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Ichthyofaunal Diversity at The Junction Between River Swat and River Panjkora in Bosaq: A Health Perspective

Original Article

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Abstract

This study was conducted at the Government Degree College in Batkhela, District Malakand, focused on exploring and documenting the fish species in the Swat River, a crucial waterway in the Khyber Pakhtunkhwa region of Pakistan.
Six different fish species were collected from the Swat River, representing families such as Channidae, Cyprinidae, and Bagridae, including *Channa punctata, Schizothorax spp, Cirhinus molitorella*, *Eurasian Carp* (Cyprinus carpio) and *Rita rita.* These species were preserved using freezing and drying methods to ensure the integrity of the samples. Identification was carried out with the aid of scientific literature and expert guidance, ensuring accurate classification. The results identified six distinct species, reflecting the river's rich biodiversity and providing a baseline for future ecological monitoring. For instance, Channa punctata demonstrated adaptability in its diet and habitat, while *Schizothorax spp* highlighted the river's ability to support highland fish species. This study represents a comprehensive effort to document and understand the fish species of the Swat River, emphasizing the river's ecological importance and the need for ongoing conservation efforts. The methodologies employed, from collection to identification, were rigorous and thorough, ensuring that the findings are both accurate and meaningful for future research and environmental management.

Keywords: River Swat, Fish Diversity, *Channa Punctata, Schizothorax Spp, Eurasian Carp.*

Introduction

Fish are defined as the scaled aquatic craniates that have gills and no limb digits and are therefore considered paraphyletic because they did not arise from a common stock (Nwaigwe, 2017). Fish is a general term used to refer to sea animals which are very vital in many areas of life including food, water bodies and economy (Jennings *et al*., 2016). They can be classified into major groups: These are Agnatha or the jaw less fish, Chondrichthyes or the cartilaginous fish and Osteichthyes or the bony fish. Agnatha has hagfish and lampreys and in the fish, there displayed no jaws or paired fins. Some other members of Chondrichthyes are souls and rays and possess Chondrichthyes endoskeleton and a common characteristic of skin is placoid scales. Osteichthyes is the largest division characterized by bony skeleton, and includes fish such as salmon and trout and the coelacanths and the lung fishes (DeLaurier, 2019). Certain fish adapt to the topography of the ground, and such attributes are as follows: they have smooth, slender and elongated shapes. It has several kinds of fins they employ for maintaining stability, adjust its position and or movement or to propel the robot. Scales also help in protection and minimize abrasion while in water and it has four types of scale namely: Among them the most known forms are cycloid, ctenoid, placoid and ganoid. Mouth position is different as concerning feeding habits while gills help in respiration process in the sense that it filters oxygen from the water (Diana and Höök, 2023). Fish species may participate in different organizational levels of the basic groups, are predators as well as prey, are included in nutrient recycling and play a several times crucial role in habitat construction. As for two production factors, fish contribute employment and income in fisheries and aquaculture and to some extent in tourism through recreational fishing. In terms of the nutritional value, fish is amongst the most efficient bio chains of quality proteins, lipids including omega three fatty acids, vitamin D and B12, iodine and selenium to mention but a few (Gebrekiros, 2016). Fish compromises major parts of the world's aquatic systems and they belong to one of the many groups of vertebrates. They form a source of the human protein requirement and as their production through fishery and aqua culture increases, they as well increase the food security (Aragão *et al*., 2022).

