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Exploring the Icthyofaunal Diversity of River Chagharzi District Buner, Khyber Pakhtunkhwa Pakistan

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Abstract: River Chagharzi is the beautiful river flowing in the area and passing through many villages and finally falls to River Indus. A details study was conducted on the River Chagharzi in the period of April to July 2014 to study the fish fauna of River Chagharzi and to find out the quality parameters of the river. During the current study a total number of 7 fishes were collected belonging to 3 orders and 3 families, 7 genera and 7 species. These species were *Pantius spohore, Tor putitora, Crossocheilus latius, Barilius pakistanicus, Schizothorax plagiostomus, Matacembelus armatus* and *Channa gachua*. The quality parameters of the river Chagharzi were checked and were found to be suitable for the survival of the fish fauna. The fish fauna of the River Chagharzi was rich but due to the flood occur in the July 2010 results in the endangering of some species i.e. *Glyptothorax punjabensis*. The anthropogenic activities are also is plying key role in the diminishing of the fish fauna of the area. Protective measurements are required to protect the fish fauna of the River Chagharzi.

Key words: Fish Fauna · Quality Parameters · River Chagharzi · Buner

INTRODUCTION

Fishes are one of the prime important elements in the aquatic habitat and play a key role in economy of many nations [1] as they have been a stable item in the diet of many people [2].

Fishes are one important group of vertebrates which influences the life of human in various ways. Fishes have a rich source of food and provide a meat, several by-products such as fish meal, fish glue, fish oil, etc. fish diet provides proteins, fat, vitamins A, B and D, minerals like Ca, Mg, P, Na, Fe, I, etc. They have good taste and are easily digestible and growth promoting value. Considerable studies on ichthyo fauna diversity from different fresh water bodies of India have been carried out during the last few decades [3].

Fish plays an important role in the development of a nation. Besides being a cheap source of highly nutritive protein, it also contains essential nutrients required by the human body [4].

Fish constitutes half of the total number of vertebrates in the world. They live in almost all conceivable aquatic habitats. 21,723 living species of fish have been recorded, out of these 8,411 are fresh water species and 11,650 are marine [5].

There are more than 186 freshwater fish species described from freshwater bodies of Pakistan. Substantial quantities of commercially important fish are caught from rivers annually. The inland commercially significant native fish fauna comprises about 30 species of which the economically important species are: *Labeo rohita, Gibelion catla, Cirrhinus mrigala, Cirrhinus reba, Channa straita, Channa marulius, Sperata sarwari, Wallago attu, Rita rita, Bagarius bagarius, Tenualosa ilisha, Notopterus notopterus, Nemacheilus* spp.*, Tor macrolepis, Schizothorax* spp. *and Clupisoma naziri* [6].

Many researchers had valuable contribution to the fish fauna of the Khyber Pakhtunkhwa. Butt [7] reported 94 species of fishes from the whole province of Khyber Pakhtunkhwa.

The first contribution to explore the fish fauna of river swat was done by [8] who record 8 species of fish from Swat, including two new Iocohes. Two new species of fishes were added in a study by Ahmad [9]. In 1973 four new species were recorded from the swat and adjoining areas by Mirza [10]. But [7] introduced brown trout (*Slamotrutta ferio*) and rainbow trout (*Oncorhynchus mykiss*) in 1928 and 1973 respectively in their studies.

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In a study by akhtar at Manglawar Valley of river Swat, total number of 18 fishes belonging to 3 orders and 3 families were recorded. These species were *Barilius pakistanicus, Barilius vagra, Cirrhinus mrigala, Crossocheilus diplocheilus, Cyprinus carpio, Garra gotyla, Glyptothorax cavia, Glyptothorax punjabensis, Glyptothorax sufii, Labeo rohita, Mastacembelus armatus, Puntius sophore, Rasbora daniconius, Salmophasia bacaila, Salmophasia punjabensis, Schizothorax plagiostomus, Tor macrolepis* and *Tor putitora* [11].

