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# Length weight relationship, relative condition factor and ponderal index of Blotched Croaker, *Nibea maculata* off Gopalpur Coast, Odisha

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**Abstract**
Study on length weight relationship, relative condition factor and ponderal index of blotched croaker, *Nibea maculata* off Gopalpur coast, Odisha was conducted from September 2012 to August 2013. 680 samples were collected and identification of sex; length and weight measurement was done in the laboratory. The length weight relationship was established for both male and female separately as Log W=-1.327 + 2.88 log L ($r^2$= 0.937) and Log W=-1.236 + 2.99 log L ($r^2$= 0.869) respectively. As the regression coefficient of the sexes did not differ significantly, a common equation has been derived as Log W= -1.346+2.96 log L ($r^2$=0.929) showing isometric growth of the species. The relative condition factor (Kn) was found to be highest during February (1.18) and lowest in April (0.8). The Kn value in different length classes during the period varied from 0.948 to 1.00. The highest ponderal index was found in February (1.84 for male and 1.77 for female) and it decreases with increasing length classes.

**Keywords:** Length weight relationship, relative condition factor, Odisha, *Nibea maculata*

## 1. Introduction
The length weight relationship of fish stocks is determined to establish a mathematical relationship between two attributes (length and weight) which enables calculation of length if weight is known or vice versa. In addition, the length weight relationship can also be used to calculate relative condition factor, setting yield equations for estimating the number of fish landed and in comparing the population in space and time (Beverton and Holt, 1957) [3]. It also provides useful information for stock assessment and population dynamic studies such as growth estimation, length and age structure (Kolher *et al*., 1995) [19]. The estimation of relative condition factor (Kn) and ponderal index (K) gives information on general well being of the fish and its development. Sciaenids are also known as Croakers, Grunters or Jew fishes are small to moderately sized fishes found primarily on coastal region, though some are distributed in the estuarine water, even up to a depth of 350 m. These fishes are widely distributed in different parts of the world, particularly in the tropical waters of Indian (Druzhinin, 1971) [11], Atlantic (Longhuost, 1964) [22] and Pacific Ocean (Skajesberg, 1939) [31]. Nearly 45 species of sciaenids have been reported from India and adjacent waters (Druzhinin, 1971) [11]. However Mohan (1991) [26] has revised the same and reported 48 species from Indian Ocean. The estimated annual average catch of sciaenids during 2011-12 period in India was around 2,20,120 ton which was about 5.76 % of the total catch of India (www.cffri.org.in/annual-data.html, 2012) [1]. In India the sciaenids catch was mainly dominated by Gujarat, Maharashtra, West Bengal, Tamil Nadu, Odisha, Andhra Pradesh and Kerala. Among the sciaenids, *Nibea maculata* (Blotched croaker) is a medium sized fish forms an important fishery and also fetch good price in the market.
Several studies have been conducted on length weight relationship, relative condition factor and ponderal index in sciaenids along Indian coast. Though the growth and mortality parameter of several sciaenid species have been studied by many authors from different regions of India (Manoj Kumar *et al*., 1992 [23]; Chakraborty, 1993, 1996, 2001 [5-7]; Chakraborty *et al*., 1994, 2005 [10, 9]; Kamat and Devraj, 1995 [18]; Murty and Ramalingam, 1996 [27]; Manoj kumar, 2005) [24], studies on length weight relationship, relative condition factor and ponderal index of different species of sciaenids particularly from Gopalpur coast,

Odisha is limited. The growth and other parameters of *Otolithes ruber* has been carried out from Tuticorin, Madras and Cochin by Rao *et al*. (1992) [28] and Chakraborty *et al*. (2000) [8]. Further, the growth of *Otolithes ruber*, *Johnius carutta* and *Pennalia macropthalmus* from Paradeep coast, Odisha has been studied by Bhuyan *et al*. (2012) [4]. In another study, Jaysanker (1994) [15] has studied the length-weight relationship, relative condition factor and spawning of some sciaenids like *Johneiops sina*, *Dendrophysa russeli, Johnieus dussumeiri* and *Johneius macropterus* from Mandapam region. Further, a detailed investigation on the growth and mortality parameters of *Nibea maculata* off Thoothukudi coast, Tamilnadu and population parameters in trawling grounds of Rameswaram island and Palk bay/Gulf of Mannar were undertaken by Santosh Kumar *et al*., 2011 [30] and Jaysankar, 1995 &1997 [16, 17] respectively.

