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Food and feeding habits of fishes inhabiting different water bodies of Kashmir: A review

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Abstract

The valley of Kashmir is a beautiful piece of land located between the Great Himalaya and Pir Panjal Mountains in the Northern India. The Kashmir valley is blessed with rich aquatic resources inhabiting diverse fish fauna comprising of indigenous and exotic species. Food and feeding habits of fishes inhabiting different water bodies of Kashmir has been investigated by many researchers. The present study is an attempt to review the studies on feeding habits of fishes inhabiting different water bodies of Kashmir.

Keywords: Kashmir, feeding habits, fishes, water bodies

Introduction

Food is an essential component of an organism as its growth, development, reproduction and other physiological activities are dependent on the energy generated by the consumed food material. Feeding is an important physiological activity of fishes like other living organisms. The study of food and feeding habit of fishes is an area of continuous research as it forms the basis for the development of a successful fisheries management programme on capture and culture fisheries (Oronsaye and Nakpodia, 2005) [13]. Jhingran (1983) [29] stated that the natural food of fishes are classified under three groups (i) Main food (ii) Occasional food and (iii) Emergency food (M R Manon, 2011) [3]. According to Parihar (2016) [33] the importance of studying food and feeding habit of fish can help in devising a suitable programmes for the development of fisheries [15]. According to Adewumi and Amoo (2014) [34] study on food and feeding habits of fish can provide valuable data for formulation of artificial feed for the species during culture and for proper management of the fish¹⁴. Unrevealing food and feeding habits of fishes is the centre of research in aquatic biology, ecology, conservation biology and fisheries. Considerable attention has been paid by many workers to study food and feeding habits of fishes inhabiting in different ecosystems. Notable contributions have been made by Mookerjee and Das (1945) [32] on the carnivorous and herbivorous fishes, Mookherjee and Mazumder (1946) [35] on the life- history, breeding and rearing of *Anabas testudineus*; Jhingran (1966) [36] on *Setipinna phasa* and *Gudusia chapra*, Sehgal (1966) [37] on *Labeo calbasu* (Ham.), Tang (1970) [38] on different culturable species in the ponds of Taiwan, Chiang (1971) [39] on *Hypophthalmichthys molitrix* and Qasim (1972) [40] on some marine fishes. Spataru (1977) [41] studied the food habits of silver carp, Datta and Das (1983) [42] on flat fish, Lubzens *et al.* [43], (1984) on *Cyprinus carpio*, Dev (1994) [44] on food selection and electivity indices of the Thai barb *Puntius gonionotus*, Mahapatra *et al.*, (2002) [45] on exotic Cyprinid, *Aristichthys nobilis*, Narejo, N. T. (2006) [46] on food and feeding habit of *Gudusia chapra*, Islam *et al.*, (2006) [47] on the seasonal variations in diet of Wallago attu; Mondol *et al.*, (2005) [48] on food and feeding habits of *Puntius gonionotus*; Begum *et al.*, (2008) [49] on the food and feeding habit of an estuarine catfish *Mystus gulio*; Sarkar and Deepak (2009) [50] on the diet of clown knife fish *Chitala chitala*; Hanjavanit and Sangpradub (2009) [51] on examination of gut contents of three species of freshwater fishes from Nong Han Kumphawapi, Thailan. Many workers have conducted extensive research on food and feeding habits of Kashmir.

The valley of Kashmir is known for its beauty and charm all over the world and is one of world's best tourist destinations. The Kashmir valley is blessed with plenty of aquatic ecosystems inhabiting rich fisheries resources. The aquatic resources comprises of rivers, lakes, streams and other water bodies. The river Jhelum flowing through the major towns of the valley is known as life line of Kashmir. Kashmir is also rich in lake resources.

The important lakes are Wular, Dal, Manasbal, Nageen etc. Some high altitude lakes are Gangabal, Kishansar, Gadsar, Tarsar, Marsar, Sheshnag, Kounsernag, Nilnag and Alipathar. Many streams flowing through different regions of Kashmir are Lidder, Bringi, Erin, Sind, Madhumati, Rambiar, Farozpora and Pohru.

