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# Short communication

# Condition factor, length–weight and length–length relationships of an endangered fish *Ompok pabda* (Hamilton 1822) (Siluriformes: Siluridae) from the River Gomti, a tributary of the River Ganga, India

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#### Summary

The present study describes the condition factor, length-weight and length-length relationships for an endangered freshwater fish species *Ompok pabda* (Hamilton) of the family Siluridae from the River Gomti in Northern India. The values of regression parameter b ranged from 2.81 to 3.32 ( $r^2 > 0.90$ ). During the pre-monsoon, the allometric coefficient *b* of the LWR was close to isometric value (b = 3.08) allometric (b = 2.87), although it suggested negative allometric growth in monsoon periods while positive growth in post-monsoon. The condition factor values ranged from 0.672 to 0.744. Results of the present study could be useful to help in conservation and sustainable fisheries management of this endangered species.

## Introduction

The catfish Ompok pabda (Hamilton) locally known as pabdah (butter fish) is an indigenous small freshwater fish belonging to the family Siluridae of the order Siluriformes. It is a highly priced delicious catfish and well preferred because of relatively few bones. In India, it is distributed in the plains and submountain regions (Sarkar et al., 2005). However, the natural population of O. pabda has been greatly reduced in the Indian water with a very low percentage catch (Relative abundance = 0.27-0.77) and a very restricted distribution in the tributaries of river Ganga basin (Sarkar et al., 2008, 2010). Due to reduced abundance it has been listed as a threatened species as per IUCN criterion (CAMP, 1998; CAFF, 2006; Lakra et al., 2010). The River Gomti supports an exceedingly rich diversity of freshwater fishes and nutritional security (Sarkar et al., 2010). Lack of definite information on the biological aspects of the threatened fishes of the river system has hampered the planning and implementation of species-specific conservation and management strategies. Length-weight relationship parameters (LWR) are useful in fisheries science. No information is available on any of these aspects of O. pabda. This study therefore presents the first reference on morphometric aspects such as condition factor, length-weight relationships (LWR) and length-length relationships (LLR) for this fish species.

### Materials and methods

From February 2008 to September 2009 samples of *O. pabda* were collected from various sites representing different habitats

in the River Gomti, a major tributary of the Ganga River basin in Northern India. Fishes were collected by gill nets of different sizes. All samples were transported to the laboratory where they were counted and measured for total length (TL), standard length (SL), fork length (FL), and body weight (BW). Lengths were measured with a digital caliper to the nearest 0.1 cm and body weight was determined with a digital balance to the nearest 0.1 g. Fish samples were identified according to Jayaram (1999).

The statistical relationship between TL and total BW of the fishes was derived using the formula:

$$\log W = \log a + b \log L$$

where W = weight of fish in grams, a = intercept (constant), L = length of fish in centimeters and b = regression coefficient (slope).

Moreover, TL vs SL; SL vs FL; and FL vs TL relationships were calculated by linear regression (Hossain et al., 2006).

The condition factor K (Fulton, 1904) was estimated from the relationship:

$$K = 100 W/L^3$$

where: W = weight of the fish in grams, L = total length of the fish in centimeters.

Statistics were performed using the **SPSS** package version 16.0. (http://www.spss.com/software/statistics/). To compare the variations among seasons the 95% confidence limits were determined.

### **Results and discussion**

Altogether a total of 201 *O. pabda* individuals were collected from the River Gomti. Details of seasonal variations in regression parameters, and minimum and maximum total length range are presented in Table 1. In the present study the estimates of parameter *b* ranged from 2.81 to 3.32 and showed distinct seasonal differentiation. The value of *b* during premonsoon periods was 3.08 (near 3) and showed isometric growth; in the monsoon and post-monsoon periods the values of 'b' varied slightly, indicating allometric growth. The isometric growth (b = 3) and low  $r^2$  value (0.9) during the pre-monsoon period might be due to the same body form and conditions and quite narrow size range of *O. pabda* specimens. A *b*-value of less than three during monsoon periods, Table 1

