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Taxonomy of the Freshwater fish species in Yamuna river in Firozabad

Dr. Ravi Kumar*

Associate professor, HOD Deptt of Zoology, Narain College Shikohabad, Distric Firozabad .U.P

Abstract - Small groups of researchers researching Indian fish have used truss morph metrics to discriminate between various species. Overfishing is caused by the use of ever-more-advanced fishing gear. Researchers examined the length-weight correlations (LWRs) of 588 fish from eight families, thirteen genera, and fourteen. The Yamuna River Firozabad (a Yamuna River tributary) was investigated. All species had a mean b value of 2.96 and a p-value of 0.001 for b = 2.96. In light of the Yamuna River's first-ever connection to the Ken River, conservation and management specialists believe these results are critical since length-weight data has never been obtained. In order to effectively manage fisheries, we set out to determine the LWRs of two previously unstudied rivers.

Keywords - Taxonomy, Freshwater Fish, Yamuna River, length-weight relationships

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INTRODUCTION

In addition to providing food and revenue for humans, freshwater fishes are also prized for their beauty and ornamentation. The use of ever-more-advanced fishing gear results in global overexploitation. Many wild fish populations have shrunk as a consequence of increased fishing activity. The illegal use of dynamite, pesticides, electro fishing, and other methods of illegal fishing pose a significant danger to fish populations across the globe. Fishery resources are a source of revenue for businesses. Prayagraj is the first large city in Uttar Pradesh, Bihar, and West Bengal to have organized fisheries in the Ganges basin. Major carps, other important carps, important catfish, and other fish comprise the economically significant fish. According to a study undertaken in 2003-2004, the fish markets were surveyed to find out how changes in catch composition impacted or influenced the price of major-to-minor catfish and carp in the market, as well as how these changes have affected the fish populations. [1]

Channing punctatus (Bloch) is the popular name for the green snake-headed spotted murrel, a teleostean fish that lives in freshwater habitats. It is known that the C. punctatus may be found in low-oxygen environments such as lakes, ponds, rivers, impoundments, ditches, and marshy places due of its accessory respiratory organs. Brackish water and beels were also reported to have the fish. The C. punctatus is found in South Asian countries such as India, Pakistan, Bangladesh, Sri Lanka, Nepal, and Yunnan in China. A "lean fish" is one that has little lipid content or no adipose tissue because of this. The demand for the fish in the local market in India and nearby nations is always larger than the supply. Because of this, it is sold at a premium price in northern, eastern, and north-eastern India as long as it is alive. Because of its indiscriminate use of natural resources and the destruction of its natural habitats, the fish has been designated as an endangered species. [2]

Geographic stocks (interspecific groupings) with varying life cycle traits such as the fish's ability to grow and reproduce are seen as essential for boosting fish output and stock development. The formation of a diverse spectrum of body forms was caused by variations in growth, development, and maturity within the same species. Because fish's body shapes are the result of ontogeny, patterns of morphometric variation reveal a range of growth and maturation rates. [3]

Truss morphometry has been utilised by a small group of researchers studying Indian fish to distinguish between different species. For example, Serajuddin and his colleagues worked on Mastacembelusarmatus, Jayasankar and colleagues, Sajina and associates and Ujjainia and colleagues and Pathak and colleagues studied Megalapsiscordyla, Catlacatla, and

Macrognathuspancalus, and the latter two worked on Rastrelligerkanagurta. Channa punctatus was also studied by Khan et al. and Das et al. The primary goal of this research was to determine whether the two C. sub-populations differed from one another. In certain cases, morphometric and meristic features of punctatus gathered from two separate settings were distinct or not. A search of the literature also indicated that no such data exists. This is why, in light of the lack of data, the research was conducted utilising both old and contemporary methods. The data is valuable for developing biodiversity conservation plans for various species, subspecies, stocks, and races, according to the researchers. [4]

