



Morphometric Characters and Meristic Counts of a Fish, *Garra gotyla gotyla* (Gray) from Ranjit Sagar Wetland, situated in the Himalayan foothills, India

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Abstract

Morphometric characters and meristic count of a fish, *Garra gotyla gotyla* (Gray) have been studied from Ranjit Sagar Wetland. Monthly sample collection of *Garra gotyla gotyla* was conducted for the study of morphometric characters and meristic counts. Eighteen characters have been studied in percentage of total fish length from which three characters were genetically controlled, thirteen characters were intermediate and two characters were environmentally controlled. Out of eighteen characters, ten characters show high values of correlation coefficient indicating that these characters are directly proportional to each other and eight characters show moderate correlation coefficient. In percentage of head length five were genetically controlled and two are intermediate. Three characters show least correlation coefficient and four shows moderate correlation. The linear relationship has been observed between dependent and independent characters. The meristic characters were counted to draw fin formula of this fish. Some variation in the count of branched and unbranched fin rays have been observed.

Keywords: Ranjit sagar wetland, *garra gotyla gotyla*, morphometric characters, meristic counts, linear relationship.

Introduction

Garra gotyla gotyla (Gray) is a very important hill stream fish and comes under IUCN threatened category of vulnerable (VU). Genus *Garra*, of ray finned fish comes in the family Cyprinidae possesses specialized adaptation which enable them to live in fast flowing waters. These bottom dwelling fishes prefer to live in fast flowing streams where they attach themselves to rocks with a highly modified mouth that is known as a sucker. This fish is one example of the long sucker and commonly kept in aquaria to keep down the growth of algae. This fish occur in several types of habitats, oftenly found in fast flowing rivers with rocky bottoms, streams and sometimes in lakes also. Though a tasty food fish it is not well placed in commercial fishery due to its small size. This is a typical hill stream fish and plays an important role to maintain the ecological balance of hill streams, hence study on its conservation and management is very essential.

The information about population structure and recruitment pattern of a fish species is highly required and considered as authentic source before initiating its proper conservation and management, otherwise it can lead to phenomenal changes in productivity and biological attributes of a species¹⁻³. In fishes, the first step towards their conservation is accurate identification. These examinations require exact measurements and counts of fin ray elements. For taxonomic and evolutionary studies the morphology of fishes is the main source of information. For morphological study various characters are used and these characters are categories into morphometric and

meristic characters⁴. The morphometric characters are classified into genetically (Narrow range), intermediate (Moderate range) and environmentally (Vast range) controlled characters⁵. Fish populations are recognized by using morphological measurements⁶⁻⁸. The two types of morphological characters that is morphometrics and meristics characters are frequently required to represent the stocks of a variety of exploited fish species⁹⁻¹². Morphometric and meristic study are vigorous tools for measuring discreteness of the same species¹³.

The present study gives information to fishery biologists about Morphometric and Meristic characters of the fish, *Garra gotyla gotyla* (Gray) from Ranjit Sagar Wetland, India. This will help to plan further conservation strategy for this fish.

Study Area: Ranjit Sagar wetland (32° 26' 33" N and 75° 43' 43" E) is situated on the Ravi river near Pathankot city, Punjab (India). The river Ravi is a part of the Indus river system which is originated from the Great Himalayas. This wetland (figure-1) is located at the boundaries of three states i.e. Punjab, Jammu & Kashmir and Himachal Pradesh and created by impoundment of the waters of the Ravi river water and its streams. This is primarily meant for water supply purposes i.e., drinking and irrigation, flood mitigation, navigation and generation of electricity. This is one of the great potential fishery resources in India. The Ranjit Sagar Wetland is cold water wetland and occupying largest catchment area (6086 sq.km.) as compared to other wetlands existing in the Punjab state. This wetland is included into the list of wetland of National importance by Ministry of Environment and Forests, Govt. of India in 2005.

