Research in ISSN : P-2409-0603, E-2409-9325

AGRICULTURE, LIVESTOCK and FISHERIES

An Open Access Peer Reviewed Journal

Open Access
Research Article

Res. Agric. Livest. Fish.
Vol. 3, No. 2, August 2016: 355-360

LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF BOMBAY DUCK *Harpadon nehereus* FROM LANDINGS OF FISHERY GHAT, CHITTAGONG

Tasnuba Hasin

Department of Fisheries Resources Management, Faculty of Fisheries, Chittagong Veterinary and Animal Sciences University, Chittagong-4225, Bangladesh

***Corresponding author:** Tasnuba Hasin; E-mail: shaily.1119@gmail.com

ARTICLE INFO

Received
18.06.2016

Accepted
14.08.2016

Online
17 August 2016

Key words
Harpadon nehereus, Length-weight relationship, condition factor, Allometric growth

ABSTRACT

The current study describes the length-weight relationships and condition factor of Bombay duck, *Harpadon nehereus* from landings of Fishery Ghat, Chittagong. A total of 300 individuals caught by various mesh size of gill nets by commercial fishers were investigated from April 2016 to June 2016. On the basis of hypothetical cube law $W=aL^b$, the variance of 'b' for both total length and standard length were estimated statistically (0.0090 and 0.0088 respectively). Using the value of t=1.96 at the 95% confidence limits for 'b' were estimated as 2.218 to 2.590 for total length-weight relationship and for standard length-weight relationship, 1.985 to 2.353 which indicated allometric growth pattern for both cases. The monthly relative condition factor during three months of observation (0.978, 1.033, and 1.097) showed no notable difference due to spawning strain, spent condition and lower feeding rate right after peak spawning season.

To cite this article: Tasnuba Hasin, 2016. Length-weight relationship and condition factor of bombay duck *Harpadon nehereus* from landings of fishery ghat, Chittagong. Res. Agric. Livest. Fish., 3 (2): 355-360.

www.agroaid-bd.org/ralf, E-mail: editor.ralf@gmail.com

INTRODUCTION

The Bombay duck *Harpadon nehereus* lives in the tropical waters of the Indo-Pacific– and traditionally caught in the waters of the Bay of Bengal. According to the Department of Fisheries (2005-2006) Bombay duck (Synodontidae) contributed 8.20 percent (37 331 t) to the total marine fish catch.Bombay duck is a soft fish and is highly perishable because of its body composition. A large part of the catch particularly during the peak fishing season is sundried on raised bamboo platforms by hanging them on ropes and it is an important exported fishery product.

In Bangladesh, the species is found mainly in the Bay of Bengal and estuaries of Bangladesh and also ascends tidal rivers (Rahman, 1989 and 2005). In addition, they are inhabitants of saline and semi saline waters of the Sundarbans (Gopal and Chauhan, 2006, Hoq et al., 2006).It is abundant in the Northwest coast of India (Rupshankar,2010).This fish is of commercial significance (Rahman, 1989 and 2005) and used as food fish in Bangladesh both fresh and sun dried. According to Rahman (1989 and 2005) it is highly esteemed as food particularly in Chittagong (Bangladesh) where these are found in abundance. He also mentioned that dried Bombay duck has commercial importance in the South and Southeast Asia. In India, the fish contributes a substantial fishery in the Hooghly estuary (Talwar and Jhingran, 1991). However, Kamal et al. (2001) treated this species as under-utilized fish in Bangladesh.

Due to initiation of mechanization of fishing crafts, the seaward fishing activity of the Chittagong coast has considerably increased in recent years. The abundance of Bombay duck along the coast is gradually increasing. Bombay duck fishery is under constant pressure due to various stresses such as habitat destruction because of pollution, over-exploitation, indiscriminate killing of juveniles etc, which in turn help the decline of this fish population. Therefore, there is an immense need to manage the fisheries more vigilantly to ensure sustainable fish production in future. In this regard fish stock assessment plays an important role in the rational management and conservation of this resource. The population Dynamics and stock assessment facilitate to know about fish growth, mortality rate, spawning time, catch rate, maximum sustainable yield, maximum economic yield etc (Larkin, 1977). The mesh size regulation, implementation of ban at breeding season and selective fishing are the results of the stock assessment of the fishes. The present study was intended to investigate the length-weight relationship and condition factor of *H. nenereus* which is an essential part of growth study and overall health status. These data are of important scientific findings to determine how fast the fish grow and the recovery time of its population after exploitation.

