RESEARCH PAPER | Statistics | Volume : 4 | Issue : 1 | Jan 2014 | ISSN - 2249-555X

A Study on the Morphometric and Meristic Characters of the Threadfin Bream (Nemipterus Japonicus, Bloch 1791) off Chennai Coast

KEYWORDS: Fish Biology, Morphometric and Meristic Characters, Nemipterus Japonicus

T. Edwin Prabakaran	R. Jeyasingh Thompson	V. Deepak Samuel
Dept. of Statistics, Loyola College, Chennai - 600 034	Dept. of Statistics, Madras Christian College, Chennai - 600 059	Department of Marine Studies and Coastal Resource Management, Madras Christian College, Chennai, 600 059

ABSTRACT *: Data on 16 Morphometric and Meristic Characters of 489 Nemipterus japonicus were analyzed. The relationship between their length and weight is expressed using the formula W = a.Lb. Observation on minute meristic characters such as Spine Count and Ray Count were obtained for each fish and the observed values were cross verified with details pertaining to fish biology from earlier work as a confirmatory test. It is observed that out of 16 variables the following ten variables namely Snout Length (SL), Pre Pelvic Distance (PPD), Width of Dorsal Fin (WDF), Head Length (HL), Body Depth (BD),Standard Length(STL), Fork Length (FL), Post Dorsal Length(PDL1), Total Length (L), Total Weight(W) had a higher degree of correlation with the total length of the fish in the present study.*

1. Introduction

The Japanese Threadfin Bream, *Nemipterus Japonicus*, (Nemipteridae) (vernacular name SANKARA) (Figure 1) is a demersal species, abundant in coastal waters, found along muddy or sandy bottoms at 5 to 80 meters depth of sea regions and they are concentrated at depths of 100-200 meters (**Sivaprakasam *et al*. 1991**). It has a wide distribution in the Red Sea, eastern shores of Africa and in the entire coverage of the Indo-Pacific region as depicted in Figure 2. Though they are not a major fishery in India, they are highly preferred by the consumers. An attempt is made in this paper to study the relationship between the length and weight of this fish along with the comparison of meristic and morphometric characters. Length and weight measurements can give information on the stock composition, life span, mortality, growth and production (**Bolger and Connoly**, **1989**; **Kolher *et al*.**, **1995**). Morphological characters, such as body shape and meristic counts, have long been used to delineate stocks and they continue to be used successfully (**Villaluz and Maccrimmon**, **1988**). Hence this paper is an attempt to study the morphometric and merisitic characters of the Threadfin Bream *Nemipterus japonicus*.

2. Materials and Methods

Samples were collected randomly from bottom trawl of Chennai neritic waters during the period 14 June'12 to 14 May'13 and a total number of 489 fish were sampled. The total length of the fish were measured to the nearest cm and total weight to the nearest gm with the help of vernier calipers (accurate to 1mm) and a mono weighing balance (accuracy to 1 gm) respectively. The values of the parameters in the length-weight relation $W = a. L^b$ were calculated from the data. Here W is the total weight and L is the total length of the fish. Taking logarithm, the length-weight relation becomes linear and is given by log W = log a + b log L. Here log a is the intercept, and "b" is the slope. Descriptive statistics namely the minimum and the maximum values are obtained for each of the variables under consideration. Using correlation matrix the scatter plot was generated to see the correlation between each of the 15 meristic characters with total length.

The 16 meristic growth characters that were analyzed for the comparisons are as follows:

1. SL = Snout Length
2. ED = Eye Diameter
3. POL = Post Orbital Length
4. PDL = Pre Dorsal Length
5. PPD = Pre Pelvic Distance
6. WDF = Width of Dorsal Fin
7. HL = Head Length
8. BD = Body Depth
9. STL = Standard Length
10. FL = Fork Length
11. CPL = Caudal Peduncle Length
12. PDL1 = Post Dorsal Length
13. DFLmin = Dorsal Fin Spine Length minimum
14. DFLmax = Dorsal Fin Spine Length maximum
15. L = Total Length
16. W = Total Weight

3. Results

The data were analyzed using SPSS and the outputs are given as Figure 1, Figure 2,

Figure 1: The Threadfin Bream- *Nemipterus japonicus*

Volume : 4 | Issue : 1 | Jan 2014 | ISSN - 2249-555X

Figure 2: The global distribution of *Nemipterus Japonicus* (source - www.fishbase.org)