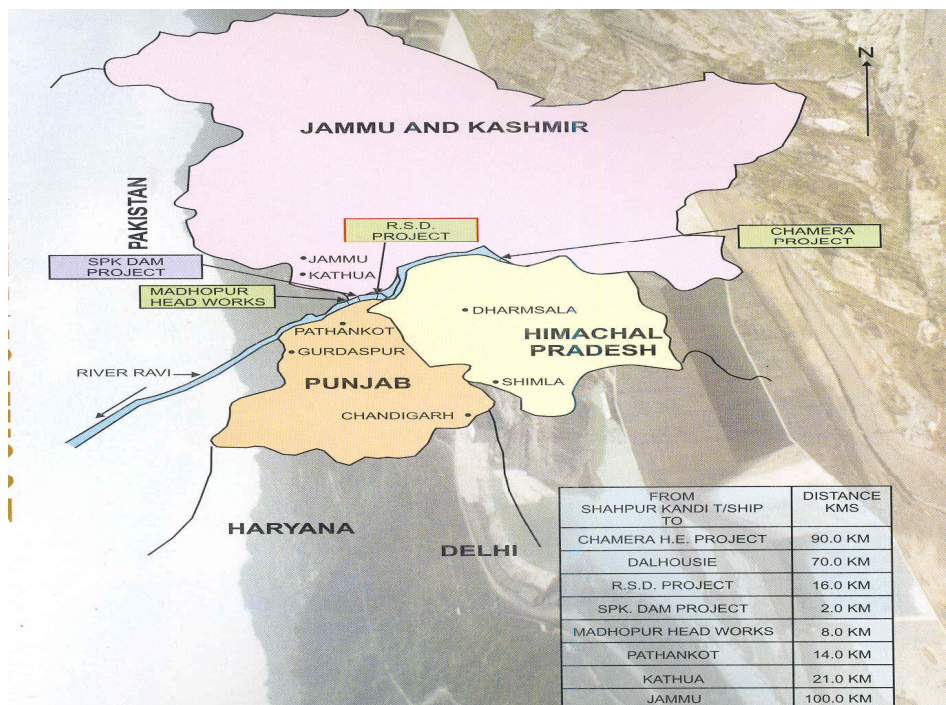


Figure-1
Location Map of Ranjit Sagar Wetland

Material and Methods

A total number of 25 specimens of *Garra gotyla gotyla* (Gray) (figure-2a) were collected from Ranjit Sagar Wetland with the help of standard fishing gears like cast and hand nets from September, 2012 to August, 2013. The specimens were preserved in 5% formaldehyde solution on the spot. Fishes were brought to the laboratory for further analysis. The meristic counts and morphometric measurements were recorded following^{14,15}. Statistical calculations such as regression equation and correlation coefficient have been calculated after¹⁶.

Results and Discussion

In case of present studies, the fish samples of *Garra gotyla gotyla* (Gray) have been collected from Ranjit Sagar Wetland. Different morphometric and meristic characters have been measured for population dynamics which includes proper identification of the fishes. These kinds of studies may help for making proper conservation measures for the fishes. Different morphometric characters which are expressed in the percentage of total fish length and head length have been taken for statistical analysis like mean, standard deviation, range, range difference, correlation coefficient and regression equation (table-1).



Figure-2
(a) Photograph of *Garra gotyla gotyla* (Gray) (b) showing adhesive disc

In percentage of total fish length: Eighteen characters have been studied in percentage of total fish length from which three characters were genetically controlled, thirteen characters were intermediate and two characters were environmentally controlled. Out of eighteen characters, ten characters show high values of correlation coefficient indicating that these characters are directly proportional to each other and eight characters show moderate correlation coefficient (table-1). Linear relationships have been observed between all the independent and dependent characters (figure-3-6).

In percentage of Head length: Seven morphometric characters have been under taken for correlation coefficient it has been observed that three characters show least correlation coefficient and four characters moderate correlation coefficient (table-1). The linear relationships have been observed between these parameters (figure-7, 8). The characters like head depth and preorbital distance have been found to be intermediate where as eye diameter, interorbital distance, postorbital distance, length of rostral barbels and length of maxillary barbels have been genetically controlled (table-1).

Table-1
Mean, S.D., Correlation coefficient (r), Range, Range Difference and Regression equation (Y=a+bX) between different morphometric characters of *Garra gotyla gotyla* (Gray)

