

Gonadosomatic Index (GSI), Hepatosomatic Index (HSI) and Condition Factor (K) in *Parailia pellucida* (Boulenger, 1901) (Schilbeidae) in Fresh Water Reaches of Lower Nun River, Niger Delta, Nigeria

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Abstract

Some aspects of the reproductive biology (GSI, HSI) and K of *Parailia pellucida* were investigated in the Nun River. Mean monthly GSI ranged from 0.12 ± 0.02 in April to 1.40 ± 0.21 in September with an overall mean of 0.53 ± 0.03 for the combined sexes. There was also seasonal variation in mean monthly GSI being higher (0.59 ± 0.17) in the dry season than the wet season (0.51 ± 0.19). However, there was no significant difference in mean GSI among the size classes observed. There was sex dependent variation in GSI with that of the female (0.90 ± 0.09) being significantly higher than the male (0.33 ± 0.01). HSI ranged from 0.45 ± 0.02 to 1.1 ± 0.17 with an overall mean of 0.67 ± 0.02 for the combined sexes. Mean HSI was significantly higher female (0.74 ± 0.06) than male (0.63 ± 0.02) and also generally higher in the dry season than the wet season. However, there was no statistically significant difference in mean HSI among the size classes. Mean K ranged from 0.62 ± 0.02 to 0.81 ± 0.01 and there was no significant difference with sex, size and seasons.

Key words : Nun River, *Parailia pellucida*, Gonadosomatic index, Hepatosomatic index, Condition factor.

The indices (GSI, HSI) and K play vital role in the reproductive biology of fish relating to oocyte condition, protein and lipid deposition and spawning activity. The ultimate aim of fisheries management is to attain sustainable exploitation of fisheries resources and requires a proper understanding of the population dynamics of the fish stock. Reproductive biology is one of the major factors influencing the dynamics of a given population. However, there is paucity of information on the reproductive biology of *P. pellucida*. Available information in this regard for other species include *Tilapia* species (1) and *Cynoglossus* species on GSI (2), HSI (3), in brook trout (4), Schilbeids (5), and *Hepsetus odoe* on K (6). This study will thus provide complementary information that will enhance the proper management of *P. pellucida* fishery in the fresh water reaches of the Nun River and similar ecological systems.

Methods

Study Area

This study was carried out at the lower Nun River

around Anyama-Ijaw community in Southern Ijaw Local Government Area, Lat. $4^{\circ}51'$ and $4^{\circ}54'$ N; Long $6^{\circ}11'$ E, and $6^{\circ}13'$ E, (Fig.1) in Bayelsa State in the Niger Delta, Nigeria covering an area of about 2,180 km².

Sample Collection and Analysis

Sampling for *P. pellucida* was carried out twice a month at 2-week intervals. Three drift gill nets of 8 mm, 12 mm and 15 mm stretched mesh sizes respectively measuring 35 m in length and 3 m in depth, with a surface area of 105 m² were used simultaneously for three hours in every sampling period using three canoes manned by two people each, one to paddle and the other to set and retrieve the gill net during sampling. On landing, the specimens were preserved in 10% formalin solution and taken to the laboratory for biological analysis. Sex was determined by the presence of a genital papilla in the male. Specimens collected were measured for total length (cm) and standard length (cm) with a plastic ruler and

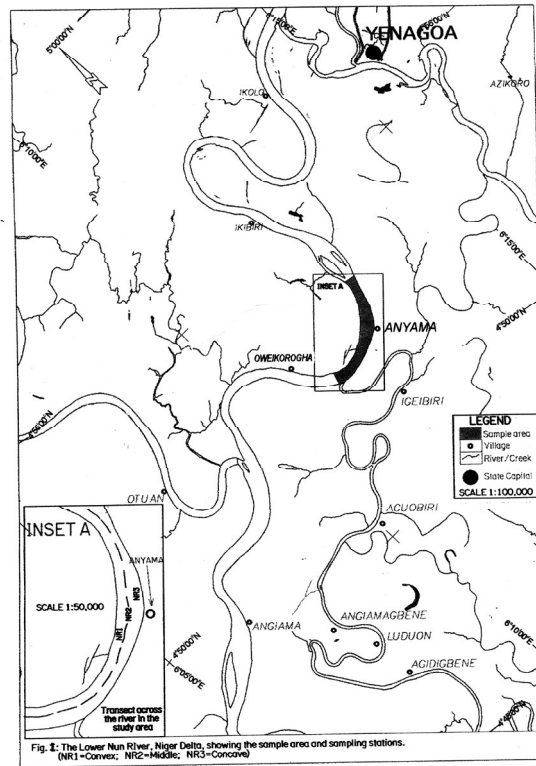


Figure 1. The lower Nun River, Niger Delta, showing the sample area and sampling stations, (NR1—Convex ; NR2—Middle ; NR3—Concave).

weighed (g) with a top loading balance.