In district Buner study on fish fauna was carried out in river Barandu district Buner by Saeed and his worker, who reported total 11 species belonging to 3 order and 4 families. These Species were *Barilius pakistanicus, Triplophysa naziri, Tor putitora, Crossocheilus latius, Schizothorax plagiotomus, Channa gachua, Gara gotyla, Glyptothorax punjabensis, Matacembelus armatus, Puntius sophore* and *Schistura punjabensis* [12].

The current study was conducted to explore the fish fauna of river Chagharzi district buner Khyber Pakhtunkhwa, Pakistan. Keeping in view the facing threats to fish fauna of district buner the current study was conducted with the following aims and objectives:

- To explore the fish fauna of river Chagharzai
- To find out the population abundance of fish fauna in river Chagharzi
- To elucidate the threats to the fish fauna of river Chagharzi

MATERIALS AND METHODS

Introduction to District Buner: Buner is a district of Malakand division. It consists of Tehsil Daggar, Gagra, Totalai, Chagharzi, Chamla and Gadeze. The Daggar is the head quarter of the district. Buner lies between 34-09 and 34-43?N latitude and 72-10 and 72-47?E longitude. It is bounded on the north by Swat District, on the west by Malakand agency, on the south by Mardan District and on the east by river Indus and Hazara division. Elevation varies from 1200 ft in Totalai in the south to 9,550 ft of Dosara peak.

Introduction to Study Area: Chagharzi Valley, District Buner, lies between 34°37'5"N and 72°41'15"E. It is bounded by Swat and Shangla districts in North, on West by District headquarter Daggar and historical shrine of Pir baba, on South by Mardan and Swabi and on East by Indus River, Haripur and Mansehra. Valley occupies 63543 ha, on which 15169 ha and 48374 ha were occupied by agriculture and forests respectively. The total population of the area comprises 66475 human including 32466 males. Elevation varies from 366 meters in south to 2911 meters in North.

Selection of Study Area and Sampling Sites: River Chagharzi was selected the study area because it was neglected for years and it was the first attempt to explore the fish fauna of this river. The study was carried out in the period of April 2014 to July 2014. The river was divided into 10 sampling points in order to have a full and brief description of the fish fauna of each point.

Brief Description of Each Collection Point

Point 1: (Shangra, 34°34'59"N and 72°42'27"E) it is the first starting collection point. It is surrounded by Peezo, Ramzai, Bami and Ghazi Banda.

Point 2: (Chalandrai, 34°33'27"N and 72°41'5"E) it is small village of Chagharzi surrounded by Manzaro Kohai, Shahi, Peero and Ramzai.

Point 3: (Pandair, 34°32'51"N and 72°40'20"E) is a small village surrounded by Beero, Kot Kalai, Gualono Borai and Karra.

Point 4: (Gumbad, 34°36'28"N and 72°38'24"E) is a small village selected as for the site of collection as it is has good fish fauna. It is surrounded by small towns like Gumbat, Alami banda, awanai, Pukhtano maira.

Point 5: (Tangora, 34°35'9"N and 72°38'39"E) is a small village surrounded by Belandai, Banj karra, Nago, Ramzai, Ghazi banda.

Point 6: (Karra, 34°33'9"N and 72°38'14"E) is a small village surrounded by Banj karra, Pandir, Kuz Shamnal, Gualono Bandai.

Point 7: (Batara, 34°32'24"N and 72°38'12"E) is a small village surrounded by Gualono Bandai, Mir Dara and Ukh dara.

Point 8: (Budal 34°29'27"N and 72°38'59"E) it is a small village surrounded by Riyal, Argha, Dhelai and Dewana Baba.

Point 9: (Matwanai, 34°29'12"N and 72°36'49"E) it is a small village surrounded by Dewana Baba, Mathak and Gatha.

