Advance Journal of Food Science and Technology 1(1): 51-56, 2009
ISSN: 2042-4876

Submitted Date: September 29, 2009 Accepted Date: October 19, 2009 Published Date: November 10, 2009

The Morphology, Abundance, Condition Factor and Length-weight Relationship of *Ethmalosa fimbriata* (Bowdish 1825) from Nkoro River Niger Delta, Nigeria

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Abstract: The morphology, abundance, condition factor and length-weight relationship of *Ethmalosa fimbriata* from Nkoro River in the Niger Delta area of Nigeria was studied from January-December 2008. The body description of *E. fimbriata* from Nkoro River was; Dorsal spine (total): 0, Dorsal soft rays(total): 16-19, Anal spine: 0, Anal soft rays: 19-23. The mouth is sharply upward and V-shaped. Caudal fin is deep chrome with long and pointed tips. The upper jaw contains distinct median notch, into which tip of lower jaw fits. Lower gill rakes are long, fine and numerous, often 3 times as long as gill filaments; upper gill rakes bent. There is a faint dark spot behind gill cover sometimes followed by others. The dorsal fin tip is black with golden tints on the body. The scute is 16-19, pre-pelvic, 10-13 post and scales in lateral series is 37-42. The highest catch was recorded in January (8.16), followed by February (4.21), May (1.65), March (1.40), April (1.11) and October (1.10). June (0.87), December (0.32), November (0.20) and July (0.14) were less than 1. No catch was recorded for August and September during the study. The highest catch per unit effort (5.62) was recorded in station 2, followed by station 1 (5.04) and station 4. The least catch per unit effort (3.75) was recorded in station 3 . From a sample size of 1200 specimens, K value was 0.946 and the exponential equation was $Wt = 0.162 (TL)^{3.199}$, indicating an isometric growth pattern. The highest condition factor value (1.00) was recorded in May and the lowest (0.6) in September. This was an indication that the beginning of rains favors *E. fimbriata* than mid rains.

Key words: *Ethmalosa fimbriata,* morphology, abundance, condition factor, lenght – weight relationship, Nkoro River and Nigeria

INTRODUCTION

The Bonga shad: *Ethmalosa fimbriata* belongs to the family clupeidae and order clupiformes.It is a coastal and estuarine clupeid found on the west African coast from Mauritania to Angola and distributed in Eastern Central Atlantic: Dakhla, Western Sahara to at least Lobito, Angola, corresponding to the extreme northerly and southerly limits of the 25ºC isotherms throughout the year; dwarf population exist in Lake Nokoué, Benin. Cape Verde records based on erroneous type locality for *Ethmalosa fimbriata.*

E. fimbriata is Pelagic-neritic; catadromous freshwater; brackish; marine, usually 0 - 50 m long, occurs in inshore waters, lagoons and more than 300 km up rivers (e.g. Gambia River). It feeds by filtering phytoplankton, chiefly diatoms and breeds throughout the year in waters of salinities 3.5-38 ppt, but with peaks in at least some areas, spawns in the sea, in estuaries and rivers and marketed fresh, smoked or dried.

Apart from being a cheap source of highly nutritive protein, it also contains other essential nutrients required by the body (Sikoki and Otobotekere, 1999).

Catch Per Unit Effort (CPUE) is a useful index in the assessment of abundance of fish species (Gulland, 1975). It is essential in the determination of maximum sustainable yield (MSY) and potential yield. Tobor (1992) reported that the inshore waters of most parts of the West African coast are rich in fish resources in quantities that can support commercial exploitation on a sustainable basis. However, later developments in fisheries studies have pointed to the depletion of the fish stocks (Okpanefe, 1987).

Condition factor compares the wellbeing of a fish and is based on the hypothesis that heavier fish of a given length are in better condition (Bagenal and Tesch, 1978). Condition factor has been used as an index of growth and feeding intensity (Fagade, 1979). Condition factor decrease with increase in length (Bakare, 1970; Fagade 1979); and also influences the reproductive cycle in fish (Welcome, 1979). Condition factors of different species of cichlid fishes have been reported by Siddique (1977), Fagade (1978, 1979, 1983), Dadzie and Wangila (1980), Arawomo (1992) and Oni *et al.* (1983). Some condition factors reported for other fish species include; Alfred-Ockiya (2000), *Chana chana* in fresh water swamps of Niger Delta and Hart (1997), *Mugil cephalus* in Bonny estuary, Hart and Abowei (2007), ten fish species from the lower Nun River, and Abowei and Davies (2009), *Clarotes lateceps* from the fresh water reaches of the lower Nun river.

