Some Biological Aspects of Taki (*Channa Punctata)* in the Pubkola Beel, Patuakhali District, Bangladesh

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Abstract: The spotted snakehead, *Channa Punctata* is an indigenous freshwater species, widely distributed to Bangladesh. Some biological aspects including length frequency distribution (LFD), length-length relationship (LLR), length weight relationship (LWR), condition factor (KF) and size at sexual maturity of *C. Punctata* were studied in the Pubkola beel, Patuakhali district. Sampling was carried out occasionally using traditional fishing gear with the help of local fisher during September-November 2019. Total length (TL) and standard length (SL) were measured using a measuring scale and body weight (BW) was measured using an electronic digital balance with 0.01 g accuracy. The LFD was estimated by 2 cm class interval. The LLR and LWRs was estimated by using linear regression and based on natural logarithms respectively. Fulton's condition factor (KF) and size at sexual maturity was calculated by using the different equations. In the present study, the results found that maximum individuals (53.65%) were distributed in the length class of 12.0 to 14.0 cm TL. The LLR between SL and TL indicated positive allometric growth. The LWRs between SL vs. BW and TL vs. BW indicated negative allometric growth. The minimum K_F value was found at size 17 cm SL and maximum at 7 cm SL. The K_F tended to be lower after 7 cm SL. The size at sexual maturity of this species was 8.02 cm SL. The findings of the present study constitute a baseline for future studies.

Keywords: Pubkola Beel, *Channa Punctata,* Growth, Linear regression, Condition factor.

Introduction

The members of family Channidae commonly known as the snakeheads are native to Asia. *Channa Punctata*, the spotted snakehead, is a species of snakehead. *C. Punctata* is native to Bangladesh, Afghanistan, Pakistan, India, Sri Lanka, Nepal, and Myanmar. This species inhabit ponds, swamps, ditches, beels and brackish water (Rahman, 1989; Pethiyagoda, 1991). Adults prefer stagnant waters in muddy streams (Talwar, and Jhingran, 1991) and feed on worms, insects and small fish (Pethiyagoda, 1991). Moreover, this species is well known for its taste, high protein content, low intramuscular pin bones, high nutritive value, recuperative and medicinal qualities, thus recommended as a diet during convalescence (Haniffa et al., 2004). Body color varies with its habitats, generally yellowish to brown on back and lighter below. A series of about 8-9 vertical bands above lateral line, alternating with a similar series below it (Rahman 1989 and 2005). Dorsal, anal and caudal fins are dark gray (Talwar and Jhingran, 1991). Spawning usually takes place at night in shallow water with a silly substrate. Eggs are laid in nests through elaborate tunnels in vegetated areas which look like vertical columns of water with the eggs floating in the center (Breder and Rosen, 1966). The male and female move towards the center of the nest during spawning where the male entwines his body to the female

moving upward while releasing the eggs to be fertilized (U.S. Fish and Wildlife Service, 2002). Eggs are guarded by one or both parents. Hatching takes place in a day (Pethiyagoda, 1991).

Patuakhali district is located in the southern part of Bangladesh and is known for its rich fishery resources. Total fish production in Bangladesh for the fiscal year 2019–20 was estimated to be 44.46 lakh metric tons, while the total fish production in Patuakhali district was 86,462 metric tons and Patuakhali is the top fish producing districts in the country (BBS, 2021). A wide variety of fish species can be found in the area's numerous rivers, canals, and other bodies of water, including beels. In particular, Pubkola Beel is renowned for having high fish productivity and serves as a significant fish supply for the neighborhood. With its numerous fish populations, it is a significant wetland environment. Researchers can help to the recording and comprehension of the local fish species and their ecological dynamics by carrying out the study in this area. Future comparisons with surrounding water bodies or comparable wetland ecosystems in the area are made possible. For fish species to be conserved and managed sustainably, it is essential to understand their population dynamics and health status.

This study will allow researchers to evaluate the condition of the target fish species in Pubkola Beel and decide whether any management or conservation efforts are required to ensure their long-term viability. The beel is inhabited to a wide variety of fish species, including rohu, catla, mrigal, grass and silver carps, taki, shing, koi, and magur, among others. In Bangladesh, taki is a small indigenous species. The species is mainly a carnivore. Favorite food of this species is other small fish's yolk flies and fish larvae. In its natural habitat, it consumes crustaceans, molluscs, insects, small fishes, semi-digested materials and sometimes plants. It's feeding habit changes seasonally. This fish is popular in our country and is being consumed as fresh and sun dried condition (Samad et al., 2009). According to Ricker (1968), LWR and LLR are basically used to assess fish stocks and populations. However, the condition factors are estimated to assess the physiological status, health and overall productivity of a fish population (Blackwell et al., 2000; Richter, 2007).

