



Research Note

Length-weight Relationship and Condition Factor of Cobia, *Rachycentron canadum* (Linnaeus, 1766) along Northwest Coast of India

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Length-weight relationship study of a fish is of considerable importance in fishery assessments. Variation from the general length-weight relationship is indicative of the overall condition and such changes have been usually analysed by means of a condition factor or coefficient of conditions or ponderal index (Hile, 1936; Thompson, 1943). Condition factor at different body lengths can give valuable information on maturation and spawning of the fish, whereas seasonal variation in the condition factor values may give definite clues regarding the breeding seasons (Le Cren, 1951).

Information on length-weight relationship of Cobia, *Rachycentron canadum* (Linnaeus, 1766) occurring in different water bodies around the world were either based on limited number of specimens or for a limited period (Sajeevan, 2011). Hence, an attempt is made to estimate the length-weight relationship of cobia occurring along northwest coast of India. Relationships established through the regression method were further used to understand the well being of the fish by assessing the condition factor.

The length-weight relationship ($W = aL^b$), can be expressed as $\log W = a + b \log L$, where weight in g, a = constant (intercept), L = length in cm and b = constant (slope of regression line). The relationship was established for both males and females by linear regression of the logarithms of the length and weight data following Pauly (1983). The

regression analysis, analysis of co-variance (ANCOVA) on the regression equations, 't' test on 'b' and 'r' value were carried out following standard statistical procedures (Snedecor, 1961; Snedecor & Cochran, 1967).

Condition factor values were assessed for males, females and pooled data. Data was analysed for various length groups for different months (two year data pooled to one year to increase the sampling size) to understand the well being of the species, reproductive behavior, feeding habits (Froese, 2006). Condition factor/ponderal index/fultons condition factor (K), modified condition factor and relative condition factor 'Kn' were estimated as described by Fulton (1904), Ricker (1975) and Le Cren (1951) respectively.

The logarithmic regression equation of length-weight relationship equations of cobia representing male, female and pooled (both sexes) are as follows:

$$\text{Male: } \ln W = -5.4261507 + 3.078 \times \ln L$$

$$\text{Female: } \ln W = -5.53194833 + 3.1075 \times \ln L$$

$$\text{Pooled: } \ln W = -5.47046 + 3.0895 \times \ln L$$

95% confidence limit estimated for the slope (b value) of length-weight relationship of male, female and pooled data are: Male: 3.0096 – 3.1464; Female: 3.0006 – 3.2134 and pooled: 2.9164 – 3.2635.

The results of 't' test carried out to understand the significance of relationship showed that there is no significant difference between 'b' value and the cube value (3) in case of male, female and pooled data. This indicates that both male and females follow

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isometric growth. In all the three cases, r^2 values estimated were very close to 1 (0.972 - 0.980).

The results of the ANCOVA on length-weight regression equation showed that F values were smaller than the table values at 5% level of significance (comparison of slope $F = 0.00977$, df 1, 281; comparison of elevation $F = 0.01432$, df 1, 282). This indicates there is no significant difference between the length-weight relationships of male and female.

Values of exponent (b value) of length-weight relationship of cobia assessed by different authors are very close to 3, similar to the values obtained in the present study. Richards (1967), Franks et al. (1999) and Williams (2001) reported similar curvilinear relationship in both the sexes of cobia. These findings are in agreement with the results of present study.

Somvanshi et al. (2000) and Abdurahiman et al. (2004) established length-weight relationship of cobia along Indian waters and the results showed that 'b' value is higher in female than male. But no significant difference between the length-weight relationships of male and female cobia were noticed.

As there is no significant difference between the length-weight relationship of the male and female cobia, the samples were pooled and the condition factor values estimated and presented in Fig. 1. As shown in Fig. 1, condition factor, relative condition factor and modified condition factor values followed similar pattern and the values were above 0.56, 1 and 0.4 respectively. According to Bennet (1970), Fulton's condition factor ≥ 0.56 , relative condition factor ≥ 1 and modified condition factor ≥ 0.4 are considered as well-being bench mark values of a fish, hence fishes with condition factor values above the well-being bench mark were considered to be in good condition. Result of the present study indicated that cobia occurring in northwest coast of India is in good condition throughout the period.

Month-wise condition factor values of cobia (Fig. 1) show that all three values were plummeting during April, August, October and November. This indicates that cobia breeds throughout the year with peak breeding season during July-August and October-December. Sajeevan (2011), through gonadosomatic index analysis and percentage of mature specimen, reported the peak breeding

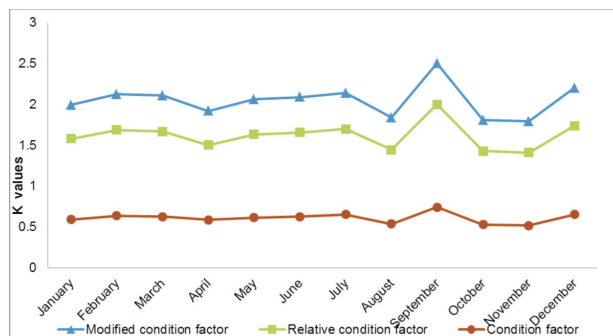


Fig. 1. Month-wise condition factor values of cobia *Rachycentron canadum* (Pooled)

season of cobia occurring in northwest coast of India as July-August and November-December.