9	63	

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Seasons	n	Total length (cm)		Regression Parameters				
		Min	Max	$\log a$	b	95% CI of a	95% CI of b	$r^2$
Pre-monsoon	50	10.5	15.5	-2.22	3.08	-2.54 to -1.89	2.79-3.37	0.90
Monsoon	64	7.1	16.8	-1.99	2.81	-2.15 to -1.83	2.67-2.94	0.96
Post-monsoon	87	7.6	14.1	-2.48	3.32	-2.62 to -2.34	3.18-3.46	0.96
Overall	201	7.1	16.8	-2.02	2.87	-2.11 to -1.94	2.79-2.95	0.96

Minimum and maximum length range, regression parameters and 95% confidence interval for Ompok pabda in different seasons from River Gomti

indicating a smaller specimen size, showed that they were in better condition than large samples (Froese, 2006). Fluctuations in b values from 3.0 during the monsoon and postmonsoon periods revealed that the length-weight relationships of this species followed the cube law and might be affected by the general condition of appetite and gonadal contents. These factors are also responsible for the variations in condition factor. The b-value of overall length-weight relation was 2.87, showing allometric growth. This value is quite different from the other closely related species of this genus, O. bimaculatus, b = 3.0 (isometric growth) as purported by Sani et al. (2010) from same river and the findings of Sivakami (1987) from a reservoir of India. Parameters of fish LWR are affected by a series of factors including season, habitat, gonad maturity, sex, diet, stomach fullness, health, and preservation techniques (e.g. Tesch, 1971; Bagenal and Tesch, 1978). A similar mode of variation in the length-weight relationship male and female M. vittatus was also reported (Hossain, 2006). All allometric coefficients (b) estimated in this study were within the expected range of 2.5-3.5. All linear regressions of length-length relationships presented in Table 2 were highly significant (P < 0.001), with  $r^2$  values being > 0.992.

The condition factor (*K*) is an index reflecting interactions between biotic and abiotic factors in the physiological condition of the fishes. It shows the well-being of the population during various life cycle stages (Angelescu et al., 1958). Average value of Fulton's condition factor (*K*) for this species in different seasons ranged from 0.62 to 0.75. There were significant differences (P < 0.001) in '*K*' values of *O. pabda* among seasons. The higher value of *K* during the pre-monsoon season indicates that the fishes are in good condition. This may be due to differences in the state of maturity and availability of fish food organisms in the riverine ecosystem. This species spawns in June to July (Sarkar et al., 2005; Hussain, 2006; Chakrabarti et al., 2009) and the low value of *K* during this season indicates that the fishes were not in good condition.

Table 2

Length-length relationships between total length (TL), fork length (FL) and standard length (SL) of *Ompok pabda*, Gomti River, India

Seasons	Equation		а	b	$r^2$	
Pre-monsoon	TL = a + bSL	50	-0.056	1.011	0.995	
	SL = a + bFL		0.029	0.991	0.989	
	FL = a + bTL		-0.031	1.005	0.992	
Monsoon	TL = a + bSL	64	-0.106	1.044	0.996	
	SL = a + bFL		0.055	0.972	0.999	
	FL = a + bTL		-0.051	1.016	0.998	
Post-monsoon	TL = a + bSL	87	-0.057	0.998	0.993	
	SL = a + bFL		0.016	1.009	0.995	
	FL = a + bTL		-0.044	1.031	0.993	

n, number of individuals;  $r^2$ , coefficient of determination; *a*, intercept; *b*, slope.

Heincke (1908) also described the seasonal variation of 'K' in the south-eastern North Sea plaice and found that the better the nutritional condition, the higher the K.

To the best of our knowledge, no previous references dealing with LWR and LLR for *O. pabda* were available in the tributaries to the Ganga basin. In conclusion, this study provides basic information on L-W, LLR relationships and the condition factor that can be useful for fishery biologists and conservation agencies to impose adequate regulations for sustainable fishery management and conservation in the River Gomti and Ganga basin in particular.