A few works have been done on different aspects from different water bodies like lake, river and beel including length-weight relationship (Haniffa et al., 2006; Hossain et al., 2006; Khan et al., 2012; Kumar et al., 2014; Serajuddin et al., 2013; Kashyap et al., 2014, 2015; Das et al., 2014; Singh and Serajuddin, 2017; Lakshmi et al., 2018; Chakraborty et al., 2018; Hossen et al., 2019), length-length (Hossain et al., 2006; Khan et al., 2012; Kashyap et al., 2014; Singh and Serajuddin, 2017; Hossen et al., 2019; Paul et al., 2019), condition factor (Serajuddin et al., 2013; Das et al., 2014; Singh and Serajuddin, 2017; Kashyap et al., 2015; Lakshmi et al., 2018; Chakraborty et al., 2018; Hossen et al., 2019). However, to the best of authors', knowledge there is no complete study on some biological aspects of *C. Punctata* from the Pubkola Beel, Patuakhali District, Bangladesh. So, keeping this in mind the present study find out some biological aspects i.e. length frequency distribution (LFD), estimate the length-length relationship (LLR) and length weight relationships (LWRs), also calculate the condition factor (KF) and estimate the size at sexual maturity of *C. Punctata*.

Materials and Methods

Sampling design and sampling technique

The study was conducted in Pubkola beel locally called 'Mridhabari beel' at Dumki upazilla of Srerampur union, in Patuakhali district, Bangladesh (Figure 1). Sample was collected occasionally in September-November 2019 from the Pubkola beel. Sample size was 82 in this

study. The samples are collected by the help of local fisher using traditional fishing gear. The collected fresh samples were preserved immediately in ice and transferred to the laboratory for further analysis.

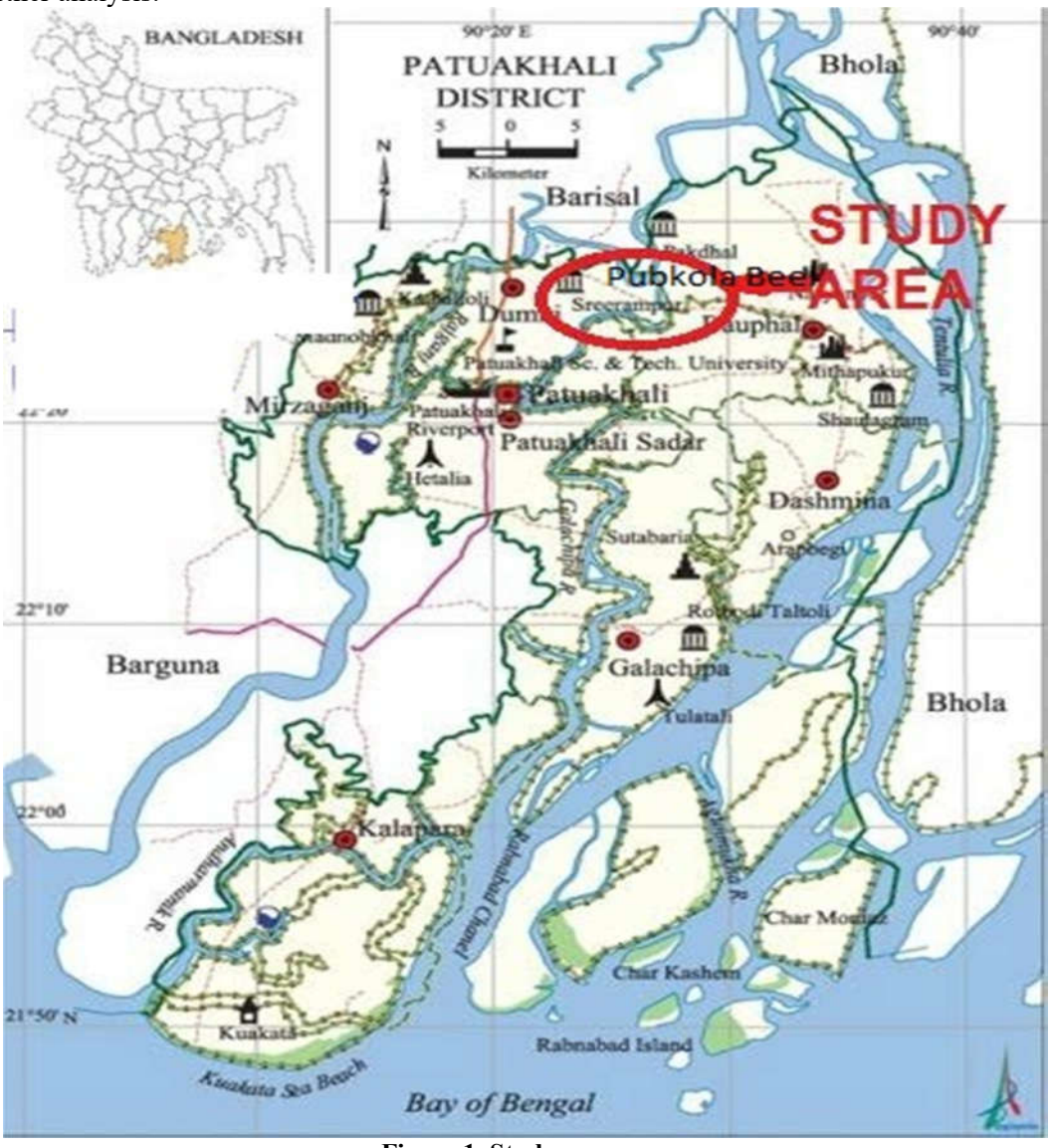

Figure 1. Study area map

Recording of length and weight

The preserved fishes were washed with running tap water to remove dirt and take half an hour in room temperature for complete removal of moisture. Standard length (SL) and total length (TL) for all individuals were measured using a measuring scale. The TL was measured from the tip of the snout to the posterior end of the caudal fin. The SL was measured from the tip of the snout to the base of the caudal fin. The individual body weight (BW) was recorded using an electronic digital balance. All estimations were done using combined sex.

