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IMPACTS OF WATER QUALITY ON *MASTACEMBELUS ARMATUS* IN BOLAN RIVER, BALOCHISTAN

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Abstract

The following paper study was conducted to analyze the effects of water quality parameters on the fish, Mastacembelus Armatus in Bolan river, Balochistan. Mastacembelus accounts for a large percentage of the fish population present in the river. Five key parameters that include temperature, pH, Total dissolved solids, Dissolved oxygen, and Turbidity were measured throughout the year 2020 along the Bolan river on 4 sites namely Bibi Nani, near the town of Daranjan, near the town of Kirta, and Gokurth Recreational Park. It was found that in the spring and around the month of October when the weather is suitable enough for crops as well as it gets crowded by people, that's when the growth of the fish is disrupted and shows allometric growth as shown by the results. Fish populations closer to the towns of Kirta and Daranjan show more allometric growth: the regression coefficient b shows greater deviation from its normal value 3 because the pollutants have a direct influence on fish populations. Thus the study shows that the conventional use of chemicals instead of organic methods for living are the leading causes for the decline in the populations of Mastacembelus Armatus.

KEYWORDS: Water Quality, Mastacembelus Armatus, Length-Weight, Bolan River.

INTRODUCTION

Mastacembelus Armatus (tire track eel) belongs to the genus Mastacembelus. It is included in the family Mastacembelidae, under the order Synbranchiformes. Generally, found in shallow water within the reach of sunlight, which has temperatures between 22°C-28°C and a pH range of 6.5-7.5 (Rudiger Riehl and Hans A. Baensch, 1991). M. armatus is mostly found as native riverine fauna in Pakistan, Indonesia, India, Sri Lanka, Thailand, and different areas of South East Asia (Serajuddin M, and Pathak BC 2012).

Length-Weight relationship is used to estimate the effects of water quality on fish and in this case on M. Armatus. Biomass is frequently estimated from length frequency data converted with length-weight relationships, and length–length relationships are useful for standardization of length type when data are summarized (Bagenal TB, and Tesch FW 1978).

The relationship between the length (L) and weight (W) of a fish is usually expressed by the equation $W = aL^b$. Values of the exponent 'b' provide information on fish growth. When b = 3, the increase in weight is isometric. When the value of b is other than 3, the weight increase is allometric (positive if b > 3, negative if b < 3). These parameters (a, b) are important in stock assessment studies (Froese, 1998).

River Bolan has located approximately 40km west of Sibi on Bolan pass road at 29° 27°N, latitude, and 67° 30°E longitude and has a total length of 88 miles (Asmatullah and Fatima, 2007). The river appears at Mach and vanishes near Ab-i-gum. It joins the Sarawan River, near Bibi Nani, and distribute in the perennial stream. For irrigation purposes, a channel of about 12 miles joins Kirtha village. After passing over Kirtha, the river changes its route, merges into the waters of the Kumbela stream at Kundalini, and appears near Pir Chauki in the Dhadar plain. After crossing Dhadar, the river is scattered in various directions in the plain of Kachhi (Sumalani M.A., and Asrar M. 2014)

Fig 1. Bolan River

Freshwater bodies have lost numerous species and their habitat and are under continuous threats due to dams, water pollutants, overharvesting, and invasive species Revenga C, 2005). The killing of fish fry and hatchlings, the use of conventional fishing methods, pollution, and siltation are also the main causes of the decline of Mastacembelus Armatus (Hossain et al., 2015). Increasing human populace, growing consumption, and rapid globalization are the main causes of worldwide destruction and disturbance of ecosystems,

particularly freshwater ecosystems (Robin et al., 2008). Ali et al., (2018) also categorized Mastacembelus Armatus as one of the dying-out fish species.

Mastacembelus A. accounts for a large percentage of biomass in the fish fauna of the Bolan river and usually can be located in shallow waters. Shallow waters are hotspots for fishing therefore they are easily affected by the unsustainable living and farming methods that the local people practice. This study focuses on the populations of Mastacembelus Armatus in the Bolan river and how they variate based on the changing water quality parameters. The proposed project is an attempt to report the influence of the human population on the numbers, growth, and distribution of this important fish. This study hence will serve as a groundwork for awareness against unsustainable living and farming methods that are endangering this specie, the results of this project will also, open a new line of research for future research.

