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Estimation of length-weight relationship and condition factor of *Crossocheilus diplochilus* (Heckel, 1838): A freshwater benthopelagic fish from Wular Lake in Kashmir Himalaya

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Abstract
A study on length-weight relationship and condition factor of *Crossocheilus diplochilus* from Wular Lake was conducted on 48 specimens collected on a monthly basis from December 2014 to November 2015. The length-weight relationship of *C. diplochilus* in the present study indicated negative allometric growth i.e. b < 3 for the given fish. The length-weight relationship equation was calculated and expressed as Log W = -1.292 + 2.408 Log L. The mean condition factor 'K' of the fish was recorded as 1.2 suggesting a moderately well condition of the fish in Wular Lake. These results provide the first basic information on length-weight parameters of *C. diplochilus* from Wular Lake which could be helpful in easy identification of the fish species. These parameters could further be employed to study the growth pattern and population dynamics of the fish species and would thus help in the development of a strategy for conservation of the natural stocks of *C. diplochilus* in Wular Lake, India.

Keywords: *Crossocheilus diplochilus*, length-weight relationship, condition factor, Wular Lake

1. Introduction
The knowledge of length-weight relationship is necessary for the effective management of a fishery. This relationship is very important in fisheries biology because it allows estimation of the average weight of the fish of a given length group [1], assess the well-being of individuals and also determines possible differences between separate unit stocks of the same species [2]. In fisheries, the general approach to quantify growth is to fit statistical models to data. Length-weight relationships also allow fisheries scientists to convert growth-in-length equations to growth-in-weight stock assessment models [3, 4].
This paper presents the length - weight relationship and condition factor of Kashmir latia, *Crossocheilus diplochilus* [5], a benthopelagic freshwater fish commonly found in Kashmir waters. Genus *Crossocheilus* belongs to the family Cyprinidae, subfamily Garrinae [6]. It reaches a length of approximately 17.0 cm [7]. However, the earlier reported length of the fish has been 10 cm [8] and 13 cm [6].
Crossocheilus diplochilus is reported from Indus drainage of Asia including India, Afghanistan and Pakistan. It prefers lakes and main river banks and does not ascend cold-water tributaries. It primarily feeds on filamentous algae, diatoms and organic detritus. This species is listed as Least Concern (LC) in the IUCN Red list of threatened species [9].

2. Materials and Methods
2.1 Study area
Wular Lake, one of the largest wetlands of Asia, is situated at an altitude of 1,580 m (A.M.S.L), between 34°16′–34°20′N latitudes and 74°33′-74°44′E longitudes. Wular Lake, an ox-bow type lake, is of fluviatile origin located in the northwest of Kashmir about 35 km from Srinagar city, being formed by the meandering of River Jhelum, which is the main feeding channel besides other tributaries. It plays a significant role in the hydrography of the Kashmir valley not only by acting as a huge absorption basin for floodwaters but also for maintaining flows to support agriculture and hydropower generation as well as sports activities.

The lake along with the extensive marshes surrounding is an important habitat for fish, accounting for 60% of the fish production within the state of Jammu and Kashmir [10]. The lake is largely shallow, with a maximum depth of 5.8m, the deeper part being on the western side. The lake is drained in the northeast by the only single outlet in the form of River Jhelum.

A large portion of the lake area has in the recent past been brought under cultivation of paddy and plantations of willow, poplar, and fruit trees. On the western side in the Sopore-Watlab section, low-lying areas have also been brought under paddy cultivation. In 1986, the lake was designated as a wetland of national importance under the Indian Governments Wetlands Programme, and, in 1990, it was enlisted as a wetland of international importance under the Ramsar Convention of 1975. The lake supports a rich biodiversity of fishes, the main species being the carps and schizothoracines along with some smaller fish species which are not commercially important.

