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Morphometric Characterization of Giant River Catfish, *Sperata seenghala* from River Sutlej, Punjab (India)

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***Abstract*:** The present study was conducted to characterize the stock of giant river catfish *Sperata seenghala* using morphometric and meristic approach and further different growth parameters and their relationships were calculated to assess the present fishery status and well-being of *S. seenghala* population from river Sutlej in Punjab (India). The total weight of fish ranged from 140-6730 g, while total length from 33-106 cm. In view of meristic characters observed the fin formula for *S. seenghala* can be expressed as D.1/7 0 P. 1/9, V. 0/8, A.0 /10. The Sutlej stock of *S. seenghala*, revealed a linear pattern of length weight relationship with strong correlation (r =0.94). The regression coefficient 'b' (2.56) indicated the negative allometric growth of the fish, tended to be thinner with increasing length. The length-length relationships between total length, standard length and fork length (LLR) indicated strong correlation (r = 0.90-0.99). The Fulton's condition factor (K = 0.544) and relative condition factor (Kn = 1.04) revealed optimum wellbeing of fish indicating suitability of habitat for the species. The data base generated in present study may serve in drafting of suitable management action plan for sustainable production of *S. seenghala* from river Sutlej.

***Keywords*:** *Sperata seenghala*, Morphometry, Length-weight relationship, Condition factor, Sutlej

Riverine fisheries, the major inland fisheries resource, provide a range of benefits including a means of livelihood and a source of food for millions of people. The riverine resources of India are traditionally grouped into Himalayan and peninsular river systems. The Indus river system is among one of the Himalayan river system which include river Indus and its tributaries (Jhelam, Chenab, Ravi, Beas and Sutlej). Sutlej is the longest tributary of the Indus system which has its source in Trans Himalayas at an elevation of 4630 masl and it enters in India at Shipki pass (Himachal Pradesh) .The river enters the plains of Punjab near Rupnagar (Ropar), flows through industrial city of Ludhiana and finally reaches to Harike where it meets river Beas and finally flows towards Pakistan. The total length of river Sutlej in the state of Punjab is approximately 440 km with a total catchment area of approximately 20303 Sq. km. (Department of Science, Technology and Environment, Punjab 2019). The rapid urbanization and industrialization in the state of Punjab during the last few decades have adversely affected the biotic and abiotic components of ecosystem of river Sutlej including major fishes of the river.

Being one of the representatives of commercial fisheries from Sutlej, Giant river catfish, *Sperata seenghala* was selected for present study. This fish has a high demand in the domestic market due to presence of few intramuscular bones. Furthermore, the market for this catfish is entirely reliant on natural resources as its aquaculture technology has not yet been established. Morphometric characters are a set of characters that help to identify a particular species (Turan et al 2005). The number of discrete, serially repeated, countable structures that are fixed in fishes is known as meristic characteristics that originally corresponded to body variations in evolutionary development. Morphometric characters, the length-weight relationship, relative condition factor are significant parameters for evaluating possible differences among various populations and providing information about growth patterns and habitat conditions of fish species (Hossain and Sultana 2014). There are very few / negligible studies on morphometric characterization of *S. seenghala* form river Sutlej (Punjab). The present study was aimed to assess the population status of *S. seenghala* from river Sutlej to formulate effective management plan for its sustainable fishery.

MATERIAL AND METHODS

Fish samples were collected from landing centers and fish markets representing fish catch from different stretches of river in Punjab covering upstream (near Ropar), midstream (Ludhiana) and downstream (Harike pattan) courses. The fish specimen were identified up to species level using taxonomic keys (Talwar and Jhingran 1991, Jayaram 1999) and further revalidated with information at www.fishbase.org. The individuals of *S. seenghala* were studied for 33 morphometric and 6 meristic characteristics. All the lengths

were measured to the nearest 0.1 cm using a wooden measuring board and measuring scales and the weight was measured using a digital balance with an accuracy of 0.01 g. Numbers of fin rays were counted in both paired and unpaired fins and represented in the form of fin formula.

