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Note

Length-weight relationship of deepsea demersal fishes from the Indian EEZ

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ABSTRACT

Parameters of the length-weight relationship of the form $w = aL^b$ are presented for 22 species of deepsea demersal fish species collected from 100-1100 m depths of Indian EEZ. The '*b*' values ranged from minimum of 2.32 (in *Gavialiceps taeniola*) to maximum of 3.50 (in *Lamprogrammus exutus*). The mean and mode value of 'b' for all species were 2.92 and 2.93 respectively. Overall, 14 species showed isometric growth, 5 species negatively allometric growth and 3 species, positively allometric growth.

Keywords: Deepsea, Demersal fishes, Indian EEZ, Length-weight relationship

Out of the total estimated harvestable potential of about 3.9 million t of marine fish from the Indian EEZ, the present exploitation is only 3.0 million t (Anon, 1991; Somavanshi, 1998; Dehadrai, 2006). The remaining potential of about 0.9 million t, largely in the deepseas and oceanic region, remains untapped (Somavanshi, 1998; Dehadrai, 2006). In recent years, there have been reports on deepsea fish composition and abundance from Indian waters (Sudarsanand Somavanshi, 1988; Sivakami, 1989; Venu and Kurup, 2002; Jayaprakash *et al*., 2006; Sreedhar*et al*., 2007). However, there is dearth of information on the biology of deepsea fishes from Indian EEZ. Studies on length-weight relationship (LWR) of deepsea fishes from Indian waters are limited and restricted to southern coast of India (Thomas *et al.,* 2003; Jayaprakash *et al.,* 2006). Knowledge on the LWR of a given fish species is of vital importance as it aids in establishing yield equations (Sekharan, 1968), allows prediction of weight from length (Pauly, 1993) and is also indicative of the condition factor *i.e.*, the relative wellbeing of the fish population. Hence the present study on the LWR of deepsea fishes from Indian EEZ was undertaken.

Sampling was carried out in four deepsea fisheries expeditions of fisheries and oceanographic research vessel (FORV) Sagar Sampada in cruises numbered 241 (January-February 2006), 247 (July-August 2006), 250 (September 2006) and 252 (January-February 2007). A total of 56 sampling stations were covered in these four cruises (Fig. 1). Sampling was carried out at depths ranging from 100 to 1100 m off Andaman coast, east and south-west coasts of India. Samples were collected using EXPO model fish trawl (45.6 m) and high speed demersal trawl-crustacean version (HSDT-CV) (44.5 m).

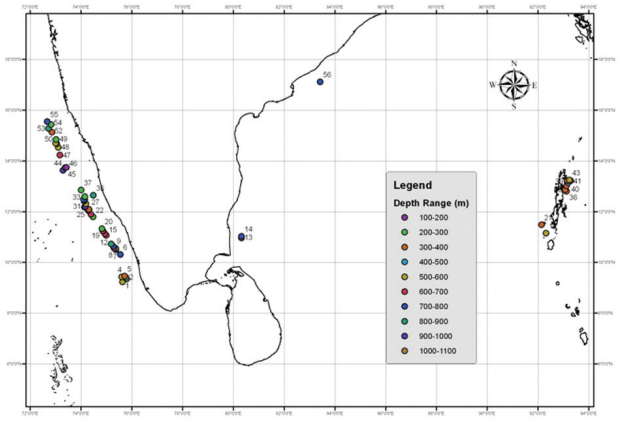

Fig. 1. Map showing sampling stations

Samples were identified to species level using standard keys and preserved in 5% formaldehyde onboard and brought to the shore laboratory. The wet samples were dried on a blotting paper before taking length-weight measurements. Length and weight were measured to 0.1 cm and 0.1 g, respectively. The relationship between the length and weight of a fish is usually expressed by the equation, $W = aL^b$. where 'W'is body weight (g), 'L' is total length (cm), '*a*' is a coefficient related to body form, and '*b*' is an exponent indicating isometric growth when equal to 3 (Pauly, 1984). The parameters '*a*'and '*b*'of LWR were estimated by the least-square method from

logarithmically transformed data, and the association degree between weight-length variables was calculated by the determination coefficient (r^2). Before estimating these parameters, curvilinear and log-log plots of length and weight values were visually inspected and no outliers were observed. Null hypothesis of the isometric growth (H_0: b=3) was tested by t - test, using the statistic: t-calculated (t_{cal}) =(b-3)/SE, where SE is the standard error of the slope(Morey *et al*., 2003). If, the t_{cal}> t-table (t_{tab}) value (α=0.05) the null hypothesis was rejected, otherwise accepted. Sample sizes of the 22 species analysed in the present study varied from 23 to 226 (Table 1). The smallest sample size corresponds to the infrequent species that occur under such depths and the largest samples belong to those which were frequently encountered below these depths in huge numbers. The '*b*' values varied from minimum of 2.32 (in *Gavialiceps teniola*) to maximum of 3.50 (in *Lamprogrammus exutus*) (Table 1). The mean and mode value of '*b*' for all species were 2.92 and 2.93 respectively. Values of the exponent 'b'provide information on fish growth. When *b*=3, increase in weight is isometric (Allen, 1938). When the value of *b* is other than 3, weight increase is allometric, (positive allometric if *b*>3, negative allometric if b<3)(Pauly, 1984). Deepsea eels like *Gavialiceps teniola* (b=2.32) and *Xenomystax trucidance* (b=2.77) exhibited negative allometric growth, whereas stout fishes like *Lamprogrammus exutus* (*b*=3.50) exhibited positive allometric growth. Overall, 14 species showed isometric growth, 5 species showed negative allometric growth and 3 species showed positive allometric growth (Table 1).