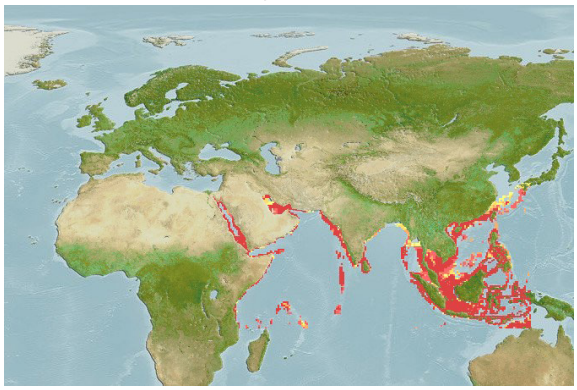

Figure 3: Scatter plot

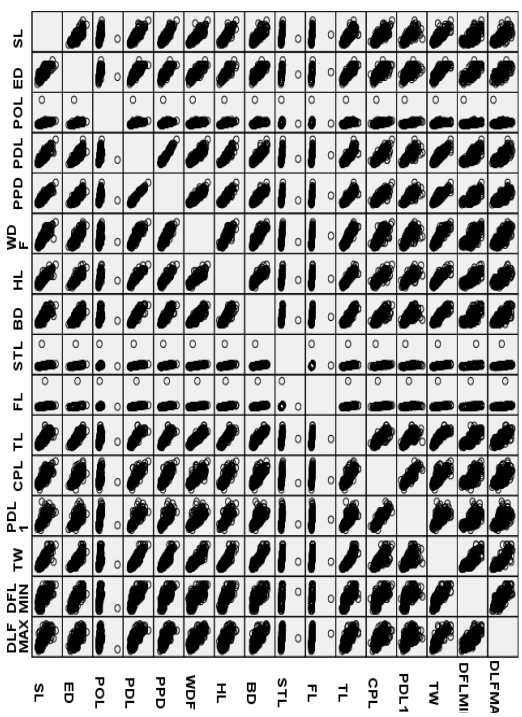

Figure 4: Power curve

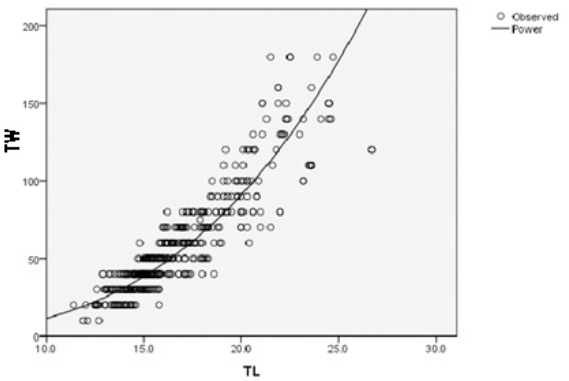

Table 1: Descriptive statistics

Descriptive Statistics

Meristic Characters	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
SL	489	.6	2.3	1.050	.2771	1.348	.110	1.875	.220
ED	489	.7	1.7	1.102	.1667	.818	.110	.430	.220
POL	489	.7	11.4	1.338	.5708	11.501	.110	197.937	.220
PDL	489	2.6	7.8	3.894	.8378	1.480	.110	2.202	.220
PPD	489	2.7	8.1	4.100	.9057	1.282	.110	1.248	.220
WDF	489	4.0	9.4	5.705	1.0610	1.202	.110	.656	.220
HL	489	2.1	6.1	3.437	.6435	1.039	.110	1.294	.220
BD	489	2.8	7.1	4.058	.8711	1.407	.110	1.523	.220
STL	489	7.9	105.0	11.462	4.7803	15.515	.110	301.265	.220
FL	489	9.3	147.9	13.116	6.5136	18.267	.110	377.369	.220
TL	489	**11.4**	**26.7**	16.613	2.7761	1.070	.110	.807	.220
CPL	489	1.0	4.0	2.045	.4843	1.363	.110	1.559	.220
PDL1	489	1.0	4.0	1.865	.5039	1.439	.110	1.541	.220
TW	489	**10**	**180**	57.70	32.969	1.502	.110	2.141	.220
DFLMIN	489	.4	1.5	.880	.2331	.090	.110	-.088	.220
DLFMAX	489	.9	2.6	1.560	.3162	.913	.110	.559	.220
Valid N (listwise)	489								