Point 10: (Mujahideen, 34°26'49"N and 72°43'52"E) it is the final destination of the River Chagharzi, after this the river meets to Rive Indus. It is surrounded by Sir Kalay, Murad Khan, Lail Dara, Chanal, Sher Ali, Bangerai and Dar Band.

Fish Sampling: The collection of fishes from different points was done with the help of different nets of different sizes, hooks, cast nets, automatic rod, gill nets, dragon nets, hook net, hand nets, pH meter (HANNA HI 8314, Membrane pH meter), thermometer, measuring tape and digital camera (Canon Power Shot A3300 IS, 16 mega pixels). The collected fishes were kept in the dilute formalin solution (10%) in order to keep the fish in original from. The fishes were injected with diluted formalin solution (2%). The fishes appearing same were stored in a same glass jar. The fishes were preserved and then brought to the museum of Abdul Wali Khan University (Buner Campus) and attached a label to each jar indicating the name of locality, date and time of collection. Various morphometric measurements of fish were made by ruler and vernier caliper. Other instruments used for laboratory work are Petri dishes, surgical gloves, forceps and tissue papers, counting needles and magnifying glass.

Identification: Taxonomic identification and classification was done on the basis of morphometric characteristics up to the species level. Fish species were identified by the different available keys, Mirza and Bhatti; Mirza; Talwar and Jhingran [13-15].

Water Sampling and Laboratory Analysis: The water samples from each collection sites were collected in a small jar and were laballed with time and site name. Maximum space between the two collections was about 20 meters. The water samples were then brought to the laboratory of Abdul Wali Khan University Mardan (Buner Campus). The temperature of the water of each collection site was measured on the spot by the mercury thermometer. The other parameters of the water like pH, river width, river depth, dissolved oxygen were also calculated.

RESULTS

During the current study a total number of 7 different fish species were collected belonging to 3 orders and 3 families, 7 genera and 7 species. These species were *Pantius spohore, Tor putitora, Crossocheilus latius, Barilius pakistanicus, Schizothorax plagiostomus, Matacembelus armatus* and *Channa gachua*.

Network of River Chagharzi

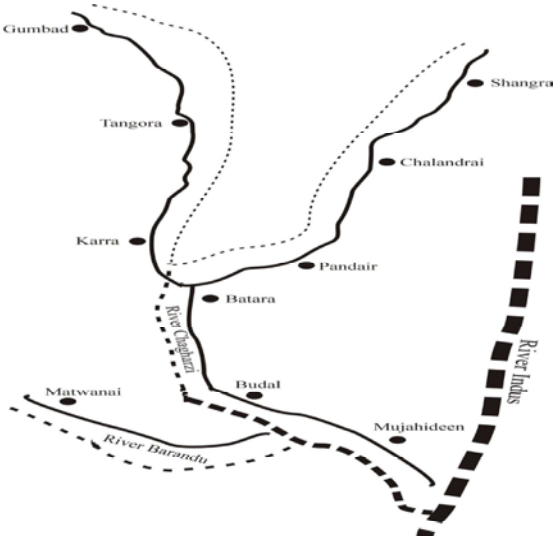

Fig. 1: Network of River Chagharzi

The taxanomic positions of the species are given in the Table 3.1.

Collection of Fishes from Each Point: During the current study the a total of 79 fish species belonging to different orders and different families were collected from every site and the highest collection was made from the 9th point (budal) and 10th site (Mujahideen) as it is the last part of the river barandu and river Chagharzi and it share most of its fauna with the River Indus. The detail of the collection from each site is given in Table 3.2.

Details of Fish's Families Collected: During the current study many fish species were collected belonging to different families. The dominant family was the family Cyprinidae. The details of the families of fishes are given in the Table 3.3.

