

## Impact of pollution on the biochemical composition of muscle tissue of fish in three lakes of different trophic status

Bilquis Qadri, Farooz A. Bhat and A. R. Yousuf

Limnology & Fisheries Laboratory, Center of Research for Development, University of Kashmir, Srinagar – 190 006

### ABSTRACT

Present investigations were undertaken to study the changes in the biochemical composition of muscular tissue of two fish species, *Cyprinus carpio communis* and *Schizothorax niger* in three lakes - Dal, Anchar and Manasbal - of different trophic status in Kashmir valley. Variations were seen in the levels of protein, lipid and carbohydrate composition of the fishes. The decline in the biochemical components of fish collected from the lakes was in the order of Anchar lake > Dal lake > Manasbal lake. Variations were correlated with the eco-physiological factors in natural situations of life.

**Key words :** Proteins, carbohydrate, lipid, carp, snow trout

### INTRODUCTION

High concentrations of nutrients transported to aquatic ecosystem through runoff from agricultural fields as well as by direct disposal of sewage and sewerage from adjoining human settlements have led to eutrophication of many water bodies of the valley, particularly the urban and rural lakes (Zutshi *et al.*, 1980; Yousuf, 1996 and Yousuf *et al.*, 2001). Contamination of the aquatic ecosystem has in turn influenced the biotic life at various levels of organization and population of several plant and animal species has been affected and even some species have been altogether ousted from these habitats. Since fish form an important component of an aquatic ecosystem an attempt was made to assess the impact of lake eutrophication on the biochemical composition of two food fishes of Kashmir, viz., *Schizothorax niger* (ale gad) and *Cyprinus carpio communis* (Punjabe gad). Both the fish play a major role in the capture fishery of flatland lakes of the valley, including the Dal, Anchar and Manasbal lakes. The data procured during the study are described in the present paper.

### MATERIAL AND METHODS

20 specimens each of *C. c. communis* and *S. niger* of almost same size and weight were collected from the Dal, Anchar and Manasbal Lakes and analyzed on wet weight basis for biochemical components. Proteins were analyzed by Lowery's method, lipid by Bligh Dyer method and carbohydrates by Anthrone method (Jayaraman, 1981). Replicate experiments were performed

firstly in May/June and then again in October / November. For checking the trophic status of the lakes water samples, collected at the time of fish collection, were analyzed for important chemical parameters as per the methods described in A.P.H.A (1998).

## RESULTS AND DISCUSSION

The average values of replicates for all the three biochemical component : are presented in the Table 1. The data obtained on the various chemical parameters of the lakes are given in Table 2. Intra as well as inter-specific variations were observed in the proximate composition of muscle tissue of the fish in the three lakes. The protein content of fish has been reported to vary in a range of about 19 – 28%, while the oil varies from 0.2% to 64 % (Stansby, 1961). Carbohydrates, on the other hand, have been found to be in relatively less quantity in fish. Stansby (op.cit) has proposed five categories with respect to oil and protein content. As per this classification both the fishes fall into category A, which is characterized by low oil and high protein content.

In case of *C. c. communis* protein content varied in the range of 18.95-19.53% (mean 19.24%), 18.98-19.26% (mean 19.12%) and 19.65-20.95% (mean 20.30%) in the fish from Dal, Anchar and the Manasbal lakes respectively. Values of lipid had a range of 2.90-3.70% (mean 3.30%), 2.67-3.56% (mean 2.73%), 3.36-4.56% (mean 3.39%), while the carbohydrates recorded a range of 2.33-3.29% (mean 2.81%), 2.12-2.60% (mean 2.36%) and 2.66-3.89% (mean 4.60%) in the fish from the three lakes respectively. *S. niger* also showed a similar trend in all the three lakes. In this fish the protein recorded a range of 19.10-19.51% (mean 19.30%), 19.20-19.37% (mean 19.28%) and 19.87-20.97% (mean 20.42%), while lipid content fluctuated in a range of 2.73-3.65% (mean 3.19%), 2.80-3.26% (mean 3.03%) and 3.43-4.59% (mean 4.01%) for the fish from the Dal, Anchar and Manasbal lakes respectively. The carbohydrate content fluctuated in a range of 2.73-3.26% (mean 2.99%), 2.07-2.59% (mean 2.33%) and 2.33-2.67% (mean 2.50%) in the fish from the three lakes respectively.

A comparison of the values of biochemical components of both the fish (Table 1) showed that all the three biochemical components were highest in the populations inhabiting the Manasbal lake and the least values were recorded for populations from the Anchar Lake.

