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Length-weight relationship in six species of threadfin breams occurring in the trawl landings at Chennai

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Abstract

Length-weight relationship was estimated in six species of threadfin breams occurring in the commercial trawl landings at Chennai during the period 2007-2008. The parameters 'a' and 'b' of the exponential length-weight relationship of the form $W = a L^b$ are presented for either sex of *Nemipterus mesoprion*, *N. japonicus*, *N. bipunctatus*, *N. zysron*, *N. peronii* and *N. nematophorus*. The regression coefficient 'b' was found to range between 2.8 in *N. nematophorus* to 3.1 in *N. bipunctatus*. The relationship was found to differ significantly between sexes ($p < 0.05$) in *N. mesoprion* and *N. zysron*. The t-test on the b-values for all these species showed that the slopes did not vary significantly ($p > 0.05$) from the isometric value of 3.

Keywords: Threadfin breams, length-weight relationship, *Nemipterus*

Introduction

Length-Weight Relationship (LWR) in fishes is defined by the hypothetical cube law $W=C L^3$, where 'W' is the weight of the fish, 'L' is the length of the fish and 'C' is a constant. If the density and form of the fish remains constant irrespective of its growth, this formula can be considered to hold good always. But actually this is not the case, and the value of the exponent in the formula may differ from 3 (Martin, 1949). The relationship is better expressed as $W=a L^b$, (Le Cren, 1951), where 'a' is a constant equivalent to 'C' in the isometric cube equation, and 'b' is another constant that needs to be calculated empirically (Martin, 1949). The growth is termed isometric when b = 3 and this is always the case in an ideal fish which maintains its shape without any change (Allen, 1938). LWR in fishes finds wide application in the study of population characteristics and stock dynamics. Pitcher and Hart (1982) have described the applied and basic uses of LWR. The LWR is particularly useful in parameterizing yield equations and estimating stock size (Abdurahiman *et al.*, 2004).

Threadfin breams constitute about 6 to 9% of the trawl landings at Chennai. The different species that occur regularly are *Nemipterus japonicus* (Bloch, 1791) and *N. mesoprion* (Bleeker, 1853). Other species which are found to occur regularly, but in lesser quantities, are *N. bipunctatus* (Valenciennes, 1830), *N. peronii* (Valenciennes, 1830), *N. nematophorus* (Bleeker, 1853) and *N. zysron* (Bleeker, 1857). Vivekanandan and James (1984) described the length-weight relationship in four species of threadfin breams from Madras, (now Chennai): *N. mesoprion*, *N. tolu* (=*N. peronii*), *N. delagoae* (=*N. bipunctatus*) and *N. luteus* (=*N. japonicus*). The present study is an attempt to define the length-weight relationships in *N. japonicus*, *N. mesoprion*, *N. bipunctatus*, *N. peronii*, *N. nematophorus* and *N. zysron*, based on collections from the trawl landings at Chennai during 2007-2008. While the length-weight relationship is being defined for the first time from this coast for *N. nematophorus* and *N. zysron*, the study is an update on the paper by Vivekanandan and James (1984), using a larger number of samples, encompassing slightly wider ranges of length and weight.

Material and Methods

Samples of the different species of threadfin breams collected from the trawl landings at Chennai Fisheries Harbour during the period 2007-2008 were measured for total length (from tip of snout to tip of the lower caudal lobe) to the nearest mm and Weight (to an accuracy of 0.5 g). The data were segregated sex-wise. The estimates were made separately for males, females and for sexes pooled. Co-efficients 'a' and 'b' of the length-weight relationship were determined by regression after log transformation and the significance of difference between sexes within each species was tested by Analysis of Covariance (Snedecor, 1961). The departure of the slope from the isometric value of 3 was tested in the case of each species by Student's t-test.

The study was based on 3761 specimens which included 1172 specimens of *N. mesoprion* (620 male and 552 female), 964 specimens of *N. japonicus* (491 male and 473 female), 510 specimens of *N. bipunctatus* (223 male and 287 female), 510 specimens of *N. peronii* (259 male and 251 female), 405 specimens of *N. nematophorus* (190 male and 215 female) and 200 specimens of *N. zysron* (116 male and 84 female).

Results and Discussion

The co-efficients of length-weight relationship in the six species of threadfin breams are given in Table 1. Analysis of Covariance revealed no significant difference ($p > 0.05$) between sexes either for slope or for elevation in the case of *N. japonicus*, *N. bipunctatus*, *N. peronii* and *N. nematophorus*, while there was significant difference ($p < 0.05$) in slope and elevation in the case of *N. mesoprion* and in elevation in the case of *N. zysron.*

The t-test on the b-values for all these species showed that the slopes did not vary significantly ($p > 0.05$) from the isometric value of 3 (Table 2). This is an important condition to be met for stock assessment studies since most of the commonly used models like the Beverton and Holt yield equation follow the assumption that the species follows the isometric growth equation $W = aL^3$. Beverton and Holt (1957) stated that significant variations from isometric growth are rare in fishes. However, the value of 'b' in fishes usually tends to vary between 2.5 and 4 (Hile, 1936; Martin 1949) and may also lie outside this range in some fishes at some stages of development. The dispersion of the estimated values of "b" in the present study about the isometric value of '3" is shown in Fig. 1.