They were dissected thereafter and ripe gonads were removed from the fish, weighed (g) and preserved in 10% formalin solution (7). The liver of each fish was also weighed (g) and recorded.

Gonadosomatic Index

GSI, is the weight of the gonad expressed as a percentage of the fish body weight (8), and was computed monthly for both sexes. Changes in GSI within and between months were statistically tested with *t*-test and significant differences between the sexes with paired *t*-test.

$$GSI = \frac{\text{Gonad weight} \times 100}{\text{Fish weight}}$$

where GSI = Gonadosomatic index, Fish weight = Less gonad weight.

Hepatosomatic Index

Measures of the liver weight known as hepatosomatic index (HSI) were made (8) :

$$HSI = \frac{\text{Liver weight} \times 100}{\text{Body weight}}$$

Mean monthly values were computed and plotted to ascertain monthly variations. Means were also computed for size classes and tested for significance between males and females by analysis of variance (ANOVA).

Condition Factor

Condition factor was determined less gonad weight for each specimen of *P. pellucida* according (5).

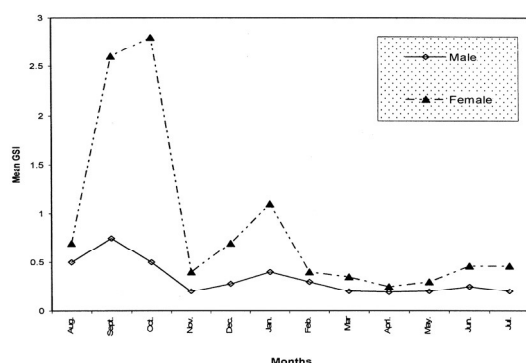


Figure 2. Monthly variation of mean gonadosomatic index (GSI) in male and Female *Parailia pellucida* in the lower Nun River, Niger Delta.

$$K = \frac{\text{Body weight} - \text{gonad weight} \times 100}{\text{Length}^3}$$

where Length = Standard length (cm).

Variation of K due to sex and season was determined by plotting the monthly means for the males and females.

Results and Discussion

Gonadosomatic Index

The seasonal variation in mean monthly

gonadosomatic index (GSI) in male, female and combined sexes of *Parailia pellucida* is shown in Table 1 while the trend of GSI for male and female is shown in Figure 2. There was sex dependent variation in GSI with that of the female (0.90 ± 0.09) being significantly higher ($P < 0.05$) than the male (0.33 ± 0.09) being significantly higher ($P < 0.05$) than the male (0.33 ± 0.01). Mean monthly GSI ranged from 0.2 ± 0.02 in April to 1.40 ± 0.48 in October for the combined sexes, with an overall mean of 0.53 ± 0.03 . GSI increased during the period of gonad maturation. This may be attributed to deposition of materials in the developing eggs and spermatozoa (2). Seasonal variation in mean monthly GSI occurred with a general, steady increase from April being 0.19 ± 0.02 (male), 0.23 ± 0.03 (female) and 0.20 ± 0.02 (combined sexes) to a maximum of 0.75 in September for male, 2.80 in October for female and 1.40 in September/October for the combined sexes and declined throughout the dry season from 1.30 in October, to 0.23 in March for combined sexes. The male mean monthly GSI was relatively higher in the wet season (0.36 ± 0.19) than the dry season (0.33 ± 0.05). The reverse was the case in the female with higher monthly GSI in the dry season (0.94 ± 0.35) than the wet season (0.80 ± 0.40). In the combined sexes, it was also higher (0.59 ± 0.17) in the dry season than the wet season (0.51 ± 0.19). This is was contrary to the earlier report (2) for other species

Table 1. Seasonal variation of mean monthly gonadosomatic index (GSI) in male, female and combined sexes of *P. pellucida* in the lower Nun River, Niger Delta. Means in row with the same letter are not significantly different at 5% probability level.

