Arquivos de Ciências do Mar

NOTA CIENTÍFICA

LENGTH-WEIGHT RELATIONSHIP OF MARINE COMMERCIAL FISH SPECIES IN RIO DE JANEIRO STATE, BRAZIL

Relação peso/comprimento de alguns peixes comerciais marinhos do Estado do Rio de Janeiro, Brasil

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ABSTRACT

Length-weight relationship parameters of thirteen species of demersal and pelagic fishes that are of economic and ecological relevance in the commercial fisheries of Rio de Janeiro State, southeastern of Brazil, are presented. These relationships indicate a positive allometry tendency for the regression slope, ***b*** *in the sampled fish community.*

Key words*: length-weight relationship, demersal and pelagic fishes, Rio de Janeiro State.*

RESUMO

Foram estimados os parâmetros da relação peso-comprimento de 13 espécies de peixes demersais e pelágicos que apresentam importância econômica e ecológica nas pescarias comerciais do Estado do Rio de Janeiro, Sudeste de Brasil. Estas relações indicam uma tendência de alometria positiva para o coeficiente angular da regressão, ***b*** *na comunidade amostrada.*

Palavras-chaves: *relação peso-comprimento, peixes demersais e pelágico, Estado do Rio de Janeiro.*

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INTRODUCTION

The relationship between length and weight of the fish's body presents great importance in fisheries biology studies (Sparre *et al*., 1989), being used broadly with different purposes, namely to estimate the mean weight of fish based on a known length value (Beyer, 1987), to convert growth equations in length into the equivalent one in weight, to compare interspecific and intrapopulation morphometry, and to determine the index of well-being of individual fish (Bolger & Connoly, 1989).

The length-weight relationship is usually calculated through a log-transformed linear regression (Zar, 1996), whose parameter **b** estimated from the potential equation ($W = a.L^b$) is also known as allometric coefficient, which measures the relative gains in weight for a given fish length. Great variations in estimates of **b** are observed among different populations of the same species or within one same population at different times. This difference can reflect changes in the individuals' condition in relation to feeding, reproduction and migratory activities (King, 1995).

The objective of this paper is to determine the length-weight relationship of thirteen species of demersal and pelagic fishes that are of economic and ecological relevance in the commercial marine fisheries of Rio de Janeiro State, southeastern Brazil.

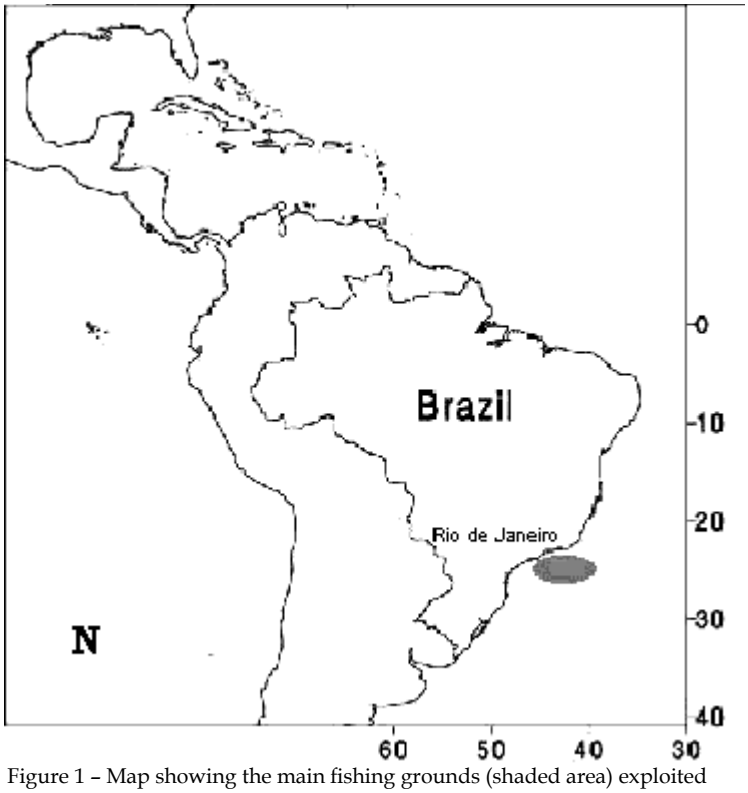

Figure 1 – Map showing the main fishing grounds (shaded area) exploited by the commercial fleet off the southeastern Brazilian coast.

