1500 mm. This zone contains a significant hydrographic network, composed of the bété, djibi and me rivers. The bété and djibi rivers emerge directly in the Aghien lagoon whereas me river emerges in the natural channel connecting the Aghien lagoon to the lagoon Potou [6]. The Potou lagoon is characterized by low depths (< 3 m). The most significant depths are recorded on the level of the channels connecting the Aghien lagoons and Potou (5 to 7 m) on the one hand and the Potou sector (7 m) with the remainder of the Ebrie lagoon on the second hand [7].

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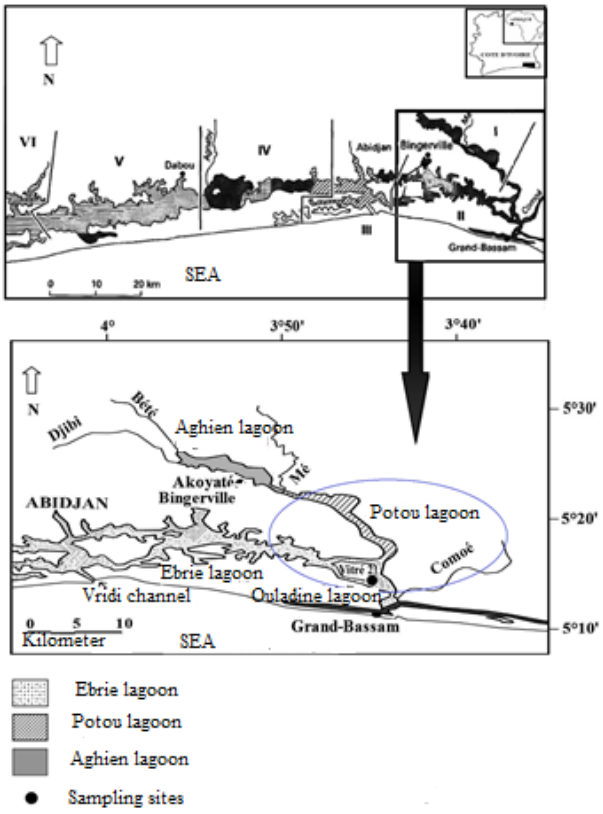

Fig 1: Map of Ebrie lagoon showing sampling zone (Aghien-Potou Sector)

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2.2 Data collection and analysis

A monthly study was conducted during 3 to 4 days continuously in Ebrié Lagoon (Aghien-Potou Sector). Furthermore, monthly fish samples were collected from commercial landings at random using gillnets, cast nets, traps, hooks and beach seines. Fishermen were chosen by random and fishes in their catches were analysed. Each specimen was identified to the species level by using [8] manual. Then each individual collected was measured for its standard length (LS) to the nearest 0.1 cm by using a fish measuring board. The fish specimens were

individually weighed to the nearest 0.01g using an electronic weighing balance model FEL-500S. Parameters of the length-weight relationship of identified fish species were estimated using the equation:

$W = aSL^b$ [9] (1)

Where,

W= weight of fish (g)

L= length of fish (cm)

a= y-intercept or the initial growth coefficient

b= Slope of the growth coefficient

Parameters (a) and (b) were determined after logarithmic transformation of (1) via least squares linear regression [10].

Log W = log a + blog SL (2)

The 95% confidence limits for b (CL 95%) were computed using the equation:

CL= b ± (1.96 x SE)

Where,

SE: is the standard error of b. In order to check if the value of b was significantly different from 3, the Student's t-test was conducted as expressed by the equation according to [11]: ts=(b-3)/SE where ts is the t-test value, b the slope and SE the standard error of the slope b. The value of b gives information on the type of growth of fish: The growth is isometric if b=3 and the growth is allometric if b≠3 (negative allometric if b inferior to 3 and positive allometric if b is superior to 3). All the statistical analysis were considered at significance level of 5% ($p<0.05$). The condition factor was estimated by the formula:

Condition factor (kc) = $100\ W/\ LS^3$ [12]

Where

W is the weight of fish 'g)

LS is the standard length of fish (cm)

3. Results

The length-weight relationships results of each species with several descriptive statistics are summarized in Table 1. A total of 16157 specimens belonging to 13 families and 18 genera were collected in the present study. The family with the highest species number four (04) species was Cichlidae (*Tylochromis jentinki,*