Feeding habits of Kashmir fish has been attempted by a number of workers (Malhotra, 1966; Das and Subla, 1969^[17]; Subla and Das, 1970^[16]; Jan and Das, 1970^[23]; Jyoti and Malhotra, 1975^[18]; Raina, 1978^[19]; Sunder, 1984^[10]; Sunder *et al.*, 1984^[10]; Sunder and Subla, 1985^[20]; Yousuf and Pandit, 1992^[21]; Kulkarni *et al.*, 1994^[25]; Yousuf and Firdous, 1997^[22] and 2001; Yousuf *et al.*, Koops *et al.*, 2004^[26];; Bhuiyan *et al.*, 2006^[27], Shaheena Shafi *et al.*, 2012^[9].

Subla (1967)^[28] studied the structure of the feeding apparatus of four fishes: *Cyprinus carpio specularis*, *Oreinus plagiostomus*, *Schizothorax socinus* and *Nemachilus stoticzkae*. The first three being herbivorous with edentulous buccal cavity, having well developed tongue, filter feeding mechanism formed by interdigitating gill – rakers.

Das and Subla (1969)^[17] while studying feeding habits of fishes of Kashmir found that feeding mechanism in fishes varied highly depending on the type of food whether herbivores, carnivores and omnivores and mode of feeding. Besides they gave an illustrated account of the mechanisms of jaws and the associated skull bones, along with the muscles.

Jan and Das (1970)^[23] studied in detail the food of some Kashmir fishes and found a definite periodicity in the intake of food in different seasons of these fishes, which depends on the availability of the food material in nature. The food spectra of commercially important fishes was extremely useful for determination of niches in fish biome.

Food and Feeding habits of fishes inhabiting River Jhelum

River Jhelum is the major water resource of valley of Kashmir. Originating from Verinag spring in South Kashmir, river Jhelum flows through the major towns of Kashmir before entering into Pakistan. While flowing through the valley, many streams merge into river Jhelum. River Jhelum also is loaded with large quantities of sewage and agricultural runoff from the catchment.

R. K. Langer 1985^[2] investigated the Food and Feeding habits of *Schizothorax longipinnis* heckel from river Jhelum. The study was conducted by observing the gut contents of 225 fishes. The species is found to be illiophagic and herbivore in nature, chiefly feeding on decayed organic matter (54.2%), sand and mud (25.7%), food of plant and animal origin (20.1%).

Food and feeding habits of fishes inhabiting Dal Lake

Dal Lake is also an important water body of Kashmir located in the Srinagar City. Dal lake is 2nd largest lake of the Kashmir next to Wular Lake. The Dal Lake (34°-06'N, 74°-45'E) is an urban Lake located to the east of Srinagar city, at the foot of Zabarwan Hills, and is situated at an average elevation of 1583 m above mean sea level. The lake covers an area of 18 square kilometers with a shore line of the lake, about 15.5 kilometres. Dal lake also hosts variety of fish species including indigenous *Schizothorax* and exotic *Cyprinus carpio*.

Gut content of *Cyprinus carpio specularis* inhabiting Dal lake were analysed by S. Sunder, K. Kumar and H. Raina in 1984^[10]. The study revealed that *Cyprinus carpio specularis* Linnaeus, is mainly a bottom feeder, all the sizes chiefly

feeding on decayed plant matter. Other important items found in the gut, in the order of importance, are diatoms, algae and desmids and Crustacea. The feeding intensity is in summer, while, in winter, the feeding is minimum.

A study conducted on food and feeding habits of *Cyprinus carpio* inhabiting Dal lake by Shaheena Shafi *et al* in 2012^[9] revealed that on an average, decayed organic matter (detritus) formed 45% of total food, while the remaining food consisted of both plant and animal matter. Arthropods and macrophytes formed the main or basic food, whereas, oligochaetes, protozoa, rotifers and algae constituted its secondary food. The molluscan and fish remains formed the incidental food. On the basis of gut content analysis, the fish was designated as detri-omnivore. Gastroscopic index (Ga.S.I.) recorded highest value in July, while lower values were recorded in February (Shaheena Shafi *et al.*, 2012)^[9].

