

## CHANGES IN THE NUCLEIC ACID IN DIFFERENT TISSUES WITH SPECIAL REFERENCE TO GONADS DURING DIFFERENT STAGES OF REPRODUCTIVE CYCLE IN THE FISH *NOTOPTERUS NOTOPTERUS*

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### ABSTRACT

The nucleic acid content in tissues of gonads of male and female freshwater fish *Notopterus Notopterus* was determined during preparatory phase, pre-spawning, spawning phase and post spawning phase of the reproductive cycle. In both the sexes gonads contain higher amount of DNA than the other tissues in spawning phase. The RNA content also exhibited similar to that of DNA having higher in gonads. The nucleic acid content gradually increases from preparatory phase, pre-spawning, spawning phase in the gonads. The nucleic acids increase may be because of gonadal activity for vitellogenesis in female and spermatogenesis in the male fish

**Keywords:** DNA, RNA, *Notopterus Notopterus*, Reproductive cycle.

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## INTRODUCTION

*Notopterus Notopterus* it is also called as feather back, Asian knife fish. In local language it is called as “chambari” meena in north Karnataka districts. Its distribution is in Pakistan, Bangladesh, Nepal, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, and Indonesia. It lives in slow moving areas of stream and canals and semi-permanent bodies of water, such as lake and ponds. The basic promise in fish culture in fish culture is the maximize growth at minimum cost with an end product that is of high nutritive value and aesthetically acceptable to the consumer. The successful cost efficient fish culture depends on the proper feeding habits and nutritional requirements of the available species. Nucleic Acids are present in all the living things and hold the key to the hereditary aspects of living things. The amount of RNA in the cell is directly proportional to the amount of protein synthesis occurring, the relationship between RNA and DNA is an index of the cell's metabolic intensity and has been used to measure recent growth in fishes (Clemmesen, 1994).

RNA: DNA ratios for assessing growth rates and condition of fish, and subsequently of different marine organisms, (e.g. size, life cycle stage and diel variation) have been identified. Also indicated the significant effects on levels of nucleic acids. To avoid the confounding effect of maturation. (Chichario *et al.*, 2007). Photoperiod and temperature are important environmental factors regulating gonadal development and maturation and other reproductive events in most of the seasonally breeding

teleosts (Lam, 1983) including cyprinids (Hontela and Stacey, 1990). Long photoperiod and increasing temperature were found to be favourable for gonadal development in *Cirrhinus reba* (Verghese, 1975), *Mystus tengara* (Guraya, 1976), *Heteropneustes fossilis* (Sundararaj and Vasal, 1976), *Clarias batrachus* (Singh and Singh, 1983) and *Cirrhinus mrigala* (Singh and Singh, 1984). The spawning of Indian major carps was correlated with the rainfall and lowering of temperature (Sinha *et al.*, 1974). The synthesis of yolk protein in the liver with the onset of a new reproductive cycle is accompanied by marked changes in DNA and RNA. Seasonal variations in the content of these cellular macromolecules are the result of variations in external (environmental) and internal (sex steroids) factors. On the present study DNA and RNA content of some tissues along with gonads during different phases of the reproductive cycle of the fresh water fish, *Notopterus Notopterus* has been investigated.

## MATERIALS AND METHODS

Fresh water fish *Notopterus Notopterus* is selected for the present study. This fish is locally available in large number in ponds, lakes, tanks and rivers in and around Gulbarga district. Fish were collected from Bheema river which is situated at about 40 kms away from Gulbarga city. During four reproductive phases such as Per-paratory, Pre-spawning, Spawning and Post-spawning phase of the reproductive cycle, about 20 fish were sacrificed and out of which 6 female and 6 male fish were used separately

for estimations. Before the sacrifice in each phase, the weight of the tissues were recorded on the Decobal Brawn balance and the size of the fishes., were measured with help of foot rule bandy and then sacrificed by decapitation and sexes are identified after dissecting them. The tissues including gonads (testis and ovary) were dissected out carefully weighted in Anamad electronic balance. The nucleic acid (DNA and RNA) content of the tissue were estimated by following the Diphenylamine method of Schneider (1940) using DNA as Standard. The RNA content of the tissues was also estimated by Orcinol Schneider (1940) method using RNA as Standard. In all the cases six observation were made and the results were expressed as arithmetic mean with their standard deviation, standard error and student "t" were made as described by Suedecur (1946) and Fisher (1963).

## RESULT AND DISCUSSION

The reproductive cycle of *Notopterus Notopterus* consists of following four phases during one year period is as follows: Preparatory Phase (January to March);Pre-Spawning Phase (April to July);Spawning Phase (August to October);Post spawning Phase (November to December).

