http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 7 (4): 452-456, 2004
ISSN 1028-8880

Length-weight Relationship, Condition Factor and Harvesting Records of Silver Pomfret (*Pampus argenteus)* in the Southwestern Region of Bangladesh

[1]M. Saifur Rahman, [1]M. Aminur Rahman, [2]M. Rafiqur Rahman and [3]Dipak Kamal
[1]Department of Chemistry, Biology and Marine Science, Faculty of Science,
University of the Ryukyus, 1 Senbaru, Nishihara-cho, Okinawa 903-0213, Japan
[2]Department of Fisheries Management, Faculty of Fisheries,
Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[3]Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna 9208, Bangladesh

Abstract: The length-weight relationship and condition factor of silver pomfret, (*Pampus argenteus),* collected from the southwestern region of Bangladesh (Khulna, Bagerhat and Pirojpur) were studied for a period of twelve months. In total, 317 fish (sex combined) were sampled in monthly intervals. Standard length-weight relationship of *P. argenteus* was obtained to be Log W = -1.1004 + 2.7931 Log L. The co-efficient of correlation (r) was found to be 0.989. Standard errors of S_x and S_y were 2.955 and 8.287, respectively. The calculated t-test also indicated that the correlation between length and weight was significant. The mean value of condition factor (K) was found to be 44.27. The peak and lean harvesting volumes of this fish were recorded during the winter and summer months, respectively.

Key words: Length-weight relationship, condition factor, harvesting records, *Pampus argenteus*

INTRODUCTION

The silver pomfret, *Pampus argenteus* locally known as 'Rupchanda' is an endemic marine fish species of Bangladesh. Commercially, it is one of the most important fish and highly valued for domestic consumption due to tastiness, as well as for foreign exchange earnings. The species is widely distributed both in highly saline water zone throughout the Sundarban region (natural mangrove forest) and the Bay of Bengal[1].

Studies on the biology of silver pomfret require adequate knowledge on length-weight conversions, because only measurement of weight rather than length has previously been recorded. Although many scientists have worked on length-weight relations and catch assessment of different fish and shrimp species[2-14], such type of researches have been lacking on *Pampus argenteus* in Bangladesh.

In view of the above, an attempt was made to determine the peak harvesting season, length-weight relationship and condition factor of *Pampus argenteus* in southwestern region of Bangladesh. It was also aimed to gather some important information through statistical analysis of the regression co-efficient that might have the important implication towards its conservation and management.

MATERIALS AND METHODS

Sample collection and sites: The experiment was conducted for a period of twelve months (from July, 2001 to June, 2002) from four fish landing centers (Khulna, Bagerhat and Pirojpur) in the southwestern region of Bangladesh. Fishes were randomly sampled from the landing centers once a month. In total, 317 fishes (sex combined) were collected and studied throughout the period of study.

Length-weight data: During the study of length-weight relationship, standard length (SL) of individual fish was measured in nearest centimeter (cm). The length was measured from the most anterior projecting part of the head to the distal tip of the caudal fin with the caudal ray squeezed together. The weight of individual fish was measured in nearest 0.01 g on a precision single pan balance. The excess water present on the body of fish was removed by blotting papers just before taking the weight of fish.

The length and weight data were used to determine the length-weight relationship, regression co-efficient (slope), correlation co-efficient(r) and intercept. All data were converted to $\log_{10}$ values to have strait line length-weight relationship.

Corresponding Author: Dr. Md. Aminur Rahman, JSPS Postdoctoral Fellow, Department of Chemistry, Biology and Marine Science, Faculty of Science, University of the Ryukyus, 1 Senbaru, Nishihara-cho, Okinawa 903-0213, Japan. E-mail: arahman1963@yahoo.com

The length-weight relationship was calculated by using the following formula given by Lecren[15]:

$$W = aL^n$$

Where, W=weight of the fish; L= length of the fish; a=constant; and n= exponential value.