Length frequency distribution

Length frequency distribution of *C. Punctata* specimens were constructed using 2 cm interval of SL. The normality of SL frequency distributions was fitted based on Hasselblad's maximum likelihood method (Hasselblad, 1966).

Length-length relationships

The length-length relationship between SL and TL was calculated by using the following equation: $Y = a + bX$

Where, "a" is the intercept and "b" is the slope of the regression.

Length-weight relationships

The relationship between length and weight was calculated using the expression: $W=aL^b$ where the "W" is the body weight (g), "L" the standard length (cm), "a" and "b" are parameters. Parameters "a" and "b" of the weight-length relationship will be estimated by linear regression analysis based on natural logarithms: $\ln (W) = \ln (a) + b \ln (L)$.

Condition factor

Fulton's condition factor (K_F) was estimated using the equation: $K_F = (BW/L^3) \times 100$.

Size at sexual maturity

The size at sexual maturity (L_m) of this species was calculated by using the equation proposed by Froese and Binohlan (2000):

$L_m = 10^{-0.1189+0.9157 *\log (Lmax)}$

Where, L_m is the size at first maturity and L_{max} is the maximum recorded size of the species.

Results and Discussion

Length Frequency Distribution

A total of 82 C. punctata specimens were obtained from the Pubkola beel in Patuakhali throughout the study period. In this study, the TL ranged from 9.0 to 22.0 cm, whereas the BW ranged from 7.80 to 110.35 g (Table 1). The length frequency distribution of *C. punctata* is shown in Figure 2.

Table 1. Descriptive statistics of different variables

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
LFD	82	9.00	22.20	1.39	3.09
LFR	82	1.99	2.88	2.42	0.22
LWR	82	2.05	4.70	3.33	0.63
KF	82	7.02	17.35	1.30	0.53
BW	82	7.80	110.35	3.40	22.16
SL	82	7.30	17.80	1.14	2.52

The mean of TL was 14.2 ± 3.27 cm. The classes with the highest frequencies, which made up 53.65% of all samples, were those with TLs of 12.0 to 14.0 cm. The species' maximum length was 22.2 cm in the current investigation. The largest size stated in this study was comparable to that reported by Hossen et al. (2019), who reported the largest size as 22.7 cm TL. According to Ahmed et al. (2012), Hossen et al. (2016), and Khatun et al. (2018), information on maximum length is required to determine the asymptotic length and growth co-efficient of

fishes, which is essential for the planning and management of fisheries resources. The majority of the species, or 53.65%, are found in the 12.0–14.0 cm TL classes, according to the current study.