S. No	In the percentage of total fish length	Mean	S.D	Range	Range difference	Correlation coefficient	Regression equation
1.	Standard length	9.30	1.46	6.6-11.9	5.3	0.977	Y=0.778-0.045X
2.	Head length	2.50	0.49	2-3.8	1.8	0.895	Y=0.236-0.336X
3.	Head depth	1.64	0.38	1.2-2.8	1.6	0.856	Y=0.175-0.467X
4.	Predorsal distance	4.40	0.66	3.2-5.7	2.5	0.956	Y=0.342+0.294X
5.	Postdorsal distance	2.76	0.54	2-3.8	1.8	0.629	Y=0.180+0.583X
6.	Length of dorsal fin	1.91	0.31	1.2-2.6	1.4	0.902	Y=0.154+0.060X
7.	Depth of dorsal fin	2.70	0.43	2-3.7	1.7	0.938	Y=0.221+0.042X
8.	Length of anal fin	0.94	0.15	0.6-1.3	0.7	0.835	Y=0.066+0.134X
9.	Depth of anal fin	2.06	0.35	1.4-2.8	1.4	0.936	Y=0.180-0.103X
10.	Preanal distance	7.18	1.10	6-9.6	3.6	0.957	Y=0.574+0.281X
11.	Length of pectoral fin	2.21	0.29	1.7-3	1.3	0.911	Y=0.144+0.480X
12.	Length of ventral fin	2.13	0.34	1.5-2.9	1.4	0.943	Y=0.176+0.009X
13.	Minimum body depth	1.34	0.21	1-1.9	0.9	0.538	Y=0.061+0.600X
14.	Maximum body depth	2.24	0.38	1.7-2.6	0.9	0.910	Y=0.189-0.042X
15.	Distance between pectoral and ventral fin	2.93	0.49	2.2-4.3	2.1	0.880	Y=0.239+0.059X
16.	Distance between pelvic and anal fin	2.59	0.47	1.9-3.6	1.7	0.887	Y=0.225-0.119X
17.	Length of caudal fin	2.78	0.47	2-3.8	1.8	0.928	Y=0.236-0.049X
18.	Length of caudal peduncle	1.27	0.27	0.8-1.9	1.1	0.810	Y=0.120-0.173X
	In the percentage of head length						
19.	Eye diameter	0.40	0.04	0.3-0.5	0.2	0.123	Y=0.008+0.373X
20.	Interorbital distance	1.06	0.17	0.8-1.4	0.6	0.825	Y=0.282+0.353X
21.	Preorbital distance	1.35	0.30	0.9-2.2	1.3	0.854	Y=0.528+0.024X
22.	Postorbital distance	0.79	0.11	0.6-1.1	0.5	0.432	Y=0.094+0.552X
23.	Length of rostral barbels	0.44	0.08	0.4-0.6	0.2	0.742	Y=0.109+0.171X
24.	Length of Maxillary barbels	0.25	0.06	0.2-0.4	0.2	0.491	Y=0.059+0.099X
25.	Head depth	1.64	0.38	1.2-2.8	1.6	0.834	Y=0.647+0.019X

Table-2

Meristic characters of *Garra gotyla gotyla* (Gray)

Meristic characters	Range
Dorsal fin ray	9-10(1-4/5-7)
Pectoral fin ray	13-14(1-6/8-12)
Ventral fin ray	7-9(1-4/5-7)
Anal fin ray	6(1-2/4-5)
Caudal fin ray	17-19(2-5/13-17)
Lateral line scales	32-35
Lateral line transverse scales	3-4 ^{1/2} /2-3 ^{1/2}
Fin formula = D. 9-10(1-4/5-8), P. 13-14(1-6/8-12), V. 7-9(1-4/5-7), A. 6(1-2/4-5), C. 17-19(2-5/13-17), LI. 32-35, L.tr. 3-4 ^{1/2} /2-3 ^{1/2} .	

Fin formula: D. 9-10(1-4/5-8), P. 13-14(1-6/8-12), V. 7-9(1-4/5-7), A. 6(1-2/4-5), C. 17-19(2-5/13-17), LI. 32-35, L.tr. 3-4^{1/2}/2-3^{1/2}.

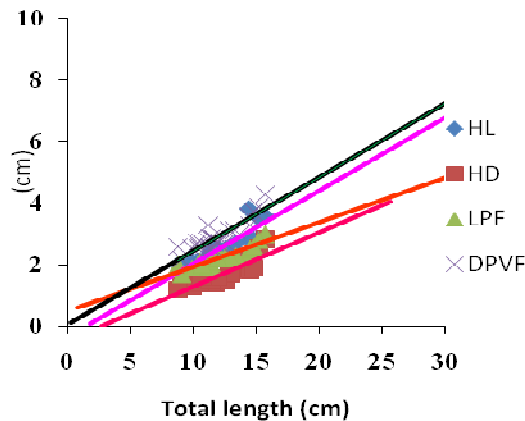


Figure-3

Relationship of Total Fish Length (TL) with Head length (HL), Head depth (HD), Length of pectoral fin (LPF), Distance between pectoral and ventral fin (DPVF)

