Comparative Studies on Relative Fecundities, GSI, HSI and K Values of *Notopterus notopterus* in Mandalay and Taunggyi Environs

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Abstract

A total of 586 *Notopterus notopterus* from Mandalay fish markets and Taunggyi fish markets were used in this work. Environmental effects on the attainment of minimum length of sexual maturity were seen when ovarian weight and GSI values were compared. The length of mature specimens differs significantly between those of Mandalay and Taunggyi environs. The egg number per unit body weight (relative fecundity), ovary weight and hence GSI also showed significant difference between two environments. The months of the peak GSI values also differed in species of two different environments. The monthly weather conditions between Mandalay and Taunggyi environs are markedly different. Standard length between *Notopterus notopterus* of Mandalay and Taunggyi environs are significantly different ($p < 0.05 < 0.001$).Ovary weight and fecundity are different between the species of the two geographically different regions. The variations in length at maturity and ovary size and weight of the two areas reflect effect of environmental factors such as temperature and light.

Keywords: Environmental effects, Fecundity, GSI values, *Notopterus notopterus*

Introduction

Taking the seasonal changes in the reproductive activities, development and recrudescence of the gonads as the criteria in the life cycle of fishes, they can be classified as seasonal and non-seasonal continuous breeders. Good examples for seasonal breeders would be *Labeo rohita* and *Cyprinus carpio* of fish breeding farms and in the wild, and *Tilapia* species for continuous breeders.

Environmental factors, such as temperature, light and availability of food, play an important role in the seasonal changes of the gonads and the reproductive activities in life of lower vertebrates. The fishes are no exception to these influences. For example *Channa orientalis* in Southern Shan State (e.g., Inlay Lake) reached a peak of reproduction a month or two later than that under Mandalay environmental condition (Thant Zin, 1988; Naing Naing Aung, 1993). Ne Win (1996) found a different situation in *Cyprinus carpio* of the Mandalay and Inlay Lake environs. This species has been found to be continuously breeding in the Inlay Lake, while under conditions of the fish breeding ponds of Mandalay, it is a seasonal breeder. The present works on the reproductive biology of fishes, using gonadosomatic index and other indices, have made on a considerable number of local species. The objectives of present study are to assess the variation in the reproductive activities of two geographically different regions (Mandalay and Taunggyi) and to investigate the values of GSI, HSI and condition factor (K) of study species in both regions.

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Materials and Methods

Collection of Specimens

Since the fish available during 1996-97 was variable due to higher rainfall and flood, a daily collection of as many fish as possible was made. Daily collected was pooled as a weekly collection after a week's time. During some weeks not a single fish was seen in the fish markets of Mandalay. The specimens from Taunggyi was made on a weekly basis, fixed in 10% formalin, and brought to Zoology Department for taking the measurement of parameters employed.

Parameters Employed

Standard length and body weight of each fish of the two different ecological conditions were weighed in gm and measured in 1cm. Each fish was dissected laterally to expose the ovaries. They were severed from other visceral organs and fixed in 10% formalin for 24 hours, after which they were transferred to small vials with 70% alcohol. Standard length and body weights, ovary weights and number of eggs were only after fixation so as to give the fish of two regions the same condition when measuring of the parameters employed were made.

Collection of Data

The standard length, body, weight, ovary weight, egg number and diameters are employed as data in the analysis the differences of means. All the data were collected from 274 *Notopterus notopterus* of Mandalay environs, 312 from Taunggyi environs, totaling 586 individuals.

Analysis of The Data

Student's "t" test was employed in analyzing the differences of monthly means of standard length, body weight, ovary weight, egg number and diameters. Analyzes were made following the methods given by Bailey (1967). Since these differences were seen in all parameters of both within and between groups, they also were analyzed in the same way.

Results and Observations

The results are based on the observation made on 274 specimens from Mandalay and 312 from Taunggyi (totaling 586 in all). Weather conditions of Mandalay and Taunggyi for 1996-97 is given in Table1. The lowest air temperature recorded was 12.5ºC in January at Mandalay and 8.4ºC in February Taunggyi. The highest environmental temperatures in Mandalay and Taunggyi were 38ºC in May in Mandalay, 28ºC in March at Taunggyi. Months of the highest rainfall and humidity also differ between the two places.