Poikilothermic (cold-blooded) aquatic vertebrates of the Chordata phylum, which breathe via their gills, are often referred to as "fish" (Nelson, 2006). Agnatha (jawless fish) and Actinopterygii (lobefinned fish) are the most often referred to by the scientific community as "fish" (rayfinned fishes). There are membranous web-finned fish called actinopterygian lepidotrichia that contain bone spines or rays holding them together. Actinopterygians have lepidotrichia that are not fleshy, while Sarcopterygians have lepidotrichia that are fleshy. In 1910, ichthyologist Regan (now known as "morphospecies") described a fish species as the result of a group of connected communities with a similar morphological trait (this is now known as "morphospecies"). According to Nelson (2006) and Mayr (1942), the "biological species" notion is accepted, whereas Simpson (1951) supports the "evolutionary species" concept. The "phylogenetic" or "cladistic" species idea is preferred byCracraft (1983). [5]

LITREATURE REVIEW

JoséphineKengneFotsing (2022) Storm waters, pollutants, and agro pastoral operations all have a significant impact on tropical rivers. Biota in these settings is no longer able to thrive. Understanding how environmental gradients influence biological assemblages at various geographical scales is critical. However, there is a lack of data in Cameroon on the links between aquatic macro invertebrate distribution and environmental factors. A research was conducted at 11 different locations in West Cameroon to better understand the factors that influence the dispersion of such patterns. Benthic macro invertebrate assemblages at these locations were sampled over a period of 13 months, and 19 taxonomic metrics were derived for the benthic macro invertebrate populations. A total of 218 different species of taxa were nabbed. Benthic assemblage taxonomic organization was shown to be primarily driven by physicochemical factors including conductivity, water temperature, dissolved oxygen, nitrates, and total hardness and alkalinity. An ecological quality monitoring method for West Cameroon's rivers may now be tested using these findings. [6]

Rayal, Rajesh & Bhatt, Akshita& Bahuguna, Pankaj (2021) The Yamuna River is a significant tributary of the Ganges River, which flows through India. In Uttarakhand, India, the Yamnotri glacier is located at a height of 6387 metres above sea level. The current investigation focuses on the fish fauna of the Yamuna RiverFirozabad. From March 2020 until February 2021, a 12-month research was carried out. Samples were taken from the Rhithron and Potamon areas of the river and preserved in formalin at an acid concentration of 8%. During this time, a total of 20 fish species belonging to 14 genera and six families were documented. ‘Thecypriniformes family was found to be the most common. Many activities including damaging fishing practices, illicit mining, and dam building, which disrupted the river's natural flow pattern, have contributed to the reduction of the river's fish population.[7]

Nõges, P.; Argillier (2015) More than a half-dozen studies on the effects of numerous stressors in rivers, lakes, coastal waters, and groundwater’s were scrutinised, yielding a total of 532 pieces of ecological data. Although there is a wealth of theoretical information in aquatic ecology, few studies have quantitatively quantified the impacts of several stressors. Nutrient stress affected 71% to 98% of the multi-stress scenarios in the three surface aquatic ecosystems and 42% of the situations in groundwaters. These ecosystems' hydro-morphological properties mandated that they had various impacts along the groundwater-river-lake-transitional-coastal continuum. Most of the papers evaluated focused on two-stressor combinations, which correspond to the actual pressures on European surface waters recorded by Member States in the WISE WFD Database. Multiple stressor stress-effect models were shown to be more accurate than single stressor models for lakes, while coastal and transitional waters were found to be less accurate. Multiple stressors were shown to improve the accuracy of fish stress-effect models in all aquatic environments, making this group an excellent indicator of aquatic environment multi-stress effects. On the other hand, models based on the benthic flora are less capable of explaining varied stresses. [8]

Serajuddin, Mohammad. (2014) Results from morphometric and meristic studies as well as a

length-weight relationship analysis of Channa punctatus from two distinct habitats are reported. The overall length of fish from both settings was shown to be linearly related to various body parameters. In univariate analysis, the 14 morphometric features were significant, and coefficients of principal component analysis revealed shape variation across populations of C. punctatus. The length-to-weight connection research of fish from two distinct settings also varied from the so-called cube rule, which showed a divergent growth rate. [9]