The water chemistry of the three lakes showed significant variations in the nutrient level from each other. While the Dal and Anchar showed hypertrophic conditions, the Manasbal depicted meso-eutrophic condition (Table 2). The three water bodies show a trophic progression in the order Anchar > Dal > Manasbal. Eutrophication of these water bodies has greatly increased the macrophytic growth in them, which in turn has led to addition of more dead organic matter and decreased the oxygen level. Murty and Priyamvada (1982), Vashist *et al* (2000) and Vutukuru (2003) have reported that stressed condition leads to depletion of proteins, lipids and carbohydrate content in the fish as more energy is needed to perform physiological activities under stress. Proteins

**Table 1: Average percentage of biochemical components of muscle tissue of fishes in three lakes of Kashmir**

<i>Fish</i>	<i>Dal Lake</i>		
	<i>Protein</i>	<i>Lipids</i>	<i>Carbohydrates</i>
<i>Cyprinus carpio communis</i>	19.24	3.30	2.81
<i>Schizothorax niger</i>	19.30	3.19	2.99
<b>Anchar Lake</b>			
<i>Cyprinus carpio communis</i>	19.12	2.73	2.36
<i>Schizothorax niger</i>	19.28	3.03	2.33
<b>Manasbal Lake</b>			
<i>Cyprinus carpio communis</i>	20.30	3.39	4.60
<i>Schizothorax niger</i>	20.43	4.01	2.50

**Table 2: Physico-chemical features of the Dal, Manasbal and Anchar lakes of Kashmir**

S. No.	Parameters	Manasbal	Dal	Anchar
01	pH	8.57	8.20	8.19
02	Conductivity ( $\mu\text{S}/\text{cm}$ )	220	290	468
03	Dissolved oxygen (mg/l)	8	7	4
04	Free Carbon dioxide (mg/l)	5	9	28
05	Total alkalinity (mg/l)	174	258	376
06	Chlorides (mg/l)	27	33	42
07	Calcium (mg/l)	33	47	42
08	Magnesium (mg/l)	10	22	15
09	NO <sub>2</sub> - N (ug/l)	14	25	250
10	NH <sub>4</sub> - N (ug/l)	26	91	240
11	NO <sub>3</sub> - N (ug/l)	121	304	235
12	TP (ug/l)	78	140	296

are second reserved energy source after carbohydrates and after the exhaustion of carbohydrates, energy requirements are met by breakdown of proteins in to amino acids. The same phenomenon seems to be operating in the fish of the Anchar and the Dal Lake as both these systems are relatively much more polluted than the Manasbal. These inferences are also supported by Haggage *et al* (1999), who reported negative effect of polluted waters on the meat quality of fish.

## REFERENCES

- A.P.H.A, 1998 *Standard Methods for the Examination of Water and Wastewater*. 20<sup>th</sup> Edition. American Public Health Assoc. Washington, D.C.
- Haggage, H. A. M., Marie, M. A. S. and Zaghoul, K. H. 1999. Seasonal effects of the industrial effluents on the Nile Catfish; *Clarias gariepinus*. *J. Egypt. Ger. Soc.* **28**: 365-391.
- Jayaraman, J. 1981. *Laboratory Manual in Biochemistry*, Wiley Eastern Ltd., New Delhi
- Murty, A. S. and Priyamvada, Devī A. 1982. The effect of Endosulphan and its isomers on tissue protein, glycogen and lipids in the fish *Channa punctata*. *Pesticide Chemistry and Physiology*. **17**: 280-286.
- Stansby, Maurice, E. 1961. Proteins and general composition In: *Fish in Nutrition* part-II, section - I: 55 - 60 Eirikheem and Rudolph Kreuzer, Washington.
- Vashist, Seema, Kumar, Indu, and Jamil, Kaiser 2000. The study of alteration in respiratory metabolism of Teleost fish *Tilapia mossambica* due to the effect of polluted waters. *Proc. Nat. Acad. Sci. India*, **70** (B), III & IV. pp 229 - 236.
- Vutukuru, S. S. 2003. Chromium induced alternations in some Biochemical profile of Indian Major Carp, *Labeo rohita* (Hamilton). *Bull. Environ. Contam Toxicol. Springer. Verlag, New York*. **70**: 118-123.
- Yousuf, A. R. 1996. Fishery Resources of Kashmir. In: *Ecology, Environment and Energy* (A.H Khan & A. K. Pandit, eds.) pp 75-120. Kashmir University, Srinagar.
- Yousuf, A. R., Firdous, G and Peerzada, K. J. 2001. Ecology and feeding biology of commercially important cyprinid fishes of Anchar lake with a note on their conservation In: *Natural Resources of Western Himalayas*. (A. K. Pandit ed.). Valley Book House, Srinagar.
- Zutshi, D. P., Subla, B. A., Khan, M. A. and Wanganeo, A. 1980. Comparative limnology of nine lakes of Jammu and Kashmir Himalayas. *Hydrobiologia* **72** (1-2): 101-112.