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## Studies on Age and Growth, VPA Analysis and Relative Condition Factor of *Harpodon nehereus* (Ham-Buch) from the Neritic Water of Bangladesh

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**Abstract:** The study is an attempt to estimate the age and growth and Virtual Population Analysis (VPA) of *Harpodon nehereus* by the FISAT programme from length-frequency data collected from Kutubdia channel of the Bay of Bengal. Growth parameters  $L_{\infty}$  and  $K$  were found to be 24.48 cm and 1.50/yr respectively. This fish attained 19.17cm at the end of 1(one) year. The equation for length-weight relationship of *H. nehereus* was  $W = 0.00243TL^{3.051}$ . The relationship was significant at 5% level ( $r = 0.997$ ). The asymptotic weight was 43.69g. The relation condition factor ( $K_n$ ) values ranged from 0.908 to 1.22 ( $\bar{x} = 1.003$ ,  $SD \pm 0.081$ ). Relative condition values changed during various months: highest peaks denoting the spawning period and the trough and small peak representing the cyclic gonadal development. Sexual maturity was attained when the fish attained 13 cm length.

**Key words:** Age and growth, *H. nehereus*

### Introduction

*Harpodon nehereus* (Ham. Beach, 1822) popularly known as Bombay duck is one of the inshore shallow water and estuarine fish of the Bay of Bengal, Indian ocean and the Arabian sea. It is locally familiar as 'Lotiya much' or 'Loitty' around the coastal areas of Chittagong and Cox's Bazar of Bangladesh.

Bombay duck is a very soft fish and due to its highly perishable body composition, a large part of the catch particularly during the peak fishing season is sundried and a small portion is sold fresh in the markets. The average percentage of carbohydrate (0.85%), protein (14.61%), fat (2.75%), moisture (80.75%) and ash (1.03%) were observed in the muscle of *H. nehereus* (Bhuiyan, 1992). Calcium content in *Harpodon nehereus* is 339.15 mg/100g (Zafar *et al.*, 1993).

This fish has a great demand among the people of coastal districts. Due to lack of proper transport facilities and processing plants, this fish is not very well-known to the people's of the interior districts. The fishes are usually sundried specially on constructed raising bamboo platforms and dried fish finds special favour with some sections of the people in the coastal districts. The dried fish is also exported to the countries like U. K, Singapore, Middle-East and Srilanka.

A large number of this fish is caught every year from the coastal areas of Bangladesh located between Latitudes 20°N to 22°N and Longitudes 84°E to 92°E (Sarker, 1967). The major portion of the fish is caught by the local fishermen and annually about one lakh tons are harvested. Kutubdia, Moheskhal, Cox's Bazar, Sonadia, Khulna and the coastal areas of Chittagong are the most important fishing place for *H. nehereus*. In the Bay of Bengal, Bombay duck contributed a major part of the catch of fish population.

The Bombay duck is generally caught by the 'Behundi nets' (Fixed purse nets) with mesh size varying from 70 mm at the wider part to 10 mm at the codend. The length and breadth of the net is varied according to the desire of the fishermen. The net is generally used in the estuaries and shallow coastal water. It is placed against the tidal flow and each haul of at least 4 hours duration. At the end of the high and low tides, the bag is taken up from the water

to collect the fishes. The fishermen use both country boats and mechanised boats' for fishing. The occurrence of juveniles of *H. nehereus* in the estuaries and channels throughout the year for their availability of food. The peak season of fishing commences from July and continues for a period of about 5 to 6 months. In other months, they occurred in comparatively small number.

Though *H. nehereus* is one of the highly esteemed table fish at home and abroad, but there no published report on age and growth of this species in Bangladesh. So, an attempt was made to study the age and growth of *H. nehereus* from the Kutubdia channel of the Bay of Bengal.

