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Study of Condition Indices in Goby, *Parachaeturichthys Ocellatus* (Day, 1873) from the Creeks of Mumbai

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ABSTRACT

Condition indices study like RNA content, DNA content, RNA: DNA, RNA: protein, RNA: lipid was carried out in goby, *Parachaeturichthys ocellatus* from the creeks of Mumbai to assess its nutritional status in different months. The study was carried out from June 2010 to September 2011. The range of RNA content in male was 72-185.6 µg/100 mg while in female was 82-145.46 µg/100 mg. RNA content was high during spawning months. The DNA content showed slight variations with range of 22.56-39.31 µg/100 mg in males and 25.20-32.52 µg/100 mg in females. The range of ratio of RNA: DNA in males was 2.08-5.13 with an average of 3.74 while in female was 2.92-5.07 with an average of 3.99. The ratio above 2 indicates good condition. The RNA: protein showed an average of 0.0015 in males and 0.0017 in females while the average of RNA: lipid was 0.0176 in males and 0.0127 in females. RNA: protein and RNA: lipid showed the lowest values in post reproductive stages while it increased with the onset of reproductive cycles. The condition indices study showed that *P. ocellatus* was in good condition throughout the year and the creeks of Mumbai were suitable habitat for feeding and reproduction.

1. Introduction

Macromolecular indices like RNA concentration, RNA: DNA ratios, RNA: protein ratios and protein: DNA ratios are frequently measured as indicators of protein synthesis potential and growth in marine fishes and invertebrates^[1,2,3]. These indices are particularly useful for evaluating recent environmental conditions as they reflect differences in growth rates over a period of several days^[4,3,5]. Individuals in good condition tend to have higher RNA : DNA ratios than those in poorer condition^[6]. It is valuable for managers of aquatic ecosystems for assessment of the health status of populations^[7]. The ratio is thus used to give measure of instantaneous growth in the field, thus

avoiding the need for repeated measurements^[3]. It is a useful technique to evaluate physiological condition in a short period and could be utilized as nutritional condition and/or instantaneous growth for routine check to verify health status in early life of cultivated species^[8].

Paracheaturichthys ocellatus is a native fish from the creeks of Mumbai. This fish forms part of creek fishery and is consumed widely by the people living along the coast. The present study of condition indices in *P. ocellatus* has been carried out to establish their relation to growth and nutritional conditions by determining indices like RNA and DNA content, RNA : DNA, RNA : protein and RNA : lipid ratios from the muscles of male and female.

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2. Materials and Methods

The samples for the present study were collected every fortnight at regular intervals from Malad, Vasai, Thane and Mahul creek during the period from June 2010 to September 2011. The fish samples were brought to the laboratory and thoroughly washed, cleaned and wiped. Total length was measured from the tip of the snout to the tip of the caudal fin in centimetres and weight was noted to the nearest gram. The fish was cut open and the sex was noted by the macroscopic examination of gonads.

The skeletal muscle was excised from the epaxial region of the trunk below the place of the origin of dorsal fin. Known weights of the tissue were processed for the extraction of RNA, DNA and Protein [9]. Techniques of Schneider [10] were followed for extraction of RNA from the tissues and its concentration was determined by the orcinol reaction. The values were read against standard curve prepared by relating the colour intensity to different concentrations of purified yeast RNA.

DNA was extracted according to the method described by Webb and Levy [11] and its quantity was estimated by the methodology of Ashwell [12]. Highly polymerised calf-thymus DNA was used for preparation of calibration curve.

Protein was assayed according to the method of Lowry [13]. Bovine serum albumin was used as the standard. Lipid was estimated by the method of Folch [14]. DNA, RNA, protein and lipid were expressed as µg/100 mg dry tissue.

3. Results and Discussions

Table 1. RNA, DNA, RNA: DNA, RNA: protein, RNA: lipid ratios from muscles of male *P. ocellatus* during different months.

Months	RNA µg/100 mg dry wt	DNA µg/100 mg dry wt	RNA: DNA	RNA: protein	RNA: lipid
Jun-10	122.45	28.5	4.2965	0.0016	0.0277
Jul-10	118.23	32.4	3.6491	0.0015	0.0182
Aug-10	98.22	24.5	4.0090	0.0013	0.0137
Sept-10	96.00	33.7	2.8487	0.0014	0.0098
Oct-10	82.00	39.31	2.0860	0.0011	0.0090
Nov-10	72.00	30.5	2.3607	0.0010	0.0078
Dec-10	89.93	31.56	2.8495	0.0012	0.0144
Jan-11	142.86	31.56	4.5266	0.0020	0.0169
Feb-11	185.6	36.19	5.1285	0.0026	0.0305
Mar-11	176.66	34.43	5.1310	0.0024	0.0236
Apr-11	146	28.82	5.0659	0.0020	0.0138
May-11	106.66	27.21	3.9199	0.0013	0.0270
Jun-11	104.26	26.4	3.9492	0.0013	0.0261
Jul-11	123.22	35.23	3.4976	0.0017	0.0220
Aug-11	99.34	32.45	3.0613	0.0013	0.0142
Sept-11	79	22.56	3.5018	0.0010	0.0081
Avg	115.15	30.95	3.7425	0.0015	0.0176