Though many studies were undertaken on population parameters, stock assessment and reproductive biology of different species of sciaenids from different waters of India, information on length weight relationship, relative condition factor and ponderal index of *Nibea maculate* particularly from Odisha coast is not available. The present study on *Nibea maculata*, is an attempt in this direction.

## 2. Materials and methods

During the present study, 680 numbers of specimens comprising 297 males and 383 females were collected from Gopalpur landing centre ($19^0$ 16′ N $84^0$ 55′ E) and nearby market ranging from 8.4 to 22.50 cm in total length and 16.5 to 145 gm in total weight from September 2012 to August 2013. Total length in cm (from tip of snout to tip of the longest rays of caudal fin) and total weight to nearest milligram were recorded for individual species. The length weight relationship was established separately for male and female using the formula given by Le Cren (1951) [21]:

$$W = a L^b$$

The relationship was expressed in logarithmic form as

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

Where, W= weight of fish in gm, L= length of fish in cm, "a" and "b" are intercept and regression coefficient, respectfully. The coefficient of correlation "r" was determined in order to know the relationship between two variables. Significance of difference at 5% level between the regression coefficients of the sexes was tested by ANOCOVA (Snedecor and Cochran, 1967) [32]. To test deviation of b value from that of "3" student's t-test was employed.

The relative condition factor (Kn) was calculated for individual fishes by the equation

$$Kn = Wo / We$$

Where, Wo= observed weight, We= calculated weight obtained by the length weight relationship.

Individual variation from general length-weight relationship have been studied under the general name condition (Le Cren. 1951) [21]. Such changes in condition have usually been analysed by means of condition factor or Ponderal index (K). Hill (1936) [13] and Beckman (1948) [2] proposed the following formula to determine the condition factor or ponderal index.

$$K = W/L^3 \times 100$$

Where, W= Weight of fish, L= Length of fish

## 3. Results and Discussion

**3.1 Length weight relationship:** The present study was based upon 680 numbers of *N. maculata* consisting of 297 males (8.6 cm to 21.0 cm) and 383 female (8.4 cm to 22.5 cm). The data collected (length and weight) were used for calculation of length weight relationship for the male fishes and female fishes separately. The b value was found to be 2.88 and 2.99 for the male fishes and the female fishes respectively. The length weight relationship of the two sexes (fig 1 and 2) was found to be as follows:

Females: Log W=-1.236 + 2.99 log L; $r^2$= 0.869)

Males: Log W=-1.327 + 2.88 log L; $r^2$= 0.937)

