INVESTIGATION OF SOME BIOLOGICAL CONDITIONS OF *JOHNIUS COITOR* (HAMILTON, 1822) FROM GYAING RIVER SEGMENT BETWEEN GADOE AND KAWBEIN AREA

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Abstract

Amphidromous croaker *Johnius coitor* (Hamilton, 1822) is one of the commercially important demersal fish of the Gyaing River segment between Gadoe and Kawbein Area. The study is based on 200 samples of *J.coitor* (Hamilton, 1822) collected at a monthly interval for a period of 12 months (January 2022 to December 2022). The result showed that the total length of male *J.coitor* specimens ranged from 12.00 cm to 20.00 cm and weight from 15.00 g to 70.00 g, while the female specimen ranged from total length 14.00 cm to 20.00 cm in total length and 13.00 g to 81.00 g in total weight. The length-weight relationship values of male and female *J. coitor* were significantly correlated (R^2 = 0.5036 and R^2 = 0.551, respectively). The peak value of GSI was attained in February for males and for females in October. A gradual increase in GSI value was found during the spawning period and gradually decreased during the post-spawning and resting periods. GSI values occur in an inverse relationship to those of HSI. The condition factor (K) is (0.41-0.95) in males and (0.40-0.89) in females, which is close to (1) and could be considered an indicator of good growth and feeding conditions. The result of this study contributes information on species restoration and fishery management in the Gyaing River.

Key words: length-weight relationship, GSI, HSI, and Condition factor, *Johnius coitor*,

Introduction

Fish are critical source of animal protein to the people and almost half of the total number of vertebrates in the world (Devashish *et al.*, 2006). And it has great commercial value and received special attention to scientists.

Johnius coitor, commonly known as coitor croaker, is an amphidromous fish species belonging to family Sciaenidae under order Perciformes, popularly known as Jew fish, croakers or drums. locally known as Thinma or (kyauk-Nga- poke thin). Besides India, coitor croaker is widely distributed in Indo-West Pacific region with reports of occurrence from Australia, Bangladesh, Brunei, Indonesia, Malaysia, Myanmar, Nepal and Singapore (Froses and Pauly 2017).

The knowledge of length-weight relationships (LWRs) has important implications in fishery biology and population dynamics. The length-weight relationship (LWR) has considerable importance in fishery research especially for the study of fish population dynamics and growth (Mathur and Bhatara, 2007), taxonomic differences, events in life history like metamorphosis, maturity (Le Cren, 1951) and to the fisheries officials in evolving effective policies for management and conservation of the resource.

The mathematical relationship between length and weight of fishes is a practical index suitable for understanding their survival, growth, maturity, reproduction and general well-being (Le Cren, 1951) and LWRs are also useful for fishery biologists for monitoring the state of health of a population (Cone, 1989).

Gonadosomatic index (GSI) is a suitable indicator of the gonad development that can be used for determining the reproductive period (Le Cren, 1951). Hepatosomatic Index (HSI) provides an indication on status of energy reserve in an animal. Condition factor (K) is widely

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used in fisheries and fish biology studies. The results can be used for sustainable management and conservation of this commercially important species in this estuary.

Therefore, the objectives of this paper are

- To record and identify the study fish in the Gyaing River segment between Gadoe and Kawbein areas
- To assess the GSI, HSI, and K values of the studied fish species
- To determine the length-weight relationship of *Johnius coitor*

Materials and Methods

Study areas and Study period

The present work was carried out in Gyaing River segment between Gadoe and Kawbein Area. It is located at North latitude 16º34´29.98"N and East longitude 97º39´20.07"E (Fig .1).The study period lasted from January, 2022 to December, 2023

Figure. 1 Topographic map of the study area (Source: Office of Land Record, Hpa-an Township, KayinState, 2022)

Specimen collection

A total of 200 specimens of *Johnius coitor* were collected and recorded from the local fisherman at the study site during the study period (January 2022 to December 2022). In this research work, 20 fresh fish samples of the species were randomly collected monthly from the local fishermen in the Gyaing River segment between Gadoe and Kawbein Area (Plate 1).

Identification and classification

The collected samples were identified referring to Talwar and Jhingran 1991 and Talwar 1995.