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Coptodon guineensis, Hemichromis fasciatus and Sarotherodon melanotheron), while three (03) species were recorded by Claroteidae (*Chrysichthys nigrodigitatus, C. auratus, C. maurus*). Two species were recorded by Clupeidae (*Pellonula leonensis, Ethmalosa fimbriata*), Mugilidae (*Mugil cephalus, Liza falcipinnis*). The other families were represented by one species each. The sample size for the fish species were ranged from 41 in *Hemichromis fasciatus* to 2662 in *Coptodon guineensis* while the value of b was ranged from 2.67 in *Monodactylus sebae* (Monodactylidae) to 3.85 in *Ethmalosa fimbriata* (Clupeidae). The lowest condition factor (k = 0.019±0.001) was recorded in *Sarotherodon melanotheron* (Cichlidae) while the highest value (6.102±0.319) was observed in *Monodactylus sebae* (Monodactylidae). The values of correlation coefficient (r^2) varied from 0.61 in *Chrysichthys maurus* (Claroteidae) to 0.99 in *Sphyraena afra*.

The condition factor (k) for twenty fish species in Ebrie lagoon (Aghien-Potou sector) is presented in Table 1. 75% of fish species showed a value of k > 1 while 25 % of fish species showed a value of < 1. The highest value of k for the fish species was 6.10±0.31 in *Monodactylus sebae* whereas the lowest value was 0.19±0.001 in *Sarotherodon melanotheron.*

4. Discussion

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The range of value of b (2.67-3.85) obtained in the present study was within the expected limits (2-4) reported by [1, 13] for most fish species. This range of b values recorded in the work is similar to the values (2.26-3.94) recorded by [14] which studied the Length-weight relationships for 18 fish species in Grand-Lahou lagoon (Côte d'Ivoire). It is also similar to the b values (2.229-3.911) obtained in [15] which studied the length-weight relationship of 30 fish species in Aby lagoon (Côte d'Ivoire). The 95% confidence interval of b for about 80% of the fish species ranged from 2.5 to 3.4. This is within the expected range of 2.5 < b < 3.5 [16]. The value of b for *Ethmalosa fimbriata* in this study is different from that reported by [14] for Grand-Lahou lagoon. It is likely that this discrepancies are due to seasonal variability [17; 18], sampling size and the length interval within different areas [19] or habitat [20]. In addition, b values are also reliant on biological and environmental conditions and geographical, temporal and sampling factors [1], [2]. The higher b value in *Ethmalosa fimbriata*, *Schilbe mandibularis*, *Pomadasys jubelini,*

Pseudotolithus elongatus and *Hemichromis fasciatus* in Ebrie lagoon showed that it provided a more favourable environment for this fish species. So Ebrie lagoon (Aghien-Potou sector) seems to be a very healthy environment for some fish species. Fulton's condition factor (k) reflects through its variations, information on the physiological state of the fish in relation to its welfare. A closer examination of the condition factors revealed that 75% (16 out of 20) of the fish species had their k superior to 1 (k > 1). Only 25% had k values < 1. [21] proposed that if the k value is 1.00, the condition of the fish is poor, long and thin. A 1.20 value of k indicates that the fish is of moderate condition and acceptable to many anglers. A good and well-proportional fish would have a k value that is approximately 1.40. Based on this criterion, the majority of sampled fishes in Ebrie lagoon (Aghien-Potou sector) were in good condition.

Table I: Length-weight relationship of twenty fish species collected from Ebrie lagoon (Aghien-Potou sector)

