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BIODIVERSITYAND OCCURRENCE OF FRESHWATER CRABS IN PATHANKOT STREAM OF DISTRICT LORALAI, BALOCHISTAN

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Abstract

The present study was conducted during April 2017 to May 2019 at Pathankot stream, district Loralai, province Balochistan. The aim of the study was to determine the diversity and morphometric measurements of crabs. During the study, a total of five species were identified such as Ashtoret lunaris, Liotelphusa quadrata, Maydelliatelphusa lugubris, Metaplax indica and Portunus pelagicus. The most dominated family was Gecarcinucidae, contained two species. From the obtained data various ecological indices were calculated. The overall diversity ranged between (1.02 to 1.58), evenness varied from (0.19 to 0.45), the index of dominance ranged from (0.58 to 0.86) and species richness varied from (0.94 to 1.61). Morphometric measurements of selected five species were determined. These measurements are weight, carapace width and carapace length of species. The ecological indices showed significant correlation with environmental parameters.

KEYWORDS: Crabs, Biodiversity, Freshwater, Morphometrics and Abundance.

INTRODUCTION

Over Pakistan is present at the junction of three key region of South Asia, Central and West Asia (Anwar, 2011) with an area of an area of 80,943 km**2** (Shinwari, 2010). Balochistan is one of the largest provinces of Pakistan covering an area of 347,190 km**2** (Akhtar *et al.*, 2021). Khan 1987, while mentioning zoogeographic bond of various reptiles and amphibians of Balochistan province, divided Balochistan into six regions owing to the presence of different species. This province has a significance especially in term of mammalian species present in deserts and mountains (Ghalib *et al.*, 2007), moreover species of amphibians and reptiles, found in Chaghi and approximately 3000 specimens of geckoes which are found only in Kharan and Chagai district (Baig *et al.*, 2006).

Loralai is a historical town located in northeast of Balochistan (Dost & Rind, 2020). Pathankot channel is located next to ShahJehan Killi of Loralai district in Balochistan, that flows form 5-6 decades from nearby hills. Pathankot channel also contain fishes and amphibians, whereas nearby hilly areas contain snakes, tortoise and lizards. Among large

invertebrates, crabs are dominant, with an increasing population seen especially during monsoon rain. Mostly, crabs are nocturnal in habit performing physiological activities at night. Crabsare omnivores where as some adapted carnivores' habits and feed on snail etc. Freshwater crabs are included in Decapoda Order, a group of crustaceans including lobsters, crayfish prawns, and also hermit crabs, being categorised by five pairs of thoracic legs. Freshwater crabs comprised of a body plan with head, abdomen and thorax. These crabs inhabit mostly all freshwater bodies including streams, rivers, fresh water swamps and also stagnant ponds. Studies shows that assemblages of freshwater crabs are complex in nature with great importance in food web (Yeo *et al.*, 2007). Crabs have occupied an important position for sustaining the stability of an ecosystem.

Crabs are used in various fields but study of invertebrates as an origin of medicine has always been considered interesting and fruitful field in research. Many of the medicinal firms have succeeded in the root of daily life therapeutic medicines, among other research (Shams *et al.*, 2020). A part from medicine, crabs are also used as a source of food in various countries i.e. Indonesia, France, Philippines, China, Spain, Japan and United states (Gulle, 2005), indicating its economic importance. Some factors such as environmental crises, Pollution and ongoing increasing need for construction of Dam and river flow modification are all responsible for threatening diversity of Crab species, therefore, it is highly concern to take essential steps for their conservation and protection (Wehrtmann *et al.*, 2016).

According to (Dudgeon et al., 2005) habitats of freshwater crabs are becoming now threatened worldwide. The plan of conservation of crabs is affected due to low level of ecological data the increasing human population and their activities is causing degradation of habitat of freshwater organisms. This study is purposed at demonstration of species diversity and abundance of freshwater crabs of district Loralai, province Balochistan, Pakistan.