The values of 'a' and 'n' were calculated for standard length-body weight relationship using log-log relation of the formula, Log W = Log a + n Log L and the values of Log a and n were calculated by using the mathematical relationship[16], as follows:

$$\text{Log } a = \frac{\Sigma \text{ Log W}. \Sigma (\text{Log L})^2 - \Sigma \text{ Log L}. \Sigma (\text{Log L} \times \text{Log W})}{N. \Sigma (\text{Log L})^2 - \Sigma (\text{Log W})^2}$$

$$n = \frac{\Sigma \text{ Log W} - (N. \text{Log a})}{\Sigma \text{ Log L}}$$

Where, W = weight in g; L = length in cm and N = sample size.

The co-efficient of correlation,'r' was calculated as follows:

$$r = \frac{\Sigma xy - \Sigma x. \Sigma y / N}{\sqrt{[\{\Sigma x^2 - (\Sigma x)^2/N\}\{\Sigma y^2 - (\Sigma y)^2/N\}]}}$$

In calculating standard errors for regression y on x and vise-versa, the following formula was used:

$S_x = \delta_x \sqrt{(1 - r^2)}$ and $S_y = \delta_y \sqrt{(1 - r^2)}$

t-test was done by the formula:

$t = r \sqrt{(N - 2)} / \sqrt{(1 - r^2)}$ with degree of freedom.

The condition factor (K) was determined as per Hile[17] using the formula:

$$K = (W \times 10^3) / L^3$$

Where, K = condition factor; W = weight of fish and L = length of the fish. Number 10^3 is the factor bringing the ponderal index or condition factor (K) near the unity[18].

Harvesting records: In order to determine the peak-harvesting season and volumes of this fish, a month-wise total catch (M ton) of *Pampus argenteus* were recorded from the above-mentioned fish landing centers (combined) during the study period.

RESULTS AND DISCUSSION

The values of length-weight relationship and condition factor obtained from the present study were shown in Table 1. The values of the Log a and n for the combined sex of *P. argenteus* were found to be –1.1004 and 2.7931, respectively. So the logarithmic form of equation for standard length and body weight relationship was Log W = -1.1004 + 2.7931 Log L. The value of 'n' obtained from the study was 2.793, which indicated that the growth of *P. argenteus* was allomatric[13] and also revealed that *P. argenteus* species strictly followed the cube law. The result agreed with the findings of Natarajan[19], Hossain[9] and Hardjamula *et al.*[20].

The value of co-efficient of correlation between log length and log weight was found to be 0.989 and the standard error of S_x and S_y were calculated to be 2.955 and 8.287, respectively. The value of co-efficient of correlation (r) indicated that the relationship between length and weight was significant or not. The calculated value of 't' was obtained to be 2.258 and the tabulated value of 't' at 5% level of probability was 1.960[21]. The calculated value was greater than the tabulated value, indicating that the correlation between length and weight was highly significant.

The mean standard length was plotted against the corresponding mean weight of the group (Fig. 1). The calculated weight was also plotted in the same graph and an exponential curve was obtained. The curve suddenly ascended from the lower left to the upper left that might be due to much gain in weight with increasing length of the fish. On the other hand log length was plotted against log weight and a linear relationship was obtained (Fig. 2). Both the conditions were the conformity for the exponential growth of this species. Similar results were also obtained by Aliakbar and Ali[7], Hossain *et al.*[9] and Rahman *et al.*[10].

In total, 317 specimens measured from the random samplings (Table 1). Length and weight of fish were ranged between 10 to 25 cm and between 40 to 570 g, respectively (Fig. 3) indicating an exponential relation between length and weight. The general co-efficient of allometry was 0.975. Similar results were obtained by Chien-Chung Hsu[12] and Andrade and Campos[14] on different marine fish species.

The mean condition factor of this species was found to be 44.27. The fluctuating curve in Fig. 4 obtained by plotting the observed K values against the standard lengths showed the variation in the condition factor of fish. This might be associated with the collection, size of fish, sample size, development of gonad and feeding conditions.

