

# Length-Weight Relationship of Marine Fish Species off São Sebastião System, São Paulo, Southeastern Brazil

E.Y. Muto, L.S.H. Soares and C.L.D.B. Rossi-Wongtschowski

## Abstract

The parameters **a** and **b** of the length-weight relationship of the form  $W = a \cdot L^b$  were estimated for 57 fish species sampled in São Sebastião Channel and shelf system in 1997, São Paulo, Brazil. The **b** values ranged from 2.746 to 3.617. The Student's t-test revealed that most (44) species had **b** values significantly different from 3. A normal distribution of the calculated LWR exponents (**b**) was obtained.

## Introduction

The present work is based on data collected in the framework of the project "Oceanography of the Inner Shelf of São Sebastião – subprogram Ichthyofauna", executed by the Instituto Oceanográfico Universidade de São Paulo (Rossi-Wongtschowski et al. 1997). This study presents the length-weight relationship (LWR) parameters of the most abundant species in the system. Because of the ecological and economic importance of these species, data on their functional LWR is important for fish stock assessment. The parameters **a** and **b** of the LWR can be used for length-weight conversion as well as to estimate the relative condition factor.

## Materials and Methods

The area under study comprises the Channel (SSC) and shelf of São Sebastião (Fig. 1). The SSC is 24 km long and is 5.8 km (28 m mean depth) and 6.4 km (20 m mean depth) wide on its northern and

southern entrance, respectively. The deepest area is along its longitudinal axis, reaching 50 m in depth (Furtado 1995). Fish samples were collected using bottom otter trawl, tow duration was 30 minutes standard at 2 knots. In the Channel, samples were taken on board the Research trawler *Veliger II*, using a

9.7 m net with 40 mm stretch mesh in the body and sleeve and 25 mm in the cod end. A total of five samplings were conducted (November 1993; February, April, August 1994; August 1997) at five sites ranging from 9 to 25 m depth. Shelf samples were taken on board R/V *Prof. Besnard*, using a 17 m net

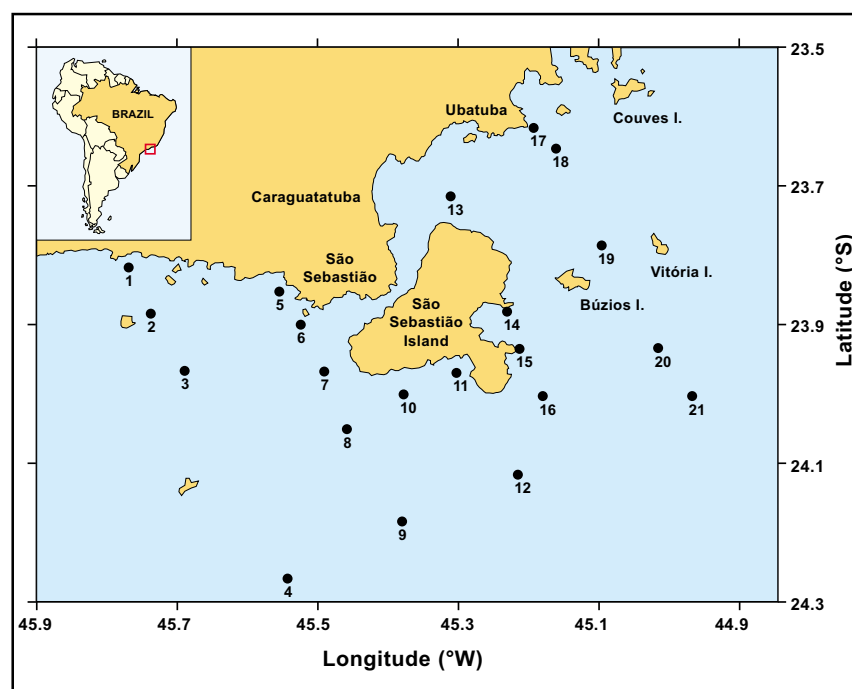


Fig.1. Map of São Sebastião Channel and Shelf System, Brazil indicating the sampling sites.