Month	Male		GSI Female		Combined sexes	
	Mean \pm SE	Sample size	Mean \pm SE	Sample size	Mean \pm SE	Sample size
Aug	0.52 \pm 0.05	42	0.73 \pm 0.07	38	0.62 \pm 0.04	80
Sep	0.75 \pm 0.07	50	2.62 \pm 0.48	30	1.4 \pm 0.21	80
Oct	0.54 \pm 0.07	12	2.80 \pm 1.05	8	1.4 \pm 0.48	20
Nov	0.23 \pm 0.02	10	0.43 \pm 0.030	16	0.38 \pm 0.02	26
Dec	0.28 \pm 0.00	1	0.72 \pm 0.00	1	0.5 \pm 0.22	2
Jan	0.4 \pm 0.01	18	1.13 \pm 0.15	22	0.80 \pm 0.11	40
Feb	0.03 \pm 0.03	22	0.41 \pm 0.04	18	0.35 \pm 0.03	40
Mar	0.2 \pm 0.01	63	0.35 \pm 0.03	17	0.23 \pm 0.01	80
Apr	0.19 \pm 0.02	38	0.23 \pm 0.03	7	0.20 \pm 0.02	45
May	0.22 \pm 0.01	61	0.33 \pm 0.02	19	0.25 \pm 0.02	80
Jun	0.22 \pm 0.01	64	0.46 \pm 0.07	16	0.32 \pm 0.02	80
Jul	0.21 \pm 0.01	43	0.46 \pm 0.04	37	0.32 \pm 0.02	80
Overall	0.33 \pm 0.01 ^a	424	0.90 \pm 0.09 ^b	229	0.53 \pm 0.03 ^{ab}	653
Wet season	0.36 \pm 0.09	298	0.80 \pm 0.40	147	0.51 \pm 0.19	445
Dry season	0.33 \pm 0.05	126	0.94 \pm 0.35	82	0.59 \pm 0.17	208

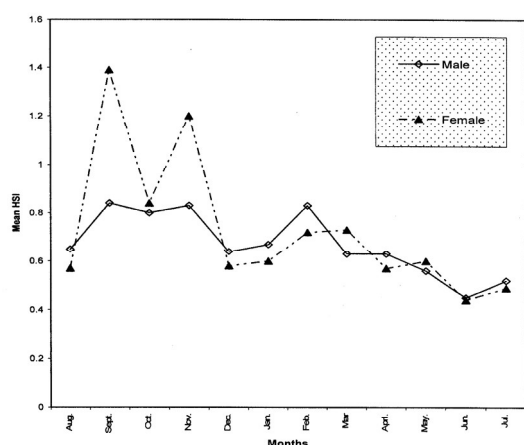


Figure 3. Monthly variation of mean hepatosomatic index (HSI) in male and female *Parailia pellucida* in the lower Nun River, Niger Delta.

such as *Cynoglossus canariensis* and *C. gorensis* where the reverse was the case.

The monthly variation in mean GSI with fish length showed an increase from 0.48 ± 0.07 in the smallest (4.0–4.9 cm) size class to a maximum (0.81 ± 0.22) in the 9.0–9.9 size class with an overall mean of 0.53 ± 0.03 . This is in agreement with for *Tilapia* species in the Lagos Lagoon (1). However, there was no significant difference in mean GSI ($P > 0.05$) among the size classes.

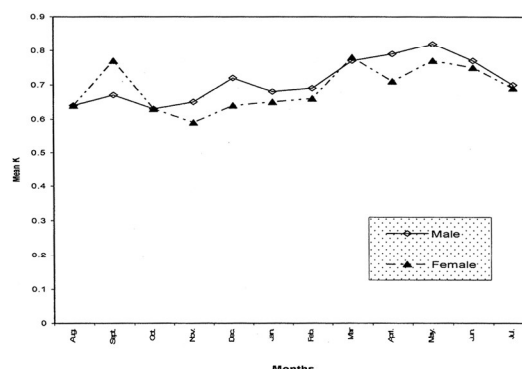


Figure 4. Monthly variation of mean condition factor (K) in male and female *Parailia pellucida* in the lower Nun River, Niger Delta.

Hepatosomatic Index

The seasonal variation in mean monthly hepatosomatic index (HSI) in male, female and combined sexes of *Parailia pellucida* is shown in Table 2. HSI ranged from 0.45 ± 0.02 (male) in June to 1.1 ± 0.17 in August with an overall mean of 0.67 ± 0.02 for the combined sexes. Mean HSI was significantly higher ($P < 0.05$) in the females (0.74 ± 0.06) than the males (0.63 ± 0.02). This may vary among species for instance Allison et al. (2) did not observe significant difference in *Cynoglossus* species. Mean monthly

Table 2. Seasonal variation of mean monthly hepatosomatic index (HSI) in male, female and combined sexes of *P. pellucida* in the lower Nun River, Niger Delta. Means in row with the same letter are not significantly different at 5% probability level.

