As long as there is hope for conservation, never give up.

G. Ledyard Stebbins (1992)

8. PUBLICATIONS

Standard Referred Journals/Reports


Abstract

The present study was carried out in the lower middle Western Himalayan streams in the Indian state of Himachal Pradesh of the three river basins namely the Ghaggar, the Sutlej and the Yamuna. The main aim was to study fish assemblage structure/composition, fish diversity in different habitats and the habitat preference of the fishes. The different habitats like pools, riffles, runs and rapids were sampled over a 2 km stretch at all the sites with the help of cast net of 1cm mesh size having a diameter of 1-2 meter on a fixed day every month between mid morning and late afternoon. All the sites when broadly delineated at level-I fall into type-B except site II that is an type F stream. A total of 23 species belonging to four orders were recorded of which the cyprinids were the most dominant group. According to Shannon-Weaver diversity index, the pool habitat supports greater diversity (H' = 0.72-0.97). Runs (H' = 0.24-0.87) and riffles (H' = 0.22-0.81) have diversity very near to each other at all the sites whereas rapids have significantly lower fish diversity (H' = 0.00-0.58) The pool is the preferred habitat for most of the cyprinid fishes recorded in the present study especially the minnows.

Abstract

Clean water is the need of the day. The water quality of rivers varies from time to time and place to place due to local factors. This paper gives an overview of major changes to stream morphology and water quality in the Western Himalayan streams. Clearing and construction on the riverbed and flood-prone area directly alter the stream morphology. Most of the rivers have been unmindfully used for disposal of domestic and industrial waste; for example the river Ganges which was considered as the embodiment of purity today is amongst the most polluted rivers of the world. The Himalayas are rich in water resources and it has been observed that the habitat in the streams/tributaries of Himalayas has been degraded due to several factors e.g. construction of dams, canalization, tourist activities, extensive road construction and industrialization (especially in the foothills). The consequences of human activities are a change of quality and quantity of surface water characteristics. One of the most extensive anthropogenic effect on the river is the modification of natural flow (Praser, 1972; Ward and Stanford, 1983) and resulting degradation of habitat (Bain et al., 1988). The impact of physical changes in river basin by canalisation and water withdrawal has also been studied by Petts and Calow, 1996a,b. Cowx and Welcomme (eds.) (1998), has categorized human impacts into two categories: Direct Impacts and Indirect Impacts. Direct impacts are dams and barrages, land drainage, industrial and urban use, recreation and transport. Indirect impacts are agriculture, forestry, civil works, extraction industry, manufacturing industry and urbanization.


Abstract

The Himalayas are the main watersheds in the Indo-Gangetic region having numerous rivers/streams, lakes and reservoirs. The Western Himalayas faces a serious water crisis on account of the low inflows, which are the least in the last fifteen years on account of lowest snowfall received this season (2001). This may well possibly be the endorsement of global warming. The China’s dam project due to begin in 2009 by nuclear explosions
in the Himalayas will seriously disturb the ecology and also the fate of large
dams like Tehri in the fragile and seismically active Himalayas. The dams
whether big or small lead to the loss of endemic fish fauna, the classic
example being the Gobindsagar reservoir where the catch of the exotic silver
carp have risen from a mere by 2% in 1978 to almost 84.73% in the year
1997-98. The paper also stresses the need for fish ladders in all the dams.

❖ Johal, M.S., Tandon, K.K., Rawal, Y.K., Tyor, A.K., Banyal, H.S. and
Rumana, H.S. 2001. Species Richness of Fish in Relation to

Abstract

The number of fish species in a particular kind of stream is considered
to be related to a definite habitat, e.g. pool, run, riffle, rapid or cascade,
Information is available on the fish communities in different kinds of hill
stream habitats and there is an agreement that the fish biodiversity occurs in
the descending order of pool, riffle/run and rapid.

For the present study, twenty-three sites of four river systems, namely
the Beas, the Sutlej, the Yamuna and the Ghaggar (each having a stretch of 3-
4 km) were sampled at monthly intervals to study the fish diversity during the
period August 1998 to September 1999.