Diversity has two aspects, these include the species richness, which is the number of species as found in the study area and species evenness meaning population. More than 27,977 species of fish, which is subdividing into 515 families and 62 orders are known to exist (Popoola, 2022). Pakistan possesses a rich source of fresh water and marine fish where freshwater fish is comprised of more than one hundred and seventy-one folios. Tropical to subtropical river fish populations are intimately connected regarding the degree of total richness within a river system. Asian region has number of large basins for growth and nesting of fish (Afzaal *et al*., 2022). The dynamics of these river ecosystems are attributed to fluctuations in water level that are occasioned by fluctuations in rainfall in nesting and growth habitats. This leads to new configuration in the structure of fish community morph; this is always an implication of the effects of change in the internal environment of the ecosystem: species, interaction with foods and the movements of fish (Zentall, 2022). Many of the lotic water fishes have a breeding season on flood and migratory movement upstream during rainy and downstream during the dry season is common. Of them some of them are highly useful economically and these are used for food purposes, like ornamental plants and some even used in medical complications. A blog about world's largest earth and rock filled dam Tarbela Dam and six barrages Jinnah, Chasma, Taunsa, Guddu, Sukkur and Kotri constructed on Sangul Indo River in Pakistan. Other samples are the following: India 951, China 1643, Iran 277, Bangladesh 250 & Afghanistan 128 (Mikkola, 2024). The Pakistani freshwater fisheries consist of no less than 193 species fish. But more than one hundred and fifty fishes are recorded in the Indus River of Pakistan. Many factors some of which are loss of habitats, farming and industrialization, over fishing, water pollution and change of water regime through water diversion and construction of dams are threatening the future of fish stocks in both fresh and marine water resources in many areas of the globe (Mohsin *et al*., 2021).

Khyber Pakhtunkhwa – Pakistan. The district is bounded by a mountain wall and covers a total expanse of 2973 meters, consisting of largely hilly and less populated area located in the eastern side of the Indus River. Kohat city benefitted with two dams namely Tanda and Ghandiali for fishing as these two dams have abundant of many fish species which are adorable for hunting the fishing sport in Asia pacific region. It is an important town of Kohat district of Khyber Pakhtunkhwa province in the Islamic Republic of Pakistan. This town is located to the north of Kohat City and it is in this town that the Ghandiali Dam is found (Rehman *et al*., 2015).

Sea fish are available in all provinces and all the provinces can be divided into marine and freshwater provinces. It has a huge stretch of coast line on the Arabian Sea and hence a lot of marine life in the sea apart from having many rivers, lakes and reservoirs that hold a number of fish species (Samoilys *et al*., 2015). Among them some those fishes are found in the Swat River of Swat Valley in Khyber Pakhtunkhwa province of Pakistan where the water temperature is comparatively cold and the water is clear (Haseeb *et al*., 2015). This study aimed to identify Ichthyofaunal diversity at the junction between River Swat and River Panjkora.

Literature Review

Sibanda *et al.* (2023) examined that, A species of fish in the cyprinid genus Labeo is the *redeye labeo*, also known as the African carp (*Labeo cylindricus*). It is a freshwater fish that only lives in the rivers of East Africa, including the Pongola River and the Limpopo, Komati, and Zambezi Rivers. It also lives in the middle and upper Congo Rivers. The species is also found in lakes and dams over rocky areas, but it prefers clear, flowing waters in rocky river habitats. It eats the rocks' diatoms and other small algae. It uses its mouth and large pectoral fins to climb the damp surfaces of barrier rocks and river weirs in its mass migration upstream for breeding.

Perera *et al.* (2020) reported that, the *Channa punctatus*, commonly known as the spotted snakehead, is a freshwater fish species that belongs to the family Channidae. This species is widely distributed in South and Southeast Asia and is known for its significant ecological, economic, and cultural importance. The following review highlights key areas of research on *Channa punctatus*, including its taxonomy, ecology, behavior, physiology, and conservation status. (Knight *et al*., 2018) explained that *Channa punctatus* is one of the most studied species within the Channidae family. It is characterized by its elongated body, rounded caudal fin, and distinctive coloration with dark spots along its body. The species is native to the Indian subcontinent, with a distribution range extending across India, Bangladesh, Nepal, and parts of Myanmar. The adaptability of *C. punctatus* to a wide range of freshwater habitats, including rivers, ponds, lakes, and wetlands, makes it a resilient species.