MATERIAL AND METHODS

The database for this study was obtained from specimens sampled from landings made in the São Pedro fish market (Niterói, Rio de Janeiro State). They were caught with long-lines and mid-water trawl nets by fishing boats operating in the Cabo Frio area (23°/24°S - 041°30"/042°30"W). The samples for Brazilian sardine, *Sardinella brasiliensis*, were acquired from purse seine-captured shoals at Angra dos Reis (23º-24ºS - 44º-045ºW).

In the period from June, 1999 to May, 2000 a number of fish were sampled and measured for the following morphometric variables: total length, with a 0.1 cm accuracy, and total weight, with a 1.0 g accuracy of a electronic scale. Sex-separated sampling was made only for two species, namely Brazilian sardine and sandperch.

The parameters **a** and **b** of the weight (W)/ length (L) regression of the thirteen species were estimated using the log-transformed equation: $\ln W = \ln A + b \ln L$.

Correlation between weight and length was ascertained through the determination coefficient (R^2), and sex differences in the length-weight relationship of Brazilian sardine and sandperch were submitted to statistical analysis by the **t** test for two slopes (b), after the methodology described by Ivo & Fonteles-Filho (1997).

RESULTS AND DISCUSSION

The fitting of length-weight relationships by regression referred to thirteen species distributed among nine families, as follows: Serranidae, with three species, Sciaenidae, with two species, and the others with one species each. In all, they are represented by 4,330 sampled specimens, out of which 2,227 account for *Sardinella brasiliensis*. Three species are pelagic, namely Brazilian sardine, common snook and fat snook, and the other ten, demersal. Sex was identified for all sampled individuals of sandperch, but not for 61 specimens of *Sardinella brasilensis*, what is not expected to cause any major effect on the significance of the regression equations for males and females. Except for the small-sized Brazilian sardine, all species are medium-sized ones (Table I and Glossary, for common names).

Table I – Data on sample numbers (N), and minimum, maximum and mean values for total length and total weight of marine commercial fishes by sex, family and species, off Rio de Janeiro State, Brazil.

Family[1]	Species[2]	Sex	N	Total length (cm)			Total weight (kg)		
				min.	max.	mean ($\bar{x}$)	min.	max.	mean ($\bar{x}$)
Clupeidae	*Sardinella brasiliensis*	Male	1,148	14.8	26.0	18.6 ± 1.6	0.03	0.1	0.06 ± 0.01
		Female	1,068	13.7	28.0	19.5 ± 1.6	0.02	0.1	0.07 ± 0.01
		Both[3]	2,277	13.7	28.0	18.9 ± 1.7	0.02	0.1	0.06 ± 0.01
Centropomidae	*Centropomus undecimalis*	Both	112	29.0	76.7	52.9 ± 12.1	0.2	5.2	1.6 ± 1.2
	Centropomus parallelus	Both	148	23.7	78.9	45.0 ± 9.4	0.1	5.6	1.1 ± 0.9
Serranidae	*Epinephelus marginatus*	Both	127	25.1	90.9	47.6 ± 12.6	0.3	17.3	2.6 ± 2.6
	Epinephelus niveatus	Both	229	23.4	122.3	46.1 ± 9.3	0.1	12.7	4.4 ± 2.1
	Mycteroperca rubra	Both	147	25.0	74.3	41.3 ± 12.2	0.2	4.8	1.1 ± 1.0
Priacanthidae	*Priacanthus arenatus*	Both	127	29.9	53.5	40.3 ± 4.9	0.5	2.6	1.1 ± 0.4
Malacanthidae	*Lopholatilus villarii*	Both	228	24.2	92.6	38.4 ± 4.7	0.2	16.4	4.3 ± 1.3
Pomatomidae	*Pomatomus saltatrix*	Both	148	36.9	91.6	57.3 ± 10.8	0.5	6.1	1.7 ± 1.0
Sparidae	*Pagrus pagrus*	Both	149	24.4	64.4	38.5 ± 7.8	0.2	3.9	1.0 ± 0.6
Sciaenidae	*Cynoscion acoupa*	Both	113	47.3	118.0	71.3 ± 16.3	1.0	15.7	3.9 ± 3.0
	Micropogonias furnieri	Both	151	24.3	71.3	47.9 ± 8.1	0.2	4.5	1.3 ± 0.8
Pinguipedidae	*Pseudopercis numida*	Male	246	39.1	114.0	66.2 ± 12.9	0.7	17.2	3.8 ± 2.6
		Female	128	23.8	80.5	55.6 ± 10.8	0.2	6.7	2.3 ± 1.2
		Both	374	23.8	114.0	62.6 ± 13.2	0.2	17.2	3.3 ± 2.4

Remarks: 1 = families' sequence according to Nelson (1994); 2 = scientific names according to Froese & Pauly (2003); 3 = number higher than the sum of males and females because sex identification was not amenable for all individuals.