LITERATURE REVIEW

In current research, diversity of fresh water crabs of Pathankot stream of district Loralai, province Balochistan, was studied. Geographically, the sampling sites was located between (1425 to 1500) meter above sea level, in the northeast of Balochistan province. The sampling site was located between latitude (30°.20′N to 30°.25′N) and longitude (68°.31′E to 68°.37′E) (table 1). For the measuring of biodiversity various sampling spots were chosen at Pathankot stream and named as spot (1), (2), (3), (4) and (5) respectively.

The climatological knowledge of the study area is quite different from other regions of same province Balochistan; moreover, the regional area gets maximum rain fall in the month of July and August. Monsoon rain fall occurs in the month of July and August whereas winter rain falls in the month of February and March. The driest months are September and October where the rain falls happens below (5) mm and (7) mm respectively. The monthly average temperature varies between (6^{o}C to 35^{o}C) and from January to August respectively. The hottest month of the year is July with an average temperature of (31^{o}C) whereas, the month of January is the coldest month with mean temperature of (6^{o}C).

Table:1. Sampling spot and geographic coordinates of Pathankot stream.

Sampling Spot	Lat. (N)	Long. (E)	Elevation (m)
Spot 1	30°.22′	68°.35′	1475
Spot 2	30°.25′	68°.37′	1467
Spot 3	30°.25′	68°.37′	1500
Spot 4	30°.21′	68°.33′	1435
Spot 5	30°.20′	68°.31′	1425

SAMPLING PROCEDURE

Samples were collected from different location in selected area (Pathankot stream) once in month. All the collected samples were acquired alive in containers and transferred to research lab. Net was used for capturing crab species easily. The method of opportunistic hand picking and effort based of (70 to 90) minutes within the stretch of (600m) of stream was adopted for crab's specimen collection. Burrowing crabs were collected by digging the burrows and lifting of rocks (Lara *et al*., 2013; Shukla *et al.,* 2013).

HABITAT PARAMETERS

The location of the species was recorded using GPS (Garmin etrex). The habitat parameter such as elevation was recorded using the data sheet. The physio-chemical characteristics such as temperature and PH were recorded for determining micro habitat of fresh water crab.

PRESERVATION AND IDENTIFICATION

The collection of specimens was tagged with number for preservation and identification. Preservation was carried by solution of (10 %) formalin (Shukla *et al*.,2013). For identification of specimen, it was brought to laboratory. Microscopy was used for identification of morphological characteristics. The identifications were done using the identification key developed by (Sakai, 1976; Ajmal Khan, 1991; Sethuramalingam). The

detailed measurement of fresh water crab morphological parts like wet weight, CW = carapace width, CL = carapace length was recorded for identification (Bahir, 2007).

DATA ANALYSIS

The diversity of fresh water crab from different spots was analysed after the collection of these crabs during study. Statistical analyses were performed using the Minitab Software (Version 13.1). The diversity was assessed using Shannon Diversity index (H' =-ΣPi*ln Pi), for the abundance, diversity, species richness and index of dominance (McGinley, 2014). The data was analysed through one way ANOVA analysis.

RESULTS

The present study provided the fundamental data about the diversity, distribution and morphometric measurements of crab's species which were found in the Pathankot Stream of district Loralai, Balochistan. In the present study, variations in temperature and pH were observed during April 2017 to May 2019. The water temperature varied from (16.9ºC to 21.4ºC) respectively, whereas the maximum water temperature (21.1ºC) was showed by spot (5) while minimum (16.9ºC) temperature was in spot (4). The pH of the various spot of study showed range between (7.3 to 7.6) whereas the highest (7.6) was observed in spot (2) and the lowest (7.3) was obtained in spot (4) (fig1).