Methods and Materials

1. Fish Sampling

a) Location:

All four sampling locations will be along the lengths of the Bolan river in the Kachhi District.

i) Near Bibi Nani bridge
ii) Near the town of Daranjan
iii) Near the town of Kirtha
iv) Gokurth recreational park

b) Time Frame

Sampling will be done once a month. Fish samples were collected from each location, each month throughout the year (from January to December 2020).

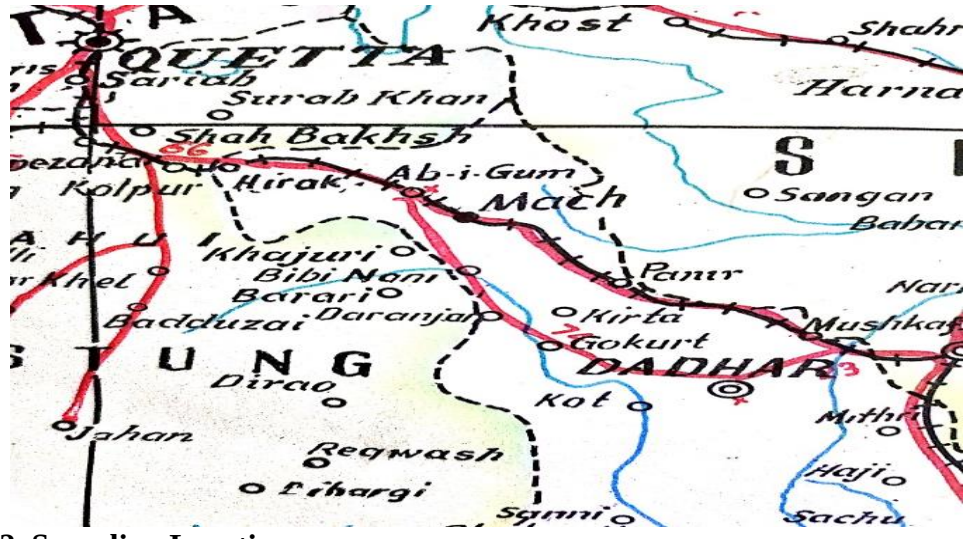


Fig 2. Sampling Locations

c) Sampling techniques and preservation

Fishes were caught using nets, the fittest samples were taken and the rest were returned to waters unharmed. The samples of Mastacembelus A. were stored in 10% formalin solution in specimen jars which were taken to the Fisheries lab at the university of Balochistan for further analysis.

2. Water Sampling (for measuring the extent of water quality parameters)

a) Sampling techniques

The river water was collected, kept in plastic bottles, and taken to the lab. It was collected far from river banks to prevent contamination, and the water was also sterilized for the same purposes. The water quality parameters were then analyzed.

i) Temperature

The temperature was measured using a centigrade thermometer onsite. Water was taken in a beaker, then the thermometer was dipped to 2/3 of the depth, and readings were taken and recorded.

ii) pH

pH was measured using the Jenway pH meter 3305 and then assessed.

iii) Total Dissolved Solids (TDS)

1000 ml of the water sample is poured into a beaker and the water is allowed to evaporate. Then, the difference between the empty beaker along with solid residue can give the mass of total dissolved solids and give the result in mg/l. The formula used by (Smitha, 2013) was used which is as given ;

$$TDS = \frac{(a-b) \times 1000 \text{ mg/L}}{\text{ml of sample}}$$

Where, a = final mass of the beaker in grams, b = initial mass of the beaker in grams.

iv) Dissolved Oxygen

A bench dissolved oxygen meter was used to measure the levels of DO at the spot.

v) Turbidity

A Secchi disc is lowered into the water and then the depth is measured where the Secchi disc completely disappears.

3. Determining Length-Weight Relationship

a) Length

The length of the fish is measured using an Inch-tape and recorded to the nearest 0.1 cm.

b) Weight

Each of the samples was placed on a weighing scale and the readings were recorded to the nearest 0.1 gram.