### Materials and Methods

Fortnightly samples were collected during the period August 1995 to July 1996 from the Kutubdia channel (Lat. 21°53' 36"N and Long. 91°54' 54"E) of Bangladesh coast. Samples were collected from Estuarine Set Bag Net (ESBN) with mesh sizes 10 cm at the month, 5 cm at the middle and 1.5 cm at the codend. Total length (TL) at 0.5 cm interval for 2366 specimens were measured and length-frequency data were pooled monthwise. The growth parameters  $L_{\infty}$  and  $K$  were estimated by using the complete ELEFANT software package (Pauly and David, 1981; Saeger and Gayanilo, 1986).

For the study of length-weight relationship a total of 321 specimens were analysed. Total length varied between 6 cm and 17 cm and body weight varied between 0.65 g and 0.14.27 g. Total length were measured with the help of a meter scale to the nearest millimetre and weight taken by electronic balance of 0.0001 g accuracy. The total length and weight relationship was determined by the equation  $W = aL^b$  given by Le Cren (1951) where 'a' is a constant and 'b' is the exponent. The equation was transformed into the logarithmic form  $\log W = \log a + b \log L$ . The values of 'a' and 'b' were determined empirically.

Relative condition factor ( $K_n$ ) was determined by using the following formula:

$K_n = W/W'$  (Where  $W$  = Observed mean weight,  $W'$  = Calculated body weight). The  $K_n$  values were also calculated for different months.

The length-frequency data also were used to carry out

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Virtual Population Analysis (VPA) using the "FiSAT" (FAO - ICLARM STOCK ASSESSMENT TOOLS ) as explained in detail by Gayanilo *et al.* (1996) is the soft ware package. The values of  $L^\infty$ ,  $K$ ,  $F$ ,  $a$  (constant) and  $b$  (exponent) for the species were used as inputs to a VPA analysis. The  $t_0$  value was taken as zero.

**Results**

**Age and growth:** The length range obtained in the fishery was 4 to 23 cm. In addition, the length range which contributed significantly to the fishery 7 to 17cm. The estimated von Bertalanffy growth parameters were found to be  $L^\infty = 24.48$  cm and  $K = 1.50/yr$ . It is assumed in the ELEFAN I analysis that the value of the third parameter of the von Bertalanffy growth function, to is zero (Pauly and David, 1981). Therefore the sizes attained by the *H. nehereus* are 13.01 cm, 19.10 cm, 21.92 cm and 23.28 cm at the end of 6, 12, 18 and 24 months of age respectively. The absolute increase is available for reading Fig. 1. The growth rate of *H. nehereus* showed 4.21cm from two to fourth month of age and 1.20 cm from twelve to fourteen month of age.

**Length-weight relationship:** The length-weight relationship for the individuals ranging in size from 5.5 cm to 17.5 cm was estimated. The length-weight relationship of *H. nehereus* was found to be  $\log W = -2.5967 + 3.051 \log TL$ .

It is observed from the Fig. 2 that weight bears a curvilinear relationship with the length which becomes linear after logarithmic transformation. The length and weight measurements of the fish are related to each other with very high co-efficient of correlation ( $r = 0.997$ ). The maximum weight or asymptotic weight was found to be 43.69 g.

**Relation condition factor:** Relation condition factor ( $k_n$ ), which is a ratio between observed and calculated mean weight, was calculated for different months as well as for each size class at 1cm interval is shown in Fig. 3. A marked decline in ' $k_n$ ' at 12 cm length and subsequent recovery after 12 cm were observed. The graph (Fig. 4) shows two peak spawning seasons during one year, one in March-June and other in September-November.

**Virtual population analysis:** The Length structure VPA is a powerful tool for stock assessment by which the size of each cohort is estimated along with the annual mortality caused by fishing. VPA results indicated that maximum number of Bombay ducks are caught between 7 and 13 cm with values of  $F$  (Fishing mortality) exceeding 3.50/yr in the mid length 11 cm. The results of the length structured Virtual Population Analysis of *H. nehereus* are shown in Fig. 5.

