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Seasonal changes in the fat contents of certain tissues of a fresh water fish *Mystus seenghala* in relation to feeding and ovarian cycle

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Abstract
In this paper we study seasonal changes in the fat contents of certain tissues of a fresh water fish mystus seenghala in relation to feeding and ovarian cycle. For this *Mystus seenghala* was collected from Tons river and other fresh water resources of Rewa Region. The specimens were also procured from fish market during different months of the year for studying the food and feeding habits of this species in different months. Our finding is maximum values during October where as in November there was a distinct fall which was followed by a rise during January and February. The fat content in liver was higher than that of the muscle and was subjected to significant variations from season to season. The curves for the male and female were almost identical and there was no quantitative difference between the liver fat of the two sexes.

Keywords: *Mystus seenghala,* tissues, habits

1. Introduction

Regarding high nutritive value, easy availability and assimilation in the human body fishes considered as the most potent staple food after food grains. Inland fish resources of India are one of the richest in the world. Fish being a high protein food can go a long way to supplement the nutritional demands of unabatedly growing vast population of India. Food is the prime need of life hence the study of food and feeding habits becomes highly significant in fishery biology. The food preferences feeding habits, availability of food in the environment and the intensity with which fish feed is an important aspect to study. A proper food supply always leads to a good growth rate which is very important from the view point of commercial fishery. The term food supply signifies the presence of certain quantity and quality of food that can be utilized by the population for growth and reproduction, the food supply thus governing the mass of a population.

However, few investigators have studied the seasonal biochemical changes in the ovaries and other tissues of fresh water fishes. Seasonal changes in the ovary and ovarian cycle have been described by Khanna and Pant (1967) in *Glyptosternum pectinopternum*; Malhotra (1971) in *Schizothorax richardsonii* of dal lake and Rita Kumar and Nair (1979) in hill stream *Noemacheilus triangularis*. But seasonal and developmental biochemical changes in certain tissues and ovarian cycle in fishes inhabiting the running water of Vindhya region have not been described. Keeping in view the economic importance of *Mystus seenghala* (now Aorichthys seenghala, according to Talwar and Jhingran, 1991) the present study was undertaken not only to know the rate of egg production of the cat fish *Mystus seenghala* but also to evaluates possibility of evolving culture practices, artificial propagation and better fishery management. The results would form a basis in taking up positive steps for management and conservation of this important food fish in Vindhya region.

Breeding is an important aspect through which a living being maintains its race. In case of fish it is highly essential to know about exact time of maturity, frequency of spawning and number of eggs that are likely to be spawned by the fish for fish culture and proper exploitation in the fish farm management. The study of maturity and spawning gives information about the spawning frequency, spawning season and size at first maturity. The attainment of the sexual maturity primarily depends on the food supply during growth.

One of the important aspects of fishery biology is to increase the stock of fish and improve its nutritive value. Knowledge of feeding habit helps in development of better baits. Management of fish culture and proper growth of fish could provide better yield. From the account given in the foregoing pages and literature consulted it is evident that the food and feeding habit of fish has its impact on the various biochemical components of the fish such as protein, fat, carbohydrate, moisture, ash and iron contents in the liver muscles and the ovary of fish. The glycogen forms an energy source during ovarian cycle.

As evident from the cited literature no significant work has so far been done on the biochemical composition of the flesh or the organs of the *M. seenghala*. The work reported here was undertaken to study the correlation of food and feeding habits with the seasonal variation in the fat, carbohydrates, proteins, moisture, ash and Iron content in the liver, muscle and ovary during entire ovarian cycle in an economically important fresh water fish *Mystus seenghala* (sykes).

2. Materials and Method

Living specimens of *Mystus seenghala* was collected from Tons river and other fresh water resources of Rewa Region.

The specimens were also procured from fish market during different months of the year for studying the food and feeding habits of this species. Out of these, 86 specimens collected from July to September 2004 were utilized for preliminary studies. The specimens collected from October 2004 to January 2006 were analyzed quantitatively for elucidating seasonal variations in the food components. This data was also analyzed for various arbitrary size groups in order to see if there is any basic change in dietary habits of the fish at various stages of its growth. Since the number of specimens in similar size groups was considered inadequate, the guts from 312 additional specimens, measuring 18 to 215 mm, were examined from October 2004 to January 2006. However, the observations on the composition of gut contents of various size groups were limited to the period from October to January as all size groups wee adequately represented during this period only.

