



Ecology of Feeding and Breeding Behavior of Some Major Endemic Fishes of River Jhelum in Kashmir Himalaya

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ABSTRACT

The River Jhelum is the lone drainage system of Kashmir valley originating from Pir Panjal of Himalayas connected by lentic and lotic habitats across the valley. For the present investigations, the fishes were collected from main River Jhelum and important tributaries like Sandran, Lidder, Rambiarah, Sindh, Pohru, Nambra and Boniyar streams. A total of 19 species of fishes belonging to cypriniformes, siluriformes, cyprinodontiformes and salmoniformes among which dominant endemic fishes are *Schizothorax plagiostomus*, *S. labiatus*, and *S. esocinus*. The overall fishing effort in the river system was 170g – 350g per man-hour, contributed significantly by these endemic fishes in upper reaches and fast flowing zones of River Jhelum. But over the decades this fishing effort is decreasing continuously due to increasing pollution by anthropogenic activities in the catchment of Jhelum. The pollution over the years changed the feeding ecology of these fishes inhabiting in the river system and prominent effect was seen on breeding behavior of these fishes. The pollution over the years has affected the whole food chain of these water bodies which have affected overall feeding and breeding ecology of some major fishes in river system. In response to this decreasing fishing trend in the River, it was found worthwhile to study the feeding and breeding behavior of these main endemic fishes in order to formulate a strategy towards conservation of these important endemic fishes and keep them in full competition with exotic fishes which otherwise would overcome them in near future.

Keywords: River Jhelum, *Schizothorax plagiostomus*, Endemic, Conservation.

INTRODUCTION

The River Jhelum in Kashmir receives all lotic (Sind, Sandran, Bringhi, Lidder, Pohru and Buniyar streams, etc.) and lentic (Dal, Wular, Alapathar, Manasbal and Anchar lakes, etc.) water bodies and attain a sizable discharge drains the valley and leaves valley through a gorge near L.O.C. Uri Baramulah to the plains of Punjab Pakistan. All these aquatic habitats of the valley form unrivalled fishery resources characteristic of the Himalayas constituting endemic *Schizothorax* fishes and *Oreinus* in Main River Jhelum system and exotic trout (*Salmo trutta fario*) thrives only in crystal clear, blue waters of streams and oligotrophic lakes. However, the introduced carps (cyprinus species) to the highly eutrophic flatland lakes of Wular and Dal and also to slow flowing zones of main Jhelum choked with macrophytic vegetation.

Fishes are an important biotic resource and greatly value by man as protein rich food since the prehistoric ages. The biological value of fish is very high, since it contains proportionately large amounts of essential amino acids, unsaturated fatty acids and minerals. There is epidemiological evidence that fish consumers have better cardiovascular health, low plasma triglyceride and less cholesterol problems. Availability of fish is of special economic importance to the people of the valley as such their availability and good variety needs to be conserved for the betterment of the society. Unfortunately, due to interference of human population in catchment area, the biological and chemical structure of water bodies has undergone undesirable changes, affecting the health of fish

as fish is the major primary consumer in the aquatic environment. Health of fishes is directly proportional to its feeding ecology and in this direction a detailed study of feeding habits of some major endemic fishes was studied in order to correlate its relationship to the fishing effort in the River Jhelum system. Although a number of research contributions have been made on fishes in Kashmir, most of them pertain to fish bio diversity¹⁻⁴ and some others describe the feeding and breeding aspects of the fishes particularly in lentic habitats⁵⁻¹⁰. A few reports regarding ecology of fishes in lotic system of the valley¹¹⁻¹³ reveals that there is a significant gaps in the data on the fish feeding. In order to fill this gap in our knowledge, it was proposed to conduct a detailed study on the feeding biology of some major endemic fishes in River Jhelum of Kashmir.