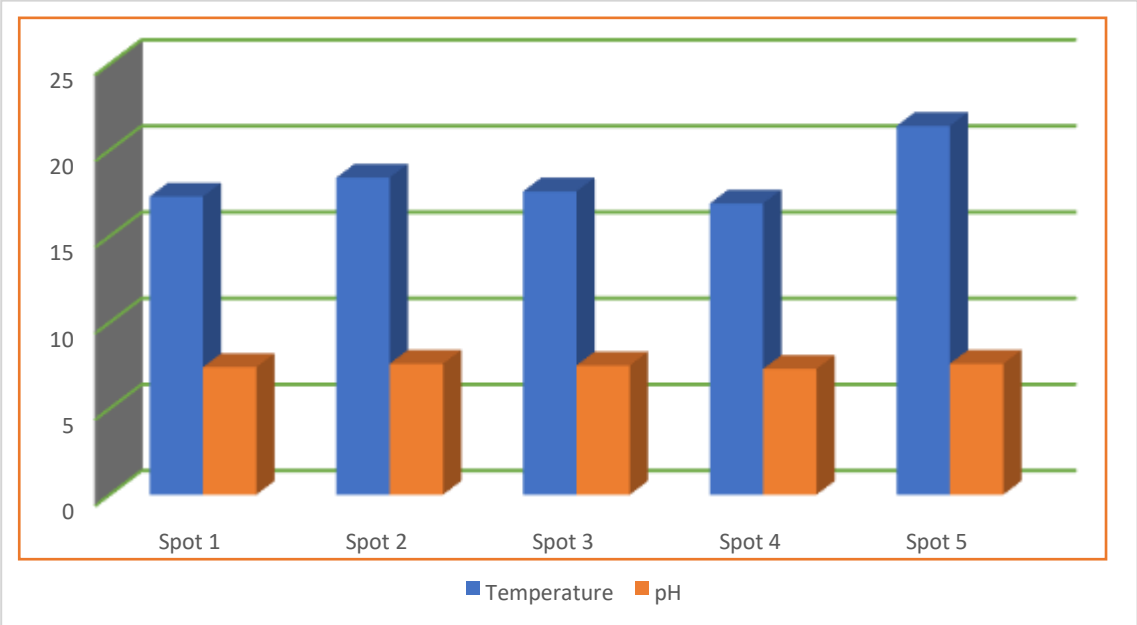

Fig.1: The average temperature and pH of the different spot in the study area.

CRABS DIVERSITY

Crab's diversity was investigated in the Pathankot stream of district Loralai. In the present study five species were captured from the various sampling stations of the study area. The species that were recorded at the different sampling stations were *Ashtoret lunaris, Liotelphusa quadrata, Maydelliatelphusa lugubris, Metaplax indica* and *Portunus pelagicus*. The most dominated family was Gecarcinucidae containing two species while the remaining Metutidae, Varunidae and Portunidae were having single species each in the study area (table2). Overall (241) specimens of species were collected in the study area. The species *Ashtoret lunaris* was the dominated species in the stream which showed (24%) dominancy.

The second dominated species was *Metaplax indica* (22%), followed by *Maydelliatelphusa lugubris* (20%), *Liotelphusa quadrata* (19%) while *Portunus pelagicus* was least dominated species about (15%) in overall sampling stations (fig.2). The occurrence of these species in the investigated area was varied from station to station however in overall stations they showed regularity in distribution. From our result, the highest number was recorded in the spot (1), followed by spot (3), spot (4), spot (5) while least counted in the spot
(2) (fig.3).

Table:2. Diversity of crabs in the stream of Pathankot.