Morphometric Measurement

The monthly fish specimen was caught with the help of fishermen. After collection, fish were kept on ice and carried immediately to the laboratory at the Zoology Department of Hpa- an University. In the laboratory, the specimens were washed with tap water. Before weighing,

excess water from the specimens was removed with blotting paper. Fish were classified according to sex, and the total length (TL) was measured to the nearest centimeter by measuring the tip. The body weight was weighted to the nearest gram by an electric digital balance. Then, the specimens were dissected to remove the entire gonad and liver. Gonad weight and liver weight were also weighted.

(A)Fishing in study area (B) Fishing Boat (c) Fishing gear; drift gill net

Plate 1 Study area of Gyaing River segment between Gadoe and Kawbein area with operation of the fishing

(A) Measuring specimen (B) A paired of ovaries (C) Extracted testes

Plate 2 Dissected female and male of *J.coitor* showing gonads

Biological Assessment

Biological Assessment such as sex ratio, length-weight relationship, GSI, HSI, condition factor (K) were assessed by the following formula.

Sexes of the sampled fish specimens were determined after examination of the gonads. The sex ratio was calculated using the following formula;

$$\text{Sex ratio} = \frac{\text{Total number of female}}{\text{Total number of male}}$$ (Vazzoler, 1996)

Growth of fish was determined on the basis of length weight relationship. The regression method was employed with the following formula.

$$Y = a + bx$$

a = regression constant (intercept)

b = regression coefficient (growth exponent) Values of the exponent give information on fish growth (Morey *et al*., 2003). When b = 3, increase in weight is isometric. When the value of b is greater or smaller than 3, weight increase is allometric (positive if b> 3, negative b<3) (Mboru *et al*., 2010).

Gonado-somatic index (GSI) and Hepato-somatic index (HSI)

Gonado-somatic index (GSI) and hepato-somatic index (HSI) for each species were calculated according to the formula of (Le Cren, 1951) and (Lagler, *et al.,* 1962).

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

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

Condition factor (K) was calculated according to the formula of (Le Cren, 1951 and Pauly, 1983)

Condition factor (K) = W x100/L^3

W= Body weight

L= Total Length

Results

Sex ratio

The monthly distribution of male and female frequencies is shown in Table 3. Out of 200 fish, 89 were male and 111 were female. The total sex ratio was found to be 1:1.2. The percentages of males and females were 44.5% and 55.5%, respectively. According to the results, the sex ratio of male: female is naturally consistent. (Table 3 & Fig. 5).

Length- weight relationship of male *Johnius coitor*

In male *Johnius coitor*, the minimum length was 12.00cm and the maximum length was 20.00cm. The total mean length was 15.70 cm. The minimum weight was 15.00g and the maximum weight was 70.00g. The total mean weight was 32.98g.The length-weight relationship was significantly correlated in *J.coitor (b = 4.7844*, R^2=0.5036, n=89) (Fig.1).

Length – weight relationship of female *Johnius coitor*

In female *Johnius coitor*, the minimum length was 14.00cm and the maximum length was 20.00cm. The mean value of length was 17.55cm. The minimum weight was 13.00g and the maximum weight was 81.00g. The mean value of total weight was 36.68g.The length-weight relationship was significantly correlated in *Johnius coitor* (b=6.1354, R^2=0.551, n=111) (Fig.2)

Correlation between GSI, HSI and K

In male *Johnius coitor*, the GSI values fluctuated throughout the study period and then increased in February as the peak GSI value (1.91%). The lowest GSI value was found in September (0.00%). But for females, the peak GSI values were observed in December (1.37%). The lowest GSI values were found in July (0.41%) A gradual increase in GSI value was found during the spawning period and gradually decreased during the post-spawning and resting periods. (Table 1&2) and (Fig. 3&4)

In male *J.coitor*, the peak HSI values were found to be 1.60% in March, and the lowest values were found to be 0.13% in August. But *J.coitor* for female the highest HSI values were observed in January (1.06%), and the lowest HSI values were found in July (0.06%) and October (0.06%) (Table 1&2) and (Fig. 3&4)

The monthly values of condition factor (K) for males and females were determined from the number of fish studied per month. The K values ranged from 0.41 to 0.95 in males and 0.40 to 0.89 in females. The K value is close to 1, therefore males and females were in good condition in the study area (Table 1&2) and (Fig.3&4).