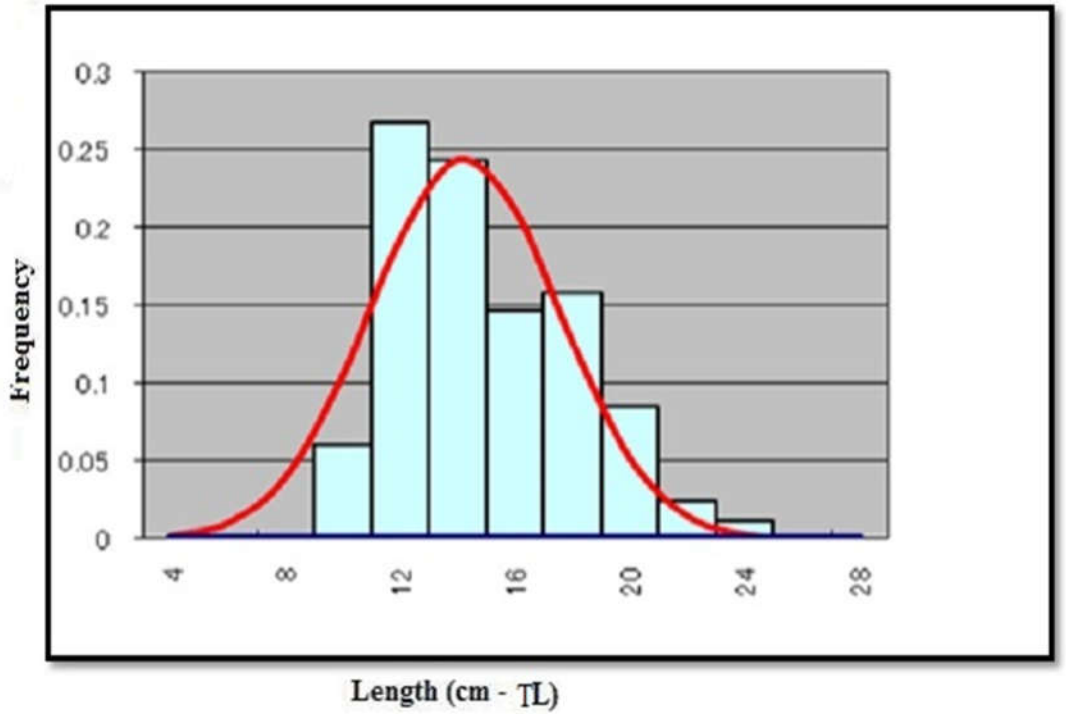

Figure 2. Length-frequency distribution of the *Channa Punctate*

Length-Length Relationship

The relationship between standard length and total length (Figure 3) indicated positive allometric growth for the specimens as the allometric coefficient "b" values was significantly different from the expected value of 1 (t-test, $p<0.05$). High degree of correlation between total length and standard length has been indicated by the coefficient of determination (r^2= 0.990). The value of the coefficient of determination indicated that 99% increase of the total length occurs due to the increase of standard length. Length-length (L-L) relationships have been used for assessment of fish stocks and populations (Richter, 2007). Length-length relationships are also important in fisheries management for comparative growth studies (Moutopoulos & Stergiou, 2002). In the current study, positive allometric growth was observed in LLR. LLR and LWRs have been conducted on *C. Punctatus* from the Indian sub-continent (Haniffa et al., 2006; Hossain et al., 2006). However, this study highlighted some life history traits of *C. punctata* including LFD, LLR, LWRs, condition factor (K_F) and size at sexual maturity. As there are no previous studies on LLR relationship of this species, the result constitutes a baseline for future work.

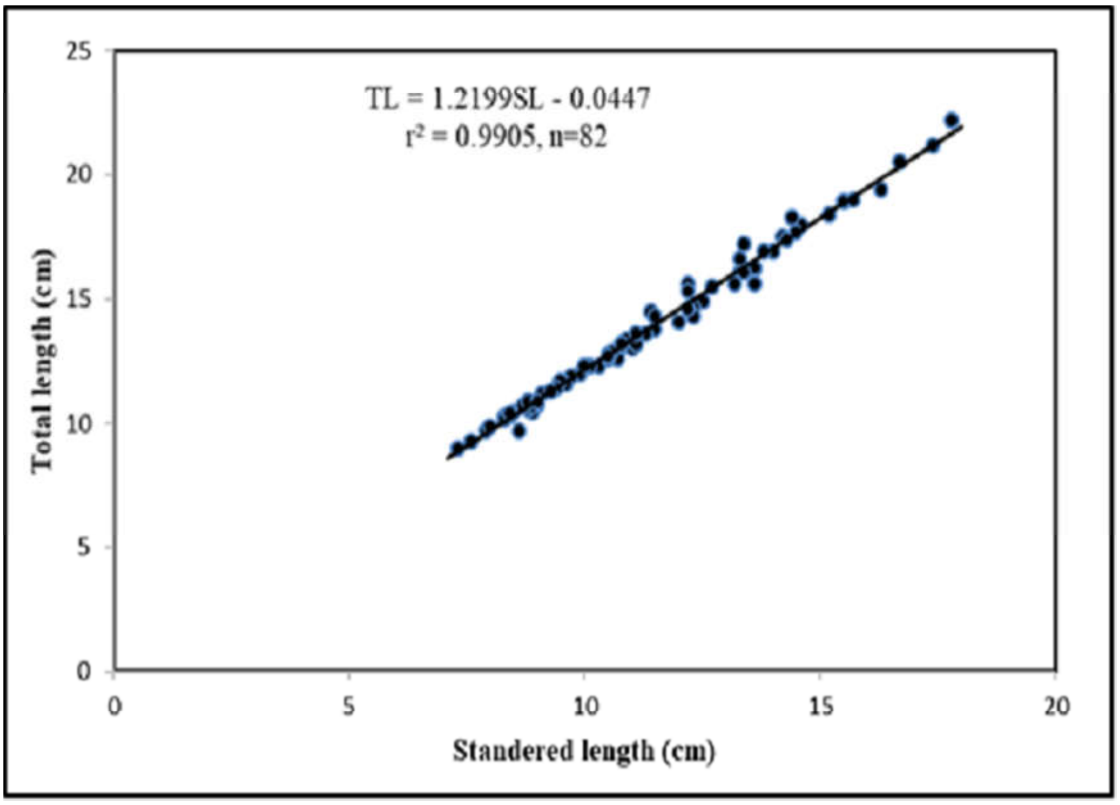

Figure 3. Relationships between Total Length (TL) and Standard Length (SL) of the *Channa Punctata*

Length - Weight Relationships

The relationships between total length and body weight (Figure 4) indicated negative allometric growth for the specimens as the allometric coefficient "b" values was significantly lower from the expected isometric value of 3 (t-test, $p<0.05$). High degree of correlation between total length and body weight has been indicated by the coefficient of determination ($r^2 = 0.969$). The value of the coefficient of determination indicated that 97% decrease of the BW occurs due to increase of TL. According to Cren (1951), length-weight relationship is useful in differentiating populations as variations occur in populations of different localities. The result indicated negative allometric growth between SL and BW which was in accordance with the study by Akter et al. (2016). Variation in b value could be related to season, diet, stomach fullness and gender (Bagenal & Tesch, 1978).