Study Sites

For the present research work four sites were chosen in main river Jhelum and Seven sites from major tributaries (figure 1) for assessing the fish catch composition, fishing effort and feeding behavior of fishes especially major *Schizothoracinae* fishes. From origin in Pir Panjal range of mountains, the river flows through the valley of Kashmir in north westerly direction till it falls into the Wular Lake near Banyari village into Baramulla district of Kashmir. After its reemergence from the Wular lake near Ningli in sopol town it takes a south westerly direction and leaves the valley through gorge near Baramulla and continues its journey through Uri at line of control before entering the Pakistan occupied Kashmir. In order to have true picture about the limnological characteristics of river and its tributaries in the



Kashmir Himalayas eleven study sites were selected for this study. The selection of the sites were done keeping in mind different types of habitats available in the system, that is fast flowing areas, slow zones as well as areas having human interferences, the sites selected are as site I (Sandran nalla), site II (river Jhelum at Batangu khanabal), site III (Lidder

Nalla), site IV (Rambiarah Nalla), site V (river Jhelum at zero bridge), site VI (Wangat tributary of sindh stream), site VII (Pohru Nalla), site VIII (river Jhelum at Gantimulla), site IX (Buniyar Nalla), site X (Nambla Nalla), site XI (river Jhelum at Dacchibridge).

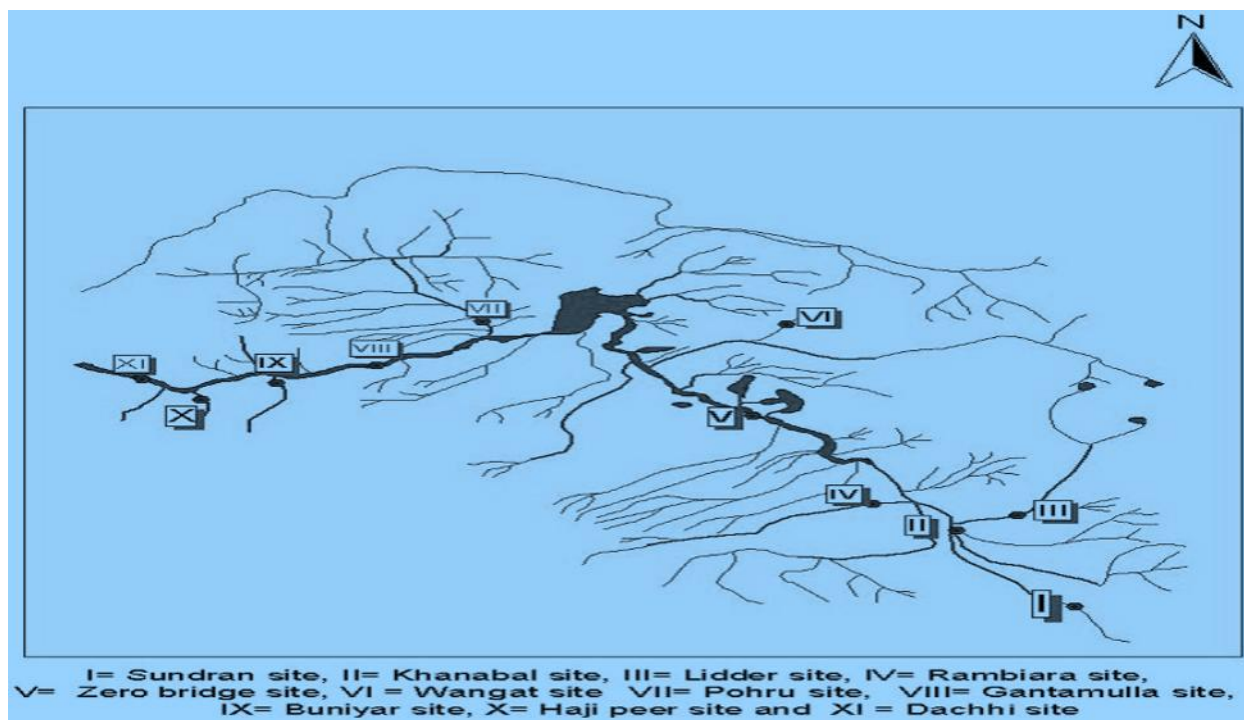


Figure 1: River Jhelum in Kashmir Himalaya showing different study sites

METHODOLOGY

Fishes were caught by cast net (with the help of local fishermen) as well as by the Electro-fisher^{14, 15}. Various morphometric parameters were noted on the spot. The data then expressed in terms of percentage value both in number and weight to assess the importance of each fish in the ecosystem. Fishing effort (total catch in terms of gms per man per hour) was done in accordance with Sunder and Subla⁸. For studying the food and feeding habits random fish samples were procured at all the collection sites. The gut contents from fore-, mid- and hind-gut were collected separately in labeled plastic tubes by flushing them out of the gut with 4% formalin. The food laden as well as empty gut was weighed in order to get the weight of the contents contained in it. The length of the gut and the weight of gut contents were noted down and the material was preserved in 4% formalin for detailed study in the laboratory. The gut contents were scrutinized qualitatively as well as quantitatively. The food items were identified up to the generic level with the help of standard taxonomic works in the field^{16, 17, 18, 19, 20}. The data was then expressed in terms of percentage value and percentage occurrence so as to assess the importance of each food item by the Index of Preponderance in accordance with Natarajan and Jhingran²¹. The volume of the food items was estimated from direct measurements using the formula given by Vollenweider²². The volume of food content like arthropods,