**Table 1. Number of specimens (n), total length (mean, standard deviation, minimum, maximum) and parameters of the length-weight relationship of fish species caught in São Sebastião Channel and Shelf System, Brazil.**

FAMILY	SPECIES	Total Length (mm)					Length-Weight Relationship			
		n	mean	s.d.	min	max	a	b	s.e. (b)	r <sup>2</sup>
Acropomatidae	<i>Synagrops spinosus</i>	72	70.2	5.7	56	85	1.909E-05	2.863	0.098	0.925
Batrachoididae	<i>Porichthys porosissimus</i>	580	156.4	49.3	50	295	2.125E-06	3.314**	0.016	0.987
Carangidae	<i>Chloroscombrus chrysurus</i>	189	109.7	35.1	35	205	1.353E-05	2.929*	0.030	0.981
	<i>Selene setapinnis</i>	378	97.4	39.2	29	217	3.236E-05	2.796**	0.016	0.988
	<i>Selene vomer</i>	204	44.5	21.5	22	243	4.236E-05	2.746**	0.060	0.912
Clupeidae	<i>Trachurus lathami</i>	250	94.4	31.1	60	178	9.212E-06	2.991	0.021	0.988
	<i>Chirocentrodon bleekermanus</i>	235	88.6	15.8	40	117	1.782E-06	3.254**	0.035	0.974
	<i>Harengula clupeola</i>	59	94.0	35.4	52	180	4.545E-06	3.181**	0.033	0.994
	<i>Pellona harroweri</i>	745	92.9	15.0	45	152	9.734E-06	2.983	0.024	0.953
Cynoglossidae	<i>Symphurus tessellatus</i>	379	181.3	32.9	97	250	1.577E-06	3.299**	0.026	0.976
Dactylopteridae	<i>Dactylopterus volitans</i>	77	102.1	55.0	55	316	2.027E-05	2.879**	0.032	0.991
Engraulidae	<i>Anchoa filifera</i>	64	91.2	7.7	54	105	2.726E-06	3.192	0.138	0.896
	<i>Anchoa lyoleps</i>	69	77.8	12.0	55	121	3.565E-06	3.101	0.121	0.907
Gadidae	<i>Anchoviella lepidostole</i>	83	103.6	8.7	79	120	1.508E-06	3.382**	0.123	0.903
	<i>Urophycis brasiliensis</i>	51	242.3	83.3	90	532	3.346E-06	3.150*	0.057	0.984
Gerreidae	<i>Diapterus rhombeus</i>	92	179.9	16.1	153	235	1.364E-05	3.028	0.117	0.882
	<i>Eucinostomus argenteus</i>	353	117.7	31.0	51	230	6.319E-06	3.135**	0.024	0.980
Haemulidae	<i>Eucinostomus gula</i>	53	146.7	23.0	100	191	2.232E-06	3.366**	0.080	0.972
	<i>Haemulon steindachneri</i>	192	200.6	57.8	78	280	7.369E-06	3.124**	0.013	0.997
	<i>Orthopristis ruber</i>	292	148.6	48.9	51	301	1.520E-05	2.986	0.020	0.987
Merlucciidae	<i>Pomadasys corvinaeformis</i>	112	123.0	24.4	65	174	6.908E-06	3.144**	0.026	0.992
	<i>Merluccius hubbsi</i>	221	137.0	42.7	45	376	4.404E-06	3.102**	0.028	0.982
Monacanthidae	<i>Stephanolepis hispidus</i>	127	77.7	35.8	22	247	5.627E-05	2.772**	0.031	0.985
Mullidae	<i>Upeneus parvus</i>	41	113.9	24.4	72	166	2.344E-06	3.334**	0.083	0.976
Muraenidae	<i>Gymnothorax ocellatus</i>	69	430.2	54.9	186	541	3.597E-08	3.617**	0.112	0.939
Ophidiidae	<i>Raneya fluminensis</i>	52	211.6	30.3	143	262	3.584E-06	3.080	0.073	0.973
Paralichthyidae	<i>Citharichthys spilopterus</i>	100	145.5	24.8	82	190	3.881E-06	3.175**	0.050	0.976