The length-weight relationship of fish is an important fishery management tool. Its importance is pronounced in estimating the average weight at a given length group

(Beyer, 1987) and in assessing the relative well being of a fish population (Bolger and Connoly, 1989).

Consequently, length-weight studies on fish are extensive. Notable among these are the reports Shenouda *et al.* (1994), for *Chrysichthys* spp. from the Southern most part of the River Nile (Egypt), Alfred-Ockiya and Njoku (1995) for mullet in New Calabar River, Ahmmed and Saha (1996) for carps in Lake Kapital, Bangladash, King (1996) for Nigeria fresh water fishes, Hart (1997) for Mugil cephalus in Bonny Estuary; Diri (2002) Tilapia guineensis in Elechi creek.

Unfortunately, no work has been done on the length-weight relationship of *Ethmalosa fimbrata, Ilishia africana, Sardinella maderensis, Cynoglossus senegalensis and Elops senegalensis* from the Nkoro River. A study of the Length-Weight relationship of five fish species from the Nkoro River adds more information on the families: Clupeidae, Cynoglosidae and Elopidae to compliment the existing data in the management and culture of the species in the Nkoro River, Niger Delta.

Accurate fisheries statistics in the river; and its adjourning flood plains is vital for the formulation of a sound fisheries management programme in the Nkoro River and similar water bodies. But, this is completely lacking. A part from (Scott, 1966; Reed *et al.*, 1967; Otobo, 1981; FAO, 1994; Otobo, 1993; Ita and Medahili, 1997; Sikoki and Otobotekere, 1999; Ezekiel *et al.*, 2002; Abowei and Ezekiel, 2003; Abowei *et al.*, 2007; Abowei and Hart, 2007; Abowei *et al.*, 2008; Abowei and Hart, 2008; Abowei and Hart, 2009 and Abowei and Davies, 2009), different water bodies, there are no reliable data on the physio-chemical characteriscs, mophorlogy and abundance of five fish species from Nkoro River. This is essential for formulation of development plan in the fishing industry. This paper therefore provides information to fill that gap in Nkoro River fisheries.

MATERIALS AND METHODS

Study Area: The Nkoro River is a distributory of the Andoni River in the Niger Delta area of Nigeria. The Nkoro River lies between latitudes 4º28' to 4º45' N and longitudes 7º 45'E. The Niger Delta is one of the world largest wetlands covering an area of approximately 70,000 km^2. The area is economical is important and rich in biodiversity. Numerous activities such as oil exploration and production and agricultural activities go on in the region. Most of Nigeria's oil and gas reserves and production, which account for over 80% federal government's revenue, is located within the Niger Delta region. The Red and white mangroves (*Rhizonhora* and *Avicenia* spp.) mangrove swamps and flood plains border the river and its numerous creeks; and these are well exposed at low tides.

Fish Sampling: Fish specimens were procured from artisanal fishers and middlemen at their landing site for the study. Sampling of landed catches was done twice in a month for a period of twelve months. The fishers used a wide range of fishing gear such as hook and line, long line, cast nets, gill nets and traps. From the catches, fish specimen were randomly and identified using keys and descriptions by Holden and Reed (1972) and Loveque *et al.* (1991) and Reed *et al.* (1967). Specimens were stored in coolers containing ice and transported to the laboratory for further analysis.

Abundance was estimated from the weight (kg) of the total catch of each station for each species over the period of this study and compared for difference using Analysis of variance (ANOVA) to test for difference between the stations. Catch per unit effort was calculated by dividing the total monthly catch by the effort (number of fishers per boat) and finally dividing by the number of hours of fishing giving:

CPUE = Total catch/No of fishers/fishing hours
CPUE = Kg/man/hr (King, 1991).

The figures for catch per unit effort were tested for variation on monthly and station basis using ANOVA. The data for each physiochemical parameter was also tested for variation between stations and for correlation against the catch data and condition factor using ANOVA.

The Total Length (TL) of the fish was measured from the tip of the anterior or part of the month to the caudal fin using meter rule calibrated in centimeters. Fish were measured to the nearest centimeter. Fish weight was measured after blot drying with a piece of clean hand towel. Weighing was done with a tabletop weighing balance, to the nearest gram. The length measurements were converted into length frequencies with constant class intervals of 2cm. The mean lengths and weights of the classes were used for data analysis, the format accepted by FISAT (Gayanilo and Pauly, 1997).

