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The Abundance, Condition Factor and Length-weight Relationship of *Cynoglossus senegalensis* (Kaup, 1858) from Nkoro River Niger Delta, Nigeria

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Abstract: The abundance, condition factor and length-weight relationship of *C. senegalensis* from Nkoro River in the Niger Delta area of Nigeria was studied from January-December 2008. The fishery of the flat fish tonguefish is highly commercial 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. No work has been done on the length-weight relationship of *Cynoglossus senegalensis* from the Nkoro River. A study of the abundance, condition factor and length-weight relationship of *C. senegalensis* from the Nkoro River adds more information on the family, Cynoglosidae to compliment the existing data in the management and culture of the species in the Nkoro River, Niger Delta. This is essential for formulation of development plan in the fishing industry. Nkoro River is economically 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, are located within the Niger Delta region. The highest catch was recorded in December (2.45), followed by January (1.60), June and July (1.10), April (0.92), February (0.81), March (0.64) and August(0.12). May, September, October and November recorded no catch during the study. The highest catch per unit effort (2.79) was recorded in station 2, followed by station 1 (2.78) and station 3 and 4 (1.01 each). From a sample size of 1800 specimens, K value was 1.00 and the exponential equation was $Wt = 0.0326\ (TL)^{3.066}$, indicating an isometric growth pattern. The highest monthly condition factor value (1.5) was recorded in May and the lowest (0.5) in September. *C. senegalensis* in Nkoro river is in a stable environment and was more abuntant in the dry season months of December and January.

Key words: *Cynoglossus senegalensis,* abundance, condition factor, length- weight relationship, Nkoro River and Nigeria

INTRODUCTION

The flat tonguefish *Cynoglossus senegalensis* (Plate 1) belongs to the family, Cynoglossidae. This flat fish is distinguished by the presence of a long hook on the snout overhanging the mouth, and the absence of pectoral fins. Their eyes are both on the left side of their body, which also lacks a pelvic fin. They are found in tropical range (22ºN-18ºS, 18ºW-14ºE) and subtropical oceans, mainly in shallow waters and estuaries though a few species are also found in deep sea floors and rivers but distributed mainly in the Eastern Atlantic from Mauritania to Angola. Some species have been observed congregating around ponds of sulphur that pool up from beneath the seafloor on sand and mud bottoms of coastal waters. Scientists are not sure of the mechanism that allows the fish to survive and even thrive in such a hostile environment. They feed on mollusks, shrimps, crabs and fish and sold as frozen filet under the name *filets de sole*. *C. senegalensis* are demersal, brackish, marine fish living in the depth range of 10-110 m. The fishery of the flat fish is highly commercial 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).

Plate 1. Dorsal view of *Cynoglossus senegalensis*

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 *Cynoglossus senegalensis* from the Nkoro River. A study of the abundance, condition factor and length-weight relationship of *C. senegalensis* from the Nkoro River adds more information on the family, Cynoglosidae 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; Abowei and Davies, 2009), different water bodies, there are no reliable data on the abundance of *C. senegalensis* from Nkoro River. This is essential for formulation of development plan in the fishing industry. This study 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 economicaly 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), 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/h (King, 1991).

The figures for catch per unit effort were tested for variation on monthly and station basis 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 2 cm. The mean lengths and weights of the classes were used for data analysis, the format accepted by FISAT (Gayanilo and Pauly, 1997).

Table 1: Monthly catch per unit effort for *C. senegalensis* in Nkoro River

Jan.	Feb.	Mar.	Apr.	May	Jun	.Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1.60	0.81	0.64	0.92	0.00	1.10	1.10	0.12	0.00	0.00	0.00	2.45

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:

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

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

RESULTS

The monthly catch per unit effort for *C. senegalensis* in Nkoro River is presented in Table 1. The highest catch cas recorded in December (2.45), followed by January (1.60), June and July (1.10), April (0.92), February (0.81), March (0.64) and August (0.12). May, September, October and November recorded no catch during the study.

The catch per unit effort of *C. senegalensis* at each station in Nkoro River is presented in Table 2. The highest catch per unit effort (2.79) was recorded in station 2, followed by station 1 (2.78) and station 3 and 4(1.01 each).

Table 3 expresses the conditon factor and the exponential equation from the length weight relationship of *C. senegalensis* in Nkoro River. From a sample size of 1800 specimens, K value was 1.00 and the exponential equation was $Wt = 0.0326\ (TL)^{3.066}$, indicating an isometric growth pattern.

Fig. 1 shows the monthly condition factor for in Nkoro River. The highest condition factor value (1.5) was recorded in May and the lowest (0.5) in September.

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

Station 1	Station 2	Station 3	Station 4
2.78	2.79	1.01	1.01

Table 3: Condition factor and exponential equation of *C. senegalensis* in Nkoro River

N	K	Exponential Equation
1800	1.00	$Wt = 0.0326(TL)^{3.066}$

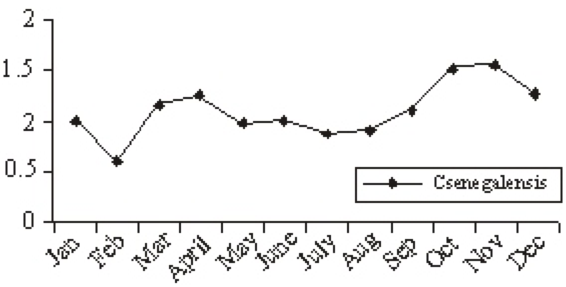

Fig. 1: Monthly condition factor for *C. senegalensis*

DISCUSSION

The catch per unit effort values range are: *C. senegalensis,* 0.00 (May, September, october and November to 2.45 (December)] 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 kg, annual production of 610.93 tonnes, estimated mean catch per boat of 384.90 kg and a standing stock of $1.19 km^{-2}$.

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 rabbits 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 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 1.00 and monthly conditon factor ranging from 0.5-1.5 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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