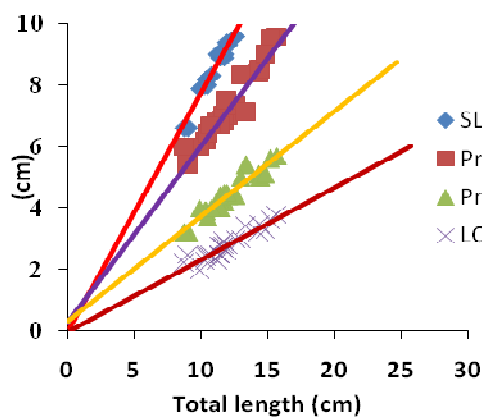


Figure-4

Relationship of Total Fish Length (TL) with Standard Length (SL), Pre-Anal Distance (PrAD), Pre-Dorsal Distance (PrDD), Length of Caudal Fin (LCF)

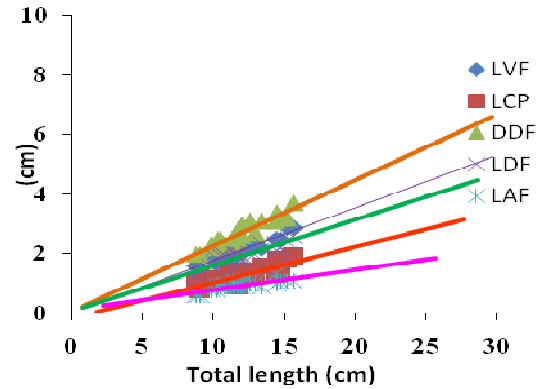


Figure-5

Relationship of Total Fish Length (TL) with Length of ventral fin (LVF), Length of caudal peduncle (LCP), Depth of dorsal fin (DDF), Length of dorsal fin (LDF) and Length of anal fin (LAF)

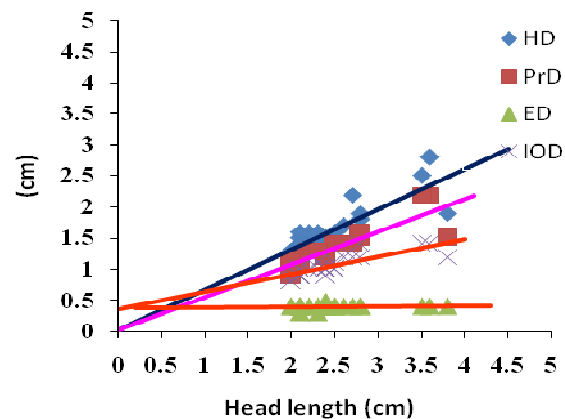


Figure-6

Relationship of Total Fish Length (TL) with Maximum body depth (MBD), Minimum body depth (MiBD), Distance between pectoral and anal fin (DPAF), Post dorsal distance (PsDD) and Depth of anal fin (DAF)

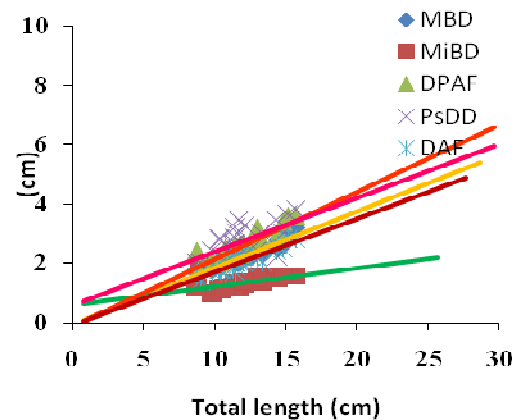


Figure-7

Relationship of Head Length (HL) with Head depth (HD), Preorbital distance (PrD), Eye diameter (ED) and Interorbital distance (IOD),

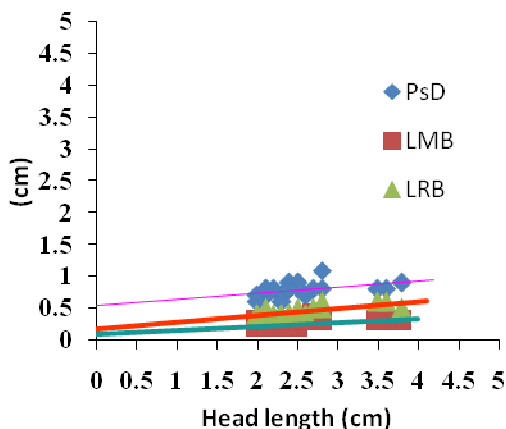


Figure-8

Relationship of Head Length (HL) with Postorbital distance (PsD), Length of Rostral barbels (LRB) and Length of Maxillary barbels (LMB)