Month	Male		HSI Female		Combined sexes	
	Mean \pm SE	Sample size	Mean \pm SE	Sample size	Mean \pm SE	Sample size
Aug	0.65 ± 0.4	42	0.57 ± 0.03	38	1.1 ± 0.17	80
Sep	0.84 ± 0.11	50	1.39 ± 0.40	30	0.81 ± 0.04	80
Oct	0.80 ± 0.54	12	0.84 ± 0.07	8	1.1 ± 0.1	20
Nov	0.83 ± 0.15	10	1.22 ± 0.11	16	0.61 ± 0.03	26
Dec	0.64 ± 0.00	1	0.58 ± 0.00	1	0.61 ± 0.03	2
Jan	0.67 ± 0.05	18	0.60 ± 0.04	22	0.63 ± 0.03	40
Feb	0.83 ± 0.04	22	0.72 ± 0.05	18	0.78 ± 0.03	40
Mar	0.63 ± 0.02	63	0.73 ± 0.05	17	0.65 ± 0.02	80
Apr	0.36 ± 0.02	38	0.57 ± 0.06	7	0.62 ± 0.02	45
May	0.56 ± 0.03	61	0.60 ± 0.05	19	0.25 ± 0.02	80
Jun	0.45 ± 0.02	64	0.44 ± 0.04	16	0.45 ± 0.02	80
Jul	0.52 ± 0.02	43	0.49 ± 0.04	37	0.51 ± 0.01	80
Overall	0.63 ± 0.02^a	424	0.74 ± 0.06^b	229	0.67 ± 0.02^{bc}	653
Wet season	0.61 ± 0.05	298	0.68 ± 0.14	147	0.64 ± 0.09	445
Dry season	0.73 ± 0.04	126	0.78 ± 0.09	82	0.76 ± 0.07	208

Table 3. Seasonal variation of mean monthly condition factor (K) in male, female and combined sexes of *Parailia pellucida* in the lower Nun River, Niger Delta. Means in row with the same letter are not significantly different at 5% probability level.

Month	K					
	Male Mean ± SE	Sample size	Female Mean ± SE	Sample size	Combined sexes Mean ± SE	Sample size
Aug	0.64 ± 0.01	42	0.63 ± 0.01	38	0.64 ± 0.01	80
Sep	0.67 ± 0.01	50	0.93 ± 0.30	30	0.77 ± 0.11	80
Oct	0.63 ± 0.03	12	0.63 ± 0.03	8	0.63 ± 0.02	20
Nov	0.65 ± 0.03	10	0.59 ± 0.02	16	0.62 ± 0.02	26
Dec	0.72 ± 0.00	1	0.58 ± 0.00	1	0.78 ± 0.14	2
Jan	0.68 ± 0.02	18	0.65 ± 0.01	22	0.66 ± 0.01	40
Feb	0.69 ± 0.01	22	0.66 ± 0.02	18	0.68 ± 0.01	40
Mar	0.77 ± 0.01	63	0.79 ± 0.02	17	0.78 ± 0.01	80
Apr	0.79 ± 0.01	38	0.71 ± 0.03	7	0.78 ± 0.01	45
May	0.82 ± 0.01	61	0.77 ± 0.02	19	0.81 ± 0.01	80
Jun	0.77 ± 0.01	64	0.75 ± 0.02	16	0.77 ± 0.01	80
Jul	0.70 ± 0.01	43	0.68 ± 0.01	37	0.69 ± 0.01	80
Overall	0.71 ± 0.01 ^a	424	0.70 ± 0.04 ^a	229	0.72 ± 0.01 ^a	653
Wet season	0.73 ± 0.01	298	0.74 ± 0.06	147	0.74 ± 0.02	445
Dry season	0.69 ± 0.01	126	0.66 ± 0.02	82	0.69 ± 0.01	208

HSI, in both male and female, increased from June to a peak in September and then dropped in October and increased forming a considerably lower peak in November. Thereafter, mean monthly HSI decreased in December but formed a minor peak in February and eventually declined to its lowest mean in June (Fig. 3). Mean monthly HSI was generally higher in the dry season than the wet season.