S. No	Species Name	Genus	Family	Order
1	*Ashtoret lunaris*	Ashtoret	Metutidae	Decapoda
2	*Liotelphusa quadrata*	Liotelphusa	Gecarcinucidae	Decapoda
3	*Maydelliatelphusa lugubris*	Maydelliatelphusa	Gecarcinucidae	Decapoda
4	*Metaplax indica*	Metaplax	Varunidae	Decapoda
5	*Portunus pelagicus*	Portunus	Portunidae	Decapoda

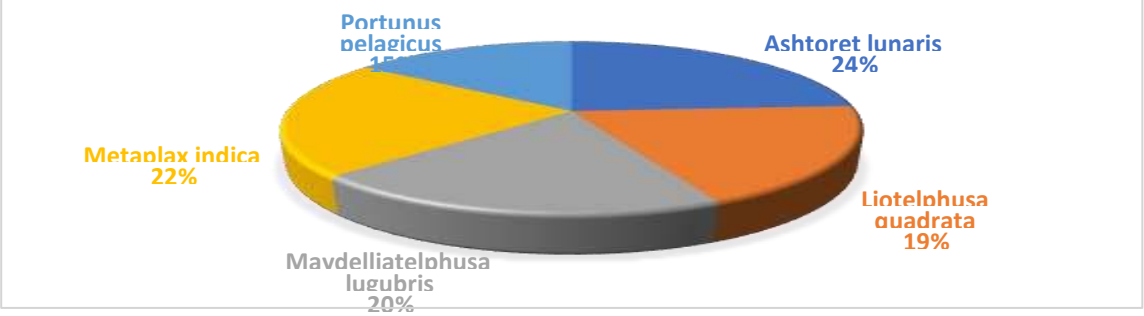

Fig.2:Overall mean percentage values of five species in the study area.

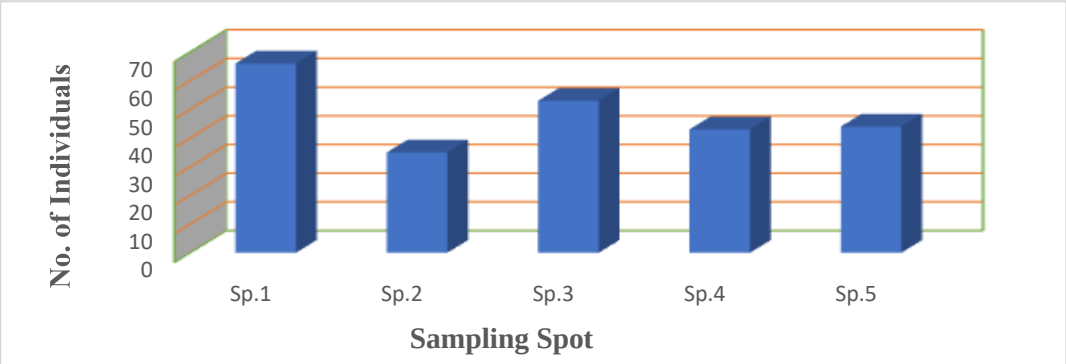

Fig.3: Number of individuals of each species in various sampling spot.

DIVERSITY INDEX VALUES

The mean abundance values of five species showed least variation abundance in the study area. However, the mean abundance of species in the different spot ranged between **(**7.2 ± 2.38 to 11.6± 8.3). The highest mean abundance was calculated in the spot (1) about (11.6± 8.3). The shinnon- weaver diversity index values in the different spot at the current sites in the order of **(**1.58± 0.87), (1.71 ± 0.35), (1.51± 0.92), (1.25± 0.56) and (1.02± 0.28). The highest was recorded in site (1) while least was observed in site (5) respectively (table3). The maximum value of evenness was (0.45 ± 0.32) while the minimum was (0.19 ± 0.01) whereas, the maximum value of index of dominance was observed in the station (2) about **(**0.86 ± 0.69). The species richness in different spot at the study was ranged between (0.94± 0.57) to (1.61± 0.89) respectively (table3).

Table:3. Mean sampling station diversity index values and the result of one-way ANVOA between different spot of the years 2017 to 2019.

