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ASPECTS OF THE BIOLOGY OF MUGILIDS IN WATERS AROUND PORT HARCOURT, NIGER DELTA, NIGERIA.

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Abstract

Aspects of the biology (species composition, Length – Weight relationships, condition factor, fecundity, and sex ratio) of Mugilids in waters around Port-Harcourt, Niger Delta were studied. Of the sampled population of Mugilidae, four species of mullet belonging to two genera were identified; *Liza grandisquamus* (33.55%), *L. falcipinus* (28.95%), *Mugil curema* (19.08%) and *M. bananensis* (18.42%). The mean sizes of all species ranged from 8.1 - 27.5cm total length and 6.10 - 170.23g in weight. There was no significant difference P>0.05 between male and female in all four species in both length and weight. All species exhibited isometric growths while populations of *L. grandisquamus* and *M. bananensis* revealed negative allometric and positive functions respectively. There was also no significant variation P>0.05 in the Fulton condition factors between male and female in all species and among species. The highest absolute fecundity value of 211, 793 eggs was recorded in *L. grandisquamus* with a body weight of 71.80g and the best predictor of fecundity for all species was ovary weight, while males and females did not depart from a 1:1 sex ratio in all species.

Keywords: Length - Weight Relationship, Condition factor, Fecundity, Sex ratio

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INTRODUCTION

Grey Mullets (Mugilidae) are highly valued commercial food fish in the tropics (Alfred-Ockiya and Njoku, 1995). However, only few studies have been conducted on the mullets of Niger Delta except related studies of Sivalimgam (1975), Kings (1984), Ikomi (1990) and Alfred-Ockiya and Njoku (1995). This paper seeks to add to these studies by focusing on the Length – weight relationships, Condition Factors, Fecundity and Sex Ratio of Mugilid in waters around Port-Harcourt, Niger Delta.

MATERIALS AND METHODS

Study Areas

The specimens used in this study were collected fresh from local fishers at Enugu and Ogu water fronts in Port-Harcourt (longitude $7^0 00$ 'E and Latitude $4^0 15$ 'N). Both water fronts are linked to the creek leading to the Marine Base axis as well as the Okrika Creek and Bonny River which were the fishing grounds of the fishers; a brackish water environment predominantly consisting of *Avicenia spp.* and *Rhizophora spp.*

Field and Laboratory Methods

The specimens were obtained fresh (May – August) from fishers at the Enugu and Ogu water fronts in Port Harcourt and later stored in deep freezer for laboratory analysis. The fish were caught with cast nets that ranged between 250-300cm in diameter and 3cm mesh size.

Prior to examination in the laboratory, the fish were allowed to thaw, identified into their various species and sex using Albaret (1990) and each was later weighed on a top loading balance and measured for total length on a measuring board.

Length – weight relationships were calculated for each sex and for the sexes combined for all; species and expressed by the equation:

$W = aL^b$ (Sparre and Venema, 1992)
Where:
W = Weight (g)
L = Length (cm)
a = Intercept
b = Slope

The relationship was established by least square regression of the logarithmic transformed
Version of the equation;
$Log_{10}W = Log_{10}a + bLog_{10}L$

All the correlation coefficient (r) obtained from the various regression analyses were tested for significance. The slopes (b) of the length-weight relationships were tested for departure from Lsometry (i.e. b = 3) using a T-statistic function.
Measurements of length and weight recorded for each species throughout the study was used in calculating Fulton's Condition Factor (K) using Bagenal (1978) formular as follows;

$$K = \frac{100w}{L^3}$$

Where:
K = Condition Factor
W = Total weight of fish (g)
L = Total length of fish (cm)

For fecundity, the gravimetric method was used (Bagenal, 1978). The female fish was dissected and the gonad removed and allowed to thaw on a filter paper, then the total weight of the gonad was weighed. A weight of 0.5g of the gonad was cut open with a pair of scissors from a section close to the posterior end of the ovary. The eggs contained therein were carefully teased out from the connecting tissue into 50ml of water, and vigorously stirred with a stirring rod: 1ml of the solution was immediately collected with a pipette into a counting chamber. The eggs in the 1ml were all counted under the microscope with the aid of a tally counter. The process was repeated 5 times and the mean value was multiplied by 50 and divide by 0.5 to give an estimate of eggs per 0.1g of the ovary. The resultant estimate was further multiplied by the combined weight of the two ova which gave an estimate of absolute fecundity.
Relative Fecundity (RF) was obtained as the number of eggs per unit length (cm) or the number of eggs per unit weight (g) of fish. The correlation between fecundity and total length, body weight and gonad weight was calculated by linear regression technique. The best predictive equation for fecundity was computed as logarithm transformation of the equation:

$F = ax^b$ (Bagenal, 1978)

i.e, $Log F = Log a + bLog X$
Where: F = Fecundity
a = Constant
b = Exponent
x = Total length (TL) or Body weight (BW) or Ovary weight (OW).