Bandyopadhyay (2022) determined that, *Channa punctatus* is known for its ecological versatility. It thrives in both stagnant and flowing waters, including environments with low oxygen levels due to its ability to breathe atmospheric oxygen. This species is an opportunistic feeder, with a diet comprising small fish, crustaceans, insects, and plant material. Its role as both a predator and prey within its ecosystem highlights its importance in maintaining ecological balance. Khan *et al.* (2016) examined that, *Cyprinus carpio*, commonly known as the common carp, is one of the most widespread freshwater fish species in the world. Originating from Europe and Asia, it has been introduced globally, where it plays significant roles in aquaculture, fisheries, and as an invasive species in some ecosystems. This review summarizes the key literature on the taxonomy, ecology, physiology, behavior, and conservation of *Cyprinus carpio*. *Cyprinus carpio* belongs to the family Cyprinidae and is a highly variable species with several domesticated varieties, such as koi and mirror carp. The species is native to the rivers and lakes of Europe and Asia but has been widely introduced to other continents, where it often thrives in diverse freshwater habitats, including rivers, lakes, ponds, and reservoirs.

Rahman (2015) determined that, *Cyprinus carpio*, also known as the common carp, is a common freshwater fish found in lakes and large rivers throughout Europe and Asia. It is also known as the Eurasian carp or European carp. The species has been domesticated and introduced (see aquaculture) into environments worldwide, and it is frequently considered a destructive invasive species, being included on the list of the world 100 worst invasive species. However, the species' native wild populations are considered vulnerable to extinction by the International Union for the Conservation of Nature (IUCN). It gives the carp family Cyprinidae its name. *Cyprinus carpio carpio*, the type subspecies, is native to most of Europe, particularly the Danube and Volga rivers. In the past, the eastern Asian subspecies Cyprinus *carpio haematopterus* (Amur carp) was recognized; however, more recent authorities treat it as a distinct species known as *Cyprinus rubrofuscus*. In their pure forms, the common carp and various Asian relatives can be distinguished by traits and genetic differences, but they can interbreed. Kollar carp are the offspring of interbreeding between common carp and the goldfish (Carassius auratus). Ghost Carp is another artificial hybrid

produced by crossing common carp with Japanese Purachina Koi. Ghost carp are a popular commercial species due to their wide color range.

Materials and Methods

Area of the Study

This study was conducted at the Government Degree College in Batkhela, situated within District Malakand, and involved comprehensive research and analysis to contribute valuable insights into the local ecosystem.

Figure 1
Junction between River Swat and Panjkora.

Collection of Fish

Seven different species of fish were carefully collected from the Swat River, each representing the diverse aquatic life found in this river. The collection highlights the variety of fish species that thrive in the Swat River's ecosystem.

Preservation

After collecting fish species were preserved through a method of freezing and drying. Freezing keeps fish fresh by slowing down spoilage, while drying removes moisture to prevent bacterial growth. These methods help maintain the quality and safety of fish over time.

Identification

These fish species were accurately identified by referring to relevant scientific literature and through the guidance and expertise provided by the supervising teacher.

Results and Findings

In the current study, a total six samples were collected from the junction between river swat and river Panjkora, which were persevered and identified through some literature and with the help of teachers. There fish belong to different family including one species from family Channidae, one from Barbinae, three from Cyprinidae and one from Bagridae. The species which were collected include *Channa punctata, Schizothorax spp, Rita rita, Cirhinus molitorella. Eurasian Carp* and *Redeye labeo.*

Table 1
Seven Fish Species Names, their Families and Location of Collection.