Meristic counts: During the present studies, seven meristic characters have been counted i.e., number of lateral line scales, lateral line transverse scales, pectoral fin rays, dorsal fin rays, anal fin rays, caudal fin rays and ventral fin rays (table-2). Meristic characters have definite number and count, sometimes they vary and falls under some specific range. The following meristic counts of this fish from Ranjit Sagar Wetland have been recorded:

Discussions: On the basis of range differences the morphometric characters are classified into genetically (narrow range), intermediate (moderate range) and environmentally controlled characters (vast range)⁵. Characters belonging to the genetically controlled show minimum range of variation, characters belonging to intermediate show moderate range and the characters belonging to environmentally controlled shows maximum range of variation. In the *Barilius bendelisis* and *Barilius vagra*, the majority of their morphometric characters showed narrow range and were genetically controlled¹⁷. In *Tor putitora* 11 characters were genetically controlled, 5 characters were intermediate and 2 characters were environmentally controlled¹⁸. In *Barilius bendelisis* all the characters show linear relationship and 13 characters were genetically controlled, 4 characters were of intermediate and 2 characters were environmentally controlled from hillstreams of Himachal Pradesh¹⁹. In *Gudusia chapra* and *Gonialosa manmina* linear relationship have been observed between both dependent and independent characters²⁰. In *Schizothorax richardsonii* 19 characters were genetically controlled, 1 character was intermediate and 1 character was environmentally controlled²¹. During the present investigation, 3 characters were genetically controlled, 13 characters were intermediate and 2 characters were environmentally controlled in percentage of total length and in percentage of head length 2 characters were intermediate and 5 characters were genetically controlled.

In *Tor putitora* from Gobindsagar standard length was found to

be most correlated part⁵. In *Tor putitora* all characters show high degree of correlation coefficient¹⁸. In *Aristichthys nobilis* regression were found to be highly significant and showed high correlation and its relation of total length or body weight is meant for isometric growth¹³. Significant relationships have been found in *Gudusia chapra* and *Gonialosa manmina*²⁰. In *Schizothorax richardsonii* all morphometric characters show high degree of correlation coefficient²¹. In *Liza paria*, the base of anal fin and dorsal fin shows positive correlation in both sexes²². In *Tor putitora* positive correlation was observed between total length and external body parts²³. During the present investigations in percentage of total lengths out of eighteen characters, ten characters show high values of correlation coefficient indicating that these characters are directly proportional to each other and eight characters show moderate correlation coefficient. Linear relationships have been observed between all the independent and dependent characters. In percentage of head length three characters shows least correlation coefficient and four characters moderate correlation coefficient.

During present studies, it has been observed that the meristic counts are kept on changing while increasing or decreasing body weight and length of the fish. Similar variations in meristic characters were reported in many fishes such as *Nematalosa nasus*²⁴, *Pseudobagrus ichikawai*²⁵ and *Pterophyllum scalare*²⁶. The number of lateral line scales of *Garra gotyla gotyla* (Gray) reported from the Himalaya, other parts of India and World was 37-40 from these areas²⁷. During the present studies, this fish is reported from the Ranjit Sagar Wetland having 32-35 lateral line scales. The count of lateral line scales during present investigation is quite different from earlier studies. The difference in lateral line count indicates that different locations and environment have considerable impact on meristic characters.

Conclusion

The morphometric measurements and meristic counts confirmed that the population of test organism, *Garra gotyla gotyla* reported from Ranjit Sagar Wetland is quite different from other places. Eighteen characters have been studied in percentage of total fish length from which three characters were genetically controlled, thirteen characters were intermediate and two characters were environmentally controlled. Surprisingly, the intermediate characters are observed highest in this fish which indicates that these characters are not very much stable in nature from this place. So there is a great chance for these characters to be controlled environmentally if proper conservation strategies have not been planned for this fish. Out of eighteen characters, ten characters show high values of correlation coefficient indicating that these characters are directly proportional to each other and eight characters show moderate correlation coefficient. In percentage of head length five were genetically controlled and two are intermediate. Three characters show least correlation coefficient and four shows moderate correlation. The

linear relationship has been observed between dependent and independent characters. The meristic characters were counted to draw fin formula of this fish. Some variation in the count of branched and unbranched fin rays have been observed. The lateral line count also shows variations amongst the populations reported from different parts of India and World. This fish is a typical hill stream fish and thrives well in fast flowing waters and also highly sensitive to any environmental change. The modifications like adhesive disc are helpful to attach with big boulders to withstand high current of water. The rampant removal of boulders from stream as well as river beds should be stopped if this fish is to be conserved, otherwise it will slip into endangered or critically endangered category of fishes.

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