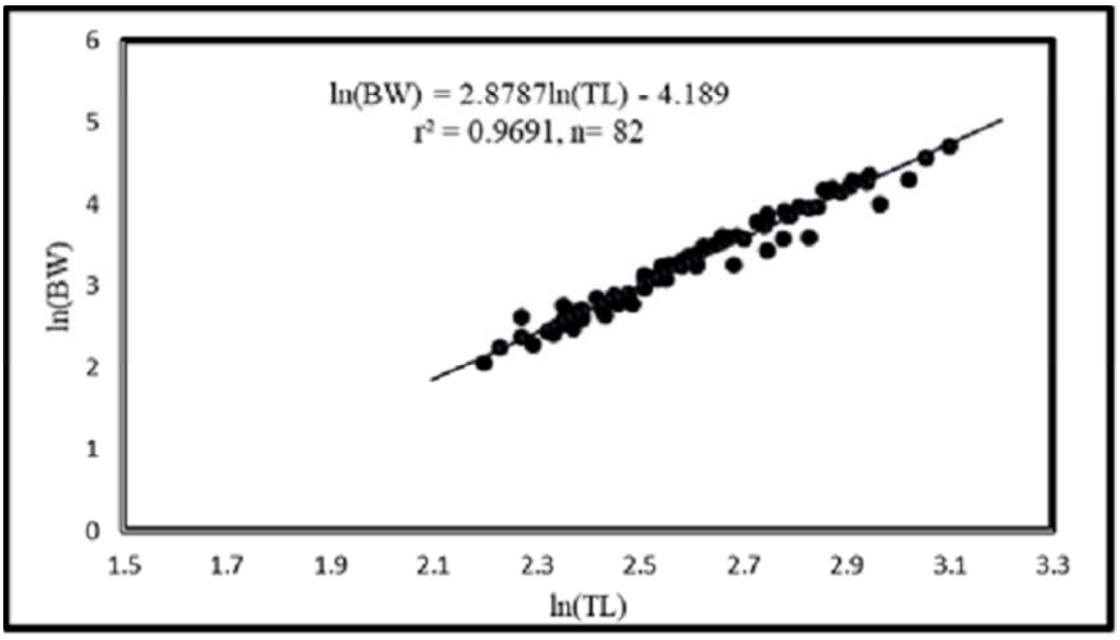

Figure 4. Relationships between Total Length (TL) and Body Weight (BW) of the *Channa Punctata*

The relationships between standard length and body weight (Figure 5) indicated negative allometric growth for the specimens as the allometric coefficient "b" values was significantly lower from the expected Isometric value of 3 (t-test, $p<0.05$). High degree of correlation between standard length and body weight has been indicated by the coefficient of determination ($r2 = 0.962$). The value of the coefficient of determination indicated that 96.2% decrease of the body weight occurs due to increase of SL.