Table 1: Standard length-weight relationship, calculated weight and condition factor of *Pampus argenteus*

Length group (cm)	Sample size	Mean standard length L (cm)	Mean body weight W (g)	Log L	Log W	Log L x Log W	$(\text{Log L})^2$	Calculated Log W	Calculated weight W (g)	Condition factor $K=Wx1000L^{-3}$
10-10.99	14	10.43	47.93	1.0182	1.6806	1.7113	1.0369	1.7449	2.2487	42.2429
11-11.99	21	11.28	65.24	1.0523	1.8145	1.9094	1.1074	1.8400	34.9109	45.4555
12-12.99	23	12.26	94.13	1.0884	1.9737	2.1484	1.1848	1.9410	72.5684	51.0807
13-13.99	22	13.22	110.64	1.1212	2.0439	2.2917	1.2572	2.0326	109.4574	47.8870
14-14.99	27	14.19	138.37	1.1519	2.1410	2.4664	1.3270	2.1185	146.7307	48.4278
15-15.99	35	15.23	171.17	1.1827	2.2334	2.6415	1.3988	2.2043	186.6938	48.4538
16-16.99	34	16.22	194.44	1.2101	2.2888	2.7695	1.4642	2.2807	224.7356	45.5652
17-17.99	29	17.19	232.14	1.2353	2.3657	2.9224	1.5259	2.3511	262.0089	45.7006
18-18.99	26	18.21	256.54	1.2603	2.4091	3.0363	1.5883	2.4211	301.2035	42.4839
19-19.99	22	19.23	294.32	1.2839	2.4688	3.1699	1.6486	2.4872	340.3981	41.3887
20-20.99	18	20.14	372.28	1.3040	2.5709	3.3525	1.7006	2.5433	375.3658	45.5713
21-21.99	13	21.23	435.38	1.3269	2.6389	3.5016	1.7608	2.6072	417.2502	45.5007
22-22.99	12	22.12	467.92	1.3448	2.6702	3.5908	1.8084	2.6571	451.4494	43.2331
23-23.99	13	23.23	506.92	1.3660	2.7049	3.6950	1.8661	2.7165	494.1023	40.4382
24-24.99	6	24.33	553.67	1.3861	2.7432	3.8025	1.9214	2.7726	536.3710	38.4437
25-25.99	2	25	570	1.3979	2.7559	3.8525	1.9542	2.8055	562.1165	36.48

Correlation co-efficient (r) =0.989, t = 2.258 and P<0.05.

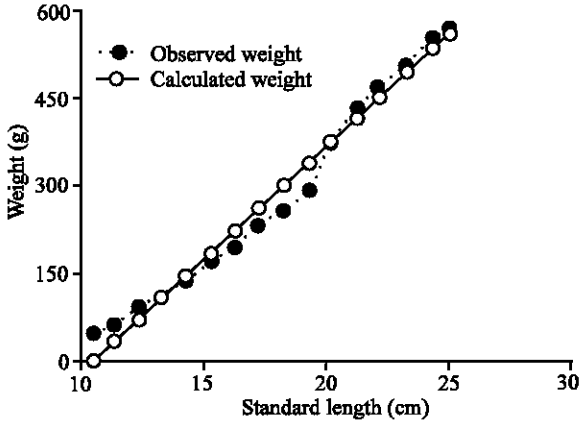

Fig. 1: Relationship between Standard length and weight of *Pampus argenteus*

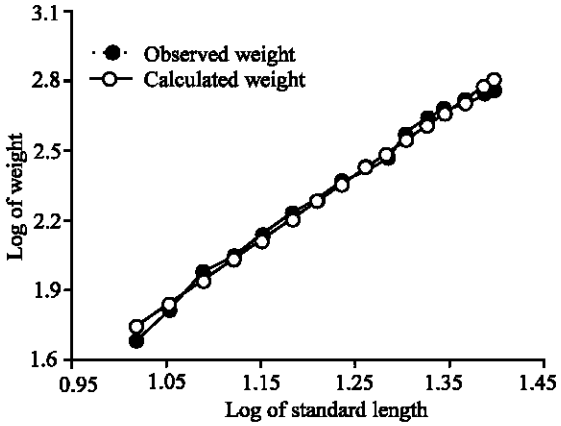

Fig. 2: Relationship between Log L (Standard length) and Log W (weight) of *Pampus argenteus*

