Aspects of the Reproductive Biology of the Grunt, Pomadasys jubelini (Cuvier, 1830) in the New Calabar-Bonny River, Rivers State, Nigeria

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Abstract. Aspects of the reproductive biology of which included the sex ratio, gonado-somatic index, stages of gonadal development and fecundity of the grunt, Pomadasys jubelini in the New Calabar-bonny River were investigated. Pomadasys jubelini had a sex ratio of 1: 2.1 (male to female). Gonado-Somatic Index ranged from 1.33 to 4.41% (2.89±0.03%). High gonado-somatic indices were recorded from September to October. Two stages of gonad maturation, maturing and mature were observed for male fish while the stages of quiescent, maturing and mature were observed for female fish. Fecundity ranged from 9,085 to 37,926 eggs (25,852±176 eggs). Correlation of fecundity-body weight (r=0.15) and fecundity body-length showed that fecundity was more related to weight than length. Pomadasys jubelini spawned during the rainy season between August and October during which large number of fingerlings and juveniles were obtained fresh water and estuarine environments.

Key words: Reproductive biology, Pomadasys jubelini, New Calabar-Bonny River

Nigeria is blessed with abundant water bodies with diverse fish species which are obtained in large quantities. The grunters are among these fish species obtained in the marine and coastal waters; it is economically important for trawl fishery in Nigeria. *Pomadasys jubelini* is important in the riparian community of the Niger Delta because of its abundance, availability (all year round), tasteful flesh, economic and its nutritional values. It is a member of the fish family Haemulidae and can be found inhabiting rivers, estuaries and coastal waters where it is principally a bottom feeder (Idodo-Umeh, 2003).

Fecundity is the total number of ripe eggs prior to spawning in the female fish (Bagenal and Braun, 1978). Reproductive strategies depend on the abiotic environment, food availability, pressure of predators and the habitat of parental fish (Wootton, 1990). The study of fecundity is useful in the estimation of population structure and productivity. Gonado-Somatic Index (GSI) is

the measure of the relative weight of the gonad with respect to total or somatic weight (King 1996). Total spawners are said to produce a large number of small eggs which are deposited over short period of time while multiple spawners produce fewer and larger eggs and with a longer breeding period which may last throughout the year, where only a proportion of the eggs ripe in the gonad at one spawning (Lowe-McConnell, 1987); though total spawners have a higher GSI than multiple spawners (Wootton, 1990). The percentage of body weight of fish that is used for egg production is determined by the gonado-somatic index.

The studies on sex ratio provide information on the proportion of male to female fish in a population. It provides the basic information necessary for fish reproduction and stock size assessment (Vicentini and Araujo, 2003). Research has been carried out on the reproductive biology of some economically important fish species which include Tilapia, Claridae, Momyridae, (Olatunde 1979; Eyo and Mgbenka, 1992; Ikomi, 1996; Eyo and Olatunde. 2001). The studies of the reproductive biology of different species of fish form the basis for developing strategies and formulating policies for effective hatchery management and propagation of the resources.

Reproductive biology of the grunters in the Niger Delta is unavailable to the authors. The available information on *Pomadasys jubelini* is mainly taxonomic. This study was designed to investigate the sex ratio, gonado-somatic index, stages of gonadal development and fecundity of *Pomadasys jubelini* in the New Calabar-Bonny River, Rivers State, Nigeria.

Materials and methods

Study area:

The New Calabar-Bonny River near Port-Harcourt, Rivers State, Nigeria was the study area. It is located between latitude 4º36' and 4º55'N and longitude 6º45' and 7º72'E. Three stations were selected along the river for the purpose of this study based on the salinity of the river (NEDECO, 1961). The stations are located at Choba (Oligohaline), Iwofe (Mesohaline) and Abonnema wharf (Polyhaline). Rain fall is heavy in May-October and this reduces the salinity of the rivers (Agbugui and Deekae, 2014).

Collection and sampling of specimens:

Fish were collected from catch landings of fishermen that used hooks, gill nets, traps and calabashes at the three stations. *Pomadasys jubelini* were collected monthly, from June 2011 to May 2013. The fish were transported in an insulated box containing ice chips to the fisheries laboratory, Department of Fisheries and Aquatic environment, Rivers State University of Science and Technology, Port-Harcourt. Fish were identified by using pictures/keys (F.A.0., 1981).