Different Parameters of the Collection Points: Current study was carried out on the river Chagharzi. River Chagharzi cover most of area and passing through many villages and finally falls into River Indus as shown in Figure 1. By passing the way the depth and width of the river varies. The average depth and average width of the river at each collection point was calculated. The details of the depth and width of the each point is listed in the Table 3.4.

Dominant Species in Relation to Water Parameters of Each Collection Point: During the current study the fishes were collected from each point. In each collection

Table 3.1: Taxonomic position of species collected during study

S.No	Order	Family	Species
1	Cypriniformes	Cyprinidae	*Pantius spohore*
2	Cypriniformes	Cyprinidae	*Tor putitora*
3	Cypriniformes	Cyprinidae	*Crossocheilus latius*
4	Cypriniformes	Cyprinidae	*Barilius pakistanicus*
5	Cypriniformes	Cyprinidae	*Schizothorax plagiostomus*
6	Synbranchiformes	Mastacembelidae	*Matacembelus armatus*
7	Perciformes	Channidae	*Channa gachua*

Table 3.2: Showing collection of fishes from each point

S.No	Point name	Frequency	Percentage
1	Shangra	6	7.95%
2	Chalandrai	5	6.32%
3	Pandair	6	7.95%
4	Gumbad	3	3.79%
5	Tangora	4	5.06%
6	Karra	4	5.06%
7	Batara	7	8.86%
8	Budal	19	24.05%
9	Matwanai	7	8.86%
10	Mujahideen	18	22.78%
	Total	79	100%

Table 3.3: Showing the details of families of fishes

S. No	Family	Frequency	Percentage
1	Cypriniformes	Cyprinidae	33.33%
2	Synbranchiformes	Mastacembelidae	33.33%
3	Perciformes	Channidae	33.33%

Table 3.4: Showing the average depth and width of the collection sites

S. No	Point Name	Longitude	Latitude	Average Depth	Average Width
1	Shangra	34°34'59" N	72°42'27" E	0.3 Meter	2.5 Meter
2	Chalandrai	34°33'27"N	72°41'5"E	0.4 Meter	3.0 Meter
3	Pandair	34°32'51"N	72°40'20"E	0.4 Meter	4.5 Meter
4	Gumbad	34°36'28"N	72°38'24"E	0.2 Meter	3.5 Meter
5	Tangora	34°35'9"N	72°38'39"E	0.4 Meter	4.2 Meter
6	Karra	34°33'9"N	72°38'14"E	0.4 Meter	4.0 Meter
7	Batara	34°32'24"N	72°38'12"E	0.8 Meter	4.5 Meter
8	Budal	34°29'27"N	72°38'59"E	8.5 Meter	6.5 Meter
9	Matwanai	34°29'12"N	72°36'49"E	2 Meter	6.3 Meter
10	Mujahideen	34°26'49"N	72°43'52"E	9 Meter	6.0 Meter

Table 3.5: Showing the dominancy of fish in each point

S. No	Point Name	Dominant Species	Temp	pH	DO
1	Shangra	*Schizothorax plagiostomus*,	20°C	7.2	10 mg/L
2	Chalandrai	*Schizothorax plagiostomus*,	22°C	7.1	10 mg/L
3	Pandair	*Schizothorax plagiostomus*	24°C	7.3	10 mg/L
4	Gumbad	*Schizothorax plagiostomus*,	21°C	7.4	10 mg/L
5	Tangora	*Schizothorax plagiostomus*	23°C	7.4	10 mg/L
6	Karra	*Schizothorax plagiostomus*	22°C	7.1	10 mg/L
7	Batara	*Schizothorax plagiostomus, Barilius pakistanicus*	26°C	7.5	10 mg/L
8	Budal	*Puntius sophore, Tor putitora, Matacembelus armatus, Channa gachua, Crossocheilus latius*	26°C	8	12 mg/L
9	Matwanai	*Puntius sophore, Tor putitora, Matacembelus armatus, Channa gachua, Crossocheilus latius*	30°C	8.5	12 mg/L
10	Mujahideen	*Matacembelus armatus, Tor putitora, Channa gachua, Crossocheilus latius*	28°C	7.8	12 mg/L