molluscs and fish was obtained by the displacement method. For phytoplankton the volumes of different taxa given by Wanganeo and Wanganeo²³ were utilized. In the occurrence method the number of guts containing a particular food item was expressed as a percentage of the total number of guts examined²⁴.

RESULTS AND DISCUSSION

Feeding habits of fishes play a crucial role in determining their growth, survival and reproductive success of fishes in the aquatic environment and generally no two species have a complete identity of feeding habits. However, some closely related species may occupy almost similar feeding niches within the community. The data on the food contents of the fish species inhabiting the Jhelum River System in Kashmir clearly indicates that these fishes do not have complete identity in their food items. But many of the food items available in the system are shared by more than one species. The extent of sharing of food between the different species varies from place to place in the system. As is evident from the data, crustaceans and insects are an important animal food of almost all the species investigated. Similarly, the periphytic algae formed an important component of food for most of the species. The *Schizothorax esocinus* is a typical carnivorous fish in the system devouring mainly insects, annelids and molluscs. *Schizothora labiatus* was found to be detri-omnivores as

their gut contained significant quantities of decayed organic matter, beside plant and animal items (table 1). However, the *S. niger* had a slight tilt towards the plant food (mainly macrophytic tissue) but animal matter was also consumed by the fish in significant quantities.

Schizothorax plagiostomus and *S. curvifrons* behave as herbivores in the system, the former occupying the whole length of the river system, especially the fast-flowing areas,

whereas the latter inhabits the slow flowing zones of the main Jhelum. The above inferences made on the feeding habits of the fish occurring in the Jhelum system are corroborated by the data on the relative gut lengths of the concerned fish species. The Relative gut length (RLG) calculated high as 4.61 in case of *S. plagiostomus* in the river, a predominantly herbivorous species in the river system.

Table 1: Average of seasonal food matter in different schizothoracinae Fishes

Food items	<i>S.plagiostomus</i>	<i>S.niger</i>	<i>S.curvifrons</i>	<i>S.labiatus</i>	<i>S.esocinus</i>
Plant matter	67	57	61.5	11.5	80
Animal matter	9.5	26	5.5	44	12
Miscellaneous	14.5	17	33	44.5	8

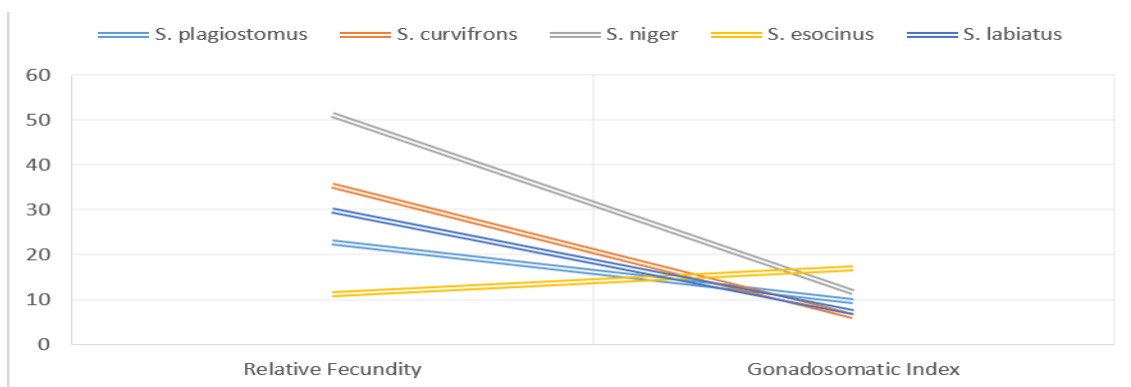


Figure 2: Relative Fecundity and Gonadosomatic Index of Schizothoracinae fishes in River Jhelum system of Kashmir Himalayas.