RESULTS

Species Composition

The relative composition of the various species of the Mugilidae in the sampled population showed that four species of mullet belonging to two genera were identified. Of the species sampled in the population, *Liza grandisquamus* constituted 33.55%, *Liza falcipinus* (28.95%), *Mugil curema* (19.08%), and *Mugil bananensis* constituted 18.42%.

Length Frequency Distribution

Result of the length frequency distribution is shown in Table 1. In *L. falcinipus*, the highest frequency (25%), occurred in the size class (20-21.9cm), while in *L. grandisquamus*, it was 31.37% in the size class (18-19cm). But in *M. bananensis*, the highest frequency (21.43%) occurred in the 16-17cm size class while 24.14% of *M.curema* occurred in the 12-13.9cm size class.

Size Composition

The size composition of the various species of Muglidae is given in Table 2. The length of *L. falcipinus* ranged from 8.1 to 26.0cm TL (mean 18.0 ± 0.7cm) with a weight range of 6.49 to 165g (mean 60.75 ± 5.57g). *L. grandisquamus* had a mean total length of 17.2 ± 0.6cm with a mean weight of 54.52 ± 4.65g while *M. bananensis* had a range of 8.5 – 27.5cm TL (mean 16.0 ± 0.9m) and a weight range of 6.10 – 190.10g (mean 47.54 ± 7.68g). Also, *M. curema* had a total length range of 9.2 - 24.0cm with a mean weight of 42.99 ± 5.37g. There was no significant difference between male and female in all the four species in terms of length or weight (P > 0.05)

Length Weight Relationships

The parameters of length-weight relationships of the four species of Mugilidae are presented in Table 2 for male and female and combined sex. The results revealed that the calculated correlations were highly significant (P > 0.01) with coefficient of determination ranging from 86-99%. The intercept ranged from 0.0041 (male *M. curema*) to 0.019 (female *L. grandisquamus*). The exponent, b, varied from 2.75 (male *L. grandisquamus*) to 3.30 (male *M. curema*). Apart from *L. grandisquamus* (2.88) and *M. curema* (3.30) that exhibited negative (b< 3) and positive allometric growths (b > 3) respectively, all other populations exhibited isometric growth function (b = 3.0).

Condition Factor

The Condition Factor (K) of Mugilids is given in Table 3. The condition factor ranged from 0.63 - 1.48. There were no significant variation in the condition factor between male and female in all species and among species (P > 0.05).

Fecundity

Thirteen specimens were used for the fecundity study of which 3 were *M. bananensis*, 4 - *L. falcipinus*, and 6 - *L. grandisquamis*. No gravid *M. curema* was observed during the period of sampling.

The ovary weight of the species examined ranged from 1.92 – 11.66g. The minimum ovary weight (1.92g) occurred in a specimen of 72.21g body weight and a total length of 21cm (*L. grandisquamus*) Table 4, while the maximum ovary weight (1.66g) occurred in a specimen (*L. grandisquamus*) of 170.23g and 26.5cm body weight and total length respectively.

The results of absolute fecundity and relative fecundity are presented in Table 4. The absolute fecundity of *M. bananensis* ranged from 91,476 – 189,200 and *L. grandisquamus* from 32,646 – 211,793; while the absolute fecundity of *L. falcipinus* ranged from 35,239 - 177,192.

The highest absolute fecundity value was recorded in *L. grandisquamus* with a body weight and ovary weight of 71.80g and 7.85g respectively. The least absolute fecundity value was recorded in *L. grandisquamus* with a body weight / ovary weight of 72.21g/1.92g. The relative fecundity of all the species sampled ranged from 430-2,950 eggs/gram body weight or 1718 -10,038 eggs/cm total length.