Table 3.6: Showing the morphometric measurements of fishes

S. No	Species	Total length	Standard length	Head length	Eye length
1	*Pantius spohore*	8.5 cm	7 cm	1.8 cm	4 mm
2	*Tor putitora*	22 cm	17.5 cm	5 cm	8 mm
3	*Crossocheilus latius*	13 cm	9.6 cm	2.3 cm	5 mm
4	*Barilius pakistanicus*	8.2 cm	6.8 cm	1.6 cm	4 mm
5	*Schizothorax plagiostomus*	18.6 cm	15 cm	3.4 cm	6 mm
6	*Matacembelus armatus*	27 cm	25.9 cm	4.2 cm	3 mm
7	*Channa gachua*	13.4 cm	11.1 cm	3.5 cm	4 mm

point there were some dominant species as compared to other species. At the collection point (1-7) the dominant species were *Schizothorax plagiostomus* and from collection point (8-10) the dominant specie was *Tor putitora*. The *Schizothorax plagiostomus* was not collected in these points. The water quality parameters of each collection point were calculated. The details of the fish's dominancy and water parameters of each point are shown in Table 3.5.

Morphometric Measurements of Fishes: During the collection the fishes collected were of different size and characteristics. The details of different characteristics of fishes collected during the study are given in Table 3.6.

DISCUSSION

In the present study a total of 7 fish species were collected and identified belonging to 3 orders and 3 families. These species were *Pantius spohore, Tor putitora, Crossocheilus latius, Barilius pakistanicus, Schizothorax plagiotomus, Matacembelus armatus* and *Channa gachua*. Most of the species were belonging to the family Cyprinidae.

Saeed [12] reported 11 species belonging to 3 order and 4 families from the river Baraandu District Buner. These species were *Barilius pakistanicus, Triplophysa naziri, Tor putitora, Crossocheilus latius, Schizothorax plagiotomus, Channa gachua, Gara gotyla, Glyptothorax punjabensis, Matacembelus armatus, Puntius sophore* and *Schistura punjabensis.* According to them the dominant species in the river barandu were *Tor putitora* and *Schizothorax plagiostomus*.

Similarly in our study the species collected were *Pantius spohore, Tor putitora, Crossocheilus latius, Barilius pakistanicus, Schizothorax plagiotomus, Matacembelus armatus* and *Channa gachua* from the river Chagharzi. The dominant species in the area were *Tor putitora* and *Schizothorax plagiostomus*. Most of the freshwater fish fauna of Pakistan is represented by family Cyprinidae. In our study the fishes collected were belonging to 3 orders and 3 families. This result is supported by Saeed *et al.* [12] who reported the fish fauna of river barandu district buner belonging to 3 order and 4 families.

The variations in the habitat attributes like pH, turbidity, total dissolved solids and conductivity across different sites was attributed to differences in land use pattern, which was responsible for variation of species diversity and distribution [16]. Abiotic water conditions (salinity and temperature) are often evoked as controls for seasonal patterns of species occurrence [17]. Biological diversity appears to play a substantial role in ecosystem resilience [18]. The physical and limnological properties of the aquatic ecosystem combined with the interaction among species are amongst the factors responsible for promoting the novel structure and composition of the Ichthyofauna [19, 20].

During the current study it was found that the factors like pH, temperature etc are responsible for the variation in diversity and distribution in species occurrence in the area. In the collection points (1-7, Shangra, Chalandrai, Pandair, Gumbad, Tangora, Karra, Batara) the endemic species were *Schizothorax plagiotomus*, while in the collection points (8-10, Budal, Matwanai, Mujahideen) the variety of species were recorded but the majority of species recorded were *Tor putitora, Pantius sophore, Channa* gachua and *Matacembelus armatus*. This might be due to the water temperature and pH, because in the collection points (1-7) most of water source was natural springs, streams, rains and were no anthropogenic activities found, while in the collection point (8-10) the domestic savages, marble pollutants etc were playing key role in polluting the water.