Table 2: Different feeding indices showing feeding behavior of Schizothoracinae fishes

Fish	Relative Gut Length	Gastrosomatic Index	Fullness index	Ponderal Index
<i>S. curvifrons</i>	2.5	7.9	4.76	0.9
<i>S. niger</i>	1.77	8.5	4.02	0.8
<i>S. plagiostomus</i>	4.61	9.26	4.78	1.1
<i>S. labiatus</i>	2.77	7.62	4.23	0.77
<i>S. esocinus</i>	1.62	5.99	3.17	0.72

Table 3: Percentage (%age) composition of different food items in some endemic Schizothoracinae fishes of River Jhelum System.

Food items	<i>S.plagiostomus</i>	<i>S.niger</i>	<i>S.curvifrons</i>	<i>S.labiatus</i>	<i>S.esocinus</i>
Animal Matter					
Zooplankton	10.75	5.25	2	5.75	1.75
Insect parts	7	5.5	7.25	56	2.2
Annelida	4.75	1.87	0.3	7	0.75
Mollusca	1.63	-	-	3.75	0.2
Others	3	2	1.75	7.5	0.5
Plant matter					
Filamentous Algae	6.5	10	7.67	2.9	8.2
Macrophytes	33.75	13	6.25	1.5	6.7
Diatoms	9.25	43	20.75	4.25	14.6
Unidentifiable	7.75	8	9.75	3.75	32
Miscellaneous items					
Fish scales	2.75	1.5	2.25	2	4
Sand, Mud and DOM	14	13	42	6.25	29.3

It is well established that the herbivorous fishes generally possess long digestive tubes and the relative length of gut (RLG) in such fish generally show values above 5. In contrast to *S. Plagiostomus*, the *S.niger* and *S. esocinus* with RLG below 2 shows their carnivorous nature. The intermediate values between these two extremes reflect the relative importance of plant and animal matter in the food of fish species. The relative Length of gut showed decreasing trend as *S. plagiostomus* > *S. labiatus* > *S. curvifrons* > *S. niger* and *S. esocinus*. The Gastro somatic index was high in *S.plagiostomus* followed by *S.niger*, *S Curvifrons* and *S. labiatus*.

The fullness index was above 4 in all the *Schizothoracinae* spp indicates that the fishes were fed properly and dissected for the experiment. The condition factor or ponderal index (length weight ratio) is a measure of fitness of fish with respect to its habitat conditions and also about the attainment of maturity, spawning behavior, feeding and growth. The value above 0.7 recorded in all endemic schizothoracinae fish states favorable environment, adequate food availability and better growth performances.

Fish fecundity and spawning which form an important aspect of fishery biology and gives the idea about the potential for development of fishery in the aquatic system. Fecundity varies from fish to fish of the same species and also from species to species. It varied considerably from 2902 in *Schizothorax esocinus* to 13462 in *Schizothorax labiatus* and generally fecundity varied with the size and gonadal development of fish. Maturation pattern of the gonads has been described from a number of fish species of the valley^{25, 26, 27}. Brown trout, *Salmo trutta fario* is an exotic fish in the valley prefers upper reaches of rivers where they find fast flowing, oxygenated and cold waters and has adapted well to the torrential zones of the various streams in the region. Gonads of the fish mature during late autumn and spawning takes place at very low temperatures during November and December. Their spawning grounds overlap with those of the migratory schizothoracines and these become great competitors of the endemic fishes. The high values of relative fecundity of some fishes *S.niger* *S. curvifrons* and *S.labiatus* indicates greater reproductive potential and better adaptation to environment however slight lower values in *Schizothorax esocinus* confirms environmental stress and poor feeding condition. (Table 2).

The Gonadosomatic index an indicator of Reproductive maturity recorded fairly good values in almost all these fishes as 17.07 in *S.esocinus* and 11.64 in *S. niger* shows advanced maturity or imminent spawning. The gonadal development of *S. niger*, *S. esocinus*, *S. curvifrons*, *S. plagiostomus* grouped in Gametogenetic group II²⁸ which includes fish showing summer and autumn gametogenesis. Detailed field survey revealed that snow trouts, *S. plagiostomus*, *S. curvifrons*, *S. labiatus* and *S. esocinus* are true lotic fishes of Kashmir and move from the main river to the tributaries for spawning which is in conformity with the findings of Yousuf²⁹.

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