Table 2. RNA, DNA, RNA: DNA, RNA: protein, RNA: lipid ratios from muscles of female *P. ocellatus* during different months.

Months	RNA µg/100mg dry wt	DNA µg/100mg dry wt	RNA: DNA	RNA: protein	RNA: lipid
Jun-10	98.00	25.20	3.8889	0.0014	0.0102
Jul-10	125.00	32.45	3.8521	0.0017	0.0125
Aug-10	122.00	32.52	3.7515	0.0017	0.0124
Sept-10	94.00	28.05	3.3512	0.0014	0.0104
Oct-10	82.00	28.05	2.9234	0.0012	0.0077
Nov-10	75.00	25.27	2.9679	0.0011	0.0056
Dec-10	98.66	26.69	3.6965	0.0015	0.0061
Jan-11	112.53	25.45	4.4216	0.0015	0.0096
Feb-11	160.8	31.93	5.0360	0.0022	0.0151
Mar-11	145.46	28.69	5.0701	0.0019	0.0241
Apr-11	134.93	28.95	4.6608	0.0019	0.0150
May-11	128.40	29.33	4.3778	0.0017	0.0290
Jun-11	138.20	32.42	4.2628	0.0019	0.0142
Jul-11	142.40	30.34	4.6935	0.0022	0.0101
Aug-11	122.50	32.45	3.7750	0.0018	0.0115
Sept-11	95.50	30.25	3.1570	0.0014	0.0103
Avg	117.21	29.25	3.9929	0.0017	0.0127