The guts were removed from fresh specimens of *Mystus seenghala* and preserved in 5% formalin for subsequent analysis. The contents of the preserved guts were teased in petridishes in order to render their microscopic examination easy. Since the most portion of the alimentary canal of this species is not differentiated into a recognizable stomach, the contents, sampled at random, were examined from various sections of the guts. The gut contents were analyzed by volumetric method, as well as by frequency of their occurrence in the guts. The volume of the gut contents was estimated by a modified point's method, which is described in the following section. In the occurrence method, the number of specimens in which a particular item occurred was given as a percentage of the total number of specimens examined. The occurrence percentage of a particular item was also calculated with reference to the sum of occurrences of all the items.

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The gut contents of *M.seenghala* broadly consisted of Teleosts, Insects Crustaceans and mud mixed with sand. The percentages of these broad groups were first assigned by 'eye estimation' as no other method was feasible for the volumetric analysis of all these groups. The percentages of various Teleosts as determined on the basis of points gained by them were then scaled down making up the total percentage of the Teleosts group previously assigned by eye estimation.

3. Method for Biochemical Study

For the biochemical study, attempt has been made to estimate the changes in the quantity of fat in the muscle, liver and ovaries of *Mystus seenghala* during different seasons.

Fats were extracted with chloroform using soxhlet apparatus. Method of Weil and Stetten (1947) as cited by Kaplan and Colowick (1957). 100 mg. of the tissue was introduced into the fractioning column of the soxhlet extractor. The flask containing chloroform was slowly heated in a water bath until the chloroform in the fractioning column become colourless. The apparatus was disconnected and the tissue was accurately weighed after evaporating the chloroform in an oven at 47ºC. The difference in the weight of tissue before and after evaporation with chloroform gave the fat content of the tissue in milligrams.

4. Result

Changes in the fat content of different tissues were as follows

Muscle

Fat cycle in muscle was not very well defined (see Table-1 and Fig.1). It recorded maximum values during October where as in November there was a distinct fall which was followed by a rise during January and February. Relatively low values were recorded in subsequent months (March to August).

Liver

The fat content in liver was higher than that of the muscle and was subjected to significant variations from season to season. These has been given in the Table-1 and plotted in fig.-2. There were two phases of maximum and minimum values of liver fat. Higher values were recorded from about August to November. This was followed by relatively low values during the winter months (December to January). The next phase of maximum fat was in April and minimum in May. The curves for the male and female were almost identical and there was no quantitative difference between the liver fat of the two sexes. The fat cycle of the liver does not indicate much relationship with that of the muscle except that high aft values occur in both the tissues during October and February.

Ovary

The changes in the ovarian fat were more marked than that of

the muscle or liver (Table-1and Fig.-3). Fat values were low during November and December but after that there was a gradual rise. Highest values were noted in June and the lowest values in August for the ovaries of *M.seenghala* contents less fat than the testes. This is probably because in the ovaries of cat fishes it is the protein (nucleoproteins) rather than the fat reserves which remains more dominant.

A comparison of the ovarian fat cycles with the fat cycle of muscle will indicate that high ovarian fat cycle from March to onwards coincide with the low muscle fat values. Similarly low ovarian fat value during the post monsoon and winter months corresponds with the high muscle fat values. In liver peek fat values proceeds the peek obtained for the ovaries. A gradual storage of the so-called visceral in the body of *M.seenghala* was noted throughout the present study. This was gradually depleted during the summer months. Deposition of adipose layer was also noticed below the skin especially caudal region. No quantitative estimation could be made foe these extra fat stores but from a gradual concluded that these fat reserves contributes substantially towards the energy demands of the developing ovary.

Table 1: Seasonal fluctuation of the Fat content in the liver, Muscles and Ovary of *M. seenghala*.