The abiotic factors like water temperature, total alkalinity, TDS,
conductivity, total hardness, dissolved oxygen (D.O.), chlorides, nitrates,
phosphates, turbidity and pH were studied every month for each stream. Out
of these, water temperature, conductivity, pH and D.O. were analysed on the
spot using multiline P-4 water analysis kit (E-merck). TDS was determined
with the help of TDS scan (E-merck). Rest of the parameters were analysed
according to the standard methods as given by American Public Health
Association (APHA, 1998). Longitude, latitude and altitude were determined
with the Magellan Trail blazer XLGPS system. Water current was determined
by Environmental Measurement and Controls digital current meter. The fishes
were caught with the help of a cast net of 1-2 m diameter of mesh size of 1cm
with iron sinkers. In addition, hand net, scoop net and drag net were also
used. The sampling was done between mid morning and late afternoon on a
fixed day every month during the period August 1998 to September 1999. The
representative specimens of different fish species were preserved in 10%
formaldehyde solution and then identified in the laboratory using standard references.

During the period of study a total of 36 species were recorded. Of these, *Barilius* spp., *Puntius* spp., *Crossocheilus latius diplocheilus*, *Garra gotyla gotyla*, *Tor putitora*, *Schizothorax richardsonii*, *Schistura* spp., *Salmo trutta fario* and *Salmo gairdnerii gairdnerii* are very common. However, species richness vs abiotic factors has been calculated on the basis of the number of species available at each site. By using the method of least squares and Karl Pearson, the regression equation, coefficient of correlation and standard deviation values were calculated using SPSS computer program (version 7.5).

Table 1 lists the details of each stream, log of fish species richness and habitat types. Table 2 gives the correlation coefficient and regression equation for species richness and the various abiotic factors. The high correlation between species richness and factors like water temperature, total alkalinity, TDS and conductivity became apparent. There is moderate correlation between species richness on one hand and total hardness and pH, on the other. Altitude, water current and D.O. showed negative correlation with species richness, whereas the factors like turbidity and chlorides showed very poor negative correlation. On the other hand, nitrates and phosphates exhibit very poor positive correlation with species richness.

A decline in the number of fish species occurs with the increase in altitude as shown in Table 3. It has been observed that those streams which are rich in *Tor putitora* have an abundance of various species of *Barilius*, because these constitute the food of the fish. Exceptions to the above classification may occur. It is, thus, concluded that the level of species richness is dependent on the abiotic factors like temperature, total alkalinity, TDS, conductivity, total hardness, pH, altitude and water current. However, the importance of habitat type, pollution level and human activities cannot be ruled out.

Extended Abstracts/Abstracts

Abstract

Schizothorax richardsonii is an inhabitant of fast flowing hillstreams of middle and upper reaches of Western Himalayas. As a measure of adaptation to hillstream environment, the mouth is inferior with fleshy lips and greatly strengthened sharp and cutting jaws. The lower lip is modified into a suctorial disc, which forms an efficient adhesive organ.

Light microscopic studies have been carried out in the past to study the adhesive apparatus of the Glyptothorax telchitta, Glyptothorax pectinopterus and Psudochenesis sulcatus. Recently, SEM investigations on a few hillstream fishes namely Garra gotyla gotyla and Glyptothorax garhwali were carried out in order to understand the adhesive apparatus of these fishes in a better way. The present work deals with the detailed investigations on the adhesive organ of Schizothorax richardsonii, which is formed by the lips. In order to understand the details of the upper lip, lower lip and the callous pad, SEM studies were conducted. The adhesive apparatus of Schizothorax richardsonii is divided into the anterior lip fold (ALF) above the mouth which is fringed, posterior lip fold (PLF), posterior margin of the disc (PMD) and in between PLF and PMD, there is present callous pad (CPD). ALF, PLF and CPD have a rough surface but not as rough as that of PMD. All these structures are the modifications of the free upper epithelial cells.

The anterior lip fold (ALF) consists of raised layers of irregular cells. There are present lobules like structures having opening at its top. The lobules present on the ALF are of varying sizes (30-57 μm) and shapes. The epithelial cells at the base of each lobule are arranged in a circular fashion in the form of flakes. Lobules probably provide the mechanism of adhesion. In hillstream fishes like Glyptothorax garhwali, Garra gotyla gotyla, there are present long spiny structures, which get entangled with the rough surface of the substratum forming a “hand in glove” mechanism. The lobules probably are performing the function of spines here.