Length-weight and Length-length relationship : By assessing the length and weight of fish specimens obtained from the Sutlej River, the length-weight relationship was studied. Cubes equations can be used to compute the relationship between length and weight (Le Cren 1951).

$W = {}_aL^b$

Where, W = weight of the fish (g) , L = length of the fish (mm) ,a = Intercept, b = Regression coefficient

A linear function was used to the data to estimate the morphometric connection between these factors (Ricker, 1975).

Log Y = Log a + b Log X

The length-length relationships (LLRs) between Total length (TL) and Fork length (FL), Standard length (SL), Head length (HL) were calculated using linear regression analysis. The equation was used to express these length relationships.

Y = a + bX

Where,Y= a dependent variable (various body lengths) ,X = an independent variable (total length)

a = constant (intercept) = regression coefficient (slope)

Condition factor (K) and Relative Condition Factor (Kn) : Condition factor (K) was calculated by using the formula given below (Fulton 1904)

$K = W * 100 / L^3$

Where, W = weight of the fish (g), L = length of fish (cm)

The ratio between the actual weight (observed weight) and the calculated weight based on the length-weight equation was defined as the relative condition factor (Kn) (Le Cren 1951).

Kn = W/Wˆ

Where, W= Observed weight (g),Wˆ= Calculated weight ($\log W * \log L / \log L^2$)

RESULTS AND DISCUSSION

In present study, a total of 70 specimens were observed for the morphometric characterization of *S. seenghala.* Thirty three morphometric and six meristic characters were recorded to observe the fish morphologically (Table 1). The total weight of fish ranged from 140-6730g while total length ranged from 33-106 cm. Average standard length and fork length was 52.72 cm and 55.55cm, respectively. In reference to meristic characters, four pairs of barbels viz. maxillary barbel, inner mandibular barbel, outer mandibular barbel, nasal barbel were present. Kaur (2020), Singh (2017) and Priyanka et al (2020) reported similar morphometric and meristic observations for *S. seenghala* from Sutlej and Harike wetland. All morphometric and meristic characters observed in the present study were in the same ranges as described by (Jayaram 1999).

All lengths measurements were taken in centimeters. Results are expressed as mean values ± standard error

Relative morphometric characters in relation to total length: The fork length (85.47%) and standard length (81.09%) were observed with maximum correlation with total length, whereas eye diameter has the least correlation (1.72%) (Table 2). Similar pattern were reported in three species of family Bagridae *viz. S. seenghala, S. aor* and *R. rita* from Harike wetland (Priyanka et al 2020). All the morphometric features change proportionally as total length increases. The morphometric characters with a higher correlation value with TL increase in accordance with TL while, the characters with lower values of relationship suggested that these characters grow slowly as TL increased.

Biometric growth patterns of *S. seenghala:* In present study, the Sutlej population of *S. seenghala* revealed a linear pattern of length weight relationship (Fig. 1) with a higher value of correlation coefficient (r =0.94). The value of regression coefficient 'b' was 2.56 for *S. seenghala,* indicating negative allometric growth pattern, where the fish increases in weight with slender body (Table 3). The value of 'b' in present study was within the expected range of 2.5-3.5 for optimum growth (Froese 2006). Priyanka et al (2018) reported similar growth pattern (b = 2.74) in *S. seenghala* from Harike wetland. The length- weight relationship of fishes by intercept (a) and regression (b) parameters are greatly influenced by sex, growth phase, season, gonadal maturity, health, nutrition, habitat, environmental circumstances; temperature and salinity variations in the length range of captured specimen and fishing gear (Froese 2006). However, these factors were not accounted in present study. The observed value of 'b' in present study might be