Volume : 4 | Issue : 1 | Jan 2014 | ISSN - 2249-555X

Table 2: Correlation matrix

Correlations

		SL	ED	POL	PDL	PPD	WDF	HL	BD	STL	FL	TL	CPL	PDL1	TW	DFLMIN	DLFMAX
SL	Pearson Correlation	1	.790**	.436**	.877**	.907**	.880**	.866**	.848**	.412**	.350**	.818**	.811**	.818**	.837**	.623**	.717**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
ED	Pearson Correlation	.790**	1	.427**	.847**	.839**	.840**	.885**	.819**	.401**	.330**	.859**	.774**	.715**	.852**	.747**	.727**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
POL	Pearson Correlation	.436**	.427**	1	.456**	.454**	.406**	.494**	.403**	.193**	.148**	.428**	.433**	.457**	.385**	.347**	.271**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
PDL	Pearson Correlation	.877**	.847**	.456**	1	.964**	.889**	.922**	.903**	.424**	.358**	.895**	.862**	.846**	.895**	.718**	.762**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
PPD	Pearson Correlation	.907**	.839**	.454**	.964**	1	.912**	.912**	.898**	.419**	.366**	.893**	.857**	.857**	.890**	.695**	.762**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
WDF	Pearson Correlation	.880**	.840**	.406**	.889**	.912**	1	.864**	.902**	.420**	.363**	.903**	.842**	.808**	.888**	.648**	.776**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
HL	Pearson Correlation	.866**	.885**	.494**	.922**	.912**	.864**	1	.868**	.421**	.331**	.900**	.838**	.810**	.883**	.762**	.735**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
BD	Pearson Correlation	.848**	.819**	.403**	.903**	.898**	.902**	.868**	1	.407**	.341**	.895**	.824**	.784**	.899**	.672**	.771**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
STL	Pearson Correlation	.412**	.401**	.193**	.424**	.419**	.420**	.421**	.407**	1	.172**	.435**	.380**	.380**	.426**	.388**	.385**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
FL	Pearson Correlation	.350**	.330**	.148**	.358**	.366**	.363**	.331**	.341**	.172**	1	.337**	.304**	.316**	.325**	.254**	.336**
	Sig. (2-tailed)	.000	.000	.001	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
TL	Pearson Correlation	.818**	.859**	.428**	.895**	.893**	.903**	.900**	.895**	.435**	.337**	1	.831**	.778**	.906**	.721**	.771**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
CPL	Pearson Correlation	.811**	.774**	.433**	.862**	.857**	.842**	.838**	.824**	.380**	.304**	.831**	1	.884**	.809**	.655**	.713**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
PDL1	Pearson Correlation	.818**	.715**	.457**	.846**	.857**	.808**	.810**	.784**	.380**	.316**	.778**	.884**	1	.739**	.619**	.664**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
TW	Pearson Correlation	.837**	.852**	.385**	.895**	.890**	.888**	.883**	.899**	.426**	.325**	.906**	.809**	.739**	1	.754**	.840**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
DFLMIN	Pearson Correlation	.623**	.747**	.347**	.718**	.695**	.648**	.762**	.672**	.388**	.254**	.721**	.655**	.619**	.754**	1	.695**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
DLFMAX	Pearson Correlation	.717**	.727**	.271**	.762**	.762**	.776**	.735**	.771**	.385**	.336**	.771**	.713**	.664**	.840**	.695**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3: Parameters of the power curve W = a. L^b

Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
ln(TL)	2.999	.065	.903	46.345	.000
(Constant)	.011	.002		5.515	.000

The dependent variable is ln(TW).

- From Table 1, we observe that the minimum and maximum lengths of the fish were 11.4cm and 26.7cm respectively, and the minimum and maximum weights of the fish were 10gm and 180gm respectively.
- The scatter plot in Figure 3 for 16 meristic characters was obtained using the correlation matrix in Table 2. From Figure 3 and Table 2 it is observed that when total length of the fish increases the following 6 variables, namely the Post Oribital Length (POL), Standard Length (STL), Fork length (FL), Dorsal Fin Spine Length minimum (DFL min), Post Dorsal Length (PDL1) and Dorsal Fin Spine Length maximum (DFL max) do not increase. The other 10 variables have high degree of positive correlation with total length. Thus the increase in the total length of the fish is followed by increase in those 10 variables.
- A total of 489 Threadfin Bream were measured for finding

Volume : 4 | Issue : 1 | Jan 2014 | ISSN - 2249-555X

the length - weight relationship using the power curve $W = a. L^b$. The length-weight relationship thus obtained is $W = 0.011 L^{2.999}$ which gives good fit to the observed data(Table 3). From the analysis of the fitted power curve, it is observed that as the total length increases, the total weight also increases, correspondingly (Figure 4).