Months	Liver	Muscles	Ovary
January	2.892±0.09	0.645±0.01	0.785±0.06
February	3.036±0.89	0.669±0.02	0.706±0.35
March	3.975±0.75	0.301±0.03	0.892±0.25
April	4.578±0.65	0.331±0.05	1.135±0.35
May	3.025±0.69	0.271±0.08	1.167±0.24
June	3.967±0.58	0.41±0.05	1.343±0.25
July	4.563±0.78	0.19±0.06	0.872±0.24
August	4.835±0.38	0.36±0.02	0.423±0.31
September	5.047±0.65	0.6±0.01	0.457±0.32
October	4.976±0.54	1.21±0.04	0.738±0.39
November	4.0265±0.25	0.3±0.06	0.985±0.29
December	2.961±0.28	0.295±0.09	0.692±0.02

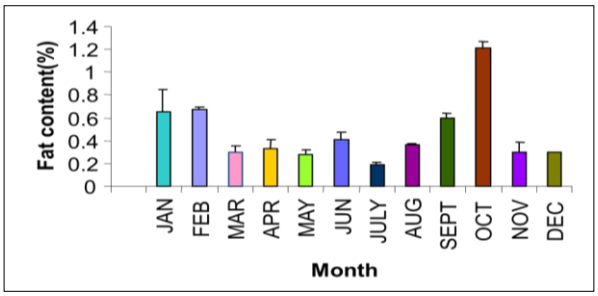

Fig 1: Monthly changes in the fat content of muscle of *M. seenghala*

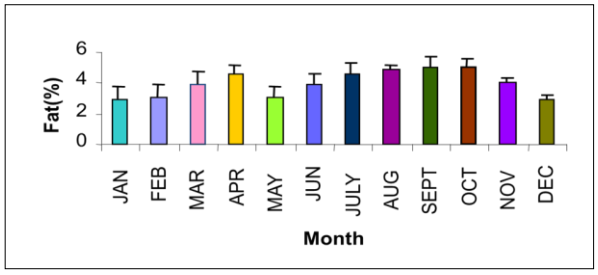

Fig 2: Monthly changes in the fat content of liver of *M.seenghala*

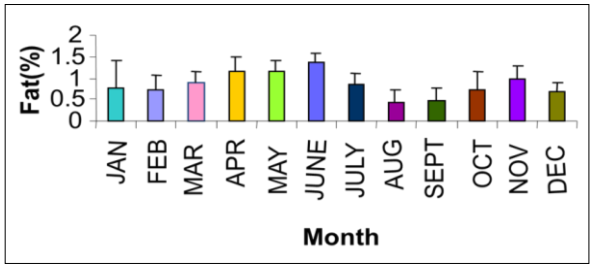

Fig 3: Monthly changes in the fat content of Ovary of *M. seenghala*

5. Discussion

Fat cycle in various tissues in relation to feeding and ovarian cycle

The rise and fall of fat in different tissues may be correlated with feeding and ovarian cycle of the fish as follows-

Intensive feeding during September and October correspond with the occurrence of high fat contents in the muscles this period may be ascribed to the abundance of fish in the food low fat in the muscles observed during November and February may similarly be due to a fall in the rate of feeding during winter and summer.

The cycle of maturation and depletion of ovary as described by Bhatt (1965) has no distinct relationship with the fat cycle of muscles. The some extents advancement of maturity influenced the cycle but generally low muscles fat values observed when the gonads were ripe. The fat value continued remain low in spawning fish and when the spawning was over there was no immediate replacement of fat in the muscles. A distinct per depletion in the muscles fat was observed in ms. As feeding and maturation cycle of this fish are interconnected, the rise and fall in the muscles fat appears to be, influenced concurrently both by feeding and maturation.

A sudden fall during the final phase maturation indicates little possibility of muscle contributing its fat towards gonads building. A clear relationship between muscles fat and maturation has been noted earlier in *O. punctatus* and *C. mrigla* was evident in *M. seenghala*. Srinivasan and Narayan (1961) have also found that the variations in the fat content of the muscles were insignificant in a closely related species Macronae (Mystus) during different season of the year.

Fat cycle in the liver also seems to be related with feeding activity of fish. High values of the liver fat from July to august

were probably the result of very active feeding during the period. The decline in the fat content observed during December and January seems entirely due to less feeding during this period. Liver fat cycle from February onwards decline with ripening of gonads. The highest value in apart with the period when the gonads were predominantly ripe and then fish was ready to spawn. The sudden changes in the liver fat probably suggest that there is no transference of liver fat towards the developing gonads. The sharp fall of liver fat during spawning in *M. seenghala* is perhaps necessitated by the immediate metabolic demand of fish.

The cycle of ovarian fat seems to be entirely related to maturation and spawning. In both sexes advancement of maturation was accompanied with a rapid building up of ovarian fat. Thus the lowest fat value observed when the gonads were spent and the highest when they were showing peak ripening.

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