MATERIALS AND METHODS

Collection of data

The present study was conducted in Fishery Ghat fish market, Firingi Bazar, Chittagong, Bangladesh during April 2016 to June 2016 of which sampling was carried out at monthly interval. The samples were collected from different commercial gill-netters. They were transported to laboratory for length and weight data measurement. The total length (from the tip of the snout to the end of the caudal fin) and standard length (from the tip of the snout to the mid- of point caudal peduncle) of 300 fish were measured using a meter scale (1±mm) and weighed to the nearby 'g' using precision balance (0.001g). Total and standard length varied in the size range of 11.8 cm to 25.4 cm and 9.9 cm to 21.4 cm, correspondingly, and the weight ranged from 4.36 g to 52.71 g.

Analysis of Data

Length-weight relationship

The length-weight relationship of *Harpadon nehereus* was estimated using the power curve equation, $W= aL^b$(King, 2007) where,

W= Body weight (g) of the fish,

L= Total length (cm) (TL) or standard length (cm) (SL) of fish and 'a' and 'b' are the constants.

The value of 'b' is used to estimate the individual growth, in which hypothetically following a premise that b = 3 stands for isometric growth (the length growth in line with the increasing weight) whereas b > 3 indicates that the weight gain is faster than length (positive allometry) and oppositely b < 3 points to negative allometry.

The above equation can be transformed into a linear form using natural logarithm as lnW = ln a + b ln L where Ln a and b equate to the intercept and slope. A power curve-of-best-fit (Figure 1a and 1b) for both total length and standard length is drawn through the points representing predicted weight for a range of arbitrarily chosen values for length wherein the value of 'a' and 'b' and the chosen value of L in the power equation were substituted (Table 1). The non-linear and linear equations were fitted separately for total length (TL) and standard length (SL). The correlation coefficient (r) and variance of 'b' (S_b^2) were calculated following standard statistical procedures. Using the value of 't' from statistical table (King, 2007)with n-2 degrees of freedom the 95% confidence limits are estimated as b ± t× S_b.

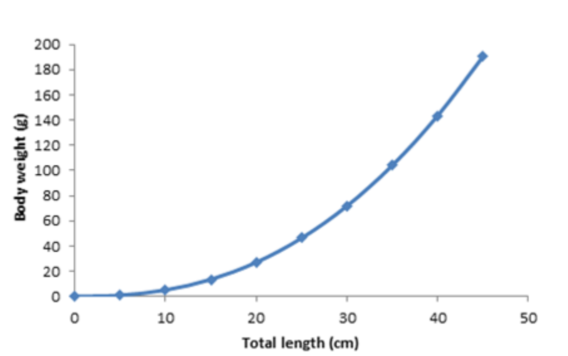

Figure 1a. The relationship between total length and body weight in Bombay duck (*Harpadon nehereus*)

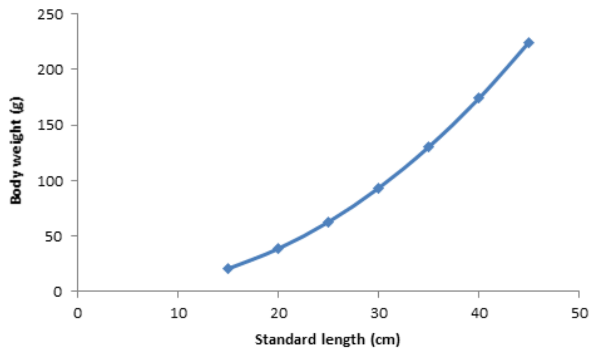

Figure 1b. The relationship between standard length and body weight in Bombay duck (*Harpadon nehereus*)

Relative condition factor (CF_w)

The relative condition factor (Kn) of *H. nehereus* was calculated using the formula $CF_w = \overline{W}/W_{pred}$ (King, 2007) based on total weight relationship,
where CF_w= relative condition factor;
$\overline{W}$= mean weight and
W_{pred} = predicted weight.
Monthly values of mean weight are compared with predicted value for fish of the same mean length.

RESULT AND DISCUSSION

Length weight relationship

Investigating 300 individuals over three months the total length was found ranging from 11.8 cm to 25.4 cm, standard length of 9.9 cm to 21.4 cm and weighing from 4.36 g to 52.71 g are given in the Table 1. The transformation into linear regression of total length-weight and standard length-weight relationship of the species and their consequent exponential forms are also represented in Table1.

Table 1. Length-weight relationship of *Harpadon nehereus*

Length type	Number of individuals studied	Range of length (cm)	Range of weight (g)	Slope (b)	Power curve equation	Linear form of Power curve equation	Correlation coefficient (r)
Total length	300	11.8-25.4	4.36-52.71	2.404	$W= 0.02019\ TL^{2.404}$	ln W= -3.902+ 2.404 TL	0.834
Standard length	300	9.9-21.4		2.169	$W= 0.05830\ SL^{2.169}$	Ln W= -2.842+ 2.169 SL	0.802

The total length - weight relationship of non-linear and linear forms were $W=0.0202\ TL^{2.404}$ and ln W= -3.0921 + 2.4039 ln TL, respectively with the correlation co-efficient (r) of 0.0.834. Likewise, the standard length-weight relationship of non-linear and linear forms were found to be $W=0.0583\ SL^{2.1693}$and ln W = -2.8421 + 2.1693 ln SL, in that order with the correlation co-efficient (r) of 0.803.