Table 1. Coefficients of length-weight relationship in threadfin breams landed at Chennai

Species	a	b	r^2
N. mesoprion (male)	0.0000168	2.955	0.932
N. mesoprion (female)	0.0000089	3.082	0.934
N. mesoprion (sexes pooled)	0.0000125	3.014	0.933
N. japonicus (male)	0.0000299	2.849	0.956
N. japonicus (female)	0.0000317	2.843	0.912
N. japonicus (sexes pooled)	0.0000308	2.843	0.934
N. bipunctatus (male)	0.000013	2.99	0.972
N. bipunctatus (female)	0.0000074	3.102	0.942
N. bipunctatus (sexes pooled)	0.0000096	3.051	0.954
N. zysron (male)	0.0000113	3.011	0.978
N. zysron (female)	0.000014	2.976	0.940
N. zysron (sexes pooled)	0.0000132	2.984	0.964
N. peronii (male)	0.0000367	2.797	0.951
N. peronii (female)	0.0000218	2.884	0.953
N. peronii (sexes pooled)	0.0000279	2.835	0.955
N. nematophorus (male)	0.0000308	2.82	0.962
N. nematophorus (female)	0.0000304	2.826	0.951
N. nematophorus (sexes pooled)	0.000032	2.814	0.960

The results obtained for *N. mesoprion*, *N. japonicus*, *N. peronii* and *N. bipunctatus* conform to the findings of Vivekanandan and James (1984). While studies in the past have indicated that differential growth in threadfin breams is a common feature (Eggleston, 1973), this is not always the case. Vivekanandan and James (1984) reported differential growth in male and female of *N. mesoprion* from the Madras coast. Murty (1981) however, did not report any significant difference in the length-weight relationship for male and female of *N. mesoprion* from the Kakinada coast. From the west coast, Zacharia and Nataraja (2003) and Kizhakudan *et al.* (2009) found significant difference in the length-weight relationships for male and female of *N. mesoprion* exploited from the Mangalore-Malpe coast of Karnataka and from the Saurashtra coast of Gujarat, respectively. In the present study, it was observed that up to 156 mm TL, males had greater weights than females of the same length; beyond

Table 2. Test of significance of regression coefficients "b"

Species	b	d.f.	"t" (estimated value) (P = 0.05)	"t" (table value)
N. mesoprion (male)	2.955	618	0.0296	1.9638
N. mesoprion (female)	3.082	550	0.0311	1.9643
N. japonicus	2.843	962	0.0253	1.9624
N. bipunctatus	3.051	508	0.0342	1.9646
N. zysron (male)	3.011	114	0.7339	1.9806
N. zysron (female)	2.976	82	0.0848	1.9893
N. peronii	2.835	508	0.0347	1.9646
N. nematophorus	2.814	403	0.0396	1.9659

160mm, females overtook the males in terms of weight. Kizhakudan *et al.* (2009) reported that in *N. mesoprion* from the Saurashtra coast, females outweighed the males after 119 mm TL.

Krishnamoorthi (1976) reported significant difference in the length-weight relationships of male and female of *N. japonicus* from the Andhra-Orissa coast. Males were found to grow to larger sizes and significant difference between the sexes was also found in the monthly mean size that occurred in the catches. Kizhakudan *et al.* (2009) found differential growth between sexes in *N. japonicus* from the Saurashtra coast. In the present study however, significant difference was not observed in the length-weight relationship in male and female of *N. japonicus* from Chennai coast. Vivekanandan and James (1984) too found no significant difference between the regression coefficients of males and females in *N. luteus* (= *N. japonicus*) from this coast and described a single length-weight equation for the species. In the case of *N. bipunctatus* and *N. peronii* also, there was no significant difference between the regression co-efficients of males and females, either in the earlier study of Vivekanandan and James (1984) or in the present study. No significant difference in the length-weight relationship of male and female of *N. bipunctatus* was reported either by Muthiah and Pillai (1979) from Bombay waters or by Ameer Hamsa *et al.* (1994) from Tuticorin coast and all these earlier studies advocate the use of a common length-weight equation for the species.