Paralichthyidae	<i>Etropus crossotus</i>	158	97.9	27.3	40	169	2.718E-06	3.277**	0.028	0.989
	<i>Etropus longimanus</i>	232	87.1	21.3	139	40	1.334E-05	2.889**	0.036	0.965
Rajidae	<i>Paralichthys patagonicus</i>	43	255.4	92.1	133	506	1.908E-06	3.284**	0.042	0.993
	<i>Syacium papillosum</i>	354	125.7	32.7	44	235	5.173E-06	3.141**	0.017	0.990
	<i>Psammobatis extenta</i>	97	230.4	44.1	83	280	4.499E-06	3.024	0.047	0.977
Sciaenidae	<i>Atlantoraja cyclophora</i>	80	369.0	145.1	120	597	1.124E-06	3.267**	0.021	0.997
	<i>Rioraja agassizii</i>	71	384.2	95.4	91	541	1.266E-06	3.22**	0.053	0.981
	<i>Ctenoscaena gracilicirrus</i>	1236	108.9	27.5	36	197	7.042E-06	3.126**	0.011	0.985
Serranidae	<i>Cynoscion guatucupa</i>	494	139.8	52.2	47	389	1.471E-05	2.924**	0.010	0.994
	<i>Cynoscion jamaicensis</i>	1044	105.0	29.9	32	274	5.338E-06	3.141**	0.014	0.979
	<i>Isopisthus parvipinnis</i>	438	97.0	25.0	45	199	7.152E-06	3.056**	0.020	0.982
	<i>Larimus breviceps</i>	167	115.1	33.0	48	239	2.702E-06	3.312**	0.032	0.984
	<i>Macrodon ancylodon</i>	86	165.4	47.0	70	305	2.385E-06	3.220**	0.073	0.958
	<i>Menticirrus americanus</i>	292	158.3	60.8	57	346	2.830E-06	3.240**	0.012	0.996
	<i>Micropogonias furnieri</i>	617	193.5	52.2	64	622	3.806E-06	3.184**	0.014	0.988
	<i>Paralichthys brasiliensis</i>	907	156.6	29.3	68	242	1.089E-06	3.396**	0.015	0.982
	<i>Stellifer brasiliensis</i>	46	103.5	17.0	69	147	1.519E-06	3.422**	0.102	0.962
	<i>Stellifer rastrifer</i>	237	85.1	19.7	49	185	2.731E-06	3.316**	0.030	0.981
Serranidae	<i>Umbrina canosai</i>	244	170.2	58.1	67	302	5.496E-06	3.173**	0.017	0.993
	<i>Diplectrum formosum</i>	54	153.1	37.8	85	219	2.806E-06	3.282**	0.058	0.984
	<i>Diplectrum radiale</i>	245	170.2	31.6	76	234	1.023E-06	3.488**	0.038	0.972
Sparidae	<i>Dules auriga</i>	193	117.9	31.2	44	172	6.388E-06	3.206**	0.022	0.991
	<i>Pagrus pagrus</i>	59	126.3	37.7	52	247	1.837E-05	2.962	0.027	0.995
Stromateidae	<i>Pepilus paru</i>	71	119.5	48.3	30	235	4.458E-05	2.831**	0.023	0.995
Synodontidae	<i>Saurida brasiliensis</i>	72	86.9	15.0	60	116	4.413E-06	3.040	0.065	0.970
	<i>Synodus foetens</i>	65	188.4	62.6	98	359	1.481E-06	3.252**	0.032	0.994
Trichiuridae	<i>Trichiurus lepturus</i>	485	399.6	155.1	69	1240	1.342E-07	3.192**	0.035	0.945
Triglidae	<i>Bellator brachyichir</i>	129	45.0	9.0	28	72	2.153E-05	2.861	0.083	0.904
	<i>Prionotus nudigula</i>	127	93.6	27.3	43	208	9.714E-06	3.005	0.039	0.979
	<i>Prionotus punctatus</i>	862	127.0	61.5	29	375	7.535E-06	3.095**	0.015	0.980
<b>ALL SPECIES (57)</b>		<b>14344</b>	-	-	-	-	-	<b>3.136**</b>	<b>0.025</b>	-