The variance of 'b' for both total length and standard length were 0.0090 and 0.0088 respectively. Using the value of 't'i.e. 1.96 from the statistical table the 95% confidence limits were estimated as 2.218 to 2.590 for total length-weight relationship and for standard length-weight relationship, 1.985 to 2.353 . Exploration on length-weight data of *H. nehereus* showed allometric growth pattern in view of the fact that neither of the two includes '3', the expected value if the relationship between weight and length was cubic and for isometric growth pattern as well.

The present results are in harmony with the earlier reports of Krishnayya (1968), Bapat (1970) and Kurian et al.,(1992) who have also investigated allometric growth pattern in *H. nehereus* from the Bay of Bengal (b=3.2657) water, Arabian Sea (3.4444 in female and 3.7169 in males) and north west coast (2.0279) respectively. Contrary to the above consequences Nurul Amin (2001) and Bapat et al. (1951) have documented the isometric growth pattern of *H. nehereus* with 'b' values 3.051 and 2.889, respectively from the Bay of Bengal and Arabian Sea. The 'b' values are known to range between 2.5 to 4 in fishes (Hile, 1936 and Martin, 1949) and in majority of cases the value deviated from 3. According to Mitra (2001) the 'b' values in various species of Hooghly estuary ranged from 2.9615 to 2.3686. Beverton and Holt (1957) reported that adult fishes follow an isometric growth pattern. The inconsistency in 'b' values could be attributed to environmental features, food availability and physiological factors including sex and phase of life (LeCren, 1951; Ricker, 1975).

Table 2. The relative condition factor (CF_w) of *Harpadon nehereus* during observation

Month	Mean weight (g) $\overline{W}$	Predicted weight (g) W_{pred}	Relative condition factor (CF_w)
April	25.61	26.19	0.978
May	29.41	28.48	1.033
June	31.97	29.15	1.097

Relative condition factor (CF_w**)**

The relative condition factor (CF_w) of *H. nehereus* during different month is represented in Table 2. The mean CF_w value of the individuals calculated during three months of observation was found to be 1.036. The monthly fluctuation of the relative condition factor (CF_w) showed the lowest in the month of April (0.978) and the highest in the month of June (1.097) though the values exhibited no noteworthy changing pattern during these months as it was 1.033 in May. The relative condition factor is calculated to study the seasonal variation in the condition of fish during different stages of growth and reproduction (King, 2007). They indicate the physiological state and general well-being of fish (Brown, 1957). Krishnayya (1968) recorded the lowest condition factor (1.7392 to 1.849) of *H. nehereus* in the period between April to June. Moreover, he also noticed the CF_w values of more than 2 from the month of October through March. On the other hand, Bapat (1970) observed an increased condition factor of the same species in the month of April and low condition factor values during December to March. Nurul Amin (2001) found the CF_w values in the range between 0.908 and 1.22. The lower CF_w value in observation period (April to June) as noticed in present study, might be due to the metabolic strain of spawning, spent condition and lower feeding rate of the species since the main spawning season of the species is reported to be December to March (Bapat, 1970). Different studies showed higher CF_w value in the month of February which might be due to peak spawning period and fully fecund gonads. The increased CF_w value after May could also attributed to be the peak feeding period for the species, as observed by Bapat (1951). Such relations of higher CF_w values during peak spawning periods and lower values after spawning periods has also been documented in *Tenualosa ilisha* (Khan et al., 2001). Fluctuations in the CF_w values are common in fishes because of food availability, differential feeding intensity, size of the fish and average reproductive stage of the stock (King, 2007; LeCren, 1951; Thakur, 1975).

CONCLUSION

In this study, the length-weight relationship of *Harpadon nehereus* samples collected from a local market was investigated over three months as part of an ongoing annual research. The findings indicate that the sample of Bombay duck individuals caught by the local gill netters followed an allometric growth pattern. The result of the study also implies that the lower values of relative condition factor was due to sampling immediately after peak spawning season which gradually changes with food availability, seasons and reproductive stages of the stock. During recent years a decreasing trend in Bombay duck fishery is being observed which might be a result of pollution, over exploitation, ineffective management and lack of information on growth in some cases. Studying population dynamics and growth parameters is necessary for proper stock assessment of a fishery where the ultimate goal is to maintain a sustainable yield in future. Present study would help to this extent. In addition further attention should be paid to for improved management of the stock.

COMPETING INTEREST

The author has read and understood RALF policy on declaration of interests and declares that she has no competing interests.