Food and feeding habits *Cyprinus carpio* of Dal lake were investigated by Gulzar Naik in 2015^[4]. The results obtained by analysing the gut contents of common carp showed that on an average basis, detritus formed 43.5% of total food, while the remaining food (56.5%) consisted of plant (31.21%) and animal matter (25.29%) (Gulzar Naik *et al.*, 2015)^[4]

Food and Feeding habits of fishes inhabiting Wular lake

Wular lake is India's largest freshwater lakes spreading its territories within Baramulla and Bandipora districts of Kashmir located in between the towns of Bandipore and Sopore approximately at a distance of 60 kilometers from the Srinagar city stretching from latitude 34°16'- 34°26'N to Longitude 74°33'-74°42'E. According to the Directory of Wetlands of India (MoEF, 1990)^[31], the area of Wular lake is about 189 Sq Km and the lake lies at an altitude of 1,580 m above mean sea level. Being the large reservoir of water, Wular Lake is an important resource for fisheries. Wular Lake contributes 60% of total fish production to the state of Jammu and Kashmir. (Neha W. Qureshi *et al.* 2014)^[5, 6].

The study conducted by Neha W. Qureshi, Nitesh V. Kadtan and Jitesh V. Keshavein 2014^[5, 6] indicated that feeding habits of different species differ in wular lake (Neha W. Qureshi *et al.*, 2014)^[5, 6]. The *Schizothorax niger* was found to be illiophagic herbivore consuming bottom detritus. The *Schizothorax curvifrons* was found as illiophagic herbivore. The *Schizothorax lonhipinnis* was found as herbivore detriphage. *Schizothorax micropogon* was found as herbivore bottom feeder. Similarly *Schizothorax ecocinus* was observed as herbivore bottom feeder. *Schizothorax richardsonii* was found as typical herbivore bottom feeder on rocks and stones and *Cyprinus carpio* was found as to be consuming detritus at bottom sediments.

Food and Feeding habits of fishes inhabiting Lidder Stream

The Lidder stream flowing through Pahalgam is world famous tourist destination. The Lidder originates from the high altitude glacier fed Lake Sheshnag, Tarsar and Kolhai glacier. *Schizothorax plagiostomus* is the dominant fish in river Lidder. Fish is locally known as khont and is highly preferred food fish in Kashmir and has an edge over the exotic trouts, because of its taste and good nutritional value.

Muddasir Jan, Neelofar Jan and Imtiaz Ahmed conducted a study on food and feeding habits of *Schizothorax plagiostomus* from Lidder stream in 2018. During the analysis it was observed that the fish is benthic herbivorous. Its food mainly consists of plant matter 62.02%. A good amount of

miscellaneous food items i.e. mud, sand and detritus 31.01% was also present in the gut of fish along with small quantity of animal food 6.97%. Overall it was concluded that diatoms formed an important constituent of food of *S. plagiostomus* in all months of the year and the presence of detritus, mud and sand indicates that the fish is a detritivorous, bottom feeder (Muddasir Jan, 2018)^[1].

Food and Feeding habits of fishes Nigeen lake

Nigeen Lake (also spelled as Nageen Lake) located in Srinagar is considered as mildly eutrophic lake. It is sometimes considered a part of the Dal lake and is connected to it via a narrow strait.

K. K. Sabha *et al.* investigated the food and feeding habits of *Schizothorax niger* inhabiting Nigeen lake in 2017. *Schizothorax niger* inhabiting Nageen lake of Srinagar has been found to be herbivorous fish, feeding mainly on green algae, plant fragments, diatoms, detritus, unrecognizable matter (sand/silt, fish scales, ropes) (K. K. Sabha *et al.* 2017)^[7].

Food and Feeding habits of fishes Manasbal lake

Manasbal Lake is located about 30 km north of Srinagar city. It is predominantly surrounded by villages. The lake has an area of 2.81 Km² and is located on 34°15'N 74°40'E coordinates. Manasbal is classified as warm monomictic lake and circulates once in a year for a short time. The lake has no

major inflow channels and the water supply is maintained through spring water inflow and precipitation. An outlet channel connects the lake with the Jhelum River.