Sp.N	Abn.	H'	J'	ID	SR
Sp.1	11.6± 8.31	1.58± 0.87	0.45 ± 0.32	0.63 ± 0.44	1.54 ± 0.78
Sp.2	9.2 5±.34	1.25± 0.56	0.22± 0.12	0.86 ± 0.69	1.29± 0.94
Sp.3	11.8 ± 6.32	1.71 ± 0.35	0.32± 0.07	0.58 ± 0.22	1.61± 0.89
Sp.4	10.4± 4.37	1.51± 0.92	0.30± 0.07	0.66 ± 0.42	1.15± 0.58
Sp.5	7.2 ± 2.38	1.02± 0.28	0.19 ± 0.01	0.75 ± 0.05	0.94± 0.57

Note: Abn. = Abundance; H'= Shinnon-Weaver diversity index; SR= Species richness; ID= Index of dominance; J'= Evenness.

MORPHOMETRIC MEASUREMENTS

Morphometric measurements of selected five species were determined. These measurements are weight, carapace width and carapace length. In the present study female *A. lunaris* showed maximum weight (50.33±41.33) and ranged between (6.9-299.7). The highest carapace width in female was showed by *P. pelagicus*(11.16±6.43) while in male *L. quadrata* (9.21 ±8.65). The *L. quadrata* female and male was found in range from (5.7-210.6) and (3.1-189.7) respectively. The maximum length of female was showed by *M. lugubris* (9.05 ±5.47) and was ranged between (1.7-24.7) while in male the maximum length was showed by *L. quadrata* (9.51 ±6.85) and range from (1.5-27.6) respectively (table 4).

A correlation among values of diversity of indices and environmental variables were recorded.

In the present study, the correlation analysis between crab's diversity indices and environmental variables showed positive correlation. Among the independent variables analysed the diversity showed significant correlation with temperature, ($r=0.760$; $p<0.05$) and pH ($r=0.402$; $p<0.01$) correspondingly. The correlation between index of dominance with temperature and pH indicated significant correlation. A non-significant correlation was indicated by species richness and index of dominance while also between temperature and species richness.

Table:4. Summary of descriptive statistics for morphometric measured in crab species of Pathankot stream.

Variables	Species	Female		Male	
		N	Mean ±SD (Range)	N	Mean ±SD (Range)
Weight (gm)	*A. lunaris*	36	50.33±41.33(6.9-299.7)	22	55.63±67.45 (4.5-288.6)
	L. quadrata	32	39.13±40.06(5.7-210.6)	14	49.96±56.65 (3.1-189.7)
	M. lugubris	29	19.49±9.76 (6.5-41.6)	20	20.40±19.49 (4.9-80.3)
	M. indica	38	42.21±63.75(2.9-311.7)	14	19.0±5.31 (11.5-29.6)
	P. pelagicus	9	11.16±6.43(3.7-21.0)	27	7.48±4.07(1.5-14.3)

Carapace Width (cm)	*A. lunaris*	36	7.43± 2.75(3.7-15.2)	22	6.33±2.67(2.7-12.1)
	L. quadrata	32	3.82± 1.39(1.35-6.9)	14	9.21 ±8.65(1.9-30.3)
	M. lugubris	29	4.47 ±1.58(1.85-7.9)	20	5.08 ±1.89(2.5-9.5)
	M. indica	38	6.16 ±4.11(1.5-21.9)	14	4.22 ±4.11(3.4-5.6)
	P. pelagicus	9	7.63 ±2.02(5.7-12.2)	27	4.66 ±1.81(1.8-7.9)
Carapace Length (cm)	*A. lunaris*	36	5.49 ±1.65(2.4-9.3)	22	7.16 ±2.76(2.1-12.7)
	L. quadrata	32	6.45 ±1.78(3.1-9.2)	14	9.51 ±6.85(1.5-27.6)
	M. lugubris	29	9.05 ±5.47(1.7-24.7)	20	8.60 ±4.49(0.78-19.3)
	M. indica	38	8.09 ±5.04(1.7-21.9)	14	3.62 ±1.46(1.2-6.3)
	P. pelagicus	9	2.65 ±0.92(1.8-3.9)	27	4.94 ±1.66(1.37-8.0)