**Discussion**

The estimated value of exponent ( $n$ ) for length- weight relationship of *H. nehereus* was 3.051. Hile (1936) and Martin (1949) showed that the exponent ' $n$ ' usually lies between 2.5 and 4.0. In the present case, the exponent lies between the values mentioned by Hile (1936) and Martin (1949).

The results of the relative condition factor ( $K_n$ ) indicate that a mark decline at 12 cm length and subsequent recovery after 12 cm length. Such rapid change and recovery is generally associated with the attainment of sexual maturity, a similar change in relative condition has

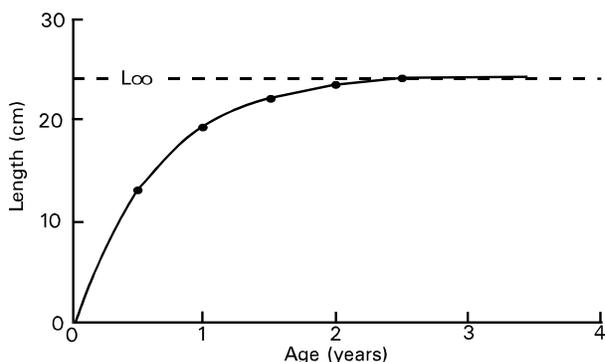


Fig. 1: Calculated growth curve of *H. nehereus* (with  $L^\infty = 24.48$  cm and  $K = 1.50/yr$ )