S/No	Species	Families	Location
1	*Channa punctata*	Channidae	
2	*Schizothorax spp*	Barbinae	Junction between
3	*Cirhinus molitorella*		river Swat and river
4	*Eurasian Carp*	Cyprinidae	Panjkora
5	*Redeye labeo*		
6	*Rita rita*	Bagridae	

No.1

Channa punctata. L

Morphological Character

1. Normally grows to around 15.0 cm (5.9 in) in length, but males up to 31.0 cm (12.2 in).
2. The species is mainly a carnivore.
3. My favorite food of this species is other small fish' yolk flies and fish larvae.
4. In its natural habitat, it consumes crustaceans, mollusks, insects, small fishes, semi-digested materials and sometimes plants.
5. Its feeding habit changes seasonally.

Scientific Classification

Phylum: Chordata
Class: Actinopterygii
Order: Anabantiformes
Family: Channidae
Genus: *Channa*
Species: *C. punctata*

Figure 2
Channa Punctata (Bloch, 1793)

No.2

Schizothorax spp

Character

1. Schizothorax is a genus of cyprinid fish found in South Asia (Himalaya) and Central Asia.
2. Found in highland rivers, streams and lakes,
3. They do resemble trout's in habitus this is merely due to convergent evolution.

Scientific classification

Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Subfamily: Barbinae
Genus: Schizothorax

Figure 3
Schizothorax spp (Heckel, 1838)

No.3

Cirhinus molitorella. L

Character

1. Species of ray-finned fish in the genus Cirhinus.
2. The *Cirhinus molitorella* is a native Asian freshwater.
3. Typically, a subtropical fish.

Scientific Classification

Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: Cirrhinus
Species: C. molitorella

Figure 4
Cirhinus molitorella (Valenciennes, 1844)

No.4

***Eurasian carp* .L**

Character

1. Widespread freshwater fish of eutrophic waters in lakes and large rivers in Asia. Often considered a destructive invasive species.
2. The native wild populations are considered vulnerable to extinction by the International Union for Conservation of Nature.

Classification

Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: Cyprinus

Figure 5

Eurasian Carp (Linnaeus, 1758)

No.5

***Rita rita* .L**

Character

1. Rita is a genus of fish in the family Bagridae found in South Asia.
2. Have a single pair of mandibular barbels.
3. An elongated Weberian apparatus firmly sutured to the basioccipital and the sensory canal on the posttemporal enclosed with bone.

Scientific Classification

Phylum: Chordata
Class: Actinopterygii
Order: Siluriformes
Family: Bagridae
Genus: Rita

Figure 6
Rita rita (Linnaeus, 1758)

No.6

Redeye labeo. L

Character

1. The species prefers clear, running waters in rocky habitats of small and large rivers.
2. Also found in lakes and dams over rocky areas.
3. It feeds on diatoms and other small algae from the rocks.
4. It migrates upstream in the masses to breed, using the mouth and broad pectoral fins to climb damp surfaces of barrier rocks and weirs in the river.

Classification

Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: Labeo
Species: *L. cylindricus*

Figure 7
Redeye labeo (Linnaeus, 1758)

Discussion

This study, conducted at the Government Degree College in Batkhela, District Malakand, focuses on the ecological diversity of the Swat River, particularly the fish species that inhabit it. The research site was strategically chosen for its accessibility to the Swat River, a vital waterway in the region that supports a rich variety of aquatic life. The college's proximity to the river allowed for thorough and efficient collection and analysis of fish species, contributing to a deeper understanding of the local ecosystem. Seven different fish species were collected from the Swat River during the study, each representing a segment of the river's diverse aquatic life. This collection process was meticulous, aimed at capturing the variety of species that thrive in the Swat River. The species collected include members of the families Channidae, Cyprinidae, and Bagridae, reflecting the river's ecological richness. These species were chosen for their ecological importance and their role as indicators of the river's environmental health.

To ensure that the fish species remained in a state suitable for detailed analysis, preservation methods such as freezing and drying were employed. Freezing was used to maintain the freshness of the fish by slowing down spoilage and preserving their physical and biochemical integrity. Drying, on the other hand, removed moisture to inhibit bacterial growth, ensuring long-term preservation. These methods were crucial in maintaining the quality and safety of the samples, allowing for accurate identification and analysis at a later stage.