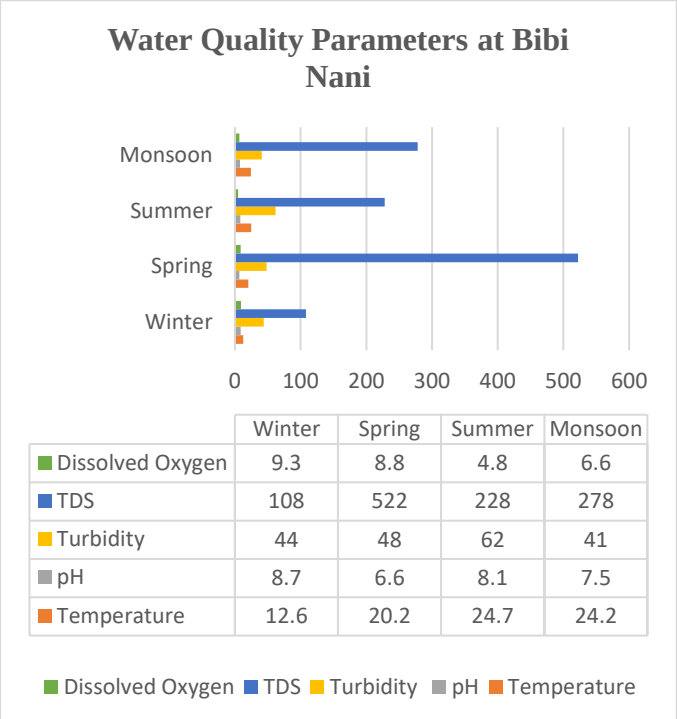
c) Length-Weight relationship

The length-weight relationship was determined by applying the formula given by Le Cren (1951)

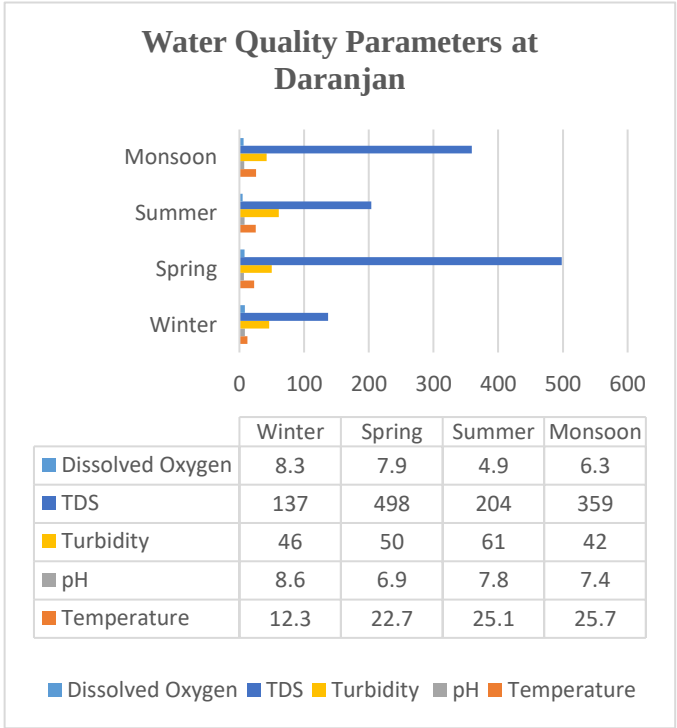
$W = aL^b$, where W is weight in g, L is the length in cm, a is coefficient related to body form and b is an exponent indicating isometric growth when equal to 3.0. a and b were estimated by linear regression on applying log to the equation hence forming: log W = a+b log L

Results and Conclusions

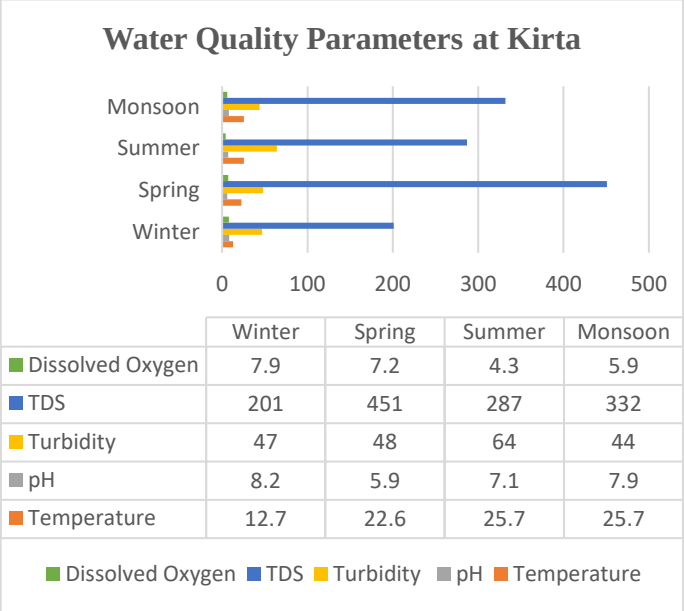
a) Effects of Water Quality on the growth of Mastacembelus