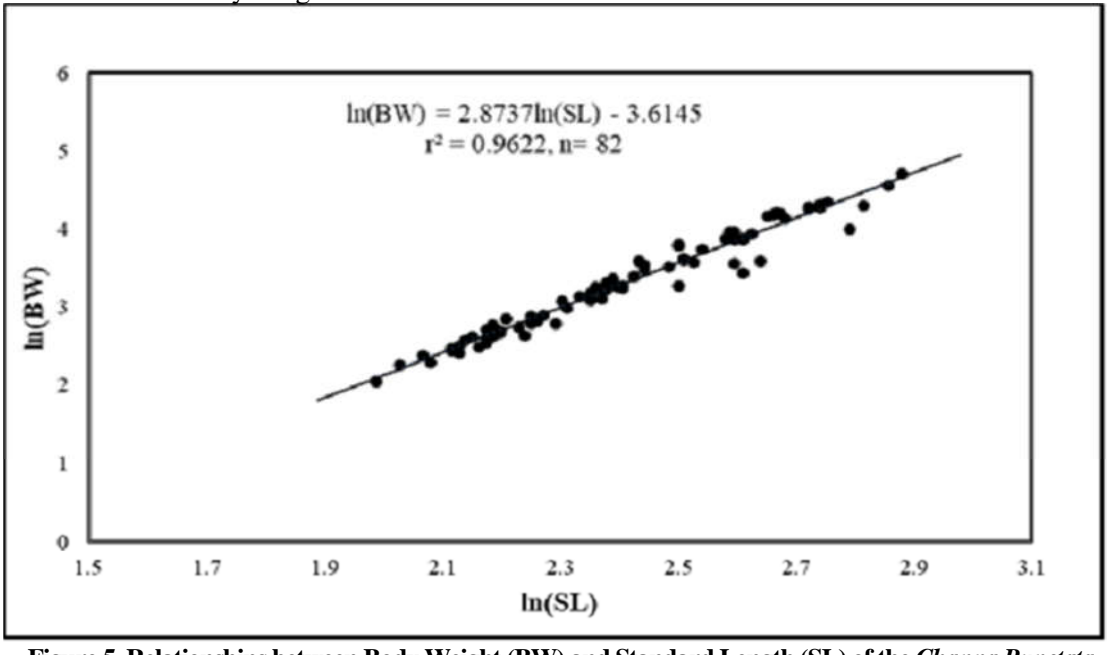

Figure 5. Relationships between Body Weight (BW) and Standard Length (SL) of the *Channa Punctata*

Condition Factor

In the present study the "K_F" values (Fig. 6) were recorded from 7.01 to 17.35. The lowest "K_F" value was found in the size of 7.01 cm SL, whilst the highest in 17.35 cm SL. The "K_F" value started to decrease after 7.0 cm SL and remains low in the subsequent size classes. The lowest "K_F" value was found in the size of 17.0 cm SL, whilst the highest in 7.0 cm SL. Fish populations are subject to changes in condition that are correlated with size, which might differ depending on the species, habitat, and environmental factors. For instance, a study by Kottelat and Freyhof (2007) discovered that the European chub's condition factor declined with size, whereas a study by Almeida et al. (2015) discovered that the Amazonian catfish's condition factor grew with size.

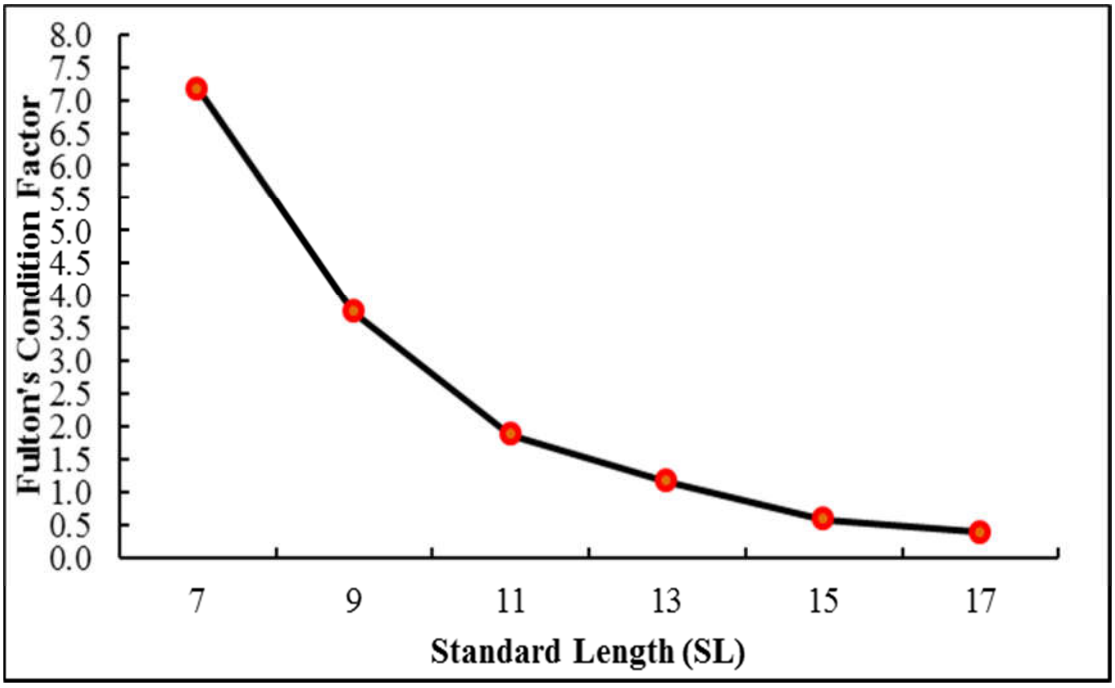

Figure 6. Fulton's condition factor of the *Channa Punctata*

Size at sexual maturity

Size at first sexual maturity *Channa Punctata* in the Pubkola beel was 8.0 cm SL. The size at sexual maturity is special interest in fisheries management and is widely used as an indicator for minimum permissible capture size. In the present study the size at sexual maturity of *C. Punctata* was estimated was 8.0 cm SL. Mukherjee and Ray (2016) examined the reproductive biology of *C. Punctata* in a floodplain wetland in West Bengal, India. The authors' estimation of the species' size at sexual maturity, which is 8.0 cm standard length (SL), is consistent with this result.