\*\* b is significantly different from 3 (p = 0.01)

\* b is significantly different from 3 (p = 0.05)

with 60 mm stretch mesh in the body and sleeve and 25 mm in the cod end. The surveys were conducted in February 1994 and October 1997, at 21 sites located between 10 and 70 m in depth. Data on total length (TL) in mm and total weight in g were recorded for each fish. For the skates, body length was considered instead of total length. The parameters **a** and **b** of the length-weight relationship of 57 species were estimated using the logarithmic transformation of the equation:

$$W = a \cdot L^b.$$

In order to verify if calculated **b** was significantly different from 3, the Student's t-test was employed ( $p = 0.01$  and  $p = 0.05$ ). Normality of the **b** distribution was also tested through symmetry and kurtosis analyses (Zar 1996).

## Results

The results of the LWR analysis of 57 species belonging to 24

families are summarized in Table 1. All regressions were highly significant, with the coefficient of determination ( $r^2$ ) ranging from 0.882 to 0.997 ( $p < 0.01$ ). The **b** values ranged from 2.746 for *Selene vomer* to 3.617 for *Gymnothorax ocellatus*. The average **b** (3.136) was significantly different from 3 and only 13 of the species (i.e. 26%) had **b** equal to 3. This implies that the "cube law" cannot be applied to most of the species in the São Sebastião system. The distribution of the LWR exponents (**b**) of the 57 species exhibited symmetry ( $g_1 = -0.7497$ ,  $p = 0.803$ ) and normality in the mesokurtic curve ( $g_2 = 0.013$ ,  $p = 0.617$ ) (Fig. 2). The estimated parameters should be applied to the species within the specific length ranges analyzed.

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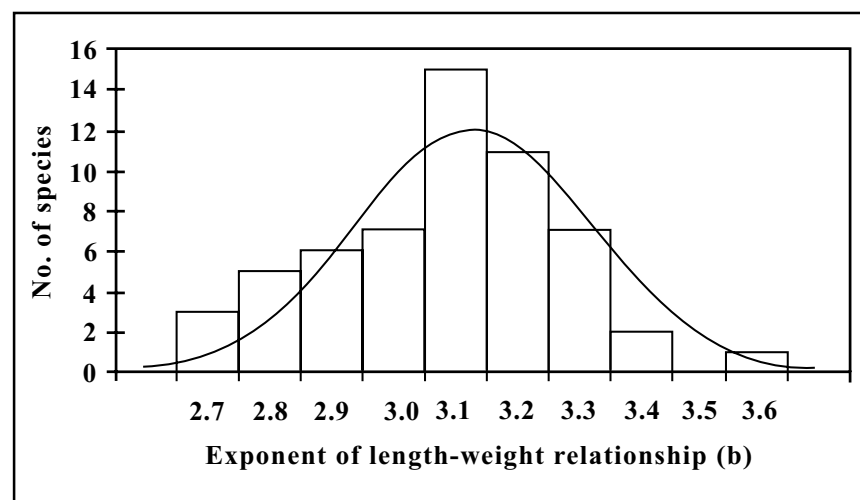


Fig.2. Distribution of values of the LWR for 57 species caught in the São Sebastião System, Brazil.

**L.S.H. Soares and C.L.D.B. Rossi-Wongtschowski** are with the Instituto Oceanográfico, Universidade de São Paulo, PO Box 9075, 05508-900 - São Paulo (SP), Brazil. **E.Y. Muto** is in the Biological Oceanography Post-Graduate Course at the same Institute.