Morphological parameters:

Measurement taken for each fish included the length (standard length (cm) and total length (cm)) girth length (cm) and, weight (g).

Determination of Sex and Gonad Classification:

The abdomen of the fish was dissected to determine the sex of the fish by visual and microscopic examination of the gonads (Ikomi and Odum, 1998). The female gonads were carefully removed from the abdominal cavity and placed on a piece of blotting paper to remove excess water. Each ovary was weighed to the nearest 0.01g on an electronic digital scale. The unsexed small fish were regarded as immature.

The maturity stages of the ovaries were classified according to Nikolsky (1963)

Stage 1, Immature; Stage 11, quiescent; Stage 111, maturing: Stage 1V, mature: Stage V running; Stage V1, Spent. The number of males and females in the different stages of gonadal development were counted and recorded.

The Gonado-Somatic Index (GSI)

This was calculated for each gonad

$$GSI = \frac{\text{Gonad weight (g)} \times 100}{\text{Fish weight (g)}}$$ ----------(Welcomme, 1985)

Fecundity Estimation:

Fecundity which is the number of ripe eggs in the female fish before the next spawning period was estimated by the "sub-sampling dry gravimetric method'' modified after Simpson (1959). Ovaries were preserved in Gilson's fluid for at least ninety (90) days after which they were removed. The eggs were then washed gently using distilled water until they disentangled from the ovarian tissues. The eggs were then poured into a filter paper in a funnel. When the water had dried off, the paper and eggs were spread on blotting paper to remove excess moisture. Clamped eggs were gently separated and air-dried for 24-30 hours at room temperature. Fecundity estimation was obtained by firstly, weighing all the eggs of each fish. Then three sub-samples of 200 eggs from each fish was randomly selected and weighed. Total weight of eggs was divided by the mean weight of the sub-samples and multiplied by 200 to give the fecundity estimate of the fish (Ekanem, 2000). The relationship between fish length/weight and fecundity was described by the equation $F = aX^b$

Where F = fecundity, x= body length (cm) or body weight (g), b = the slope, a= intercept Through a logarithmic transformation the equation becomes:

$$\log F = \text{Log } a + b \log X$$ ----------(Ekanem, 2000).

Results:

287 fish (194 females and 93 males) were examined, a ratio of 2.1:1 (female to male). Three out of six and two out of six documented stages of gonad development were observed in female and male *P. jubelini* respectively (Table 1). Mature males with milt while mature females with ripe ovaries (stage IV) were found in September and October. The smallest gravid female was 1736g (total length 50.60cm) while the largest gravid female weighed 2125g (total length of 50.20cm). The estimated fecundity ranged from 9,085 eggs to 37,926 eggs (Table 2). The gonado-somatic index ranged from 1.33% to 4.41% (Table 2). There was a poor correlation (r = 0.14) between Length and Fecundity, but a high positive correlation (r = 0.94) was established between Weight and Fecundity (Figures 2 and 3).

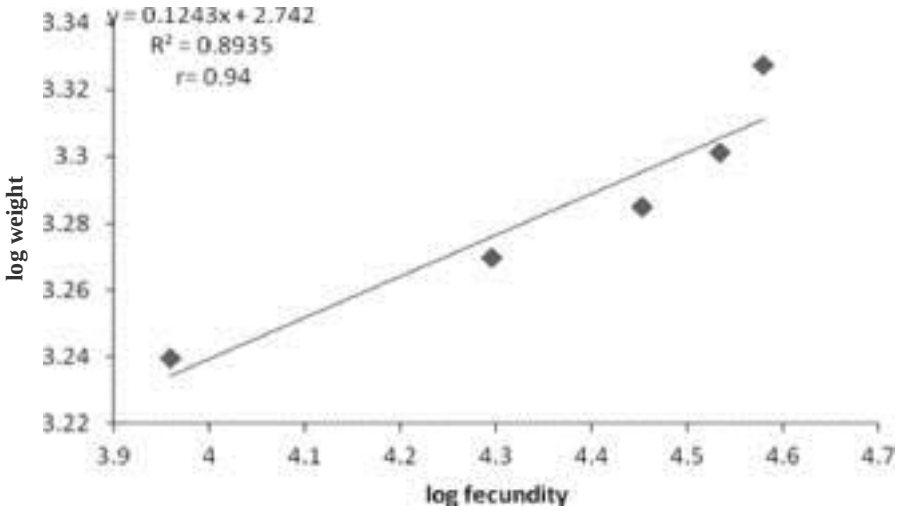
.The fecundity-weight relationship (Figure 1) is represented by the equation Log F = 0.1243+2.74 Log W (r = 0.950). Fecundity-length relationship (Figure 2) was Log F = 0.0247 + Log 1.779 Log L (r = 0.114).