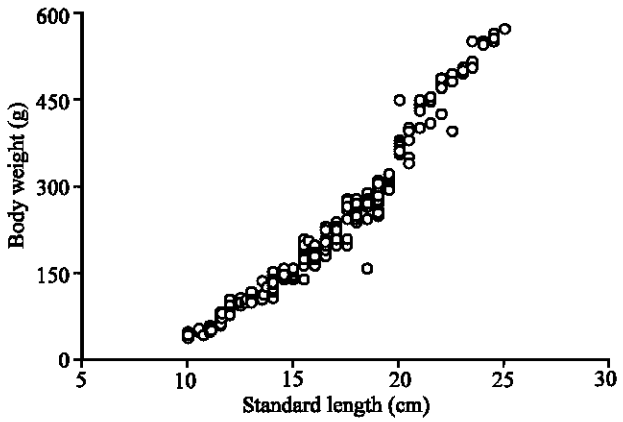

Fig. 3: The length-weight relationship of *P. argenteus* in arithmetic scale from pool data

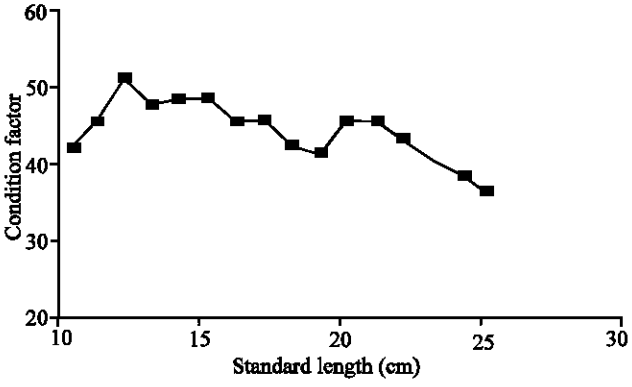

Fig. 4: Relative condition factor at different lengths of *Pampus argenteus*

Figure 5 showed the monthly harvesting volumes of *P. argenteus* in the southwestern region of Bangladesh. The peak-harvesting months were from October to February. In this period harvesting volume were recorded to be 40.56 to 51.7 M tons. Among these months, the highest harvesting obtained in January (51.7 M tons) due to winter season when the sea condition was clam as

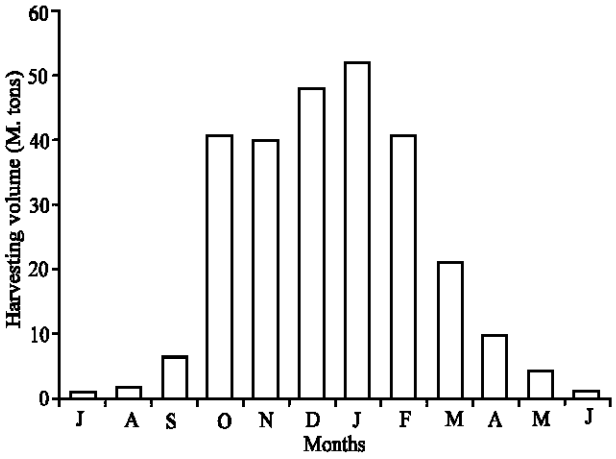

Fig. 5: Monthly variation of harvesting volumes (combined) of *P. argenteus* from the four fish landing centers in the southwestern region

well as suitable for the fishermen to catch fish. March to September were the lean harvesting months as the volumes of fish were varied from only 0.4 to 20.98 M tons. The poorest harvesting month was June, when only 0.4 M ton of fish were caught. The reason behind this was the occurrence of frequent natural disasters (such as cyclone, flood, heavy rain fall etc.), which might eventually affected the fishermen to catch large volume of fish.

This is the first successful attempt to assess the harvesting status, length-weight relationship and condition factor of silver pomfret (*P. argenteus*), which has been serving as one of the most important marine fish for both domestic and commercial purposes. Although the fish has not yet been treated as a culture rather than capture fishery from the wild stocks and there have been no much records on their biology, ecology and distribution patterns. Therefore, the findings of the present study would immensely be helpful towards formulating the future strategies for the development of mariculture techniques, conservation and rehabilitation of *P. argenteus* to a greater extent.

ACKNOWLEDGMENTS

We are much indebted to Dr. Khairul Azam and M. Mostafa, Fisheries and Marine Resources Technology Discipline, Khulna University, for their scholastic suggestions and encouragements during carryout this research as well as for the preparation of the manuscript. Sincere thanks are also to the employees and fishermen for their help and cooperation during collecting data from the different fish landing centers.