Sen, Jag. (2014) Matatila Reservoir Bundelkhand area district Jhansi was the focus of this research to look at the variety of fish species that live there. For twelve months, an ichthyological investigation was carried out (Feb.2013Mar.2014). In addition to plankton and bird life, it had a total of 27 kinds of fish fauna. There were a wide variety of large and small carps, catfishes, and weedfishes found. Some of the world's most endangered species, such as Ompokbimaculatus, Eutropiichthysvacha, and Notopteruschitala, were also seen. [10]

RESEARCH METHODOLOGY

From December 2007 to January 2009, the fish were harvested. Five locations were chosen from each river, upstream, midstream, and downstream, to ensure that all typical ecosystems were included in the samples. It was possible to collect the ichthyofauna using different fishing gear, including drag nets and cast nets. A 10% formalin solution was used to preserve the specimens, which were subsequently identified using Jayaram (1981), and Talwar and Jhingran (1991). By using digital calipers (Mitutiyo) and a digital weighing machine, In order to get an accurate weight and length measurement, each fish was weighed from its snout to the caudal fin's enlarged tip. (ACCULAB Sartorius Group).

As a result of this, the number of specimens collected for each species varied greatly. O. bimaculatus required a sample size of n = 96 instead of the recommended n = 13 (Table 1). Equation W = aLb was used to estimate LWR (Ricker, 1973).

Log W = Log W + Log a + Log b Log L and the least squares linear regressions were used in GRAPHPAD 5 for this task. Using log-transformed data, linear regressions were found for every species studied.

DATA ANALYSIS

588 specimens of 14 species from eight families were collected, including the most common kind of fish, namely Notopterusnotopterus (Pallas, 1769),

Mystuscavasius and Mystuscavasius were both described by Hamilton in 1822. Gudusiachapra, Labeocalbasu, Puntius sarana, and Cirrhinusmrigala were also described by Bloch in 1795. When a linear regression is computed, it shows that the L-W relationship's slopes (ii) vary significantly across species. The availability of food and shifts in the development stage may be to blame for these discrepancies (Weatherly and Gill, 1987).

M. armatus (Baam) was found to have a b value of 2.4, whereas P. sarana (Putti) was found to have a b value of 3.52 in the Yamuna River. The Yamuna had a mean b of 2.95, whereas. A median r2 value of 0.96 was found in the Yamuna River, where r2 values ranged from 0.95 for four different species to 0.98 for P. sarana; five out of nine regressions had r2 values greater than 0.95; in the ken River, r2 values ranged from 0.97 for three different species (W. att It was found that all linear regressions were statistically significant. An ideal fish, according to Hile (1936) and Martin (1949), is often found to have a value of 3.0 for b Beaverton and Holt (1957) stated, however, that mature fishes seldom deviate from a b value of three. Most of the fish in this research deviated from the optimal value in this investigation. b = 2.40 and 2.91 for M. cavasius and M. armatus, respectively, on the Yamuna River Firozabad,