Variation of mean HSI with fish size indicated that HSI decreased with increased fish size from 0.89 (4.0–4.9 cm) size class to 0.45 in the 10.0–10.9 cm size class. This may indicate more active feeding habit in the younger species because HSI is a reflection of large amount of protein and lipid deposited in the liver and muscles during active feeding season (3). This result is contrary to Allison et al. (2) in *Cynoglossus canariensis* and *C. goreensis* where HSI increased with increasing fish size. There was however, no statistically significant difference ($P > 0.05$) in mean HSI among the size classes.

Condition Factor

The seasonal variation in mean monthly condition factor (K) in male, female and combined sexes of *P. pellucida* is shown in Table 3 and the trend in Figure 4. Though mean monthly K was higher in the

males than females, there was no significant difference ($P > 0.05$). The highest mean K in the combined sexes of 0.81 ± 0.01 occurred in May while the lowest of 0.62 ± 0.02 was observed in November. The females attained best condition (0.93 ± 0.03) in September and the worst (0.58 ± 0.0) in December with an overall mean of 0.70 ± 0.04 while the males were in best condition in May (0.82 ± 0.01) and the reverse in October (0.63 ± 0.03) with a slightly higher overall mean of 0.71 ± 0.01 . The December value of 0.92 was not considered as highest because of the sample size ($n=1$). The attainment of best condition in the female in September (beginning of spawning activity) and worst condition in November (peak spawning period) indicate a correlation between fish condition and spawning activity in the fish. This is because K-values decline as fishes with developed ripe gonads and spawn until a minimum value is reached during peak spawning (4). Thereafter K improves steadily to a peak in the month of minimum spawning activity. Similar observation was made by Ikomi and Sikoki (9). The fluctuation in K may therefore be associated with spawning activity rather than feeding activity in schilbeids (5). This is because the fish were in good condition with K ranging from 0.62 ± 0.02 to 0.81 ± 0.01 throughout the investigation. The good condition of the fish irrespective of sex is in agreement with olatunde (5) for schilbeids and may be due to its generalist food habit.

Table 4. Variation of mean gonadosomatic index (GSI), hepatosomatic index (HSI) and condition factor (K) with size for combined sexes in *Parailia pellucida* of the lower Nun River, Niger Delta. Means in row with the same letter are not significantly different at 5% probability level.

Size Class SL (cm)	GSI			HSI			K		
	Mean	SE	N	Mean	SE	N	Mean	SE	N
4.0—4.9	0.48 ^a	0.07	24	0.89 ^a	0.07	24	0.67 ^a	0.02	24
5.0—5.9	0.76 ^a	0.12	130	0.87 ^a	0.07	130	0.76 ^a	0.01	130
6.0—6.9	0.52 ^a	0.04	141	0.063 ^a	0.02	141	0.72 ^a	0.01	141
7.0—7.9	0.37 ^a	0.04	172	0.60 ^a	0.02	172	0.68 ^a	0.01	172
8.0—8.9	0.49 ^a	0.07	140	0.63 ^a	0.08	140	0.78 ^a	0.06	140
9.0—9.9	0.81 ^a	0.22	45	0.50 ^a	0.03	45	0.66 ^a	0.01	45
10.0—10.9	0.16 ^a	—	1	0.45 ^a	—	1	0.63	—	1
Overall	0.53	0.03	653	0.67	0.02	653	0.73	0.01	653

K values were slightly higher during the wet season than the dry season though not significantly different. The non-seasonality in K is in agreement with Ezenwaji and Offiah (10) and contrasts with Ikomi and Sikoki (11) who observed higher K values in *Brycinus nurse* in the rainy season than the dry season which was related to food regime of the fish food resources and accumulating a large quantity of fat. However, Elakhame and Sikoki (6) observed higher mean K values in *Hepsetus odoe* in the dry season than in the wet season. Monthly fluctuations in condition factor could be attributed to the influence of breeding activity and food availability with better condition resulting from accumulated food and ripe gonads carried by mature adult females which deplete as a result of spawning activity (11).

Fish conditions are often known to vary with the stage of maturation. The trend in some fish is a high K value for immature fish and a low one for mature fish, particularly those that have just spawned. Thus fish conditions have been correlated with spawning activities (12) However, the correlation of K values with spawning activities should be taken with caution in view of the reason that factors other than spawning activities (e.g. feeding) are known to affect fish condition (5) and in most cases, it is hard to separate the effect of one from the other (13). There was also no significant difference ($P > 0.05$) in mean K with fish size (Table 4).

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