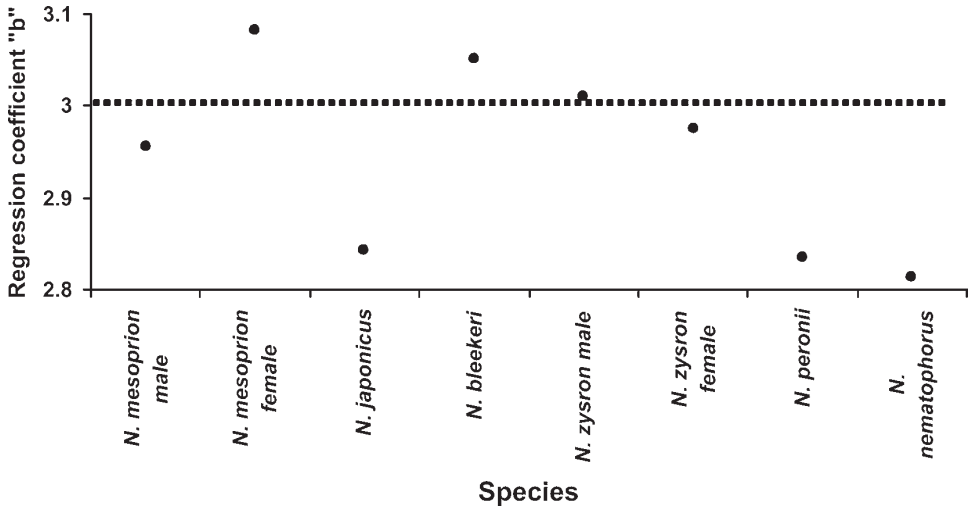

Fig. 1. Dispersion of regression coefficients "b" of length-weight relationship in different threadfin bream species, from the isometric value "3"

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References

Abdurahiman, K.P., T. Harishnayak, P.U. Zacharia and K.S. Mohamed. 2004. Length-weight relationship of commercially important marine fishes and shellfishes of the southern coast of Karnataka, India *NAGA World Fish Center Q*., 27: 9-14.

Allen, K. R. 1938. Some observations on the biology of the trout (*Salmo trutta*) in Windrmere. *J. Anim. Ecol.*, 7: 333-349.

Ameer Hamsa, K.M.S., H. Mohamed Kasim and G. Arumugam. 1994. The fishery, biology and stock assessment of *Nemipterus delagoae* Smith off Tuticorin, Gulf of Mannar. In: *Perch Fisheries of India*. *Bull. Cent. Mar. Fish. Res. Inst.* 47: 112-120.

Beverton, R.J.H. and S.J. Holt. 1957. On the dynamics of exploited fish populations. *Fish. Invest. Minist. Agric. Fish. Food.* (*G.B.*) *Ser. II*, 19: 533 pp.

Eggleston, D. 1973. Patterns of biology in Nemipteridae. *J. Mar. Biol. Ass. India*, 14: 357-364.

Hile, R. 1936. Age and growth of the *Cisco Leucichthys artedi* (Lesueur) in the lake of Northeastern highlands of Wisconsin. *Bull. U.S. Bur. Fish.*, 48: 211-317.

Kizhakudan, S. J., S. Thomas, J.K. Kizhakudan, and M.S. Zala. 2008. *Nemipterus japonicus and N. mesoprion. J. Mar. Biol. Ass. India*, 50 (1): 43-51.

Krishnamoorthi, B. 1976. A note on the size difference between males and females of *Nemipterus japonicus* (Bloch). *Indian J. Fish*., 21(2) : 608-609.

Le Cren, C.D. 1951. Length-weight relationship and seasonal cycle in gonad weights and condition in the perch (*Perca fluviatilis*). *J. Anim. Ecol.*, 20: 201-219.

Martin, W.R. 1949. The mechanisms of environmental control of body form in fishes. *Univ. Toronto Stud. Biol. 58, Publ. Ont. Fish Res. Lab.*, 70: 1-91.

Murty, V.S.R. 1981. Observation on some aspects of biology of the threadfin bream *Nemipterus mesoprion* (Bleeker) from Kakinada. *Indian J. Fish.*, 28(1&2): 199-207.

Muthiah, C. and Pillai S. Krishna, 1979. A new distributional record of Nemipterus delagoal smith from Bombay waters with notes on its biology. *J. Mar. Biol. Ass. India*, 21(1&2): 174-177.

Pitcher, T.J. and P.J.B. Hart. 1982. *Fisheries Ecology*. Chapman & Hall, London, UK, 408 pp.

Snedecor, G. W. 1961. *Statistical Methods*. Allied Pacific Pvt. Ltd., Bombay, 534 pp.

Vivekanandan, E. and D.B. James. 1984. Length-weight relationship in four species of threadfin breams from Madras. *J. Mar. Biol. Ass. India*, 26(1&2): 132-135.

Zacharia, P. U. and G.D. Nataraja. 2003. Fishery and biology of threadfin bream, *Nemipterus mesoprion* from Mangalore-Malpe. *Indian J. Fish*., 50 (1): 1-10.

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