BIOMETRIC RELATIONSHIPS AND GROWTH OF THE MEDITERRANEAN HAKE (*MERLUCCIUS MERLUCCIUS* L.) FROM THE SANTA POLA BAY (SPAIN)

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Abstract

The Hake, *Merluccius merluccius* (Linnaeus, 1758), is a widely distributed groundfish species on the continental shelf and slope off Europe and in the Mediterranean Sea. Hake is a target species in the trawl fisheries. In this paper its biometric relationships and growth are described. From the different biometric-relations estimeted, we propose as length-weight relationship those founded for the total population Weight = 0.0048 * Length $^{3.12}$. The Von Bertalanffy Growth Function parameters were obtained using different packages, given high K values, proposing the following expression $L_t = 106 * (1 - e^{-0.2 (t - 0.4)})$ for the total population.

Key-words: Teleostei, Biometrics, Western Mediterranean

The hake *Merluccius merluccius* (Linnaeus, 1758) is a widely distributed groundfish species on the continental shelf and slope off Europe and in the Mediterranean Sea at depths between 30 and 1 000 m, though it is most abundant between 70 and 370 m. The species carries out daily vertical feeding migrations, staying close to the bottom in the daytime and rising off the bottom to adopt a midwater habit at night, and is a target species in trawl fisheries. In this paper are described some biometric relationships and growth, in order to contribute to the knowledge on the biology of the species.

The data base includes data obtained from sampling of commercial trawl fleet landings at the Santa Pola fish wharf (Figure 1). Sampling was carried out monthly, and 36 samples were collected from January 1991 to December 1993. A total of 20 806 individuals were measured (total length at the nearest lower cm). Each month more detailed observations were carried out : total length in cm, total weight in g,gutted weight in g, girth around the base of the pectoral fins in cm, and sex determination; they were obtained on a subsample over a total of 2 889 individuals.

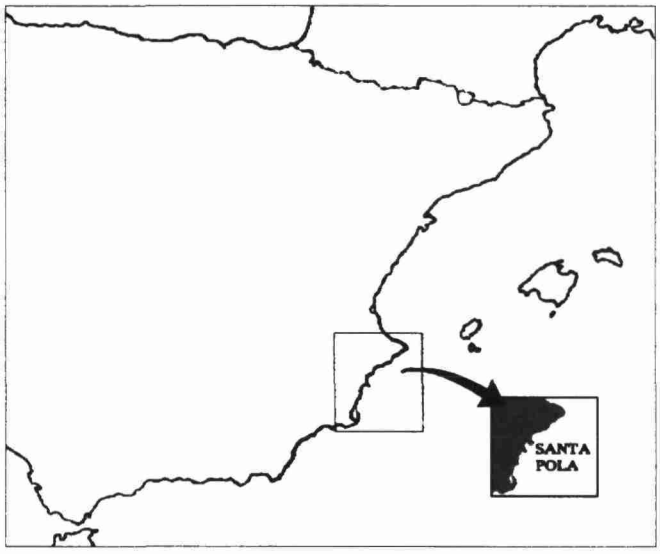

Figure 1. Situation of the area of study

The relationships between several parameters were determined. For total length/total weight and girth/total weight, the data was expressed by a power equation of the form $W = a*L^b$. For the other parameters total weight/gutted weight and total length/girth, the data were adjusted by linear regression: $Y = a + bX$. The relationships were established separately for males, females, individuals of undetermined sex (immature), and the population as a whole.

The age-length relationship was computed from size frequencies. Monthly data samples were extrapoled to the total number of individuals caught per month by the fleet. Then they were grouped by 2cm size class, separated by sexes using the sex ratio by size, and smoothed over three classes; the pool of individuals for which sex could not be determined was divided equally between males and females. The Von Bertalanffy growth function (VBGF) was used as growth expression, and the growth parameters ($L\infty$, K and t_0) estimated using the Elefan (1) and Fishparm (2) automatic computer programs. Estimations of the "best combination" of the VBGF parameters were done, giving a value of t_1= 12 cm to determine t_0. The method of Bhattacharia (MPA mode of the Elefan program) was applied to the quarterly histograms and the results were then applied to the Fishparm program.

Length distribution ranged between a minimun of 4 cm to a maximun of 68 cm and the length range between 4 to 20 cm represented the 86 % of the total number of individuals. The results for the relationships between the various biometric parameters of hake established in this study have been presented as follows :

The length-weight relationships are presented in Table I, the coefficient b significantly differs from 3 in all cases except in males.

Table I.- Parameters of relative growth (Length-Weight relationship: Weight = a * Length b) calculated for the different groups (undetermined, males, females and total) of *Merluccius merluccius*; significance levels = ***<0.001, NS<0.1 in a "t"Test.

Group	a	b	err.b	signif.	r2	n	range
males	0.006	3.05	0.02941	NS	0.96	502	13.5-52.5
females	0.0048	3.12	0.01259	***	0.99	955	11.5-68.0
undeterm.	0.0056	3.06	0.01681	***	0.96	1 369	4.0-32.5
total	0.0048	3.12	0.00477	***	0.99	2 826	4.0-68.0

The girth-weight relationships are presented in Table II, show a significant difference between b and 3 in all cases except in the undetermined (immature).

Table II.- Parameters of relative growth (Girth-Total Weight relationship: Weight = a * Girth b) calculated for the different groups (undetermined, males, females and total) of *Merluccius merluccius*; significance levels = ***<0.001,NS<0.1 in a "t"Test.

Group	a	b	err.b	signif.	r2	n	range
males	0.210	2.72	0.03390	***	0.93	437	13.5-52.5
females	0.214	2.71	0.01683	***	0.96	819	11.5-68.0
undeterm.	0.125	2.93	0.02464	NS	0.91	1 230	4.0-32.5
total	0.141	2.86	0.00675	***	0.99	2 486	4.0-68.0

The girth-length relationships are presented in Table III, resulting a relation between parameters in the form that the girth is nearly the half of the length.

Table III.- Parameters of relative growth (Length-Girth relationship: Girth = a + b Length) calculated for the different groups (undetermined, males, females and total) of *Merluccius merluccius*.

Group	a	b	r2	n	range
males	-0.289	0.42	0.86	437	13.5-52.5
females	-1.552	0.48	0.92	819	11.5-68.5
undeterm.	0.080	0.38	0.90	1 230	4.0-32.5
total	-0.995	0.46	0.97	2 486	4.0-68.5

The gutted weight-total weight relationships are shown in Table IV. The size-weight relationship values obtained, were similar to the values calculated by other researchers in the Western Mediterranean, (3). In general the values of b were higher than 3. Differences between group sizes were small and were mainly ascribable to the fact that the size ranges for the immature and for males were smaller than for