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#### References

- Angelescu, V.; Gneri, F. S.; Nani, A., 1958: La merluza del mar argentine (biologia e taxonomia). Secr. Mar. Serv. Hidrog. Nav. Publico, H1004: pp. 1–224.
- Bagenal, T. B.; Tesch, F. W., 1978: Age and growth. In: Methods for assessment of fish production in fresh waters, 3rd edn. T. Begenal (Ed.). IBP Handbook No. 3, Blackwell Science Publications, Oxford, pp. 101–136.
- CAFF, 2006: Conservation Assessment of Freshwater Fish Diversity for Central India. Proc. workshop, organized by National Bureau of Fish Genetic Resources, 25 Nov, CIAE, Bhopal, MP, India.
- CAMP, 1998: Conservation Assessment and Management Plan (CAMP) for freshwater fishes of India. Workshop report, Zoo Outreach Organization, Coimbatore / CBSG and NBFGR. Lucknow, India, pp. 1–158.
  Chakrabarti, P. P.; Chakrabarty, N. M.; Mondal, S. C., 2009:
- Chakrabarti, P. P.; Chakrabarty, N. M.; Mondal, S. C., 2009: Breeding and seed production of butter catfish, *Ompok pabda* (Siluridae) at Kalyani Centre of CIFA, India. Research and farming techniques, Jan–Mar.
- Froese, R., 2006: Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. J. Appl. Ichthyol. 22, 241–253.
- Fulton, T. W., 1904: The rate of growth of fishes. 22nd Annual Report, Part III. Fisheries Board of Scotland, Edinburgh, pp. 141–241.
- Heincke, F., 1908: Bericht über die Untersuchungen der Biologischen Anstalt auf Helgoland zur Naturgeschichte der Nutzfische. (1 April 1905–1 Oktober 1907). In: Die Beteiligung Deutschlands an der Internationalen Meeresforschung, 4 & 5. Jahresbericht. Verlag von Otto Salle, Berlin, pp. 67–150.
- Hossain, M. Y.; Ahmed, Z. F.; Leunda, P. M.; Jasmine, S.; Oscoz, J.; Miranda, R.; Ohtomi, J., 2006: Condition, length-weight and length-length relationships of the Asian striped catfish *Mystus vittatus* (Bloch, 1794) (Siluriformes: Bagridae) in the Mathabhanga River, southwestern Bangladesh. J. Appl. Ichthyol. 22, 304–307.

- Hussain, A., 2006: Seed production of *Ompok pabda* (Ham.) in hatchery of C.G. Co-operative Fish Federation. Fishing Chimes **26**, 136–139.
- Jayaram, K. C., 1999: The Freshwater fishes of the Indian region. Narendra Publ House, New Delhi, pp. 551.
- Lakra, W. S.; Sarkar, U. K.; Gopalakrishnan, A.; Pandian, A. K., 2010: Threatened freshwater fishes of India. NBFGR publication, National Bureau of Fish Genetic Resources, Lucknow, Uttar Pradesh, India, ISBN: 978-81-905540-5-3.
- Sani, R.; Gupta, B. K.; Sarkar, U. K.; Pandey, A.; Dubey, V. K.; Lakra, W. S., 2010: Length–weight relationships of 14 Indian freshwater fish species from the Betwa (Yamuna River tributary) and Gomti (Ganga River tributary) rivers. J. Appl. Ichthyol. 26, 456–459.
- Sarkar, U. K.; Deepa, P. K.; Negi, R. S.; Poul, S. K.; Siongh, S. K., 2005: Captive breeding of an endangered fish *Ompok pabda* (Hamilton-Buchanan) using different doses of ovaprim. J. Inland Fish. Soc. India **37**, 37–42.
- Sarkar, U. K.; Pathak, A. K.; Lakra, W. S., 2008: Conservation of freshwater fish resources of India: new approaches, assessment and challenges. Biodivers. Conserv. 17, 2495–2511.

- Sarkar, U. K.; Gupta, B. K.; Lakra, W. S., 2010: Biodiversity, ecohydrology, threat status and conservation priority of the freshwater fishes of River Gomti, a tributary of river Ganga (India). Environmentalist **30**, 3–17.
- Sivakami, S., 1987: Length-weight relationship and relative condition in *Ompok bimaculatus* (Bloch) from Bhavanisagar Reservoir (Tamil Nadu). Indian J. Fish. **34**, 202–207.
- Tesch, F. W., 1971: Age and growth. In: Methods for assessment of fish production in fresh waters. W. E. Ricker (Ed.). Blackwell Scientific Publications, Oxford, pp. 99–130.
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