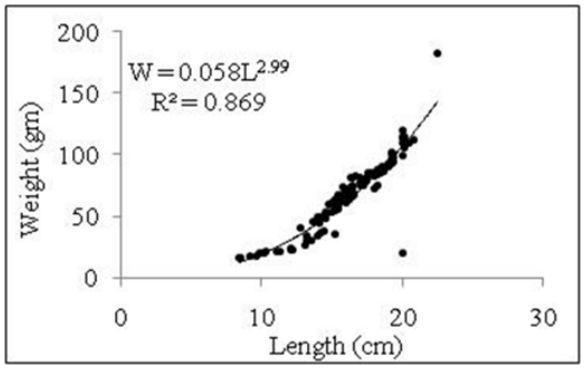


**Fig 1:** Length weight relationship of Female *N. maculate* during the study period

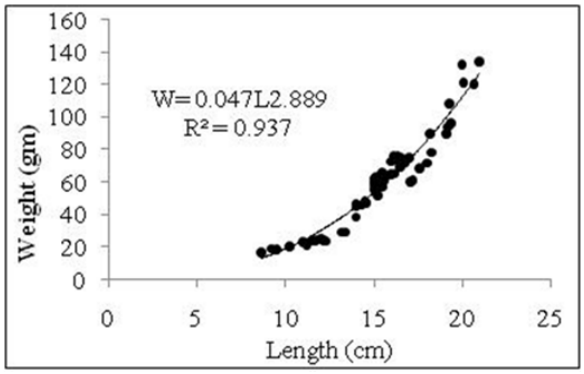


**Fig 2:** Length weight relationship of male *N. maculata* during the study period

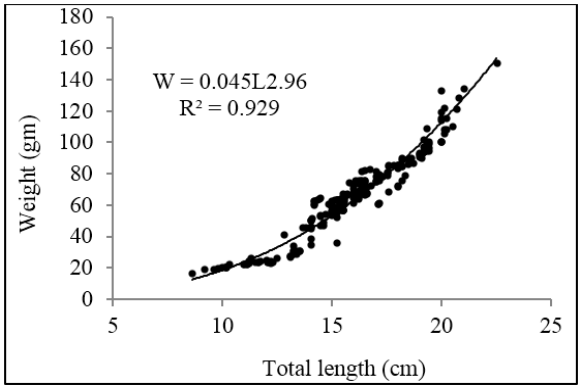


**Fig 3:** Overall Length weight relationship of *N. maculata* during the study period

The analysis of covariance revealed no significant difference in the regression co-efficient of the sexes. Hence, a common equation has been established for the species as Log W= -1.346+2.96 log L ($r^2$=0.929) (Fig 3). Though no parallel literature is available regarding the study of length-weight relationship of the species *N. maculata*, many works has been done in this regard for many sciaenid fishes (Jayasankar, 1990 [14]; Telvekar, 2006 [33]; Kumar, 2012 [20]). In a recent study conducted by Kumar (2012) [20] on *Johnieopes sina* along Ratnagiri coast of Maharastra, reveals that there is no significance difference in 'b' value (at 1% and 5% level) between sexes and therefore a common equation was derived as Log W= -5.295+3.1751 Log L ($r^2$=0.9394). The common 'b' value was found to be significantly differing from the isometric value indicating allometric growth. Telvekar (2006) [33] has also established length weight relationships as Log W= -4.2305+2.712 Log L and Log W= -4.6507+2.8813 Log L for female and male of *Otolithes cuvieri* from Mumbai.

In the present investigation, the regression co-efficient (b value) for the species (2.96) does not differ significantly from the value 3 and therefore, *Nibea maculata* does follow the cube law indicating isometric growth. The co-efficient of determination ($r^2$) for the length weight relationship was estimated as 0.929, indicating a high degree of positive correlation between the two attributes (length and weight). This may be due to the conducive environmental parameters of the ecosystem for growth of the fish.

**3.2 Relative condition factor (Kn):** This is considered as an index of general well being and suitability of fish to grow in a particular water body. The value expresses the condition of fish such as degree of well being, relative robustness, plumpness and fatness in numerical terms. Its value differs seasonally and is influenced by the maturity of gonads and spawning. From the month wise observation of kn value (Fig 4) it is evident that, the relative condition factor increases from Sept 12 (0.89) to Jan 13 (1.09), showing highest in Feb 13 (1.18) and the lowest value (0.8) was observed in April 13.