Monthly mean maximum length of *Notopterus notopterus* in Mandalay was recorded to be 23.79 cm whereas that of Taunggyi was 17.91 cm. From Table 3 it would be seen that the monthly means of the standard lengths of the fish from the two regions were different significantly ($p>0.05<0.001$).

Monthly variations in ovary weights (Plate II), GSI, HSI and condition factor (k) seen in both within between groups (Table 2). Changes in egg diameters of both regions were observed. Here only the eggs of the largest ovaries were used. Selected specimens of each region were photographed Plates I.

Table1. Weather chart of Mandalay and Taunggyi environs during 1996-97

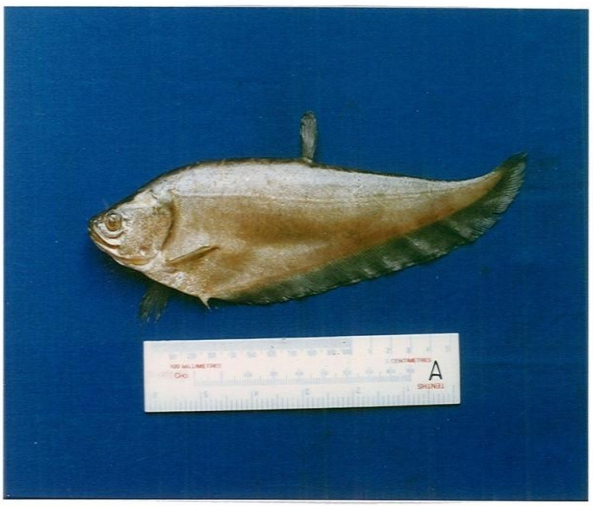
Months	Mandalay environs				Taunggyi environs			
	Air Temperature °C		Humidity	Rainfall	Air Temperature °C		Humidity	Rainfall
	Max	Min	%	(mm)	Max	Mi	%	(mm)
October	33.3	24.3	79	129	25	16	79	183
November	31	20.2	78	050	23.6	13	74	061
December	30.4	17.2	77	Nil	22.4	10	70	007
January	29.2	12.5	76	Nil	23.8	9	71	Nil
February	31.4	13.9	64	Nil	24.1	8.4	39	001
March	34	20.7	58	008	28.1	13	40	011
April	36.1	21.9	61	056	26.7	13	51	100
May	38.9	26.3	61	059	27.9	17	66	139
June	26.8	24.6	64	045	25.7	17	80	140
July	34.3	26.2	73	147	24.2	18	90	298
August	33.8	25.8	79	113	24.4	18	88	189
September	32.5	25	80	374	24.4	17	87	65

Table 2. Monthly means of GSI, HSI and condition factor (k values) of *Notopterus notopterus* of Mandalay and Taunggyi environs

Months	Mean GSI values (%)		Mean HIS values (%)		Condition factor (k values)	
	Mdy	Tgyi	Mdy	Tgyi	Mdy	Tgyi
October	0.833	0.333	1.000	0.620	0.896	0.942
November	0.330	0.313	1.073	0.845	0.900	0.888
December	0.213	0.144	1.078	0.705	0.840	0.986
January	0.212	0.102	1.066	0.224	0.856	0.881
February	0.960	0.272	0.980	0.610	0.851	0.843
March	0.318	0.763	0.930	0.810	0.870	0.956
April	0.473	0.956	0.842	0.953	0.796	0.903
May	4.399	4.490	0.512	0.681	0.820	0.909
June	9.096	4.693	0.913	1.360	0.932	0.916
July	6.942	1.892	1.136	0.855	0.885	0.988
August	7.071	4.438	1.027	0.680	0.877	0.881
September	7.494	6.745	1.052	0.883	1.014	1.034

Table 3. Comparison of standard length of *Notopterus notopterus* from Mandalay to that of Taunggyi environs during breeding season.

Months	**Mdy v Tgi environs**
May	2.3500 ($p<0.05$)
June	3.9300 ($p<0.01$)
July	7.600 ($p<0.002$)
August	11.9000 ($p<0.001$)
September	12.300 ($p<0.001$)



PlateIA. Study species *Notopterus notopterus* (mature) from Mandalay, September,1996

B. Study species *Notopterus notopterus* (mature) from Taunggyi, September,1996

Plate II. Photograph of ovaries of *Notopterus notopterus* from Mandalay (upper row) and Taunggyi (Lower row) June, 1997.