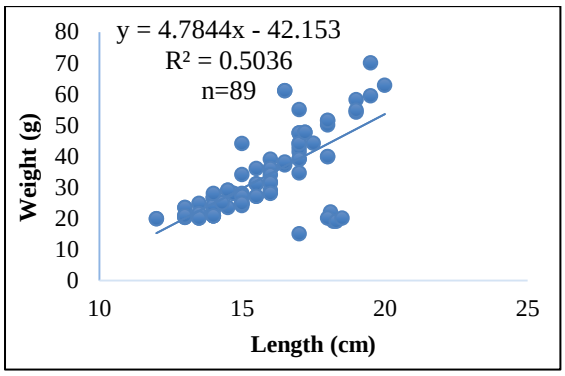

Figure. 1 Length-weight relationship of male *Johnius coitor*

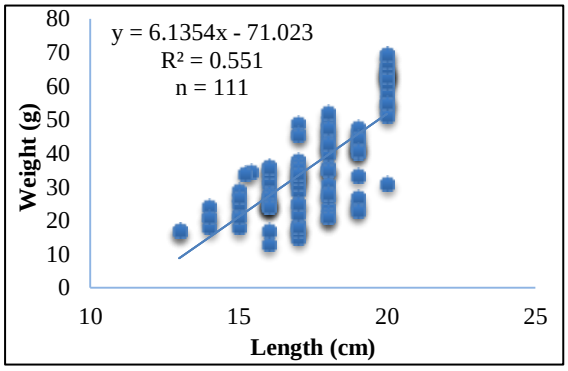

Figure.2 Length–weight relationship of female *Johnius coitor*

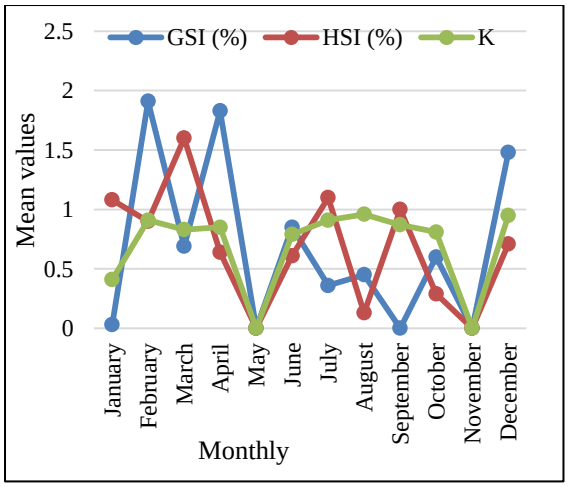

Figure.3 Monthly values of GSI, HSI, and K of male *Johnius coitor*

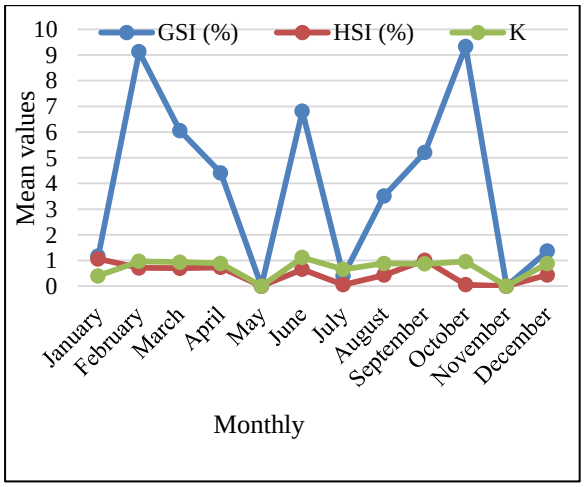

Figure.4 Monthly values of GSI, HSI, and K of female *Johnius*

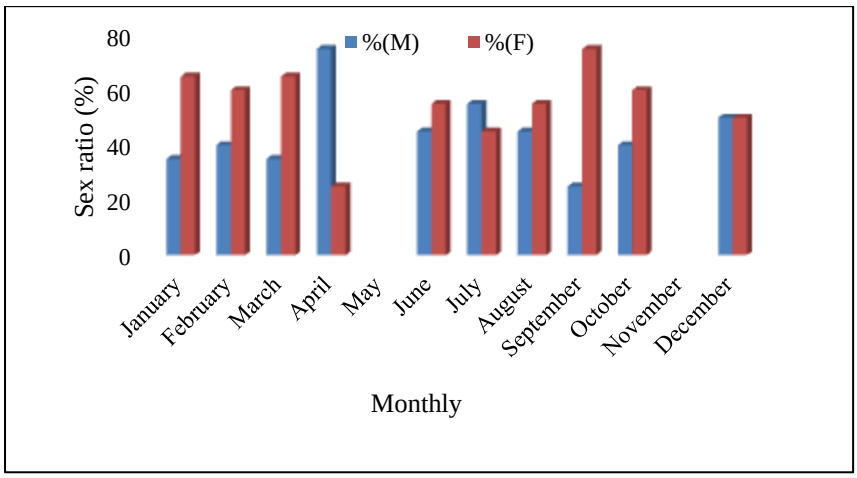

Figure. 5 Monthly sex ratio of *Johnius coitor*

Table 1.Monthly mean values of GSI%, HSI%, and K value of male *Johnius coitor*

Monthly	Total length (g)	Body weight (g)	Ovary weight (g)	Liver weight (g)	GSI (%)	HSI (%)	K value
January	18.23±0.68	26.43±17.90	0.01±0.01	0.22±0.00	0.03±0.05	1.08±0.04	0.41±0.22
February	13.50±0.83	22.13±2.37	0.43±0.25	0.20±0.05	1.91±1.06	0.90±0.17	0.91±0.14
March	17.31±1.73	43.96±11.77	0.33±0.33	0.24±0.07	0.69±0.72	1.60±0.24	0.83±0.04
April	15.33±1.42	31.44±9.28	0.60±0.48	0.19±0.08	1.83±1.30	0.64±0.25	0.85±0.07
May	-	-	-	-	-	-	-
June	15.13±0.86	27.57±4.85	0.20±0.33	0.17±0.12	0.85±1.37	0.61±0.41	0.79±0.08
July	16.05±0.99	37.95±6.59	0.17±0.49	0.04±0.06	0.36±1.02	1.10±0.11	0.91±0.06
August	16.36±1.37	41.66±11.08	0.23±0.28	0.05±0.06	0.45±0.54	0.13±0.18	0.96±0.24