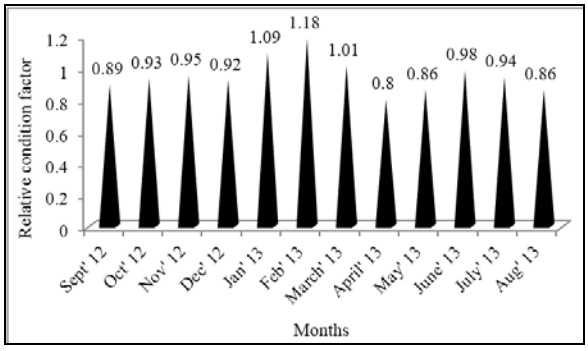


**Fig 4:** Month wise relative condition factor (Kn) of *N. maculata* during the study period

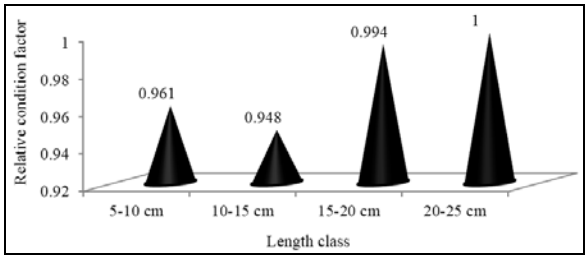


**Fig 5:** Length wise relative condition factor of *N. maculata* during the study period

The higher values during Jan and Feb may be correlated with the spawning season of the species. This result is in agreement with the study of Manojkumar (2011) [25] where he inferred that during spawning season the Kn value becomes higher. Further, the relative condition factor in different length classes (Fig 5) during the whole study period varied from 0.948 to 1.00 indicating favorable environmental condition for growth of the fish in the ecosystem.

**3.3 Ponderal index (K):** In fish, the factor of condition, K reflects through its variation, information on the physiological state of the fish in relation to its well being. From nutritional point of view, it indicates accumulation of fat and gonadal development (Le Cren, 1951) [21]. The k value is also influenced by reproductive status of fish (Thakur, 1975) [34]. In the present investigation, the ponderal index for male and females of *N. maculate* were determined separately on month wise (Fig 7) and also for different length classes (Fig 6).

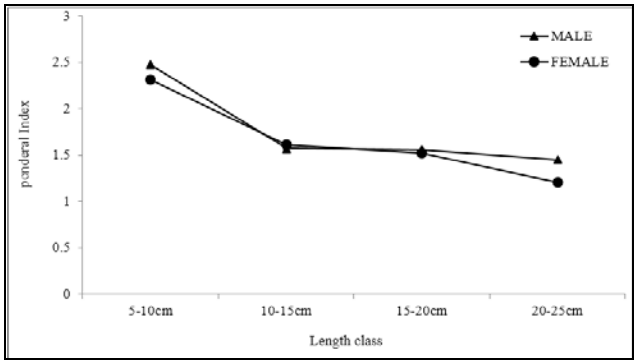


**Fig 6:** Length wise Ponderal index (K) of male and female *N. maculata* during the study period

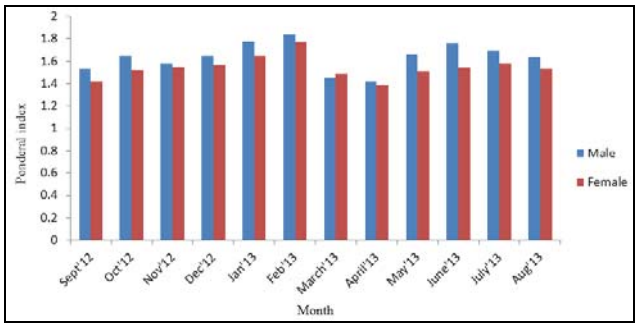


**Fig 7:** Month wise Ponderal index (K) of male and female *N. maculata* during the study period

The K value varied between 2.47 (5-10 cm) to 1.44 (20-25cm) in case of male showing a decreasing trend with increasing length classes. A similar trend was also observed in case of females where the K value varied from 2.31 (5-10cm) to 1.20 (20-25cm). The decreased K value with increasing length classes may be due to the higher feeding intensity in the smaller fishes compared with the larger fishes. The result is in agreement with of Rizvi, 2001 [29], where K value increases with increasing feeding intensity of ribbon fishes. From the month wise result of K value, it is apparent that the highest K value was observed during February for both male (1.84) and female (1.77). Gupta (1967) [12] has stated that in the young ones, the condition factor is determined by feeding intensity, but in larger individuals, it is largely because of maturation of gonads.