Table 1 Stages of gonad developments of *Pomadasys jubelini*

Stages of gonad development		macroscopic characters	
	Stage	**Testis**	**Ovaries**
I	Immature	Not seen	Not seen
II	Resting	Not seen	Ovaries were tiny, Translucent and creamy,
III	Maturing	Large testis, opaque and cream colouration	Large ovaries, opaque and light yellow in colour. Blood vessels were visible on the surface of the ovaries
IV	Mature	Testis was enlarged and whitish in colour. Milt was released on application of pressure	Ovaries larger than in stage iii above, yellowish and the eggs were visible
V	Spawning	Not seen	Not seen
VI	Spent	Not seen	Not seen

Table 2. Gonado-Somatic Index (GSI) of *Pomadasys jubelini*

Total length (cm)	Weight(g)	GSI (%)	Fecundity
40.30	1860.00	3.25	19,720
43.10	2001.00	4.38	34,164
50.60	1736.10	1.33	9,085
50.20	2125.10	4.25	37,926
49.80	1927.00	4.41	28,363
Mean 46.80	**1929.84**	**2.89**	**25,85**



c e 2: Relationship between total weight (g) and fecundity of *Pomadasys jubelini*

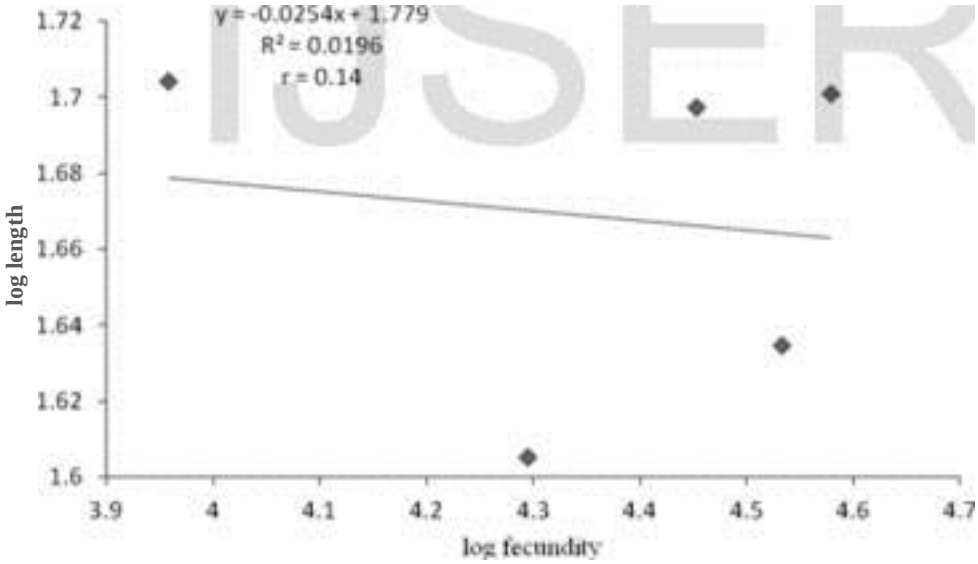


Figure 3: Relationship between total length (cm) and fecundity of *Pomadasys jubelini*

Discussion

In this study, there were more females than males of *Pomadasys jubelini.* The male to female ratio was significantly different ($P<0.05$) from the expected ratio of 1:1. In the West Coast of the United Arab Emirates, stripped piggy grunt *Pomadasys stridens* had a sex ratio of 1:2.5 (male to female) Al-Ghais, 1995). Asabere - Ameya (2010) reported the sex ratio of the big eye grunt *Bachdeuterus auratus* off Cape Coast Ghana, to be in favor of females. Adebiyi (2013), observed the dominance of males over females in the study of *P. jubelini* in the Lagos coast but statistically insignificant.