A comparison of the present results with information in the electronic database, Fishbase (Froese and Pauly, 2013) and published literature (Thomas *et al*., 2003; Jayaprakash *et al*., 2006) showed that there are no existing records of LWR data for 10 of the 22 species (*Alepocephalus bicolor, Bathyuroconger vicinus, Cubiceps squamiceps, Epigonus pandionus, Eridachnis radcliffei, Gavialiceps taeniola, Lamprogrammus exutus, Ostichthys archiepiscopus, Peristedion barbiger* and *Synagrops philippinensis*). The values of '*b*' for the remaining 12 species differed slightly from the earlier records. It is likely that this discrepancy is due to the difference in sampling area, sampling size, length range and preservation in formalin. The information provided in this study will be useful as a further reference for population dynamics studies and to establish yield equations for these deepsea species.

Table 1. Length, weight ranges and regression parameters of deepsea fishes collected from the Indian EEZ.

Species	N	Length (cm)		Weight (g)		Regression parameters			S.E	t_{cal}	t_{tab}	Growth type
		min	max	min	max	*a*	*b*	r^2				
Alepocephalus bicolor	119	17.5	45.6	80.4	920.2	0.0071	3.05	0.76	0.156	0.288	1.980	I
Bathyuroconger vicinus	29	50.0	135.2	69.2	355.5	0.0009	3.03	0.97	0.100	0.330	2.052	I
Bembrops caudimacula	116	11.2	20.8	10.5	66.7	0.0065	3.03	0.95	0.064	0.469	1.981	I
Chelidoperca investigatoris	111	11.1	18.3	15.3	63.6	0.0114	2.93	0.95	0.062	-1.129	1.982	I
Chlorophthalmus agassizi	110	13.5	24.0	20.2	110.5	0.0090	2.94	0.94	0.072	-0.833	1.982	I
Chlorophthalmus bicornis	51	8.6	14.1	8.5	37.0	0.0088	3.09	0.95	0.097	0.948	2.010	I
Coloconger raniceps	69	29.4	42.6	145.6	409.4	0.0293	2.54	0.97	0.051	-9.059	1.996	N
Coryphaenoides macrolophus	129	13.2	32.5	20.5	195.8	0.0169	2.64	0.92	0.069	-5.203	1.979	N
Cubiceps squamiceps	23	13.4	18.8	13.4	88.5	0.0199	2.89	0.93	0.175	-0.640	2.079	I
Epigonus pandionus	23	12.5	18.4	24.5	73.5	0.0141	2.94	0.98	0.093	-0.656	2.079	I
Eridachnis radcliffei	104	19.8	44.5	20.8	240.0	0.0017	3.13	0.98	0.039	3.410	1.984	P
Gavialiceps taeniola	226	38.5	86.0	58.1	268.7	0.0096	2.32	0.89	0.055	-12.436	1.972	N
Hoplostethus cornutus	44	11.1	32.0	20.5	380.5	0.0171	2.94	0.96	0.089	-0.685	2.018	I
Lamprogrammus exutus	134	32.0	66.0	140.8	1550.5	0.0064	3.50	0.95	0.066	7.576	1.978	P
Luciobrotula bartschi	68	12.0	40.0	10.3	280.5	0.0045	3.02	0.95	0.088	0.216	1.996	I
Ostichthys archiepiscopus	34	14.5	72.0	24.4	264.5	0.0755	2.56	0.98	0.062	-7.081	2.037	N
Peristedion barbiger	44	14.9	45.0	32.9	760.2	0.0113	2.89	0.98	0.062	-1.855	2.018	I
Priacanthus hamrur	154	10.4	26.5	16.6	196.0	0.0143	2.92	0.97	0.043	-1.930	1.976	I
Psenopsis cyanea	182	11.4	15.3	26.2	69.3	0.0194	3.00	0.88	0.083	-0.048	1.973	I
Setarches guentheri	27	7.6	11.7	6.2	22.8	0.0107	3.15	0.92	0.187	0.813	2.059	I
Synagrops philippinensis	62	11.9	19.3	17.2	88.0	0.0071	3.17	0.96	0.081	2.037	2.000	P
Xenomystax trucidans	41	53.2	79.0	122.5	410.5	0.0020	2.77	0.97	0.075	-3.040	2.023	N

N = total number of samples; min = minimum; max = maximum; *a* = intercept; *b* = slope, r^2 = coefficient of determination, S.E. = standard error of the slope; t_{cal} = t-calculated; t_{tab} = t-table; I = isometric; N = negativelyallometric; P = positively allometric.

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