2.2 Collection and identification of fish

The present study was conducted for a period of one year from December 2014 to November 2015. During this period a total of 48 specimens were collected from Wular Lake with the help of local skilled fishermen using a cast net with mesh size 5 to 9 mm. Identification of the fishes was done with the help of standard taxonomic studies made by [8, 11]. The total length (including tail and head) of the fish samples was measured to the nearest 0.1 millimeter and total body weight to its nearest 0.01 grams. The samples were preserved in 10% formaldehyde solution.

2.3 Length- weight relationship and condition factor

The analysis of length-weight data is aimed at describing mathematically the relationship between length and weight to enable conversion of one to another. It also measures the variation from the expected weight for length of individual fish. Calculations were done using the conventional formula described by [12] as $W = aL^b$. The above equation and data were transformed to logarithms before the calculations were made. Therefore the equation becomes: Log W = log a + b log L. Where, W is the total body weight in grams, L is the total length in millimeters (mm), 'a' and 'b' are the coefficients of the functional regression between W and L.

The condition factor or ponderal index (K) for individual fish species was evaluated using the conventional formula described by [13] as: K = W×100/L [3], Where, K is the condition factor, W is the weight of fish in grams (g) and L is the total length in mm.

Fig 1: A specimen of *Crossocheilus diplochilus* from Wular Lake, Kashmir

3. Results

3.1 Length weight Relationship

In order to determine the length weight relationship of *Crossocheilus diplochilus*, a total of 48 specimens were studied whose length and weight ranged from 9 - 15 mm and 9.9-39.2 g respectively. The equation for length weight relationship was obtained as Log W = - 1.292 + 2.408 Log L (Fig 3). The coefficient of determination (R^2) was calculated as 0.899.

3.2 Condition Factor

The condition factor (Kn) of *Crossocheilus diplochilus* varied between 1.1 to 1.3 (Fig. 2) with a mean value of 1.2, minimum of 1.1 in July, whereas the maximum value of 1.3 was noticed in February, March and April.

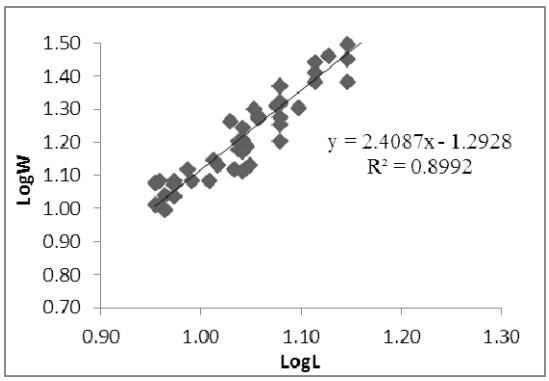

Fig 2: Scatter diagram showing length-weight relationship of *Crossocheilus diplochilus*

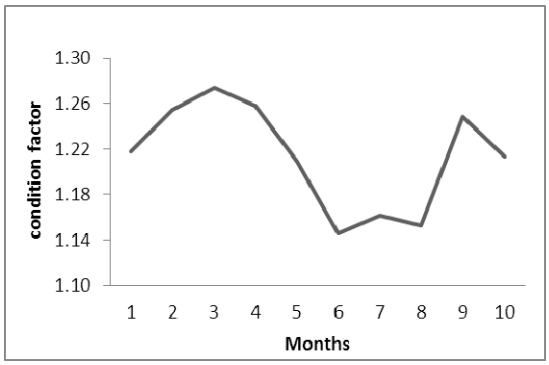

Fig 3: Monthly variation in condition factor of *Crossocheilus diplochilus*

4. Discussion

4.1 Length - weight relationship

The study of length - weight relationship of fish is of paramount importance in studying the growth, gonadal development and general wellbeing of fish population [12, 14] and for comparing life history of fish from different habitats [15, 16] stressed upon the importance of length weight relationship in modeling aquatic ecosystems [17]. Opined that length weight relationship of fish varies depending upon the condition of life in the aquatic environment.