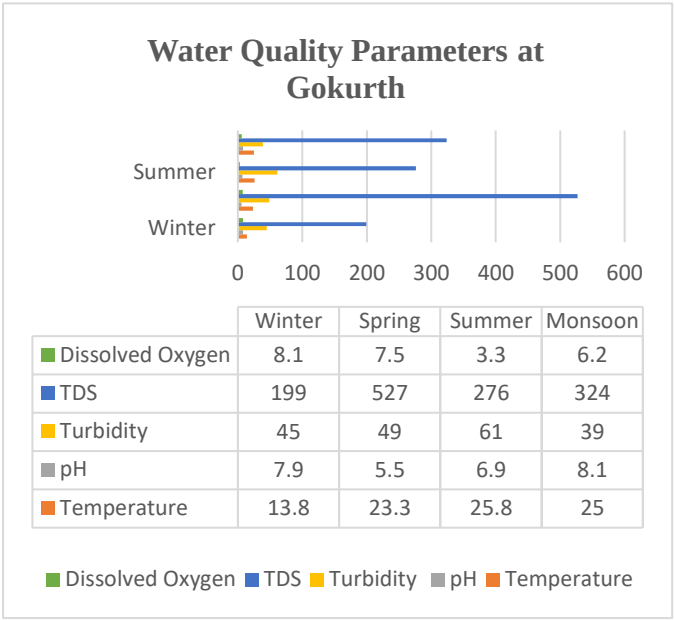
	Winter	Spring	Summer	Monsoon
Dissolved Oxygen	9.3	8.8	4.8	6.6
TDS	108	522	228	278
Turbidity	44	48	62	41
pH	8.7	6.6	8.1	7.5
Temperature	12.6	20.2	24.7	24.2



	Winter	Spring	Summer	Monsoon
Dissolved Oxygen	8.3	7.9	4.9	6.3
TDS	137	498	204	359
Turbidity	46	50	61	42
pH	8.6	6.9	7.8	7.4
Temperature	12.3	22.7	25.1	25.7



	Winter	Spring	Summer	Monsoon
Dissolved Oxygen	7.9	7.2	4.3	5.9
TDS	201	451	287	332
Turbidity	47	48	64	44
pH	8.2	5.9	7.1	7.9
Temperature	12.7	22.6	25.7	25.7



	Winter	Spring	Summer	Monsoon
Dissolved Oxygen	8.1	7.5	3.3	6.2
TDS	199	527	276	324
Turbidity	45	49	61	39
pH	7.9	5.5	6.9	8.1
Temperature	13.8	23.3	25.8	25

i) Temperature and pH

Water temperatures range from 10.2-29.6 throughout the year and pH ranges from 5.4-8.5. The minimum temperature is in the month of January and the maximum is recorded in June. While the maximum pH of water is in the month of December and the minimum in March.

The temperature plays an important role in the metabolic activities of the organisms and is considered a biologically significant factor (N., Varunprasath K. and Daniel A., 2010). Temperature and pH are known as the 'master factor' when it comes to determining the growth of fish. During winter and very hot summers, the growth of Mastacembalus A. slows down as metabolic processes are also slowed down. Most of the samples caught when the water temperature is around optimum that is 23-25 degrees are usually found to have isometric growth while those in cold or warm waters grow allometric. pH also shows the same effects, around optimum pH the organism grows healthy and otherwise shows allometric growth because If pH exceeds the optimum range it will affect the mucus membrane of the cells (Koul Nishtha *et al.*, 2012).

ii) TDS and Turbidity

Total dissolved solids depend on various factors such as the geological character of the amount of rainfall and total surface runoffs giving an indication of the degree of total dissolved substances (Singh M.R *et al.*, 2010). High levels of TDS are found during the

months of march and October which are generally when the growing season starts. Heavy use of chemicals during that time causes the chemicals to seep into the ground. Freshwater streams originating from underground sources are contaminated and high amounts of TDS are found. High amounts of TDS could damage or clog the respiratory surfaces hence causing poor growth (Sukumaran and Smitha 2013)