4. Discussions

The exact relationship between length and weight differs among various species of fish according to their inherited body shape, and within a species according to the condition (robustness) of individual fish. This depends on food availability and growth within the weeks prior to sampling. But, condition is variable and dynamic, as individual fish within the same sample may vary considerably, and the average condition of each population varies seasonally and yearly. Sex and gonad development are other important variables in some species, especially the Percids. The Threadfin Breams come under the order Perciformes, family Nemipteridae and thus sex and gonad development becomes important in this family. Research on close or minute characters, unique to a particular species, leads to micro taxonomic findings. These findings in turn are salient precursors for future research. Length-weight relationships were originally used to provide information on the condition of fish and may help determine whether somatic growth is isometric (b=3) or allometric (negative allometric: b<3 or positive allometric: b>3) (**Ricker**, **1973**). It is recommended that the assumed theoretical value of *b*=3 not be used in applied ichthyological surveys, since this value was rarely obtained in the studies, and since a much wider range is usually seen (**Safran**, **1992**).

The findings from the present study reveal that in the correlation matrix, when total length increases, the Post Oribital Length (POL), Standard Length (STL), Fork length(FL), Dorsal Fin Spine Length minimum (DFL min), Post Dorsal Length (PDL1) and Dorsal Fin Spine Length maximum(DFL max) does not increase. These six measurements do not display significant correlation when compared to total length. This indicates that the effect of body length had been successfully removed from the allometric transformation in the case of the 6 variables namely Eye Diameter (ED), Post Orbital Length (POL), Dorsal Fin Spine Length Minimum (DFL min), caudal peduncle length (CPL) , Pre Dorsal Length(PDL) and Dorsal Fin Spine Length maximum (DFL max). This finding is similar to the analysis carried out for horse mackerel (*Trachurus mediterraneus*) (**Turan**, **2004**). Morphometric and meristic characteristic analyses of two western Irish populations of Arctic Char, *Salvelinus Alpinus* were carried out by **Doherty and McCarty** (**2004**). They concentrated on minute merisitic characters like number of branchiostegal rays, number of gill rakers and snout bluntness index. For the present study, more focus was on the dorsal spine max and dorsal spine min to draw a correlation between the body length and 6 meristic characters. The remaining 10 variables other than (Eye Diameter (ED), Post Orbital Length (POL), Dorsal Fin Spine Length Minimum (DFL min), Caudal Peduncle Length (CPL) , Post Dorsal Length(PDL) and Dorsal Fin Spine Length maximum(DFL max)) had a higher correlation with the total length of the fish in the present study.

REFERENCE Bolger, T. and Connoly, P.L. (1989). The selection of suitable indices for the measurement and analysis of fish condition. J. Fish Biol., 34, 171–182. | | Doherty, D. and McCarthy, T.K. (2004). Morphometric and Meristic characteristics analyses of two western Irish populations of Arctic Char, Salvelinus alpinus (l.) Biology and environment: Proceedings of the Royal Irish Academy, 104b, No. 1, 75–85. | | Kolher, N., Casey, J. and Turner, P. (1995). Lengthweight relationships for 13 species of sharks from the western North Atlantic. Fishery Bulletin, 93, 412-418. | | Ricker, W.E. (1973). Linear regression in fisheries research. J. Fish. Res. Board Can., 30, 409-434. | | Safran. P, (1992). Theoretical analysis of the weight-length relationship in fish juveniles. Marine Biology, 112, No: 41992, 545-551. | Sivaprakasam T.E, P.S.Parasuraman, B. Premchand, S.A.Rajkumar and G. Nagarajan. (1991). Marine Fishery resources of the lower east coast of India. Fishery Survey of India. Bulletin No.21. | Turan, C. (2004) Stock identification of Mediterranean horse mackerel (Trachurus mediterraneus) using morphometric and meristic characters. e ICES Journal of Marine Science, 61, 774 781 | Villaluz, A. C., and Maccrimmon, H. R. (1988). Meristic variations in milkfish Chanos chanos from Philippine waters. Marine Biology, 97, 145 150. | http://www.fishbase.org/summary/Nemipterus-japonicus.html