Condition factor values were also analysed on the basis of length to understand the well being of the fish in respect of pooled data and the results are illustrated in Fig. 2. There was a drop in all condition factor values at length classes 31 - 40 cm and 81 - 90 cm. After a fall in the initial length class viz., 31 - 40 cm, condition factor values increased in other length classes. All three condition factor values were dropping at the class interval 71 - 80 cm. This can be an indication of the size at maturity of the fish. Analysis of length wise condition factor indicates that male mature at the size class 61 - 70 cm and female mature at 71 - 80 cm class interval.

Length-wise condition factor values (Fig. 2) showed that condition factor values were either above or close to the Bennet (1970) well-being bench mark values in all length groups of cobia. Except some minor variations during certain months and in

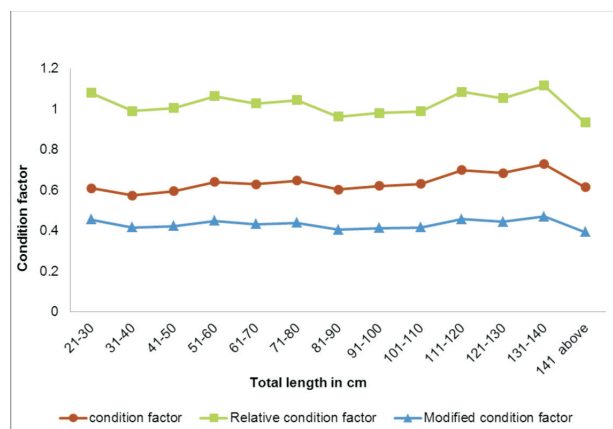


Fig. 2. Length-wise condition factor values of cobia *Rachycentron canadum* (Pooled)

different size groups, results obtained by all the three methods (Fulton's condition factor, relative condition factor and modified condition factor) were almost complementary; indicating that cobia is in good condition throughout its life cycle.

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References

- Abdurahiman, K. P., Harishnayak, T., Zacharia, P. U. and Mohamed, K. S. (2004) Length-weight relationship of commercially important marine fishes and shellfishes of the southern coast of Karnataka, India. *Naga World Fish Center Q.* 27 (1& 2): 9-14
- Bennet, G. W. (1970) Management of lakes and ponds. 385 p. Van Nostrand Reinhold, New York
- Franks, J. S., Warren, J. R. and Buchanan, M. V. (1999) Age and growth of cobia, *Rachycentron canadum*, from the northeastern Gulf of Mexico. *Fish. Bull.* 97(3): 459-471
- Froese, R. (2006) Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. *J. Appl. Ichthyol.* 22(4): 241-253
- Fulton, T. W. (1904) The rate of growth of fishes. In: 22nd Annual Report Fishery Board for Scotland 1904, pp 141-241, Fishery Board for Scotland, Scotland, UK
- Hile, R. (1936) Age and growth of CISO *Leucichthys artedi* (Le Suer) in the lake of the northeastern high lands, Wisconsin. *Bull.US Bur. Fish.* 48: 211-317
- King, M. (1995) Fisheries biology, assessment and management. 341 p. Fishing news books, Oxford, England.
- 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
- Pauly, D. (1983) Some simple methods for the assessment of tropical fish stocks. FAO Fishery Technical Paper. 234. 52 p. Food and Agriculture Organisation of the United Nations, Rome
- Richards, C. E. (1967) Age, growth and fecundity of the cobia, *Rachycentron canadum*, from Chesapeake Bay and adjacent mid-Atlantic waters. *Trans. Am. Fish. Soc.* 96(3): 343-350
- Ricker, W. E. (1975) Computation and interpretation of biological statistics of fish populations. *Bull. Fish. Res Board Can.* 191: 382-471
- Sajeevan, M. K. (2011) Systematics, life history traits, abundance and stock assessment of Cobia *Rachycentron canadum* (Linnaeus, 1766) occurring in Indian waters with special reference to the northwest coast of India. 271 p. Ph.D. Thesis, Cochin University of Science and Technology, Kochi, India
- Snedecor, G.W. (1961) Statistical methods applied to experiments in agriculture and biology. 183 p. Allied pacific Pvt. Ltd., Bombay, India
- Snedecor, G. W. and Cochran, W.C. (1967) Statistical methods. 593 p. Iowa State University Press, Ames, IA
- Somvanshi, V.S., Vargese, S., Gulati, D.K. and Bhargava, A.K. (2000) Some Biological aspects of kingfish *Rachycentron canadum* (Linnaeus, 1766) from the north-west Indian EEZ. Occasional Paper of Fishery Survey of India 10. 36 p. Fishery Survey of India, Mumbai, India.
- Thompson, D. A. W. (1943) On growth and form. 987 p. University press, Cambridge
- Williams, E. H. (2001) Assessment of cobia, *Rachycentron canadum*, in the waters of the U.S. Gulf of Mexico. National Oceanic and Atmospheric Administration Technical Memorandum NMFS-SEFSC.469. 61p. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle, WA