Discussion

The discussion that follows is based on the differences in the parameters of *Notopterus notopterus* the Mandalay and Taunggyi environs. The number of fish for both regions (i.e., sample size) for each month is more than 30 and parameters collected from such a sample size was felt reliable to be statistically analyzed.

The monthly means of the standard length and hence GSI and HSI values, are significantly different ($p<0.05$ <0.001) between geographically different regions. This probably is due to taxonomic variation, which still has yet to be ascertained, but the temperatures vary markedly and would definitely exert its effect on the fish of the two regions.

Ovaries of the specimens out of breeding season were of thread- like size, and the oocytes were visible only under microscope. Hence these were not included in the counting, because these would give unreliable number, due to failure to develop and reabsorbed on the way to maturation, for analysis. Only those visible with the naked eye were used as a criterion of fecundity. Even such eggs show necrosis and attrition in some cases (Myint Zu Minn, 1988).

The GSI values vary among different months in the fish of the same area e.g., Mandalay and Taunggyi. On the basis of variation in the monthly mean GSI values four periods have been designated as has been made by Thant Zin (1988). HSI values also were different significantly but not the condition factors. Such differences are seen due to the fish of both regions being seasonal breeder as has also been found by Mu Mu Lwin (1996) working on various fish species of Inlay Lake. In the Mandalay specimens the highest mean ovary weight was 24.41 g in June with mean egg number 3060 ± 395.47. The ovary weight of the specimen of the same place in was 17.51g and number of eggs 3500 ± 260.56 in September which is the month included in post-spawning period. In Taunggyi environs the highest ovary weight of 8.01g and egg number of 2750 ± 415.33 in June also, but a higher egg count was met with in May when the ovary weight was 7.39g and the mean egg count of 2820 ± 409.39. Hence the higher egg count corresponds with smaller egg size. Even intraspecific individuals local stock may show considerable differences in egg number produced per female. For instance, in the Chilko lake in Canada the Sockeye Salmon (*Onchorhyncha nerka)* produce about 2260 relatively small eggs in female of 5 years average (Raitt,1932, cited by Scott, 1979).

The egg number, however, varies with environment and physiological conditions. In the present work the egg number as well as size is definitely different between the two species of the different environmental conditions .We cannot rule out the fact that this probably is due to

taxonomic variation, taking into consideration of the fact that the two habitats have been separated from the time immemorial a time long enough to have generated a subspecies. This still has yet to be ascertained. But significant differences have been noted by previous workers on other species (e.g.,Naing Naing Aung(1993) in *Channa striata*, Ne Win in *Cyrpinus carpio* and Mu Mu Lwin in the present species *Notopterus notopterus*. but the temperature differences are very marked (Table 1) and would definitely exert its effect on the fish of the two regions. Ne Win has ventured to assigned subspecific name intha to Nga-hpein of the two regions. Ne Win has ventured to assigned subspecific name intha to Nga-hpein (*Cyprius carpio intha*) in support of Annandale (1918) compared to the same species *C. carpio* of the Mandalay environs.

As Scott (1979) has pointed out the effect of environmental factors especially light, temperature and nutrition are attributable for these differences. The Mandalay environs abound in rivers, rivulets and streams and the habitat of these fish would never be deficient in nutrient. The species *N. notopterus*, being a carnivore, would never be short of food supplies, as lakes, ponds, rivers and streams are the abodes of a variety of both invertebrate and vertebrate animals. Inlay lake,on the other hand, has Baluchaung as the only source of water feeding into it. Naturally it would not be nutritionally as rich as the fresh water habitats of the Mandalay environs. The Inlay Lake bed is full of silt setting from water coming down the hills around it that brought by Baluchaung.

From the significant differences in sizes, i.e., standard length and body weight, fecundities, etc., and the evidence of the environmental factors mentioned above implied to have their effects in the reproductive biology of other freshwater fish species, it would suffice, for the time being, to state that the differences in the reproductive biology of *Notopterus notopterus* in the Mandalay and Taunggyi environs are due to effects of the environmental factors. If such differences were maintained for a long time to come, then, perhaps, a mutant strain would have resulted as it happened when animals are long separated by various means. If it happens so, then a third taxon would have to be added as in the case of *Cyrpinus carpio intha* proposed by Annandale and supported by Ne Win.

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