Conclusions

This study provides some basic information on biological aspects of *C. Punctata* in the Pubkola beel, Patuakhali, Bangladesh. The outcomes of present study provided some new and updated information on the length frequency distribution, length-length and length-weight relationships, condition factors and size at sexual maturity of *C. Punctata* in Pubkola beel. The

experimental findings revealed that the length-length relationship of *C. Punctata* exhibits the positive allometric relation (r^2 = 0.990) and length-weight relationship of C. punctate was negative allometric relation (r^2 = 0.969) during the study period. However, the relationships between standard length and body weight indicated negative allometric growth (r^2 = 0.962). These results will be very helpful to formulate better management and conservation strategies of *C. Punctata* in the Pubkola beel. Moreover, this work would also contribute to knowledge by acting as baseline data for carrying out future research.

References

Ahmed, Z. F., Hossain, M. Y., and Ohtomi, J. (2012). Modeling the growth of silver hatchet chela Chela cachius (Cyprinidae) from the old Brahmaputra River in Bangladesh using multiple functions. *Zoological Study* 51: 336-344.

Akter, S., Zaman, M. F. U., Jaman, M. H. U., Sithi, I. N., Yesmin, D., & Al Asif, A. (2016). Morphometric study of banded gourami (Colisa fasciata) in Jessore, Bangladesh. *Asian Journal of Medical and Biological Research*, *2*(1), 113-120.

Almeida, F. S., Santos, G. M., Ribeiro, R. P., & Isaac, V. J. (2015). Length-weight relationships and condition factor of nine fish species from the Tapajós River, Brazil. *Journal of Applied Ichthyology*, 31(1), 198-200.

Bagenal, T. B., and Tesch, F. W. (1978). Age and Growth. In: Bagenal, T., Ed., Methods for Assessment of Fish Production in Fresh Waters, 3rd Edition, IBP Handbook No. 3, Blackwell Science Publications, Oxford.

BBS. (2021). Bangladesh Bureau of Statistics. Statistics & informatics division (Sid), Ministry of Planning, Government of the People's Republic of Bangladesh.

Blackwell, B. G., Brown, M. L. and Wills, D. W. (2000). Relative weight (*WR*) status and current use in fisheries assessment and management. *Rev. Fish. Sci*., 8: 1-44. https://doi. org/10.1080/ 10641260091129161.

Breder, C. M., and D. E. Rosen, (1966). Modes of reproduction in fishes. T.F.H. Publications, Neptune City, New Jersey. 941 p.

Chakraborty, R., Das, S. K. and Bhakta, D. (2018). Length-weight relation, relative condition and GSI of *Channa punctata* (Bloch, 1793) in wetlands of Nadia District, West Bengal. *J. Aquac. Trop*., 33(1-2): 11-18.

Cren, E. D. Le. (1951). The Length-Weight Relationship and Seasonal Cycle in Gonad Weight and Condition in the Perch (*Perca fluviatilis*). *The Journal of Animal Ecology*, 20(2), 201. https://doi.org/10.2307/1540.

Das, S., Das, T., Das, B. K. and Kar, D. (2014). Length-weight relationship and condition factor in *Channa punctata* of the River Manu in Tripura. *Int. J. Fish Aquat Stud*., 2(3): 56-57.

Froese, R. & C. and Binohlan, C. (2000). Empirical relationship to estimate asymptotic length at first maturity and length at maximum yield per recruit in fishes with a simple method to evaluate length frequency data. *Journal of Fish Biology* 56(4):758 – 773. DOI: 10.1111/j.1095-8649.2000.tb00870.x

Haniffa, M. A., Marimuthu, K., Nagarajan, M., Jesu Arokiaraj, A., Kumar, D. (2004). Breeding behavior and parental care of the induced bred spotted Murrel Channa punctatus under captivity. *Current Sciences*, 86: 13751376.

Haniffa, M. A., Nagarajan, M., and Gopalakrishnan, A. (2006). Lengthweight relationships of Channa punctata (Bloch, 1793) from Western Ghats Rivers of Tamil Nadu. *J Appl Ichthyol*., 22: 308309.

Hasselblad, V. (1966). Estimation of Parameters for a Mixture of Normal Distributions. *Technometrics*, *8*(3), 431–444. https://doi.org/10.1080/00401706.1966.10490375

Hossain, M. A., Hossain, M. Y., Hossen, M. A., Rahman, M. A., Islam, M. A., Khatun, D., Nawer, F. and Ohtomi, J. (2019). Temporal variations of sex ratio and growth pattern of critically endangered catfish *Clupisoma garua* from the Ganges River of north-western Bangladesh. *Indian J. Geo-Mar. Sci.*, 48(05): 647-653.

Hossain, M. Y., Ahmed, Z. F., Leunda, P. M., Islam, A. K. M. R., Jasmine, S., Oscoz, J., Miranda, R., and Ohtomi, J. (2006). Length-weight and length-length relationships of some small indigenous fish species from the Mathabhanga River, southwestern Bangladesh. *J Appl Ichthyol*., 22: 301-303.

Hossen, M. A., Hossain, M. Y., Pramanik, M. N. U., Nawer, F., Khatun, D., Parvin, M. F., and Rahman, M. M. (2016). Morphological characters of Botia lohachata. *J Coast Life Med*, 4: 689-692.