A.R Yousf and Gazala Firdous conducted a research to investigate the food and feeding of *Cyprinus carpio specularis* inhabiting Manasbal lake in 2001^[30]. The detailed study of gut contents revealed large quantities of detritus throughout the year, with a range of 36.96% in May and 74.02% in February. The plant material formed about 15.05% of total gut contents. The animal material contributed on average 14.32% of the gut contents.

Food and Feeding habits of fishes inhabiting other water bodies

Sunder and Subla (1985)^[24] investigated food of juveniles of *Schizothorax curvifrons* from Bringhi stream in Kashmir and described its planktophagous nature of feeding.

A.R Yousuf (2003)^[12] studied food and feeding habits of *Glyptosternon reticulatum* from different streams of Kashmir. The streams covered under study were Lidder stream at Pahalgam, Wangat Nalla at Narayan Nag, Boniyar nalla Slamabad Uri and Haji Peer Nalla at Nambla Uri. The study revealed that *Glyptosternon reticulatum* is a benthophagic carnivore feeding exclusively on benthic insects. Trichoptera constituted the major component of the diet followed by Ephemeroptera and Diptera (A.R Yousf *et al.*, 2003)^[12].

Table 1: Feeding Habits of Fish Species of different water bodies of Kashmir

Authors	Water body	Fish species	Feeding habits
S. Sunder, K. Kumar and H. Raina (1984) ^[10]	Dal lake	<i>Cyprinus carpio specularis</i>	Detritivorous Bottom feeder
R. K. Langer (1985) ^[2]	River Jhelum	<i>Schizothorax longipinnis</i>	Illioiphagic and herbivore
Sunder and Subla (1985) ^[24]	Bringhi Stream	<i>Schizothorax curvifrons</i>	Planktophagus
A.R Yousf and Gazala Firdous (2001)	Manasbal lake	<i>Cyprinus carpio specularis</i>	Detritus
A.R Yousuf (2003) ^[12]	Lidder stream at Pahalgam, Wangat Nalla at Narayan Nag, Boniyar nalla Slamabad Uri and Haji Peer Nalla at Nambla Uri	<i>Glyptosternon reticulatum</i>	Banthophagic carnivore
Shaheena Shafi <i>et al.</i> (2012) ^[8]	Dal lake	<i>Cyprinus carpio</i>	Detritus feeder
Neha W. Qureshi <i>et al.</i> (2014) ^[5,6]	Wular lake	<i>Schizothorax niger</i>	Illioiphagic herbivore
Neha W. Qureshi <i>et al.</i> (2014) ^[5,6]	Wular lake	<i>Schizothorax curvifrons</i>	Illioiphagic herbivore
Neha W. Qureshi <i>et al.</i> (2014) ^[5,6]	Wular lake	<i>Schizothorax lonhipinnis</i>	Herbivore detriphage
Neha W. Qureshi <i>et al.</i> (2014) ^[5,6]	Wular lake	<i>Schizothorax micropogon</i>	Herbivore bottom feeder
Neha W. Qureshi <i>et al.</i> (2014) ^[5,6]	Wular lake	<i>Schizothorax ecocinus</i>	Herbivore bottom feeder
Neha W. Qureshi <i>et al.</i> (2014) ^[5,6]	Wular lake	<i>Schizothorax richardsonii</i>	Herbivore bottom feeder
Neha W. Qureshi <i>et al.</i> (2014) ^[5,6]	Wular lake	<i>Cyprinus carpio</i>	Detritus at bottom sediments
Gulzar Naik (2015) ^[4]	Dal lake	<i>Cyprinus carpio</i>	Detrito-omnivore
K. K. Sabha <i>et al.</i> (2017) ^[7]	Nigeen lake	<i>Schizothorax niger</i>	Herbivorous fish
Muddasir Jan, Neelofar Jan and Imtiaz Ahmed (2018) ^[1]	Lidder Stream	<i>Schizothorax plagiostomus</i>	Detritivorous, bottom feeder

Conclusions

The review of feeding habits of fishes from Kashmir suggests that majority of fish species inhabiting in Kashmir are detritivorous herbivore. The exotic *Cyprinus carpio* seems to be consuming wide variety of food material as compared to indigenous *Schizothorax species*. *Glyptosternon reticulatum* inhabiting different streams of Kashmir is only reported carnivore species.

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