ACKNOWLEDGEMENT

The author wish to expresses her profound gratitude to Professor Dr Zoarder Faruque Ahmed, Department of Fisheries Management, Bangladesh agricultural University and is grateful to the Faculty of Fisheries, Chittagong Veterinary and Animal Sciences University for laboratory facilities and technical support.

REFERENCES

1. Bapat SV, SK Banerji and DV Bal, 1951. Observation on the biology of *Harpadon nenereus* (Ham.). Journal of Zoological Society India, 3: 441 - 356.
2. Bapat SV, 1970. The Bombay duck, *Harpadon nehereus* (Ham.). Bulletin of Central Marine Fish Research Institute, 21: 1 - 66.
3. Beverton RJH and SJ Holt, 1957. On the dynamics of exploited fish populations. Fishery investigations / Ministry of Agriculture, Fisheries and Food, Great Britain (2 sea fish), 19: 533.
4. Brown MR, 1957. Experimental studies on growth. In the physiology of Fishes. Vol-1 (Ed.Brown, M.E.) New York, Academic Press. 361 – 400.
5. Gopal B and M Chauhan, 2006. Biodiversity and Its Conservation in the Sundarban Mangrove Ecosystem. Auatic Sciences 68:338-354.
6. Hile R, 1936. Age and growth of Cisco, *Leucichthyes artedi* (Le Surr) in the lakes of three northern highland, Wisconsin. Wise Bulletin of United States Business Fisheries, 48: 211-317.
7. Hoq ME, MA Wahab and MN Islam, 2006. Hydrographic status of Sundarbans mangrove, Bangladesh with special reference to post-larvae and juveniles fish and shrimp abundance. Wetland Ecology and Management, 14: 79-93.
8. Kamal M, BC Biswas, L Yasmin, KM Azimuddin and MN Islam, 2001. Influence of temperature on the gel-forming ability of some under-utilized marine fish species in Bangladesh. Pakistan Journal of Biological Science, 4: 1525-1542.
9. Khan MA, D Kumar and R Sinha, 2001. On some biological aspects of *Tenulosa ilisha (*Hamilton-Buchanan) from Hooghly estuary. Journal of Inland Fisheries Society of India, 33: 38 - 44.
10. King, M, 2007. Fisheries Biology, Assessment and Management, Second Edition, Blackwell Publishing Ltd.,Oxford, UK, pp: 172-238.
11. Krishnayya CH, 1968. Age and growth of *Harpadon nehereus* (Ham.) and its fishery in the Hooghly. Journal of Zoological Society of India, 20: 129 - 147.

12. Kurian A and KN Kurup, 1992. Stock assessment of Bombay duck *Harpadon nehereus* (Ham.) off Mahasashtra coast. Indian Journal of Fisheries, 39: 243-248.
13. Larkin PA, 1977. An epitaph to the concept of maximum sustainable yield. Transactions of the American Fisheries Society, 106:1-11.
14. LeCren ED, 1951. The length-weight relationship and seasonal cycle in gonad weight and condition of the pearch, Pereafluviatilis. Journal of Animal Ecology, 20: 210 - 219.
15. Martin WR, 1949. The mechanisms of environmental control of body form in fishes. University of Toronto Studied in Biology, 58:1 - 91.
16. Mitra PM, 2001. Length-Weight relationship of some commercially important fish species of Hooghly estuary. Journal of Inland Fisheries Society of India, 33: 12 - 14.
17. Nurul Amin S M, 2001. Study on age and growth VPA analysis and relative condition factor of *Horpadon nehereus* (Ham.) from the neretie water of Bangladesh. Online Journal of Biological Science, 1: 192 - 194.
18. Rahman AKA, 1989. Freshwater fishes of Bangladesh. Zoological Society of Bangladesh. Department of Zoology, University of Dhaka, 364.
19. Rahman AKA, 2005. Freshwater fishes of Bangladesh, second edition. Zoological Society of Bangladesh, University of Dhaka, Dhaka, Bangladesh, 394.
20. Ricker WE, 1975. Computation and interpretation and biological statistics of fish populations. Bulletin of Fisheries Research Board of Canada, 191: 382.
21. Rupshankar C, 2010. Improvement of cooking quality and gel formation capacity of Bombay duck (*Harpadon nehereus*) fish meat. Journal of Food Science and Technology, 47: 534-540.
22. Talwar PK and AG Jhingran, 1991. Inland fishes of India and adjacent countries, volume 2, Oxford IBH Publishing Co Pvt Ltd, New Delhi-Calcutta, pp. 724-725.
23. Thakur NK, 1975. On the Length – weight relationship and relative condition factor in *Clarias batrachus* (Linn.). Proceedings of the National Institute of Science, India, 45: 197 – 202.