The regression equation for the relationships between Fecundity (F) and Total length (TL), body weight (BW) and ovary weight (OW) were;

For *M. bananensis*;

$F = 54.95\,TL^{2.54} (P > 0.05; r = 0.66)$

$F = 3159.34\,BW^{0.82} (P > 0.05; r = 0.78)$

$F = 19{,}404.64\,OW^{1.00} (P < 0.01; r = 1.00)$

For *L. falcipinus*;

$F=0.16\,TL^{4.27}(P>0.05; r=0.43)$

$F=2.18\,BW^{2.30}(P>0.05; r=0.79)$

$F=5,484.23\,OW^{1.64}(P<0.01; r=0.92)$

For *L. grandisquamus*;

$F=17.78\,TL^{2.79}(P>0.05; r=0.43)$

$F=1400.46\,BW^{0.93}(P>0.054; r=0.43)$

$F=18,336.06\,OW^{0.98}(P<0.01; r=0.95)$

Only the ovary weight – fecundity relationships were significant in all species. This shows that the ovary weight is the best predictor of fecundity in all the species studied.

Sex Ratio

The monthly sex ratio of the mugilids studied is presented in Table 5. Males and females did not depart from a 1:1 sex ratio in allometric species except in July (1:2, $P > 0.05$ in *L. grandisquamus*), August (1:13, $P < 0.01$ in *L. falcipinus*) and August (1:2.1, $P < 0.05$ in combined sex).

DISCUSSION

The species of grey mullet identified in the study were the same as those observed by Njoku (1988) in the New Calabar River and Tawari (1988) in the Bonny River except for *Mugil cephalus* which was not observed in this study. George (1985) also observed *M. cephalus* in the Bonny River. These results indicated that the species identified in this study are probably the most common species in the waters of Port Harcourt.

The mean sizes of all the species found in waters around Port Harcourt were smaller (in length and weight) than those reported by Alfred-Ockiya and Njoku (1995) in the New Calabar River. This difference may be due to the selectivity of the gear used in exploiting these species, age of the species, environment and season of sampling. However, the insignificant difference in the sizes of male and female in all species indicate that both sexes of all species have the same growth rate.

In general, from length-weight regression equations, the exponent 'b' often lies between 2.5 and 3.5, and is usually close to 3 (Petrakis and Stergion, 1995; Dulcic and Kraljevic, 1996; Jones *et.al.*, 1999). An exponent (b) value of 3 indicates symmetrical or isometrical growth; values other than 3 indicate allometric growth. In the present study, the values for the exponent (b) fell between 2.75 and 3.30, and they were all higher than those estimated for these same species by Alfred-Ockiya and Njoku (1995).

The results of this study indicate that *L. falcinipus* had isometric growths contrary to what Alfred-Ockiya and Njoku (1995) reported in New Calabar River but similar to the results of Ching (1977) in the Juvinile of *Liza malinoptera* where isometric growth pattern was also observed. The difference observed in growth patterns may be attributed to various factors such as season, years, temperature, salinity, food (quantity, quality and size), sex, and stage of maturity (Pauly, 1984; Sparre, 1992).

The mean condition factor (k) of the four muglids show that they were in good condition during the study period, a similar trend observed by Alfred - Ockiya and Njoku (1995) for the same species. However, the 'K' values were lower than those estimated for the same species in the New Calabar River (Alfred - Ockiya and Njoku, 1995). Atar and Secer (2003) had already reported that numerical magnitude in condition factors can be attributed to sex, in addition to many other factors such as time of year, stage of maturity and stomach contents. Therefore, comparisms should only be made when these factors are roughly equivalent among the samples to be compared (Pauly, 1984).

The high fecundity values observed in this study confirms the description given by Njoku (1988) that mullet are highly fecund. The values recorded in this study are within those reported by Silva and De Silva (1981) (45,000 - 4.2 million eggs) for *Mugil cephalus* in a coastal lagoon, Sri Lanka and Hotos *et. al.*

(2000) (80,000 – 1.41 million eggs) for *Liza aurata* in the Lagoon of Klisova, Greece, although in a low side of the ranges.

The observed significant correlations in the Fecundity – ovary relationships was also observed by Brusle (1981), Silva and De Silva (1981) and Hotos *et. al.* (2000) in their various studies. There was no clear or distinct trend in the sex ratio. Though the male to female sex ratio was observed as 1:1, female formed a slightly higher male proportion than female. The departure observed in *L. grand squamus* in July and *L. falcipinus* in August may be caused by the differential timing in the spawning migrations of the two sexes (Silva and De Silva, 1981).

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