The value of regression coefficient, "b" in length - weight relationship remains constant at 3 for an ideal fish living in an ideal condition [18]. However, as a fish passes through several stages, the simple cube law does not hold well throughout its life span and equilibrium constant shows certain variations [19] in the growth pattern of fish. The present study revealed that the fish species did not follow the cube law completely with the value of exponent "b" recorded as 2.408, thus revealing negative allometric growth (b<3).

The b values in length – weight relationships determine the growth pattern of the fish species. When b is equal to or close to 3, growth in the fish is said to be isometric, i.e. fish become

more robust with increasing length [20]. Similarly when b is far less or greater than 3, growth in the fish is allometric i.e. the fish becomes thinner with an increase in length [21]. [22] reported the value of "b" as 2.4487 for *S. plagiostomus* from the peripheral water bodies of Dal Lake, while as [23] reported it to be 2.9288 for the same fish from the Jammu water bodies. Similar departures from cube law have been observed by [24-26].

4.2 Condition factor

In the field of fisheries, the condition factor (K) is used in order to compare the condition, fitness or wellbeing of fish [27]. The condition factor is important in understanding the life cycle of fish species, thus contributing to the management of the species and maintaining the equilibrium in the ecosystem [28]. Condition factor (K) is also a useful index for monitoring of feeding intensity, age and growth rates of fish [29]. It is strongly influenced by both biotic and abiotic environmental conditions and can be used as an index to assess the status of the aquatic ecosystem in which fish lives [30].

According to [31], if the K value is 1.00, the condition of fish is poor, long and thin. A K value of 1.20 indicates that the fish is living in moderate condition. A good and well-proportioned fish would have a K value of approximately 1.40. Based on this criterion, the sampled fish in Wular Lake were living in a moderately well condition as the K value was obtained as 1.2.

5. Conclusion

The study provides the first basic information on length weight parameters for *Crossocheilus diplochilus* from Wular Lake, Kashmir. On the basis of the present study on *Crossocheilus diplochilus,* it was concluded that Length weight relationship indicated negative allometric growth in accordance to the cube law. Mean condition factor (K) was 1.2 which shows fairly good condition of fish.