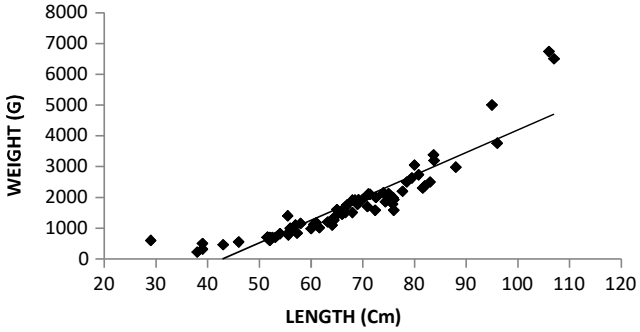

Fig. 1. Length-weight relationship of *S. seenghala* from river Sutlej

Table 1. Morphometric and meristic characters of *S. seenghala* (Nov 2020 - Oct 2021)

Measurements	Maximum	Minimum	Mean ± SE
Total weight (g)	6730	140	1679.9 ± 143.7
Total length (TL) (cm)	106	33	65.14±1.91
Standard length (SL)	92.5	23.5	52.72±1.65
Fork length (FL)	96.5	24.5	55.55±1.7
Head length(HL)	22.5	6.1	13.04±0.39
Head depth (HD)	6.2	1	3.19±0.14
Snout length (Sn L)	7.7	1.9	4.1±0.13
Body depth (BD)	13.5	2.8	6.89±0.22
Pre-orbital length (POL)	6.1	1.3	3.61±0.11
Post-orbital length (PoOL)	14.7	3.1	8.45±0.28
Eye diameter (ED)	2	0.4	1.12±0.03
Maxillary barbel (MBL)	33.4	13.7	21.36±0.45
Inner mandibular barbel length (IMBL)	11.6	2.3	5.03±0.15
Outer mandibular barbel length (OMBL)	12.4	4.2	7.16±0.16
Length of pre-dorsal fin (PDL)	38	9	21.95±0.67
Length of nasal barbel	4.3	0.5	2.09±0.08
Length between dorsal & adipose fin (LtbAdDF)	15.1	3.6	8.75±0.31
Length of pre-pelvic fin (PPeL)	48	12	27.72±0.85
Length of pre-anal fin (PAL)	65.1	16.3	38.99±1.14
Height of dorsal fin (HtDF)	15.7	4.2	9.84±0.3
Length of dorsal fin base (LDFB)	17.1	3	7±0.3
Length of adipose fin (AdFL)	12.5	3	6.93±0.22
Length of pelvic fin (PeFL)	5.5	0.8	2.1±0.08
Length of pectoral fin (PFL)	6.7	0.8	2.2±0.1
Length of anal fin (AFL)	8.6	0.9	4.94±0.18
Length of caudal fin (CFL)	23.6	5.4	12.84±0.37
Length of caudal peduncle (CPL)	12.4	2.3	6.48±0.22
Caudal peduncle depth (CPD)	9.6	2	5.57±0.18
Length of pre-pectoral fin (PPL)	22.9	5.2	12.32±0.37
Inter-orbital length (IOL)	6.8	1.2	3.6±0.13
Length of upper jaw (UJL)	7.5	1.7	3.91±0.13
Length of lower jaw (LJL)	7	1.2	3.46±0.12
Distance b/w upper & lower jaw	5.1	1	2.24±0.01
Meristic Characters			
Number of barbels	4	4	4
Dorsal fin rays (spiny/ soft)	1/9	7	7.19±0.04
Pectoral fin rays (spiny/ soft)	1/10	6	8.31±0.12
Pelvic fin rays	7	5	6.06±0.03
Anal fin rays	15	9	11.87±0.14
Caudal fin rays	27	17	23.12±0.22

Fin Formula: D.1 /7 I 0, P. 1/9, V. 0/8, A.0 /10
All lengths measurements were taken in centimeters. Results are expressed as mean values ± standard error

Table 2. Relative estimate of morphometric characters of *S. seenghala* as a function of total length