The high gonado-somatic index recorded in September and October suggests the possible spawnig period of *P. jubelini* which coincided with the rainy season. The Bastard grunt, *Pomadasys icisus* had a GSI range of 0.159 to 7.88% from July to September, the GSI of *P. commersonni* ranged from 0.4 - 5.5% from July to November, and the GSI of *P. jubelini* ranged from 0.07 to 7.30 from July to September (Fehr-Bedoui and Gharbi, 2008; Al-Nahdi *et al,* 2010; Adebiyi, 2013). According to Al-Ogaily and Hussain (1990) high gonado-somatic indices were recorded for the trout sweet lip grunt *Plectorhynchuspictus* in March, April and May. The spawning period of *P. argenteus* were February, April and October (Abu-Hakma, 1984). These are in contrast with the findings of this study because GSI index of *P. jubelini* in September and October was 1.33 and 4.41%. Furthermore spawning was reported to occur in bastard grunt *Pomadasys incises* (Pajuelo *et al,* 2003) throughout the year. This is also in contrast with the findings of this study on *P. jubelini* obtained from the tropical waters of Niger-Delta, Nigeria. Lowwe-McConnel (1979) stated that most tropical fishes breed during the rainy season when physic-chemical conditions of the aquatic environments are favorable.

The stages of gonad development found in this study were maturing and mature for males, and resting, maturing and mature for females; this is similar to the findings of (Adebiyi, 2013) in the Lagos coast where the stages of encountered were quiescent, maturing and mature for both males and females. Eight stages of gonadal development found in the silver grunt *Pomadasys argenteus*, were the immature, resting, developing mature, gravid, spawning and spent and recovering spent stages (Abu-Hakima, 1984). Fehri-Bedoui and Gharbi (2008) reported immature, resting, maturing, mature, spawning, and spent stages of gonadal development in *P. incises.* In *P commersonnii*, all developmental stages were encountered in both male and female fish except the ripe running stage (Al-Nahdi *et al*, 2010)

The fecundity of *P. jubelini* increased with increasing size of the fish (length and weight). The minimum and maximum fecundity estimates obtained in this study are similar to the findings of (Adebiyi 2013) in the Lagos coast Nigeria. The fecundity of *P. jubelini* in this study was lower than that of *Pomadasys commersonni* with a range of 214,510 to 1,421,520 eggs (Al-Nahdi *et al.,* 2010), eggs of 3-6 years old trout sweet lip, *Plectorhynchus pictus* with a range of 495,450 - 855,067 (Al-Ogaily and Hussain, 1990) and the silver grunt *Pomadasys argenteus* with eggs ranging from 625,848 - 2, 424,864 (Abu-Hakima, 1984). Abayomi and Arawomo (2001) reported the fecundity of *C. gariepinus* in Opa reservoir in the range of 1,567 to 65,000 eggs. Oniye and Onimisi (2011) reported that *H. b. occidentalis* in Zaria dam had fecundity estimates of 2,025 to 4,192, while *Tilapia mariae* in the New Calabar River has fecundity of 339 to 1881 (King, 1991) which was lower than that observed in this study. The weak correlation (r=0.008) between the total length and the fecundity of *P. jubelini* indicated that increase in fish length does not necessarily correspond to increase in fecundity. Ikomi and Odum (1998) and Allison (2006) made similar observations in the studies of *Chrysichthys auratus* (r=0.12) and *P.*

pellucida (r=0.17) respectively. However there is a significant correlation (r=0.97) between fish weight and fecundity. This suggests that as fish weight increases, fecundity also increases. Similar observations were made by Tsadu *et al.* (2001) on *Bagrus bayad.* King (1997) also reported that as weight of fish increased, the number of eggs produced per gram also increased and remarked that growth continued after fecundity had stabilized. These reports indicate that fecundity varies with either increasing length or weight of fish and also varies among species and size. The mean GSI value obtained in this study revealed that this species uses up to 2.89% of its total body weight for egg production. *Physalia pellucida* was 1.7% while *Hyperopisus bebe occidentalis* use 2.25% (Allison, 2006; Oniye and Onimisi, 2010).

In conclusion

Pomadasys jubelini is a total spwner, producing numerous small size eggs once in a year, its fecundity is low in comparison to other members of the genus Pomadasys.

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