September	14.36±0.37	25.80±1.94	0.00±0.00	0.01±0.01	0.00±0.00	1.00±0.22	0.87±0.05
October	17.31±1.78	43.15±13.08	0.34±0.44	0.10±0.11	0.60±0.78	0.29±0.37	0.81±0.10
November	-	-	-	-	-	-	-
December	14.07±1.58	27.97±13.58	0.39±0.22	0.15±0.07	1.48±0.89	0.71±0.36	0.95±0.18

Table 2 Monthly mean values of GSI%, HSI%, and K value of female *Johnius coitor*

Monthly	Total length (g)	Body weight (g)	Ovary weight (g)	Liver weight (g)	GSI (%)	HSI (%)	K value
January	17.08±1.54	19.62±3.56	0.28±0.64	0.01±0.01	1.17±2.63	1.06±0.04	0.40±0.10
February	15.54±1.44	37.36±11.05	3.90±3.36	0.26±0.09	9.13±6.61	0.71±0.25	0.97±0.10
March	15.45±2.21	36.01±13.70	2.02±1.11	0.22±0.09	6.06±3.18	0.70±0.33	0.94±0.11
April	15.08±0.77	30.90±6.90	1.44±0.85	0.22±0.07	4.41±2.18	0.73±0.25	0.89±0.09
May	-	-	-	-	-	-	-
June	15.36±1.17	41.40±18.31	3.24±2.91	0.34±0.29	6.81±5.47	0.66±0.43	1.12±0.42
July	16.72±1.12	29.44±10.67	0.10±0.21	0.02±0.01	0.41±0.94	0.06±0.04	0.66±0.30
August	16.76±1.03	42.35±13.27	1.50±2.03	0.25±0.30	3.51±4.84	0.43±0.20	0.89±0.07
September	17.49±1.47	46.69±11.84	2.59±2.50	0.42±0.22	5.21±5.81	1.01±0.00	0.87±0.15
October	17.58±1.26	51.72±19.88	4.70±1.99	0.46±0.35	9.33±3.79	0.06±0.05	0.96±0.36
November	-	-	-	-	-	-	-
December	14.97±1.85	0.37±0.23	0.37±0.23	0.11±0.10	1.37±0.86	0.44±0.44	0.89±0.06