Characters	Percent of total length
Standard length	81.09
Fork length	85.47
Head length	20.03
Head depth	4.91
Snout length	6.27
Body depth	10.58
Pre-orbital length	5.57
Post-orbital length	12.97
Eye diameter	1.72
Maxillary barbel	32.39
Inner mandibular barbel length	7.69
Outer mandibular barbel length	10.86
Length of pre-dorsal fin	33.77
Length of nasal barbel	3.19
Length between dorsal & adipose fin	13.48
Length of pre-pelvic fin	42.56
Length of pre-anal fin	59.91
Height of dorsal fin	15.11
Length of dorsal fin base	10.79
Length of adipose fin	10.65
Length of pelvic fin	3.14
Length of pectoral fin	3.27
Length of anal fin	7.63
Length of caudal fin	19.63
Length of caudal peduncle	9.97
Caudal peduncle depth	8.57
Length of pre-pectoral fin	18.92
Inter-orbital length	5.56
Length of upper jaw	5.98
Length of lower jaw	5.30
Distance b/w upper &lower jaw	3.44

attributed to environmental variations, differences in numbers and length ranges of specimen studied.

In present study, all LLRs in *S. seenghala* were highly correlated with 'r' values ranging from 0.90 to 0.99 (Table 4). The present investigation indicated, the highest correlation between SL and FL (r=0.991) followed by TL-SL (r=0.959) and TL-FL (r=0.958) relationships. Similar observations were reported for *S. seenghala* from Harike wetland with higher correlations (r = 0.89-0.96) between TL, SL and FL (Priyanka et al 2020).

Condition factor and relative condition factor: In present study, Fulton's condition factor ranged from 0.22–0.93, with an average of 0.544 indicating the optimum well-being of *S. seenghala* in river Sutlej. Kaur (2020) also evaluated the value of 'K' in the range of 0.55-0.88 in *S. seenghala* from Sutlej, in corroboration with present study. However, Priyanka et al (2018) recorded the slightly lower 'K' value (0.49) from Harike wetland. Variations in the condition factor

Table 4. Length-Length Relationship (LLRs) of *S. seenghala* from Sutlej River

Relationship	Y=a+bx	r^2	r
TL vs FL	Log y = -0.058+0.993log X	0.919	0.958
TL vs SL	Log y = -0.114+1.011log X	0.92	0.959
SL vs FL	Log y = 0.066+0.974 log X	0.982	0.991
SL vs HL	Log y = -0.424+0.893 log X	0.865	0.93
HL vs TL	Log y = 0.811+0.897 log X	0.827	0.909
HL vs FL	Log y = 0.676+0.956 log X	0.874	0.934

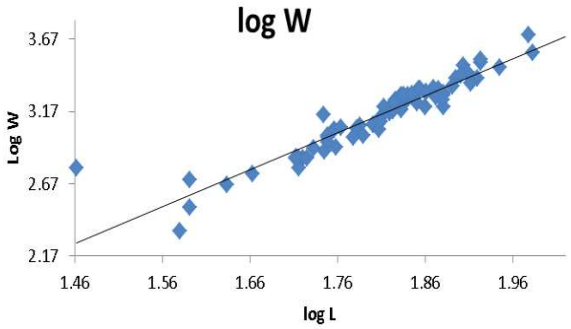

Fig. 2. Log length and log weight relationship of *S. seenghala* from river Sutlej

Table 3. Length-weight relationship (LWR) parameters of *S. seenghala*

	Length (cm)		Weight (g)		Growth Parameters			
Species	Maximum	Minimum	Maximum	Minimum	a	b	r	r^2
S. seenghala	106	33	6730	140	-1.49	2.56	0.94	0.88

Logarithmic equation of Length-Weight Relationship (LWR) as log W=log a +b log L

Log W= -1.49+2.56 log L

from different habitats might be attributed to food availability, ecology of a water body, different level of sexual maturity and physiological status of fish along with other unknown factors (Alam et al 2014). The relative condition factor (Kn=1.04) indicated suitability of habitat for the candidate species as overall fitness for fish species is assumed when Kn values are equal or close to 1. Jatoi et al (2013) recorded the relative condition factor value greater than 1 in *S. seenghala* from Indus river, Pakistan. Priyanka et al (2018) estimated relative condition factor in three species of Bagrids viz. *S. seenghala* (1.66), *S. aor* (1.65) and *Rita rita* (1.73) which may be attributed to different environmental conditions of wetland. Jisr et al (2018) reported a state of well-being for the nine species inhabiting in marine area of North Lebnon with Kn values of 0.99 to 1.01. The factors that could have caused the K and Kn to fluctuate were identified as general physiological parameters, seasonal variations, feeding intensity and environmental suitability.