## 4. Conclusion

From the present study, it may thus be concluded that the species *N. maculata* showed isometric growth and the length weight relationship was established as Log W= -1.346+2.96 log L ($r^2$=0.929). The fluctuation in the ponderal index throughout the year can be correlated with sexual maturity cycle and feeding intensity of the species. The results of relative condition factor (Kn) indicates favorable environmental for growth of the fish along Gopalpur coast, Odisha.

## 5. Acknowledgement

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## 6. Reference

1. Annual Report. www.cffri.org.in/annual-data.html, 2012.
2. Beckman CW. The length-weight relationship, factor for conversions between standard and total lengths, and coefficients of condition for seven Michagian fishes. Trans. Am. Soc. 1948; 75:237-256.
3. Beverton RJH, Holt SJ. On the dynamics of the exploited fish populations. Fish. Invest. Minist. Agric. Fish. Food G.B. (2 Sea Fish). 1957; 19:533.
4. Bhuyan SK, Jena JK, Pillai BR, Kumar P, Chakraborty SK. Studies on the growth of *Otolithes ruber* (Bloch & Schneidet, 1801), *Johnius carutta* Bloch, 1793 and *Pennahia macrophthalmus* (Bleeker, 1851) from Paradeep coast, Orissa, India. Indian J. Fish. 2012; 59(2):89-93.
5. Chakarborty SK. Growth studies of sciaenids from Mumbai Waters using the Bhattacharya's method. *Naga*, ICLARM Quarterly. 2001; 24(1&2):40-41.
6. Chakraborty SK. Population dynamics of *Johnieops vogleri* (Bleekeri) of Bombay waters. J. Mar. Biol. Ass. India. 1993; 35 (1&2): 114-122.
7. Chakraborty SK. Stock assessment of sin croaker *Johneieops sina* (cuvier) from Bombay waters. J. Indain Fish. Ass. 1996; 26:9-15.
8. Chakraborty SK, Devadoss P, Manojkumar PP, Feroz Khan M, Jayasankar P, Sivakami S *et al*. Fishery, biology and stock assessment of Jew fish resources of India. *In*: Pillai, V. N. and Menon, N. G. (Eds), Marine fisheries research and management. Central Marine Fisheries Research Institute, Cochin, India. 2000, (604-616).
9. Chakrabotry SK, Biradar RS, Jaiswar AK and Palaniswamy R. Growth, mortality and yield per recruote of *Johnius macrorhynus* (Mohan) from Mumbai coast. Indian J. Fish. 2005; 52(3): 307-313.
10. Chakrabotry SK, Deshmukh VD, Khan MZ, Vidyasagar K and Raje SG. Estimate of growth, mortality, recruitment pattern and MSY of important resources from Maharashtra coast. J. Inland Fish. Ass. 1994; 24:1-39.
11. Druzhinin AD. Distribution of Lutjanidae and Sciaenidae (Pisces) of the Indian Ocean. Indian J. Fish. 1971; 18(1&2):52-66.
12. Gupta MV. Studies on the taxonomy, biology and fishery of ribbon fishes (Trichiuridae) of the Hooghly estuarine system and Biology of *Trichiurus savala* Cuvier Proc. Zool. Soc., Calcutta. 1967; 20:153-170.
13. Hill R. Age and growth of the *Leucichthys artedi* Le Sueur, in the lakes of the Northeastern Highlands, Wisconsin. Bull. Bur. Fish. U.S. 1936; 48(19):211-317.
14. Jayasankar P. Length-weight relationship and relative condition factor in *Otolithes ruber* (Schneider, 1801) from the Gulf of Mannar and Palk Bay. Indian J. Fish. 1990; 37(3):261-263.
15. Jayasankar P. Observations on the biology of some sciaenid fishes from Mandapam region. Indian J. Fish. 1994; 41(2):80-86.