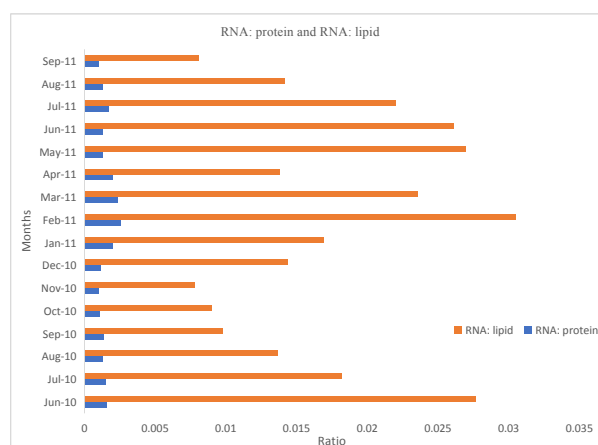


Figure 1. RNA: protein and RNA: lipid ratio in male *P. ocellatus*

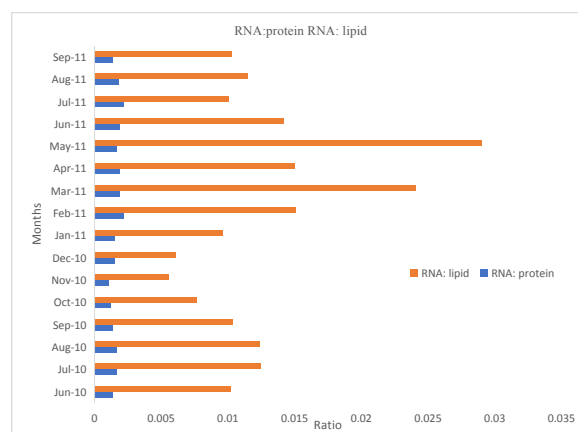


Figure 2. RNA: protein and RNA: lipid ratio in female *P. ocellatus*

Variations in RNA and DNA content, RNA : DNA, RNA : protein, RNA : lipid in the muscles of male and female *P. ocellatus* during different months is presented in Table 1 and Table 2. This was estimated to determine condition indices in *P. ocellatus* male and female monthly. The total amount of DNA in a defined amount of dry tissue will depend on cell size which changes with age, stage of the reproductive cycle and nutritional status^[15]. RNA concentrations depend on factors that affect cell size and are usually more variable than DNA concentration because RNA is required for protein synthesis, which responds quickly to changes in environmental condition^[1]. The RNA content was maximum in February 2011 and minimum in November 2010, in male and female. The range of RNA content in male was 72-185.6 µg/100 mg and in female was 82-145.46 µg/100mg. The RNA content in male was observed to increase from November 2010 to February 2011 and then decrease gradually till June 2011. In female RNA content was found to increase from November 2010 to February 2011 and decreased progressively till May 2011. This increase in RNA content may probably be due to increase in protein synthesis in male and female for the spawning period. The DNA content was maximum in male in October 2010 and minimum in September 2011. In female maximum value was observed in August 2010 and minimum in June 2010. The range of DNA content in male was 22.56- 39.31 µg/100 mg and in female was 25.20-32.52 µg/100 mg. In male DNA content was found to increase from November 2010 to February 2011 and then decreased gradually till June 2011. In females the values increased in February 2011 and decreased till May 2011 and further increased in June 2011. DNA content in females showed slight variations every month.

The RNA : DNA ratios ranged between 2.08-5.13 in males and 2.92-5.07 in females. In fish RNA : DNA ratio having values lower than 2 have usually been associated with prolonged fasting and an enhanced risk of mortality^[16]. Thus biochemical indices reflect on a very good condition indices of the fish throughout the period of present study from June 2010 to September 2011 Therefore the creeks of Mumbai appears to be suitable nursery ground for this species.

The average RNA : DNA in *P. ocellatus* female was slightly higher compared to that in males. Similar findings were recorded in goby *Pomatochistus microps*^[17]. The range for the RNA : DNA in the females was also narrow with the range in the males at 2.08-5.13 while in female it was 2.92-5.07. The lowest value in females is nearing the index 3 while that in the male is nearing 2. Value of RNA : DNA lower than 2 indicates prolonged fasting. Thus

though the ratio is nearing 2 it was not below 2 and hence though in some months the ratio indicates poor condition, the average index in male is 3.74. The males enjoy good condition indices. The average ratio in female was 3.99 indicating a good condition of females than males. Maturation and reproduction differ between males and females and often require different amounts of energy and the reproductive costs are much greater for females than for males, which imply protein synthesis and therefore RNA : DNA ratio is greater in females than in males^[18,19].

An analysis of monthly variation showed that condition values in terms of RNA : DNA ratio increased from October 2010 to March 2011 in both male and female. The value further decreased till June 2011 in male and May 2011 in female. The increase in protein synthesis associated with the development in gonads from November to February might have resulted in the increasing RNA : DNA ratio. The lower values in November and December are in accordance with that observed in *Mysis diliviana*^[20] during the pre-reproductive season. The RNA : DNA values were found to be higher in reproductive season extending from January 2011 to April 2011 in *P. ocellatus*. RNA : DNA ratio increased during gonad development gradually from the developing to the spent stage^[21]. As the fish mature, seasonal cycles of temperature and gonad development have large effects on nucleic acid levels in different tissues^[3]. Increase in RNA : DNA ratio in recovering fishes can be considered as an indicator of protein synthesis and growth^[22].

Figure 1 and Figure 2 shows the variation in RNA: Protein and RNA: Lipid ratio during various months of study. The RNA : protein ratio showed an average of 0.0015 in males and 0.0017 in females. Monthly variation in terms of RNA : protein showed minimum value in November 2010 in male and female and again in September 2011 in male. The maximum value for the ratio was observed in February 2011 in both male and female *P. ocellatus*. In male and female *P. ocellatus* RNA : protein ratio increased from November 2010 to February 2011 which is the progression from resting stage to spawning stage. The RNA : protein ratio further decreases in the post spawning stage of male. In female it was observed to show an increase in July 2011 probably due to recovery of spent stage. The maximum number of matured male and female *P. ocellatus* were observed in February 2011 and spent stages were observed in November 2010^[23]. The RNA : protein ratios along with RNA : DNA ratios reflect protein synthetic rates in organisms^[24,25]. Condition indices shows a significant relationship with protein synthesis and growth rates^[25,26].

The RNA : lipid ratio showed minimum values in No-

vember 2010 in male and female *P. ocellatus*. Maximum values were recorded in June 2010 in males, May 2011 in females. The increase in RNA: lipid in female fishes in the month of May 2011 may be due to recovery of spent stage with increase in fat. The seasonal variations in the lipid content were related to reproduction and food availability in cod fish *Gadus morhua* [27].

4. Conclusions

Thus RNA : DNA, RNA : protein and RNA : lipid ratios can be used to evaluate conditional status of fishes in general. It is an indicator of the potential for protein and lipid synthesis. It also reflects the feeding, nutritional and growth rate of the fish. The goby fish *P. ocellatus* from the creeks of Mumbai showed good conditional indices in the creeks. This habitat thus seems to be suitable as nursery, feeding and reproductive ground for *P. ocellatus*.

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