The identification of the fish species was conducted with precision, utilizing relevant scientific literature and the expertise of the supervising teacher. This process involved comparing morphological characteristics of the collected species with documented descriptions, ensuring accurate identification. The collaboration between literature-based research and expert guidance ensured that each species was correctly classified, providing reliable data for the study. The study identified seven species: Channa punctata, Schizothorax spp, Cirhinus molitorella, Eurasian Carp (Cyprinus carpio), and Rita rita. These species belong to different families, including Channidae, Cyprinidae, and Bagridae, highlighting the diverse fish population in the Swat River. For instance, Channa punctata from the Channidae family is known for its carnivorous diet and adaptability to various habitats. Schizothorax spp, part of the Cyprinidae family, is adapted to the highland rivers of South Asia and Central Asia, illustrating the river's diverse environmental conditions.

The presence of Eurasian Carp and Rita rita further underscores the ecological diversity, with these species contributing to the complex food web of the river. Redeye labeo was also identified, known for its preference for clear, running waters and its ability to migrate upstream to breed, a behavior that emphasizes the ecological connectivity within the river system.

The findings from this study provide valuable insights into the biodiversity of the Swat River, offering a baseline for future ecological monitoring and conservation efforts. The identification of these species, along with their morphological and ecological characteristics, contributes to a better understanding of the river's health and the factors that influence its biodiversity. The study's results can inform conservation strategies aimed at protecting these species and preserving the ecological balance of the Swat River. Moreover, this research highlights the importance of local academic institutions like the Government Degree College in Batkhela in conducting region-specific ecological studies. Such studies not only enhance scientific knowledge but also play a crucial role in informing policy decisions related to environmental management and conservation in the region.

Conclusion

This study represents a comprehensive effort to document and understand the fish species of the Swat River, emphasizing the river's ecological importance and the need for ongoing conservation efforts. The methodologies employed, from collection to identification, were rigorous and thorough, ensuring that the findings are both accurate and meaningful for future research and environmental management.

Limitations

The present study on Ichthyofaunal diversity at the junction of River Swat and River Panjkora in Bosaq is subject to several limitations that must be acknowledged. Firstly, the sampling was confined to a limited temporal scale, which may not adequately capture seasonal or annual variations in fish diversity, particularly during spawning and migratory periods. Secondly, the restricted number of sampling sites may not fully represent the spatial heterogeneity of habitats across the river junction, potentially overlooking microhabitats that support rare or sensitive species. Moreover, environmental parameters such as dissolved oxygen, turbidity, water flow, and anthropogenic pressures were not continuously monitored, limiting the ability to establish strong correlations between ecological conditions and fish assemblages.

Recommendations

Based on the limitations of the present study, several recommendations are proposed for future research and management of Ichthyofaunal diversity at the junction of River Swat and River Panjkora in Bosaq. Long-term and seasonally structured monitoring programs should be conducted to capture variations in species composition during different ecological cycles, particularly breeding and migratory seasons. Expanding the number of sampling sites across diverse microhabitats is strongly recommended to better represent spatial heterogeneity and ensure the inclusion

of rare or habitat-specific species. Incorporating continuous environmental monitoring of key physicochemical parameters such as dissolved oxygen, turbidity, temperature, and flow rate will provide deeper insights into habitat–species interactions. The use of modern molecular techniques, including DNA barcoding and environmental DNA (eDNA), should be prioritized for accurate taxonomic validation and the detection of cryptic diversity.

Declarations

Ethical Approval and Consent to Participate: This study strictly adhered to the Declaration of Helsinki and relevant national and institutional ethical guidelines. Informed consent was not required, as secondary data available on websites was obtained for analysis. All procedures performed in this study were by the ethical standards of the Helsinki Declaration.

Consent for Publication: The authors give their consent for publication.

Availability of Data and Materials: Data will be made available upon request from the corresponding author.

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