The high statistical significance of the determination coefficient (R^2), which varied in the range of 0.85 - 0.99 ($P < 0.01$), attested to the existence of strong correlation between length and weight. Statistical significance in the length-weight relationship between sexes was observed for *Sardinella brasiliensis* ($t = 18.63$; $P < 0.01$) and *Pseudopercis numida* (6.28; $P < 0.01$), so that sex-specific regression equations are presented. For the other species, only one regression equation is available, since their data were analyzed for both sexes together (Table II).

Table II – Data on regression equation, curve interception (A) and determination coefficient (R^2) of the length-weight relationship for demersal and pelagic fishes, in the marine fisheries of Rio de Janeiro State, Brazil

Common name	Sex	Equations	Parameters	
			A	R^2
Brazilian sardinella	Male	lnW = ln - 2.94 + 2.400 lnL	0.052744	0.86
	Female	lnW = ln - 3.69 + 2.655 lnL	0.025052	0.85
	Both	lnW = ln - 3.46 + 2.578 lnL	0.031350	0.86
Common snook	Both	lnW = ln -12.66 + 3.267 lnL	0.000003	0.98
Fat snook	Both	lnW = ln -11.79 + 3.092 lnL	0.000008	0.96
Dusky grouper	Both	lnW = ln -11.71 + 3.210 lnL	0.000008	0.99
Snowy grouper	Both	lnW = ln -10.70 + 2.904 lnL	0.000011	0.96
Mottled grouper	Both	lnW = ln -10.98 + 2.921 lnL	0.000017	0.99
Atlantic big-eye	Both	lnW = ln -10.33 + 2.814 lnL	0.000033	0.97
Tilefish	Both	lnW = ln -11.95 + 3.184 lnL	0.000009	0.98
Bluefish	Both	lnW = ln -10.09 + 2.601 lnL	0.000042	0.96
Common seabream	Both	lnW = ln -10.52 + 2.852 lnL	0.000027	0.95
Acoupa weakfish	Both	lnW = ln -11.54 + 2.987 lnL	0.000010	0.98
Croaker	Both	lnW = ln -11.56 + 3.030 lnL	0.000010	0.95
Sandperch	Male	lnW = ln -11.63 + 3.063 lnL	0.000009	0.97
	Female	lnW = ln -11.33 + 2.999 lnL	0.000012	0.98
	Both	lnW = ln -11.36 + 2.634 lnL	0.000012	0.88

The values of **b** varied from 2.400, for males of *Sardinella brasiliensis*, to 3.267 for *Centropomus undecimalis*, with an average 2.837±0.288 at 95% confidence the level. The estimated figures are in agreement with Pauly & Gayanilo Jr. (1997), in the sense that **b** should vary in the range of 2.5 - 3.5, what allows for the occurrence of isometry, and negative and positive allometry in the length-weigh relationship.

A tendency for a negative allometry in relative growth of the thirteen analyzed species suggests a restriction to the use of the isometric condition factor, a parameter related to individual size and sexual maturity, because of an inverse variation occurring between the regression's slope (b) and its intercept (a). Similar observations were made by Braga (1993 and 1997) in analyses of the weight-length allometric equation and the condition factor in, respectively, *Paralonchurus brasiliensis* and *Plagioscion squamosissimus*.

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Glossary of common names. Mottled grouper = *Mycteroperca rubra* (Bloch, 1793); tilefish = *Lopholatilus villari* Miranda-Ribeiro, 1915; snowy grouper = *Epinephelus niveatus* (Valenciennes, 1828); croaker = *Micropogonias furnieri* (Desmarest, 1823); bluefish = *Pomatomus saltatrix* (Desmarest, 1823); dusky grouper = *Epinephelus marginatus* (Lowe, 1834); sandperch = *Pseudopercis numida* Miranda-Ribeiro, 1903; Atlantic big-eye = *Priacanthus arenatus* Cuvier, 1829; common seabream = *Pagrus pagrus* (Linnaeus, 1758); acoupa weakfish = *Cynoscion acoupa* (Lacépede, 1802); common snook = *Centropomus undecimalis* (Bloch, 1792); fat snook = *Centropomus parallelus* Poey, 1860; Brazilian sardinella = *Sardinella brasiliensis* (Steindachner, 1879).