The posterior lip fold (PLF) and callous pad (CPD) has rows of raised cells of irregular shapes having numerous fingers like projections called microvilli. The occurrence of a fine network of microvilli on the epithelial cells indicates the multifunction as it performs the functions of absorption and scrapping of food.

-223-
On posterior margin of the disc (PMD), there are present 3-4 rows of tubercle (T) in a linear fashion. The size of each tubercle varies from 130µm-200µm. Each tubercle on PMD consists of loosely arranged epithelial cells. Inter tubercle space (ITS) is covered by irregular double walled tile shaped epithelial cells of various shapes i.e. hexagonal, elongated or club shaped and the size varies from 10-24 µm.

The surface of epithelial cells is thrown into several micro ridges (MCR) which increases the absorptive surface. Between the cell walls of adjacent epithelial cells (EC) there are present mucous pores (MP) of size 0.75µm. Mucous decreases the impact of friction between adhesive apparatus and rough substratum.

From the structural and physiological significance of the above structures, it is inferred that PLF, ALF, PMD and CPD not only act as help in anchoring the fish to the substratum which is not a smooth surface but also performs other functions. Therefore in case of *Schizothorax richardsonii*, adhesive organ is a modified structure and should be called as Anchoring Organ.


Abstract

*Glyptothorax garhwali* is an extremely specialized fish inhabiting the fast flowing hillstreams of Western Himalayas. The most important characteristics in response to the harsh water current coupled with a variety of substrate is the integumentary modification in the form of an adhesive disc which have become a life saving kit for this fish. Very few attempts have been made by workers to describe these modifications. Light microscopic investigations were done on *Glyptothorax telchitta, Pseudochenesis sulcatus* and *Glyptothorax pectinopterus*. In the present case, lateral folds of skin just above the adhesive disc and a portion of the adhesive disc were subjected to
SEM investigations. Numerous mucous pores with mucous glands which were placed quite randomly were observed in the lateral folds of skin. The primary purpose of these being the secretion of mucous. The mucous pores have a highly porous mucous gland. These spread their secretion over the whole surface with the help of a complex system of canaliculi.

The adhesive disc under SEM shows numerous long hook shaped spiny structures (LHS). These are all epidermal growths. These aggregations of LHS's are present all around the central pit, interspersed with mucous pores. These spiny structures get entangled themselves with the rough surface of the small boulders/stones. The hooked spiny structures along with mucous glands presents the most advanced case of morphological adaptation. What seems to be the case here is that mucous is secreted on receiving the necessary stimuli from surroundings, providing a sort of platform in the form of a feeble adhesion for a secondary adhesion of spines with the rough surface of the substratum. There may quite well be a possibility that these two (mucous glands and LHS's) may be complementing each other simultaneously.


**Abstract**

The streams have been classified into A, B, C and F types based on channel slope (gradient), shape, pattern and bed material. The habitat structure varies from predominating riffle-pool morphology in the lower reaches to the dominating rapids in the upper reaches where the water current and the water volume are tremendous. However, the narrow channels with high gradient and less of water volume have typical step-pool morphology. The lower reaches have further two types of channels: entrenched and those with a large flood prone area. The dominance of a particular kind of habitat i.e. pools, rapids, runs, riffles and cascades, determines the type and diversity of fish species.

**Abstract**

Scale structural patterns are a very practical and significant means of determining the age of a certain fish. Actually, every year one ANNULUS is added to a scale. Besides annulii, circulli, radii and other indications are imprinted on the body of a scale. These provide very important clues towards the life history of a fish. In the present research paper, authors have attempted to focus on these point only.


**Abstract**

The Himalayas have always been a subject of great interest to the people all around the world. The towering mountains and rivers and streams flowing through them are largely unexplored. Himachal Pradesh, which lies in the Western Himalayas, has a number of streams flowing through different climatic zones and support a diverse fish fauna. The fish is a reflection of the health of the stream. This paper underlines the threats being faced by the hillstream fishes and the need to protect the aquatic biodiversity.