Table 1: Estimated parameters of length-weight relationships

Family	Species	Total length (cm) n	Min	Max	Max. known length (cm)	Regression parameters 10^a	b	95% CL of *a*	95% CL of *b*	r^2
Notopteridae	*Notopterus notopterus* (B)	45	7.3	29	60.0	0.0176	2.99	−2.3 to −1.8	3.9-2.80	0.95
	Notopterus notopterus (G)	41	5.7	27.6	60.0	0.0089	2.95	−2.21 to −1.89	2.81-3.08	0.98
Clupeidae	*Gudusia chapra* (B)	30	8.5	15	20.0	0.0079	2.98	−2.40 to −1.8	2.69-3.27	0.95
Cyprinidae	*Labeo calbasu* (B)	30	12.5	37	90.0	0.010	2.94	−2.3 to −1.63	2.75-3.13	0.95
	Puntius sarana (B)	30	7.5	21	42.0	0.0081	3.18	−2.31 to −1.88	2.99-3.38	0.98
	Cirrhinus mrigala (G)	22	18.0	31.6	100.0	0.0019	3.52	−3.12 to −2.27	3.21-3.83	0.97
Siluridae	*Ompok bimaculatus* (B)	30	13.5	29	45.0	0.0039	3.12	−2.81 to −2.01	2.82-3.43	0.96
	Ompok bimaculatus (G)	90	7.1	25.2	45.0	0.0059	3.08	−2.43 to −2.22	2.99-3.17	0.98
	Wallago attu (G)	13	10.5	78.0	240.0	0.0250	2.56	−2.05 to −1.17	2.26-2.85	0.97
Bagridae	*Sperata aor* (B)	30	12.4	45	180.0	0.0059	2.98	−2.55 to −1.90	2.76-3.20	0.97
	Sperata aor (G)	28	9.8	48.0	180.0	0.0043	3.02	−2.64 to −2.11	2.83-3.20	0.98
	Sperata seenghala	19	13.5	85.0	150.0	0.0062	2.97	−2.48 to −1.93	2.78-3.15	0.99
	Mystus cavasius (B)	30	7	27.4	40.0	0.0120	2.91	−2.22 to −1.6	2.65-3.17	0.96
Schilbeidae	*Eutropiichthys vacha* (G)	23	8.4	21.5	40.2	0.0138	2.73	−2.08 to −1.63	2.52-2.93	0.97
	Clupisoma garua (G)	48	5.4	36.6	60.9	0.0056	3.10	−2.37 to −2.12	2.99-3.21	0.98
Mugilidae	*Rhinomugil corsula* (B)	50	6.5	34	45.0	0.0109	2.94	−2.22 to 1.7	2.75-3.13	0.95
Mastacembelidae	*Mastacembelus armatus* (B)	29	12.4	45.1	90.0	0.0288	2.40	−1.9 to −1.2	2.17-2.62	0.97

Samples of yamunaRiver (B) were collected, as well as the total number of samples, n; the lowest and

maximum values of min and max are shown in the table below.

Using the mean exponent b = 2.95, N. demonstrates that the rate of growth in body length and weight are not directly related. are shown in the figure the notopterus, P. sarana, and G. O. and chapra (2.98) both appear in this list. In contrast to the typical exponent b = 2.94, bimaculatus (3.12) has an exponent greater than 3.12. The bimaculatus C. The garua (3.10) and S. and C, respectively, in 3.02. According to the results, mrigala (3.52) was determined to be higher than the identical mrigala.

According to Parameswaran and Sinha (1966), N. notopterus has a length-to-weight relationship in Orissa ponds and wild tanks that is comparable and near to the computed values of regression coefficients from the yamunarivers, respectively. In the River, C. mrigala's regression coefficient was 3.53. Khan also found a staggeringly high regression coefficient (b = 3.05) in his research (1972). A near-identical regression coefficient was found for S. aor in both rivers by Ramakrishniah (1988) in the Bagridae family from Nagarjunasagar reservoir. M. armatus, on the other hand, had a much lower slope regression (b), according to Narejo et al. (2003) in Mymensingh, Bangladesh. A review of the scientific literature found that no data was available for fish species such E. vacha, M. cavasius, Cgarua, or R. corsula. The values of b in N. notopterus, S. aor, and O. bimaculatus were found to be quite near to each other when compared to the species found in both rivers. C. mgigala, P. sarana, and L. calbasu, all of which have the typical cyprinid body shape or heavy body, have comparable values of b and development trends. Compressed species, including M. armatus, M. cavasius, G. chapra, and N. notopterus, exhibit minor changes in growth pattern trends. The health of the riverine ecology may be a contributing factor to the observed decline in maximum growth rates of fish in the two rivers, with the exception of G. chapra (Table 1).

Other variables that could have affected our results include the number of specimens examined, their location in relation to each other and the seasons in which they were caught. These factors were not taken into account when the b values were calculated, which could have resulted in the observed variations in b values. The coefficient of determination was extremely significant (P 0.001) in all regressions (r2 ranging from 0.95 to 0.99). Fisheries management actions like as fishing restrictions, recovery programmes, or other fisheries management activities may make the LWR data collected useful.

CONCLUSION

Because it gives fundamental information on the length–weight ratios of 14 indigenous Indian fish species found in the Yamuna Rivers and other rivers of the Yamuna basins in India, this research will be useful to fisheries biologists and environmentalists.

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Corresponding Author

Dr. Ravi Kumar*

Associate professor, HOD Deptt of Zoology, Narain College Shikohabad, Distric Firozabad .U.P