Table.3. Monthly sex ratio of *Johnius coitor*

Month	Male	Female	Total	%(M)	%(F)	Sex ratio (M:F)
January	7	13	20	35	65	1:1.8
February	8	12	20	40	60	1:1.5
March	7	13	20	35	65	1:1.8
April	15	5	20	75	25	1:0.3
May	-	-	-	-	-	-
June	9	11	20	45	55	1:1.2
July	11	9	20	55	45	1:0.8
August	9	11	20	45	55	1:1.2
September	5	15	20	25	75	1:3
October	8	12	20	40	60	1:1.5
November	-	-	-	-	-	-
December	10	10	20	50	50	1:1
Total	89	111	200	44.5	55.5	1:1.2

M=male, F=female

Discussion

A total of 200 specimens of *J.coitor* (Hamilton, 1822) were studied for some biological conditions **in the** Gyaing River segment between Gadoe and Kawbein Area. The total sex ratio of male: female was 1:1.2. According to the results, the sex ratio of male: female is naturally consistent. Many researchers studied the sex ratio of *J.coitor*, (Sarkar *et al.,* 2017) studied that the sex ratio of male: female was 1:2. The present finding is in disagreement with the above authors. It may be suggested that locality, mesh size, fishing gear, and study period were different, and then it may be due to the females migrating from the estuarine to entering freshwater for breeding. Different populations inhabiting different regions show different sex ratios. (Nikolsky, 1956)

The regression coefficient values in the length-weight relationships may change with age, sex, and seasons and be related to the metabolism of each species and the environment in which they live as well (Schneider *et al.,* 2000). The previous author, Sushi K.V. *et al. (2018), who reported that the value of regression coefficient "b" was isometric b=3. In the present study, the value of the parameter "b" was 4.7844 in male and 6.1354 in female of J.coitor.* Therefore, the value of the regression coefficient "b" was a positive allometric b>3. The present finding disagrees with the previous authors. It may be suggested that there is a difference in the environment condition, the study period, and the number of studied specimens. In this present result, the value of both species 'b' was positively allomatric growth (b>3). Thus, the weight

fluctuation was higher than the length. It may be due to the majority of specimens having developed gonads. The positive allometric growth can be due to higher proficiency in feeding and better environmental conditions for survival for the species (Saikia *et al.,* 2011).

Lagler (1962) staged that the several fish species spawn more than once a year and more or less continually. The GSI values are higher in spawning period and declining in the post spawning period (Le Cren, 1951). According to the monthly GSI, *Johnius coitor,* peak GSI values were found in February for males and in December for females. The lowest GSI value was found in September for males and in July for females. So that peak GSI value indicates the peak spawning season of *J.coitor* is during post-monsoon periods. Similar results are found in Kumar *et al.,* (2013), who described that during peak breeding season (maximum July–September > January–May >October–December minimum) throughout the year for *J.coitor.*

In the present finding, the highest HSI value of *J.coitor* was found in March for males and in January for females. The lowest HSI value occurred in August for males and in July and October for females. Wootton (1990) also stated that the liver weight (HSI) decreased as the ovary weight increased during vitellogenesis. This showed that HSI has reversed action on GSI.

Sarkar *et al.,* (2018) recorded that condition factor (K) of *J.coito*r was lower in December and higher in January. The present finding was disagreement with the previous author. It may be suggested that different in food resources, environmental temperature or evolutionary adaptation of different population to the specific ecological properties of specific ecosystem. An important conclusion is that the fundamental basis for the conservation and management of fisheries resources is data from this study of some biological conditions of *Johnius coitor.* This information would be useful for conservationists and fishery biologists for sustainable fishery management and conservation in the Gyaing River.

Conclusion

Among fish, *Johnius coitor* was abundantly distributed in round year. The data on length-weight relationships is used for estimating a fish's condition factor, and these values are used for comparing the general well-being of fish. The irregular pattern of GSI and HSI of studied species were now an evidence of potential indicator which directly reflect the hazard conditions of aquatic medium. This, study is suggestive to take necessary step to monitor the aquatic medium to protect the fish reproductive physiology and fish population as a whole. The findings are very important to fishery management to fix closed season and closed areas for conservation of fish population.

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