Population of some of the species is declining due to habitat loss and degradation, water abstraction, drainage of wetlands, dam construction, pollution and eutrophication. These factors have caused substantial declines or changes in inland fish species [21]. About 600 marble factories are present in District Buner [21]. The pollutants of marble from these factories are discharged directly to river Barandu [12]. Mostly marble pollutants

affect the gills of the fish. Marble Sediment destroys spawning and feeding grounds for fish, reduces fish and shellfish populations, destroys pools used for resting, smothers eggs and fry and fills in lakes and streams and decreases light penetration, thus endangering aquatic plants [12]. The low evenness however is indicative of disturbance of the natural habitats by anthropogenic activities [22]. The decline in fish diversity in water reservoirs may be attributed to the environmental factors like drought, pollution, over fishing or illegal poaching and other human activities [23].

During our study it was found that the marble pollutants were the main problems affecting the fish fauna of district buner. Due to the rapid increase in the numbers of marble factories and no protective measurements the fish fauna of the remote area was declining. In the collection sites (1-7, Shangra, Chalandrai, Pandair, Gumbad, Tangora, Karra, Batara), there were no marble factories and no anthropogenic activities due to which these collection points were presenting the rich fish fauna, while in the collection site (8, Budal), (9, Matwanai) and (10, Mujahideen), many marble factories were present and the river barandu meets it at these points which is also affected by the anthropogenic activities, therefore the fish fauna of these collection points were effected and if the preventive measurements are not taken, this will lead to the declining of fish fauna in these area.

The State Fisheries Department is authorized to look into the maintenance and watch and ward of the aquatic resources of the State. Because of vast dimensions of the river Jhelum and shortage of man power proper watch and ward of river is difficult resulting in illegal and unapproved fishing. The fishermen community is not adhering to the mesh size to be used as per the rules. As a result very small fish are also caught in the net. The gill nets which are not permitted are also used for catching the fish [24]. In the tributaries of river Jhelum fish is harvested by poisoning them to death by chemicals like DDT [25]. Problem affecting mountain river ecosystem includes dam construction, reservoir creation, alteration of hydrobiological regime in tail water, paper mill effluents, domestic and industrial pollutants, agricultural runoff, channelization, dredging and subsequent spoil disposal, removal of stream bank cover, eutrophication, riverine flood plain encroachment, degradation of wetlands, alteration of natural hydro-periods, watershed urbanization and development. Fishermen with novel harmful fishing gear such as electrical shocker and dynamite also affected fish population by overfishing [26].

During our study it was found that the River Chagharzi share its fauna with the River Indus at the point (10, Mujahideen) and have rich fauna but the illegal human activities like hunting by electric current, generators, chemicals, dynamite and other modern fishing gears are playing an important role in the declining of the fish fauna of the area and due to which some species are becoming endangered. The fishery authorities are suggested to take legal action against these people in order to save the fish fauna of the area.

Species richness and total relative abundance depends strongly on water temperature fluctuations, increasing during the warm period of the year [27]. Species richness is widely employed as a tool in ecological assessments because it has positive correlations with measurements of habitat and water quality [28, 29].

Water temperature influences the distribution and migration of fishes [30]. Temperature effects many limnological phenomenon like stratification of water, solubility of gases, pH, amplification of odor and taste and elevation of metabolic activities of plants and animals. Metabolic rate increases 2 or 3 times for every increase of 10°C. Increased metabolic rate leads to higher oxygen consumption and waste production (CO_2 and NH_3) [31].