CONCLUSIONS

The population of *S. seenghala* from river Sutlej is in good condition as evidenced from morphometric characters and growth pattern. The species showed negative allometric growth pattern along with strong correlation between length and weight increment. Relative condition factor represented the suitability of habitat and conducive environmental conditions for the growth of *S. seenghala* in river Sutlej. The data base generated w.r.t. *S. seenghala* population may serve in drafting of strategic action plan for its sustainable production from river Sutlej.

REFERENCES

Alam MM, Rahman MT and Parween S 2014. Morphometric characters and condition factors of five freshwater fishes from Pagla river of Bangladesh. *International Journal of Aquatic Biology* **2**(1): 14-19.

Froese R 2006. Cube law, condition factor and weight–length relationships: History, meta-analysis and recommendations. *Journal of Applied Ichthyology* **22**(4): 241-253.

Fulton TW 1904. The rate of growth of fishes. *Twenty-second Annual Report:* 141-241.

Hossain MS and Sultana N 2014. Morphometric characters and length-weight relationship of Bele (*Glossogobius giuris*) from Mithamoin haor, Kissorgonj, Bangladesh. *Journal of the Bangladesh Agricultural University* **12**(452-2016-35816): 389-395.

Jatoi S, Baloch WA, Soomro AN and Gachal GS 2013. Length-weight relationship of the silurid catfish *Sperata seenghala* Sykes 1839 (Bagridae) from Indus River, Sindh, Pakistan. *Sindh University Research Journal-SURJ (Science Series)* **45**(4): 661-664.

Jayaram KC 1999. *The Freshwater fishes of the Indian region*. Narendra Publishing House, Delhi, India.

Jisr N, Ghassan Y, Sukhn C and El-Dakdouki MH 2018. Length-weight relationships and relative condition factor of fish inhabiting the marine area of the Eastern Mediterranean city, Tripoli-Lebanon. *Egyptian Journal of Aquatic Research* **44**(4): 299-305.

Kaur S 2020. *Ecological studies on river Sutlej with respect to physico-chemical parameters, plankton diversity and heavy metal concentrations along its course in Punjab*. Ph.D. Dissertation, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India.

Le Cren ED 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *The Journal of Animal Ecology:* 201-219.

Priyanka C, Tewari G and Hassan S S 2018. Study on biometric growth parameters in different fish species of family Bagridae from Harike wetland, Punjab, India. *Journal of Entomology and Zoology Studies* **6**(4): 1667-1672.

Priyanka C, Tewari G, Datta SN and Kumar BTN 2020. Morphometric and meristic variations in different fish species of family Bagridae from Harike wetland. *Journal of Entomology and Zoology Studies* **8**(4): 1788-1793.

Ricker WE 1975. Computation and interpretation of biological statistics of fish populations. *Bulletin of the Fisheries Research Board of Canada* **191**: 1-382.

Singh A 2017. *Hydro-biological studies of Harike wetland, Punjab with special reference to biology, biometric characteristics and diversity of family Bagridae* –M. F. Sc. Thesis, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India.

Talwar PK and Jhingran AG 1991. *Inland fishes of India and adjacent countries*. Oxford and IBH publishing co., New Delhi.

Turan C, Yalçin S, Turan F, Okur E and Akyurt I 2005. Morphometric comparisons of African catfish, Clarias gariepinus, populations in Turkey. *Folia Zoologica* **54**(1/2): 165.

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