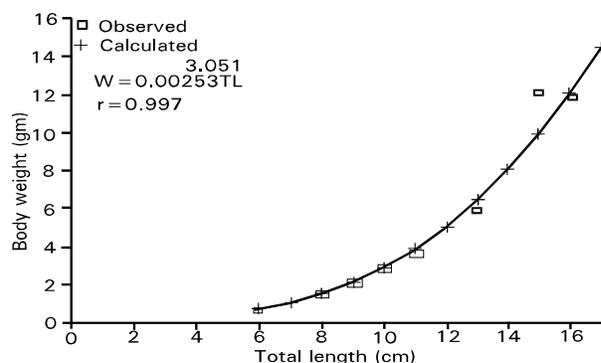


Fig. 2: Total length and body weight relationship of *H. nehereus*

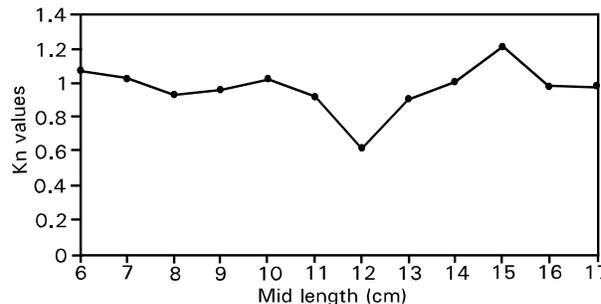


Fig. 3: Relative condition factor ( $K_n$ ) of *H. nehereus*

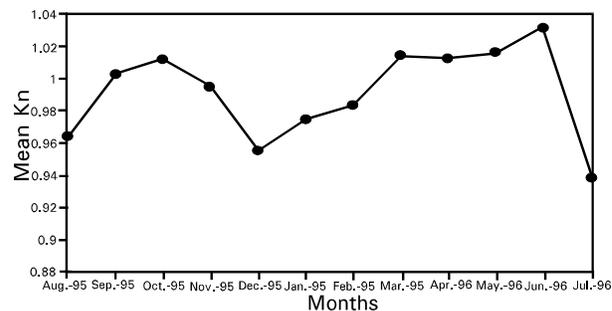


Fig. 4: Monthly relative condition factor ( $K_n$ ) of *H. nehereus*

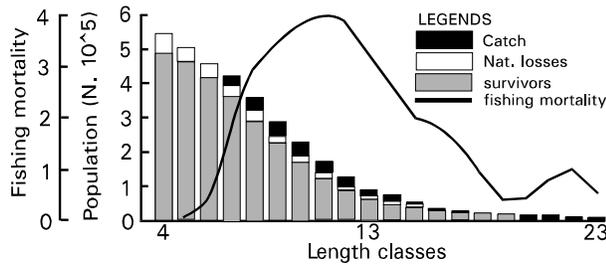


Fig. 5: Length structured Virtual Population Analysis of *H. nehereus*

been observed by Rao (1967) on *M. rosenbergii* and Pantulu (1961) on fish. The ratio between weight of food ingested and body weight is negligible (Thomas, 1975) and therefore, the food can not affect the  $k_n$  values. The highest values of  $k_n$  (Fig. 4) during spawning months (March to June and September to November) were mainly due to maturity of gonads while in other months it was due to the availability of foods. Virtual Population Analysis indicate that the fishing pressure is high between 7 to 13 cm length of fish. The annual rate of fishing mortality (F) and exploitation level (E) were recorded as 3.27/yr and 0.57 by Mustafa *et al.* (1998). Its fishing pressure is high and needs to be reduced for getting more sustained production.

#### References

Bhuiyan, M.R.U., 1992. Proximate biochemical analysis and spoilage pattern of six marine fishes of the Bay of Bengal. M.Sc. Thesis, Institute of Marine Science, University of Chittagong, Bangladesh.

Gayanilo, Jr. F.C., P. Soriano and D. Pauly, 1996. The FAO-ICLARM Stock Assessment Tools (FISAT) Users Guide. FAO, Rome, Pages: 266.

Hile, R., 1936. Age and growth of cisco, *Lencichthys artedi* (Le Sueur) in the lakes of the North Eastern Highlands, Wisconsin. Bull. Bureau Fish., 48: 211-337.

Le Cren, E.D., 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in the Perch (*Perca fluviatilis*). J. Anim. Ecol., 20: 201-219.

Martin, W.R., 1949. The mechanics of environmental control of body form in fishes. Univ. Toronto Stud. Biol., 58: 1-91.

Mustafa, M.G., M. Zafar, A.K.M.A. Matin and S.M.N. Amin, 1998. Population dynamics of *Harpodon nehereus* (Ham.-Buch.) from the Kutubdia channel of Bangladesh. Bangladesh J. Fish. Res., 2: 83-90.

Pantulu, V.R., 1961. On the use of pectoral spines for the determination of age and growth of *Mystus gulio* (H). Proc. Natl. Inst. Sci. India, 27B: 1-30.

Pauly, D. and N. David, 1981. ELEFAN-I, a basic program for the objective extraction of growth parameters from Length frequency data. Meeresforschung, 28: 205-211.

Rao, R.M., 1967. Studies on the biology of *Macrobrachium rosenbergii* (de Man) in the Hoogly estuary with notes on its fishery. Proc. Natl. Inst. Sci. India, 33: 252-279.

Saeger, J. and F.J. Gayanilo, 1986. A revised and graphics oriented version of ELEFAN-I and II basic programs for use on HP/86/87 microcomputers. Technical Report Department of the Marine Fish No. 8.

Sarker, M.R., 1967. Estuarine and coastal fisheries of East Pakistan with special reference to gill netting trans. Proceedings of the Fish Protein Concentrate Seminar, November 7-8, 1967, Dhaka, Pakistan.

Thomas, M.M., 1975. Reproduction, fecundity and sex ratio of the green prawn, *Penaeus semisulcatus* de haan. Indian J. Fish., 21: 152-163.

Zafar, M., Z. Hossain and A. Mehdi, 1993. Calcium content in some commercially important fishes in the Bay of Bengal, Bangladesh. Chittagong Univ. Stud. Part II: Sci., 17: 63-65.