DISCUSSION

Crab is a source of protein having immense importance and its use as a food is not hidden from anyone (Zafar *et al.*, 2021; Shams *et al.*, 2020). These are utilized by the traditional healers and therapists for animals as a healthy calcium supplement and in healing of other injuries. (Shams *et al.*, 2020). The distribution of crabs in overall sampling station showed least variation in their abundance, the maximum abundance was found in the spot (1) while minimum was found in the spot (2) during study. Maximum diversity index of species and highest abundance of species in Pathankot stream showed the maximum productivity of the stream.

In the present study five species of crabs were identified, under the family of Gecarcinucidae two species (*Liotelphusa quadrata, Maydelliatelphusa lugubris*) while the remaining families contained a single species Metutidae (*Ashtoret lunaris*), Varunidae (*Metaplax indica*) and Portunidae (*Portunus pelagicus*). All of these species belong to same order Decapoda. variation of seasonal condition like temperature, pH and rainfall affects the crab's distribution and abundance in different habitat. The pH is one of the main environmental factors that influence the diversity of crabs and their distribution in habitat.

Increase in number of crab species could be connected to alkaline pH, although enhanced pH has resulted in reducing the individuals of species in an ecosystem, being described by (Varadharajan *et al*., 2013). Aquatic (or) marine organisms are depending upon pH, for suitable life, the optimal pH range is (6.5 to 8.2) reported by (Adeyemo *et al.*, 2008). During the study, throughout year the pH (Hydrogen ion concentration) remains slightly acidic to alkaline. The variaion in pH usually during various seasons of the year are influenced by several components such as mixing (or) runoff of freshwater, reduction of salinity, temperature and as removal of ($CO_{2)}$ by photosynthesis.

The water temperature ranged between (16.9 ºC to 21.4ºC), the differences in temperature may result from atmospheric heat and sun and change in temperature of water allows the maxing of the column of water. Most of the species during study showed regularity in their abundance and distribution however the Portunidae displayed least regularity in their abundance and distribution. This should be connected to its ability to tolerate temperature and pH with a wide range, which affects the occurrence, movements and activity of species. Overall species were observed in various period of study. Many biological processes and physiological factors such as, growth, feeding habits, migration and reproduction may affects the crab's distribution (Hosseini *et al.*, 2012).

In the investigated area, H' values were varied from (1.02 to 1.58). High value of H' was observed in spot (1) while least value was observed in site (5). The occurrence of high values was due to nutrients availability in stream. The index of dominance and species richness was estimated at spot (2) and spot (1) respectively. The change in the values of dominance and species diversity is known to fluctuation in the patterns of rainfall and connected with the floodwater influx reported by (Onuoha *et al*., 2010). Diversity with low may be influence of various conditions of environment in the stream of Pathankot in different seasons. This can possibility act as a natural stress which results in reduction if species individuals. Among the independent variables analysed the diversity showed significant correlation with temperature, ($r=0.760$; $p<0.05$) and pH ($r=0.402$; $p<0.01$) correspondingly. A strong correlation was observed between evenness and temperature ($r=0.485$; $p<0.001$).

A non-significant correlation was indicated by species richness and index of dominance while also between temperature and species richness. For the stability of ecosystem biodiversity is an essential form and protection of overall environmental quality to understanding inherent worth of all living things on the globe.

CONCLUSION

Five species of freshwater crabs were recorded in the Pathankot stream of district Loralai, Balochistan, Pakistan. Gecarcinucidae two species (*Liotelphusa quadrata, Maydelliatelphusa lugubris*) while the remaining families contained a single species Metutidae (*Ashtoret lunaris*), Varunidae (*Metaplax indica*) and Portunidae (*Portunus pelagicus*). Overall abundance of these species was significant but low diversity was found in streams. Protection of crab habitat from human activity-based degradation will ultimately result in conservation of crab species in the area under study.

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