Species	N	a	b	95% of Cl of b	r^2	k	Mean length (cm)	Mean weight (g)	GT
Clupeidae									
Pellonula leonensis Boulenger, 1916	98	0.183	2.85	2.83-2.86	0.66	1.48±0.04	8.96±1.78	13.56±8.91	I
Ethmalosa fimbriata (Bowdich, 1825)	2471	0.103	3.85	3.85-3.87	0.78	4.22±0.50	11.78±1.71	186.53±64.93	A+
Claroteidae									
Chrysichthys nigrodigitatus (Lacepède, 1803)	1382	0.180	2.91	2.78-3.03	0.81	1.65±0.04	22.29±1.71	266.5±217	I
Chrysichthys maurus (Valencienne, 1839)	1137	0.134	2.98	2.83-3.12	0.90	1.67±0.01	25.23±8.96	428.08±388	I
Chrysichthys auratus (Geoffroy Saint-Hilaire, 1808)	51	0.169	2.98	2.86-3.09	0.78	1.56±0.04	14.84±2.37	58.07±25.41	I
Schilbeidae									
Schilbe mandibularis (Günther, 1871)	514	0.086	3.17	3.11-3.27	0.61	0.59±0.02	17.68±3.51	43.99±30.47	I
Clariidae									
Clarias güentheri Pfeffer, 1896	71	0.192	2.76	2.69-2.82	0.80	1.08±0.03	22.98±3.32	144.39±60.78	I

Haemulidae									
Pomadasys jubelini									
(Cuvier, 1830)	158	0.122	3.12	2.95-3.29	0.85	1.16±0.02	19.45±3.44	99.23±48.39	I
Sciaenidae									
Pseudotolithus elongatus									
(Bowdich, 1825)	125	0.038	3.21	3.20-3.21	0.80	1.10±0.04	21.92±3.83	12.95±6.78	A+
Monodactylidae									
Monodactylus sebae									
(Cuvier, 1829)	46	0.419	2.67	2.37-2.96	0.90	6.10±0.31	11.97±1.84	112.01±43.45	I
Cichlidae									
Tylochromis jentinki									
(Steindachner, 1894)	1276	0.159	3.04	2.86-3.19	0.79	1.67±0.008	22.03±2.68	212.3±93.80	I
Coptodon guineensis									
(Günther, 1862)	2662	0.260	2.84	2.76-2.91	0.86	2.88±0.07	19.74±3.082	247.09±103.90	I
Hemichromis fasciatus									
Peters, 1852	41	0.095	3.25	3.21-3.28	0.91	0.89±0.04	19.17±2.91	76.56±42.62	I
Sarotherodon melanotheron									
Ruppel, 1852	2345	0.421	3.64	3.60-3.67	0.89	0.19±0.001	19.90±2.99	1779.71±901.52	A+
Mugilidae									
Mugil cephalus									
Limnaeus, 1758	96	0.156	3.012	2.85-3.16	0.79	1.44±0.04	23.88±5.01	244.65±167.31	I
Liza falcipinnis									
(Valencienne, 1836)	49	0.143	2.98	2.90-3.05	0.73	1.11±0.001	18.75±2.15	79.25±30.15	I
Elopidae	2494	0.105	3.09	3.08-3.09	0.68	0.73±0.009	20.22±3.58	70.20±34.85	I
Elops lacerta									
Sphyraenidae									
Sphyraena afra									
Peters, 1844	80	0.197	2.75	2.48-3.01	0.90	0.97±0.03	35.24±4.95	454.67±172.35	I
Polynemidae									
Polydactylus quadrifilis									
(Cuvier, 1829)	737	0.119	3.09	3.06-3.11	0.85	1.020±0.030	24.71±11.21	267.27±102.25	A+
Cynoglossidae									
Cynoglossus senegalensis									
(Kaup, 1858)	327	0.071	3.029	2.73-3.32	0.68	2.54±0.001	35.40±4.18	121.29±40.11	

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N: sample size; a and b regression coefficient; Cl: confidence interval r^2: correlation coefficient: k: condition factor; GT : Growth type ; I : isometric growth, A+ : positive allometric

5. Conclusion

The study provides basic information on length-weight parameters for twenty major fish species collected from Ebrie lagoon (Aghien-Potou sector). Three species namely *Ethmalosa fimbriata*, *Pseudotolithus elongatus* and *Polydactylus quadrifilis*

exhibited a trend of positive growth whereas seventeen fish species showed isometric growth. The condition factor k was superior to 1 for 75% of the fish species and inferior to 1 for 25 % of the fish species. These growth trends denote that the lagoon could provide a favourable environment and suitable habitat for the growth of those fish species.

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Comment [a22]: There are reference consist of 12 books and 9 articles. There should be more articles than books. Article should have been 10 years ago. There are 4 articles that are more than 10 years old and not up to date.

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