7. References

1. Beyer JE. On length- weight relationships. Part 1: Computing the mean weight of the fish of a given length class. Fishbyte. 1987; 5(1):11-13.
2. King M. Fisheries Biology, assessment and management. 2nd edition, Blackwell Scientific Publications, Oxford. 2007, 189-192.
3. Stergio KI, Moutopoulos DK. A review of length-weight relationships of fishes from Greek marine waters. Naga, ICLARM Quart. 2001; 24(1-2):23-39.
4. Ozaydin O, Taskavak E. Length-weight relationship for 47 fish species from Izmir bay (Eastern Agean Sea, Turkey). Acta Adriatica. 2007; 47(2):211-216.
5. Heckel JJ. Fischeaus Cashmirgesammelt und herausgegeben von Carl Freiherrn v. Hügel. Mechitaristen, Wien. 1838; 110:13.
6. Kullander SO, Fang F, Delling B, Ahlander E. The fishes of the Kashmir valley. Pp.99-167. In: Nyman, L. (ed.). River Jhelum, Kashmir. Impacts on the Aquatic Environment. Svedmar, Goteberg, Sweden. 1999, 198.
7. Sharma NK, Mir JI, Pandey NN, Akhtar MS, Bashir A, Singh R. Meristic and Morphometric characteristics of *Crossocheilus diplochilus* from the Poonch. Valley of Jammu and Kashmir, India. World Journal of Zoology. 2014; 9(3):184-189.
8. Talwar PK, Jhingran AG. Inland Fishes of India and Adjacent Countries. Oxford and IBH publishing Co, N. Delhi, 1991, 205.
9. IUCN. IUCN Red List of Threatened Species. Version 2014. 2.www.iucnredlist.org. Accessed on 25 September 2015.
10. Rumysa K, Sharique AA, Tariq Z, Farooq M, Bilal A, Pinky K. Physico chemical status of Wular Lake in Kashmir. Journal of Chemistry Biology and Physics Science. 2012; 31:631-636.
11. Jayaram KC. The freshwater fishes of the Indian region. Narendra Publishing House. Delhi, 1999, 551.
12. Le Cren ED. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (Perca fluviatilis). J Animal Ecology. 1951; 20:201-219.
13. Worthington GH, Richardo CK. Scientific results of the Cambridge expedition to the East African lakes No15: the fish of Lake Rudolf and Lake Baningo. J Linn Soc zool. 1930; 267:353-389.
14. Nagesh TS, Jana D, Khan I, Khangngain O. Length weight relationship and relative condition of Indian major carps from Kuliabeel, Nadia, West Bengal, Aquacult. 2004; 5(1):85-88.
15. Petrakis G, Stergiou KI. Weight-length relationships from 33 fish species in Greek waters. Fish. Res. 1995; 21:465-469.
16. Basheer VS, Khan AA, Sidiqqui IA. Length-weight relationship of hanna punctatus (Bloch) from the river Yamuna. Advances in limnology. 1993, 241-246.
17. Allen KR. Some observations on the biology of the trout (Salmo trutta). J Anim Ecol. 1938; 7:333-349.
18. Martin WR. The mechanism of environmental control of body form in fishes. Univ. Toronto. Stu. Biol. 58: Ont. Fish. Res. Lab. 1949; 70:1-91.
19. Bagenal TB, Tesch FW. Methods of Assessment of Fish Production in Fresh Waters. IBP Handbook No 3, 3rd ed. Oxford Blackwell Scientific Publication, London. 1978, 101-136.
20. King RP. Length-weight relationship of Nigeria freshwater fishes. Naga ICLARM Quaterly. 1996; 19(3):49-52.
21. Qadri MY, Mir S. Length-weight relationship of *Orienus plagiostomus* (Mc Cl). Geobios, 1980; 7:158-159.
22. Bhagat MJ, Sunder Shame. A preliminary note on the length-weight relationship and relative condition factor of *Schizothorax plagiostomus* (Heckel) from Jammu region. J. Inland Fish. Soc. India. 1983; 15(1-2):73-74.
23. Sunder S, Kumar K, Raina HS. Food and feeding habits and length weight relationship of *Cyprinus carpio specularis* of Dal Lake, Kashmir. Indian J Fish. 1984; 31(1):90-99.
24. Raizada S, Chadha NK, Ali Mushraf KA, Javed H. Length weight relationship of milk fish, *Chanos chanos* (Forskal) reared in inland saline ground water. Indian. J. Fish. 2005; 52(1):115-117.
25. Mandal B, Nagesh TS, Behera S, Devi OJ. Lenght-weight relationship and relative condition factor of Gangetic bola, *Johnius gangeticus* (Talwar) from esturine region of Kakdwip, West Bengal. J Inland Fish Soc India. 2008; 40(2):72-82.
26. Ahmed EO, Ali ME, Aziz AA. Length-weight Relationships and Condition factors of six fish species in Atbara River and Khashm el- girba Reservoir, Sudan. International Journal of Agriculture Sciences. 2011; 3(1):65-70.
27. Imam TS, Bala U, Balarabe ML, Oyeyi TI. Length-weight relationship and condition factor of four fish

species from Wasai Reservoir in Kano, Nigeria. African Journal of General Agriculture. 2010; 6(3):125-130.
28. Kumolu-Johnson AK, Ndimele PE. Length-weight relationship and condition factors of twenty-one fish sps. In: Ologe lagoon, Lagos, Nigeria. Asian Journal of Agricultural Sciences. 2010; 2(4):174-179.
29. Anene A. Condition factor of four Cichlid species of a man-made Lake in Imo State, South-eastern Nigeria. Turkish Journal of Fisheries and Aquatic Sciences. 2005; 5:43-47.
30. Barnham PSM, Charles and Baxter A. Condition factor 'Kn' for Salmonid fish. Fisheries Notes 1998; 5:1-3.