Hossen, M. A., Paul, A. K., Hossain, M. Y., Ohtomi, J., Sabbir, W., Rahman, O., Jasmin, J., Khan, M. N., Islam, M. A., Rahman, M. A., Khatun, D., and Kamruzzaman, S. (2019). Estimation of Biometric Indices for Snakehead Channa punctata (Bloch, 1793) through Multi-model Inferences. *Jordan Journal of Biological Sciences*, 12: 197-202.

Kashyap, A., Awasthi, M. and Serajuddin, M. (2014). Length-weight and length-length relationship of freshwater murrel, *Channa punctatus* (Bloch, 1793) sampled from river Gomti in Lucknow region (Uttar Pradesh). *World J. Fish. Mar. Sci*., 6(4): 336-339. DOI: 10.5829/idosi. wjfms.2014.06.04.84293.

Kashyap, A., Awasthi, M., Arshad, M. and Serajuddin, M. (2015). Length-weight, length-length relationship and condition factor of freshwater murrel, *Channa punctatus* from northern and eastern regions of India. *World J. Fish Mar. Sci*., 7(3): 164-170. DOI:10.5829/idosi.wjfms. 2015.7.3.94100.

Khan, M. A., Khan, S. and Miyan, K. (2012). Studies on length-weight and length-length relationships of four freshwater fishes collected from river Ganga. *J. Fish Aquat. Sci*., 7(6): 1816-4927.

Khatun, D., Hossain, M. Y., Parvin, M. F., and Ohtomi, J. (2018). Temporal variation of sex ratio, growth pattern and physiological status of Eutropiichthys vacha (Schilbeidae) in the Ganges River, NW Bangladesh. *Zool Ecol*., 28: 343-354.

Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat, Cornol, Switzerland.

Kumar, R., Yadav, S. S. and Tripathi, M. (2014). Studies on length-weight relationship of seven commercially important freshwater fish species of Gomti River Lucknow (U.P.), India. *Int. J. Fish. Aquat. Stud*., 1(3): 1-3.

Lakshmi, D. K., Uma, D. and Jayasri, E. (2018). A study on length-weight relationship and condition factor of freshwater murrel, *Channa punctatus* (Bloch, 1793) from Budameru Channel, Vijayawada, Andhra Pradesh. International Multidisciplinary Conference on "Knowledge Sharing, Technological Advancements and Sustainable Development, p. 459-462.

Moutopoulos, D. K., and Stergiou, K. I. (2002). Length-weight and length-length relationships of fish species from the Aegean Sea (Greece). *Journal of Applied Ichthyology*, 18(3), 200–203. https://doi.org/10.1046/j.1439-0426.2002.00281.x

Mukherjee, M., & Ray, S. (2016). Reproductive biology and size at sexual maturity of the spotted snakehead Channa punctata (Bloch) from a floodplain wetland in West Bengal, India. *Journal of Applied Ichthyology*, 32(4), 717-721.

Paul, S., Das, J. D., Roy, N., Choudhury, M. and Kar, D. (2019). Estimation of length-weight relationship (LWR) and condition factor (CF) of certain fishes of Barak Valley region belonging to order Perciformes. *Int. J. Life Sci.*, 7(2): 321-324.

Pethiyagoda, R. (1991). Freshwater fishes of Sri Lanka. The Wildlife Heritage Trust of Sri Lanka, Colombo. 362 p.

Rahman, A. K. A. (1989). Freshwater fishes of Bangladesh. Zoological Society of Bangladesh. Department of Zoology, University of Dhaka. 364 p.

Rahman A. K. A. (2005). Freshwater Fishes of Bangladesh (2nd ed.): Zoological Society of Bangladesh.

Richter, T. J. (2007). Development and Evaluation of Standard Weight Equations for Bridgelip Suckers and Largescale Suckers. *North American Journal of Fisheries Management*, 27(3), 936–939. https://doi.org/10.1577/m06-087.1

Ricker, W. E. (1968). *Methods for assessment of fish production in freshwaters.* IBP Handbook No. 3.F. A. Davis, Philadelphia, Pennsylvania, USA, 328 pp.

Samad, M. A., S. M. Galib. and F. A. Flowra. (2009). Fish drying in Chalan Beel areas. Bangladesh *J. Sci. Ind. Res*. 44(4): 461-466.

Serajuddin, M., Prasad, L. and Pathak, B. C. (2013).Comparative study of length-weight relationship of freshwater murrel, *Channa punctatus* (Bloch, 1793) from lotic and lentic environments. *World J. Fish Mar. Sci*., 5(2): 233-238.

Singh, M. and Serajuddin, M. (2017). Length-weight, length-length relationship and condition factor of *Channa punctatus* collected from three different rivers of India. *J. Entomol. Zool. Stud*., 5(1): 191-197.

Talwar, P. K. and Jhingran A. G. (1991). Inland Fishes of India and Adjacent Countries. Vol 1. A.A. Balkema, Rotterdam, 541p.

U. S. Fish and Wildlife Service (2002). Injurious wildlife species: snakeheads (family Channidae). U.S. Environmental Protection Agency, Federal Register Environmental Documents, Vol. 67, No. 193.