REFERENCES

1. IUCN, 1994. Mangrove of the Sundarbans. Vol. 2: Bangladesh. The IUCN Wetland programme. IUCN, Gland, Switzerland.
2. Anderson, W.W and M.J. Linder, 1958. Length-weight relationship in the common or white shrimp *Penaeus setiferus*. U.S. Fish. Wildl. Serv. Spec. Sci. Rept. Fish., 61: 243-256.
3. Chin, E., 1960. The bait shrimp fishery of Galveston Bay, Texas. Trans. Amer. Fish Soc., 89: 135-141.
4. Kutkuhn, J.H., 1962. Daynamic of a penaeid shrimp population and management implications. U.S. Fish. Wildl. Serv. Fish. Bull., 65: 313–338.
5. MeCoy, E.G., 1968. Migration, growth and mortality of North Carolina pink and brown penaeid shrimps. North Carolina Dept. Cons Devel. Spec. Sci. Rept., pp: 15-26.
6. Pathak, S.C., 1975. Length-weight relationship, Condition factor and Food study of *Labeo calbasu* (Hamilton) from Loni reservoir (M.P.). J. Inland Fish. Soc. India, 7: 58-64.
7. Aliakbar, M. and M.M. Ali, 1978. Length-weight relationship of *Macrobrachium rosenbergii* (de Man) of Dakatia river. Bangladesh J. Aqua., 1: 74-78.
8. Kader, M.A., A.L. Bhuiyan and M.M. Rahman, 1984. The length-weight relationship and condition of *Penaeus monodon* (Fabricius, 1798). Bangladesh J. Fish., 7: 71–80.
9. Hossain, M.M., M. I. Miah and S. Dewan, 1987. Length-weight relationship and condition factor of *Macrobrachium rosenbergii* (de Man) of Tetulia river. Bangladesh J. Fish., 10: 89-95.
10. Rahman M.S., M.A.H., Miah, S. Awal and G.C. Halder, 1994. Studies on the Length-weight relationship and condition factor of *Macrobrachium rogenbergii* (Deman) in integrated pond. Progress. Agric., 5: 111-117.
11. Martin-Smith, K.M., 1996. Length/weight relationships of fishes in a diverse tropical freshwater community, Sabah, Malaysia. J. Fish Biol., 49: 731-734.
12. Chen-Chung Hsu., 1999. The length-weight relationship of Albacore, *Thunnus alalunga* from the Indian Ocean. Fisheries Res, 41: 87-92.
13. Sayduzzaman A.K.M., M. Das and M.R. Hasan, 1999. Catch assessment of indigenous and exotic carp species of Nasti baor. Bangladesh J. Fish. Res., 3: 113-122.
14. Andrade, H.A. and R.O. Campos, 2001. Allomerty coefficient variations of the length-weight relationship of skipjack tuna (*Katsuwonus pelamis*) caught in the southwest South Atlantic. Fisheries Res., 55: 307-312.

15. Lecren, E.E., 1957. The length-weight relationship and seasonal cycle in gonad weight and condition in the pearch. J. Anim. Ecol., 20: 219.
16. Lagler, K.F., 1956. Fresh water Fishery Biology. 2nd Ed. V. C. Brown Co. Dubuque, Lowa, USA., pp:360.
17. Hile, R., 1996. Age and growth of the Cisco. Bulletin of the United States Bureau of Fisheries, 48: 211-317.
18. Carlander, D.K., 1970. Handbook of Fresh water fishery Biology. Vol. 1. The Lowa State University press. Lowa, USA., pp:281.
19. Natarajan, A.V., 1972. Project report in 2nd workshop of All India Co-ordinated Research Project on Ecology and Fisheries of freshwater reservoir. Indian Coun. Agric. Res. Report, pp: 33.
20. Hardjamula, A., K. E. Setiadi and N.S. Rabegnator, 1988. Some biological aspect of the predominant species in the Jatluhur Reservoir, west Java, Indonesia. In: S.S. De Silva (Ed.), Reservoir Fishery Management and development in Asia. IDRC, Ottawa, Canada, pp: 98-104.
21. Mason, R.D., D.A. Lind and W.G. Marchal, 1991. Statistics-an introduction. Harcourt Brace Jovanovich Inc., pp: 707.