The condition of the gonads as observed during different phases indicate that in the preparatory phases, the gonads are at developing stage while in the pre-spawning phase, the gonads are at different stage of maturity comprising of maturing and mature stages. In the spawning phase the gonads are ripe and some are in the spent stage and

post-spawning phases includes immature stages (Sudarshan and Kulkarni, 2003), The nucleic acid content in different tissues of gonads of male and female fish estimated during Preparatory Phase (January to March), Pre-Spawning Phase (April to July), Spawning Phases (August to October), Post-spawning (November to December) of the reproductive cycle has been determined. Among the biochemical indices, the ratio of DNA to RNA has been proven a reliable indicator of nutritional condition. Hence, the nucleic acid content (DNA/RNA) and their ratio of the tissues in both male and female fish *Notopterus Notopterus* studied during four phases of the reproductive cycle. The study indicates that in both male and female, gonads contain higher amount of DNA than the other tissues. In comparison to male and female tissues, the DNA and RNA content has been found to be more in female tissues (brain has 2:1,liver, 2:1, gonads, 2:1, and only in kidney it is 1:1). RNA/DNA ratios and larval growth of winter and spring-spawned sardine larvae, *sardine pilchardus*, from the southern coast of Spain were studied by (Teodoro Ramirez *et al.*, 2004) and found that the seasonal variations of larval growth and RNA/DNA ratios were analyzed in relation to environmental variables. The ovarian changes with respect to its protein, RNA and DNA contents, and the gonado-somatic index of singi fish *Heteroneusates fossils* were investigated at different seasons of the year, e.g. from April to September which includes the rainy season (breeding season) and October to March including non-monsoon months (non-breeding season). It was found that the level of protein in ovary and the gonado-somatic

index were found to be higher April to September. The protein level reduced from October to March. The gonado-somatic index following the same course during these months (October to March). But the RNA and DNA contents of the ovary were found to be at the higher level from October to March (Dasmathapatra and Medda, 1978). Seasonal variation in the concentrations of proteins, RNA and DNA and the RNA/DNA ratio were studied in the liver of major carps, *Catla catla*, *Labeo rohita* and *Cirrhina mrigala* during their prematurity phase. The biochemical parameters maintained strikingly similar patterns of change in the three species. Alternations in nucleic acids were reciprocal to that of protein. Magnitude of such interrelation, however, varied with the season. Protein level was generally low during winter and high in the summer

months, attaining peak value in March and June, higher concentration of RNA and DNA were registered in December and June and a sharp decline was evident in January as well as July. During the remaining months, protein, RNA and DNA varied intermittently, but not profoundly. (Saleem Mustafa and S.M.Zofair 1985). The present study on the overall nucleic acid content of the fish, *Notopterus notopterus* shows nucleic acid content increased from Preparatory Phase (January to March), Pre-spawning phase (April to July) to spawning phase (August to October), indicating that the nucleic acid content of the tissues of the fish including gonads is increased on approach of breeding phase indicating improvement in the health condition of the fish for breeding activity and also suggesting favorable feeding and other condition of the environment.

**Table-1**

Showing DNA and RNA content (mg/g) in different tissues of the freshwater fish  
*Notopterus Notopterus* during

1. Preparatory phase (January to March)
2. Pre-Spawning Phase (April to July),
3. Spawning Phase (August to October).
4. Post-spawning phase (November to December).

Reproductive cycle	Months	ORGANS SEX	GONADS	
			DNA	RNA
1.Preparatory phases	January	MALE	103 ± 1.5 SE ± 0.65	45 ± 1.9 SE ± 0.50
		FEMALE	105 ± 1.1 SE ± 0.85	47 ± 1 SE ± 0.75
	February	MALE	103 ± 1.3 SE ± 0.45	44 ± 1.6 SE ± 0.54
		FEMALE	108 ± 1.3 SE ± 0.56	46 ± 1.4 SE ± 0.55
	March	MALE	105 ± 1.7 SE ± 0.65	42 ± 1 SE ± 0.39
		FEMALE	110 ± 1 SE ± 0.85	42 ± 1 SE ± 0.65
2.Pre-Spawning	April	MALE	106 ± 1.20 SE ± 0.49	43 ± 1.2 SE ± 0.49
		FEMALE	112 ± 1.98 SE ± 0.81	45 ± 2.1 SE ± 0.86
	May	MALE	108 ± 1.74 SE ± 0.71	44.8 ± 1.6 SE ± 0.66
		FEMALE	112.5 ± 2.12 SE ± 0.86	45.5 ± 2.3 SE ± 0.94
	June	MALE	118.3 ± 1.76 SE ± 0.72	46.8 ± 1.06 SE ± 0.44
		FEMALE	116 ± 2.12 SE ± 0.86	47.83 ± 1.16 SE ± 0.47
	July	MALE	158.3 ± 1.7 SE ± 0.72	51.66 ± 1.96 SE ± 0.79
		FEMALE	132.5 ± 2.23 SE ± 0.91	54 ± 1.50 SE ± 0.61
3.Spawning Phase	August	MALE	145.8 ± 2 SE ± 0.81	55.19 ± 1.79 SE ± 0.73
		FEMALE	145 ± 2.18 SE ± 0.89	72.91 ± 2.10 SE ± 0.86
	September	MALE	175.83 ± 1.63 SE ± 0.66	55 ± 1.00 SE ± 0.40
		FEMALE	170 ± 1.93 SE ± 0.79	58 ± 2 SE ± 0.81
	October	MALE	178 ± 1 SE ± 0.80	58 ± 1.40 SE ± 0.45
		FEMALE	179 ± 1.3 SE ± 0.30	60 ± 1.35 SE ± 0.82
4.Post spawning phase	November	MALE	173 ± 2 SE ± 0.90	55 ± 1.2 SE ± 0.65
		FEMALE	170 ± 1.7 SE ± 0.75	58 ± 1.30 SE ± 0.72
	December	MALE	130 ± 1.5 SE ± 0.32	52 ± 1.8 SE ± 0.60
		FEMALE	132 ± 1.8 SE ± 0.75	53 ± 1.7 SE ± 0.78

\* Each Value Is Expressed As Mean, Standard Deviation And Standard Error Of Six Observations.

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