High levels of turbidity could contribute to various factors that cause unhealthy growth of the fish. During the Monsoon season (months of July, August, and September) high levels of turbidity are seen. High levels of turbidity make finding food for fish difficult, and poor growth of aquatic plants thus limiting the supply of dissolved oxygen. This slows down the metabolism and growth are slow due to very less nutrition. It also can damage the gills of the fish.

iii) Dissolved Oxygen

Dissolved oxygen plays an immense role in the survival of aquatic organisms and especially fishes. Temperature has an inverse relation with Dissolved oxygen levels. In summers the levels drop and, in the winters, they get sufficient enough to ensure survival and healthy growth. Fish exposed to oxygen-deficient water stop intake of food, rather they collect near the water surface, gasp for air, and fail to react to irritation losing their ability to escape predation and finally die (Svobodova Z., 1993).

b) Length-Weight Relationship

Site	n	Length Range in (cm)	Weight Range in (g)	a	b	R^2
Bibi Nani	13	12.5 - 38	27 - 465	0.0443	2.5505	**0.858**
Daranjan	8	10.5 - 38.6	19.4 - 367	0.0874	2.3125	**0.9513**
Kirta	11	13 - 34	19 - 190	0.0669	2.1829	**0.8959**
Gokurth	9	11 - 37.5	17.8 - 191	0.2126	1.8656	**0.9706**

Table 1. LWR's

The length and weight range on each site were given as; At Bibi Nani, the samples ranged from 12.5-38cm in length and 27-465g in weight, At Daranjan the length ranged from 10.5-38.6cm and the weight of the fishes ranged from 19.4-367g, at kirtha weight ranged from 19-190g and length from 13-34cm and at the site of gokurth 11-37.5cm and 17.8-191g was the length and weight ranges respectfully. According to the application of length

and weight relationships, the growth was found to be negative allometric as the regression coefficient 'b' values are shown stated in table 1.

Further the sites are from the main source of the river the more negative allometric their growth becomes. The bodies of Mastacembalus become more slander and are longer but their weights compared to lengths become lesser. The more the river courses through human populations the contaminants increase thus affecting the length and weight of these fishes. The water quality also changes their feeding habits as well as directly influences the fish itself and causes unhealthy growth. All linear regressions were significant, with coefficients of determination ($r^{2)}$ ranging from 0.858-0.9706.

CONCLUSION

It is concluded that therefore the contaminants and overuse of chemicals are the leading cause for the unhealthy growth of this fish which in turn is causing populations to decline. Poor growth causes early death and very low rates of reproduction of Mastacembalus Armatus; the numbers are decreasing rapidly of Mastacembalus Armatus in the Bolan river. Hopefully, this research will serve as the base for awareness and prevent the fish populations from totally finishing in the Bolan river.

REFERENCE

Bagenal TB, a. T. (1978). Methods for assessment of fish production in freshwater. *Age and Growth*.

Froese, R. (1998). Length-weight relationships for 18 less-studied fish species. *Journal of Applied Icthyology* , 117-118.

Koul Nishtha, L. R. (2012). Physico Chemical, Bacteriological and Pesticide analysis of Tap Water in Millennium City Gurgaon, Haryana, India. *I. Res. J. Environ. Sci.*, 1-7.

N., V. K. (2010). Comparison Studies of three freshwater Rivers (Cauvery, Bhavani, and Noyyal) in Tamil Nadu, India. *Iran. J. Energy and Environ.*, 315-320.

Revenga C, C. I. (2005). Prospects for monitoring freshwater ecosystems towards the 2010 targets. *Philosophical Transactions of the Royal Society*, 397-413.

Rudiger Riehl, a. H. (1991). *Aquarian Atlas.* Germany.

Serajuddin M, a. P. (2012). Study of reproductive traits of spiny eel, Mastacembelus armatus (Mastacembeliforms) from Kalinadi - a tributary of the Ganges river basin, India. *Research Journal of Biology*, 145-150.

Singh M.R., G. A. (2010). Physico-chemical properties of water samples from Manipur River system, India. , *J.Appl. Sci. Environ.Manage.*, 85-89.

Smitha, S. a. (2013). Physico Chemical Analysis of the Freshwater at River Kapila, Nanjangudu Industrial area, Mysore, India. *International Research Journal of Environment Sciences*, 59-65.

Sumalani M.A., a. A. (2014). Two new freshwater algal records from district kachhi of Balochistan, Pakistan. *Sci. Tech. and Dev.*, 137-141.

Svobodova Z., R. L. (1993). Water quality and fish health. *EIFAC Technical paper 54*.