The relationship between the length (L) and weight (W) of fish was expressed by equation (Pauly, 1983):

$$W=aL^b \quad (1)$$

Where

W=Weight of fish in(g)
L=Total Length (TL) of fish in(cm)
a=Constant (intercept)
b=The Length exponent (slope)

The "a" and "b" values were obtained from a linear regression of the length and weight of fish. The correlation (r^2), that is the degree of association between the length and weight was computed from the linear regression analysis:

$$R = r^2 \quad (2)$$

The condition factor (k) of the experimental fish was estimated from the relationship:

Table 1: Monthly catch per unit effort for *E. fimbriata* in Nkoro River

Jan.	Feb.	Mar.	Apr.	May	Jun	.Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
8.16	4.21	1.40	1.11	1.65	0.87	0.14	0.00	0.00	1.10	0.20	0.32

$$K = \frac{100\ W}{L^3} \quad (3)$$

WhereK = Condition factor,W = Weight of fish, L = Length of fish (cm)

RESULTS

The body description of *E. fimbriata* from Nkoro River was; Dorsal spine (total): 0, Dorsal soft rays (total): 16-19, Anal spine: 0, Anal soft rays: 19-23. The mouth is sharply upward and V-shaped. Caudal fin is deep chrome with long and pointed tips. The upper jaw contains distinct median notch, into which tip of lower jaw fits. Lower gill rakes are long, fine and numerous, often 3 times as long as gill filaments; upper gill rakes bent. There is a faint dark spot behind gill cover sometimes followed by others. The dorsal fin tip is black with golden tints on the body. The scute is 16-19, pre-pelvic, 10-13 post and scales in lateral series is 37-42 (Plate 1).

The monthly catch per unit effort for *E. fimbriata* in Nkoro River is presented in Table 1. The highest catch cas recorded in January (8.16), followed by February (4.21), May (1.65), March (1.40), April (1.11) and October (1.10). June (0.87), December (0.32), November (0.20) and July (0.14) were less than 1. No catch was recorded for August and September during the study.

The catch per unit effort of *E. fimbriata* at each station in Nkoro River is presented in Table 2. The highest catch per unit effort (5.62) was recorded in station 2, followed by station 1 (5.04) and station 4. The least catch per unit effort (3.75) was recorded in station 3 .

Table 3 expresses the conditon factor and the exponential equation from the length weight relationship of *E. fimbriata* in Nkoro River. From a sample size of 1200 specimens, K value was 0.946 and the exponential equation was $Wt = 0.162\ (TL)^{3.199}$, indicating an isometric growth pattern.

Fig. 1 shows the monthly condition factor for *E. fimbriata* in Nkoro River. The highest condition factor value (1.00) was recorded in May and the lowest (0.6) in September.

DISCUSSION

The body description of *E. fimbriata* from Nkoro River compared favorably with its description from other studies. Whitehead (1985) in the FAO species catalogue also described *E. fimbrata* as having the dorsal spine (total): 0, dorsal soft rays (total): 16-19, anal spine: 0, anal soft rays: 19-23, mouth sharply upward and V-shaped, caudal fin is deep chrome with long and pointed tips, upper jaw containing distinct median notch, into which tip of lower jaw fits, lower gill rakes are long, fine and numerous, often 3 times as long as gill filaments; upper gill rakes bent, a faint dark spot behind gill cover sometimes followed by others, black dorsal fin tip with golden tints on the body, scute: 16-19, pre-pelvic: 10-13 post and scales in lateral series: 37-42.

Table 2: Catch per unit effort of *E. fimbriata* at each station in Nkoro River

Station 1	Station 2	Station 3	Station 4
5.04	5.62	3.72	4.75

Table 3: Condition factor and exponential equation of *E fimbriata* in Nkoro River

N	K	Exponential Equation
1200	0.946	$Wt = 0.162(TL)^{3.199}$

Plate 1. *Ethmalosa fimbriata*

Fig. 1: Monthly Condition factor for *E. fimbrata* in Nkoro River

The catch per unit effort values range are: *E. fimbrata,* 0.00 (August and September) to 8.16(January)] from this study varied from the results obtained from other studies. Scott (1966) reported that, rivers, lakes and swamps of the Niger Delta produced about 2,000 tonnes of fish per year. Moses (1981) estimated a mean annual catch of 4,791 tonnes from the cross river over a period of twelve years. Sikoki and Hart (1999) in the Brass river, estimated the total biomass of 160.20 of fish per boat, total catch of 254,554 sskg, annual production of 610.93 tonnes, estimated mean catch per boat of 384.90kg and a standing stock of $1.19km^{-2}$.