16. Jayasankar P. Population dynamics of big eye croaker *Pennahia macrophthalmus* and blotched croaker *Nibea maculate* (Pisces/ Perciformes/ Sciaenidae) in the trawling grounds off Pameswaram island, east coast of India. Indian J. Mar. Sciences. 1995; 24:153-157.
17. Jayasankar P. Population parameters of *Pennahia macrophthalmus* and *Nibea maculate* in the Palk Bay/ Gulf of Mannar area, NAGA, The ICLARM Quaterly. 1997, 46-48.
18. Kamat SS, Devraj M. Stock assessment and biology of *Johnius glaucus* (Day) off the North coast of India. J. Indian Fish. Ass. 1995; 25:15-24.
19. Kolher N, Casey J, Turner P. Length-weight relationship for 13 species of sharks from the western north Atlantic. Fish. Bull. 1995; 93:412-418.
20. Kumar T, Chakraborty SK. Jaiswar AK, Sandhya KM, Panda D. Biometric studies on *Johnieopssina* (Cuvier, 1830) along Ratnagiri coast of Maharashtra. Indian J. Fish. 2012; 59(1):7-13.
21. Le-Cren ED. The length-weight relationship and seasonal cycle in gonadal weight and condition in perch, *Perca fluviatilus.* J. Animal. Ecol. 1951; 20:201-219.
22. Longhurst AR. Bionomics of sciaenidae of tropical West Africa. J. Cons. Int. Explor. Mer. 1964; 29(1):93-114.
23. Manojkumar PP. Acharya P, Gulati D. Population dynamics and stock assessment of Koth (*Otolithoides biauritus. Cantor*, 1850) along the North-west coast of India. J. Indian. Fish. Ass. 1992; 22:33-40.
24. Manojkumar PP. Sciaenid fishery of Veraval with stock assessment of *Otolithes cuvieri* (Terewavas, 1974). Book of Abstracts, The seventh Indian Fisheries Forum. Banglore. 2005, 15.
25. Manojkumar PP. Fishery of sciaenids with some observations on the biology and stock assessment of *Johnieopes sina* (Cuvier, 1830) exploited along the Malabar Coast. J. Mar. Biol. Ass. India. 2011; 53(1):68-74.
26. Mohan RSL. A review of the sciaenid fishery resources of the Indian Ocean. J. Mar. Biol. Ass. India. 1991; 33(1&2):134-145.
27. Murty VS, Ramalingam P. Characteristics of the exploited stock of *Nibea maculate* (Schneider) (Sciaenidae) as revealed by trawl landings at Kakinada. J. Mar. Biol. Ass. India. 1996; 38**(**1&2):40-49.
28. Rao TA, Lal Mohan RS, Chakraborty SK, Murty VS, Nair KVS, Vivekanandan E *et al*. Stock assessment of sciaenids resources of India. Indain J. Fish. 1992; 39(1&2):85-103.
29. Rizvi AF. Studies on two ribbonfish from Mumbai waters. Ph. D. Thesis. University of Mumbai. 2001, 305.
30. Santhoshkumar S, Jawahar P, Rajagopalsamy CBT, Venkatasamy M. Growth and mortality characteristics of *Nibea maculate* (Blotch & Schneider, 1801) exploited off Thoothukudi coast, Tamil Nadu. Indian J. Fish. 2011; 58(4):17-20.
31. Skajesberg T. The fishes of the family sciaenidae

(croakers) of California. Fish. Bull. 1939; 54:62.
32. Snedecor GW, Cochran WC. Statistical Methods. Oxford and IBH Publishing Co., Calcutta, India. 1967, 593.
33. Telvekar PA, Chakraborty SK, Jaiswar AK. Length-weight relationship and food and feeding habits of *Otolithes cuvieri* (Trewavas, 1974) from Mumbai. Indian J. Fish. 2006; 53(4):131-134.
34. Thakur NK. On the length weight relationship and relative condition in *Clarias batrachus* (Linn). Proc. Natl. Acad. Sci. 1975; 45(B)111:197-201.