During our study it was found that the water temperature of the collection points (1-7, Shangra, Chalandrai, Pandair. Gumbad, Tangora and Karra) was 20-26°C and the endemic and dominant specie was Schizotorax as it is found in cold water, while the water temperature of the collection points (8-10, Budal, Matwanai and Mujahideen) was 26-30°C and the endemic and dominant specie was *Tor putitora, Pantius sophore, Channa* gachua and *Matacembelus armatus*.

Yousafzai [31] reported the water temperature of River Swat ranged from 15-26°C. Saeed [12] reported the temperature of the river barandu district buner from 15-25°C. Akhtar [11] reported the temperature of the river swat from 15-25°C.

These results are similar to our study. During the present study on river Chagharzi district Buner, the temperature of water of the river Chagharzi was in range from 20-30°C.

The pH value is favorable for fishes and show good quality of water [31]. The pH of River Swat ranged from 7.2 to 7.9 [31]. The normal pH value of water recommended by World Health Organization ranges from 7.5-8.5 [32]. IUCN [33] reported pH value of river swat between 7.3-7.9.

The pH of river barandu buner was reported by Saeed *et al.* [12] in range from 6 to 8.5. During a study by

Hamza [34] in Mattani Azakhel, Pakistan, reported the pH value as 7.6. The value of pH 7.6 of the rive Kabul was reported by Khan and Khan [35]. Muhammad [36] has reported the pH value 6.7 for River Swat at Mingora, Khyber Pakhtunkhwa Pakistan.

During our study the pH of each site was different. The pH of the collection points (1-7, Shangra, Chalandrai, Pandair, Gumbad, Tangora Karra and Batara) was in range of 7.1 to 7.5. This might be due less human anthropogenic activities and no marble industries were present in the area. The pH of the collection points (8-10, Budal, Matwanai and Mujahideen) was in range from 7.8-8.5.

All animals need oxygen to survive. Land animals breathe atmospheric air that contains 21 percent oxygen. However, oxygen is not always available in water. Dissolved oxygen levels in water can range from 0 percent to over 100 percent saturation, depending on water temperature, elevation, air pressure, other dissolved gases and water quality [37].

Fish extract dissolved oxygen from the water using their gills. In breathing, fish first gulp a mouthful of water, then close their mouths and pressurize the water, forcing it over the rich red blood supply of gills and out the opercula (gill-flaps). Oxygen is absorbed directly into the fish's blood supply and distributed through-out the body via the circulatory system [37].

Dissolved oxygen (DO) is necessary for the respiration of living organisms both animals and plants in water. Oxygen like temperature has major influence on the distribution and migration of fishes. Stagnant water comparatively has less DO as compared to fresh and cold water [31].

In our study the dissolved oxygen levels was ranging from 10-12 mg/L. In the collection points (1-7) the dissolved oxygen level was 10 mg/L, while in the collection points (8-10) the dissolved oxygen level was 12 mg/L.

Regarding the previous studies it was found that the fish fauna of the District Buner is becoming endangered due to the anthropogenic activities. The direct discharge of the marble industries effluents is one of the main problems for the aquatic biota of district Buner as it destroys the habitat, food, shelter etc of the fishes. The illegal hunting of fishes through different gears is the main causative agent for the destruction of the fish fauna of Buner. The collection points (1-7) were not facing such conditions but the collection points (8-10) are badly affected by the anthropogenic activities. Preventive measurements are required in order to save the fish fauna of District Buner.

CONCLUSION

It was concluded from the current study that River Chagharzi bears rich fish fauna but it is facing the illegal human activities like; domestic and anthropogenic activities, agricultural runoff, channelization, dredging and subsequent spoil disposal, removal of stream bank cover, eutrophication, introduction of vehicle oils, riverine flood plain encroachment, degradation of wetlands, alteration of natural hydro-periods, watershed urbanization and development. The harmful and novel introduction of fishing gears by fishermen such as electrical shocker, chemicals and dynamite also affect the fish population of the river Chagharzi.

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