Variation in the total estimate values Nkoro River could be attributed to differences in fishing and industrial activities in the different rivers. The reason for the low estimates in the Nkoro River could be as a result of high mortality of both juveniles and brood stock of various fish species as a result of predatory activities, which is typical

of the study area. A similar remark was made by, Ssentengo *et al* (1986). Satia, 1990 also noted the controversy surrounding fish production statistics. In the lower Nun River, much of the problem hampering the acquisition of reasonably accurate fisheries statistics and resource appraisal appear to stem mainly from lack of, or inadequate investment and lack of trained personnel to handle data collection.

Factors affecting fish distribution and abundance have already been reported by different workers. Availability of food, spawning rates, breeding grounds coupled with shelter, presence of current, vegetation, depth of water, breeding habits migration and low predation have been suggested as major limiting factors affecting the distribution and abundance of various fish families in Kainji Lake (Ita, 1978).

Angelescu *et al.* (1958) reported that fish catch varied with type of gear used, tidal condition and period of capture, diurnally and seasonally. From the work of King (1991), it is clear that most commercially and scientifically important fish species occurring in the Niger Delta waters can be landed all year round by artisanal fishers but there are months when they are more abundant.

The values obtained for the weight-length relationship showed that *E. fimbrata was* isometric in growth. Several authors have reported both isometric and allometric growth for different fish species from various water bodies. King 1991, reported allometric growth patterns for Tilapia species from Umuoseriche lake. King (1996) reported isometric growth for *Pseudotolithus elongatus* from Qua Iboe estuary. Ekeng (1990) also reported an isometric growth pattern for *Etmalosa fimbriata* from Cross River estuary in Cross River state. Marcus (1984), obtained an isometric growth patterns for *E. fimbriata* from coastal and brackish water of Akwa Ibom state. Sheneuda *et al.* (1994) also observed an isometric growth patterns for *Chysichthys auratus* from the southern most parts of River Nile and Egypt.

The transformed length fitted over weight gave linear growth indicating the three dimensional growth structures of most fish species (Lagler *et al.*, 1977). Values of the length exponent in the length-weight relationship being isometric implies that the fish species did not increase in weight faster than the cube of their total lengths. However, the weight of the rest species increased faster than the cube of their total lengths.

Length-weight relationships give information on the condition and growth patterns of fish (Bagenal and Tesch, 1978). Fish are said to exhibit isometric growth when length increases in equal proportions with body weight for constant specific gravity. The regression co-efficient for isometric growth is '3' and values greater or lesser than '3' indicate allometric growth (Gayanilo and Pauly, 1997).

The mean condition factors 0.946 and monthly conditon factor ranging from 0.6-1.00 obtained in this study varied slightly with the results from other studies. Ajayi (1982), reported K = 0.77-0.81 for *Clarotes filamentosus* in lake Oguta; Nwadiaro and Okorie (1985) obtained K = 0.49-1.48 in Andoni river. The value obtained from the study showed that all species studied were in good condition. Gayanilo and Pauly (1997) reported that certain factors often affect the well-being of a fish. These include: data pulling, sorting into classes, sex, stages of maturity and state of the stomach.

The factor of condition factor (K) reflects, through its variations, information on the physiological state of the fish in relation to its welfare. From a nutritional point of view, there is the accumulation of fat and gonadal development (Le Cren, 1951). From a reproductive point of view, the highest K values are reached in some species (Angelescu *et al.*, 1958). K also gives information when comparing two populations living in certain feeding, density, climate, and other conditions; when determining the period of gonadal maturation; and when following up the degree of feeding activity of a species to verify whether it is making good use of its feeding source (Weatherley, 1972). From the above assertions we could conclude that the five species in this work reproduce between May to October since they recorded the lowest K at about this period.

Furthermore, Vazzoler (1996) confirmed that lowest K values during the more developed gonadal stages might mean resource transfer to the gonads during the reproductive period. Braga (1986), through other authors, showed that values of the condition factor vary according to seasons and are influenced by environmental conditions. The same may be occurring in the environment under study since the floodplain is influenced by many biotic and abiotic factors, which favor the equilibrium of all the species in the ecosystem.

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