

Length-length and length-weight relationships of the round sardinella *Sardinella aurita* Valenciensis, 1847 (Osteichthyes, Clupeidae) from the Aegean Sea

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Abstract

This study describes the length-weight (LWR) and length-length (LLR) relationships of round sardinella *Sardinella aurita* (Linnaeus, 1758) from Izmir Bay, Turkey. A total of 1948 specimen of *S. aurita* collected from fisherman's catch with gillnets from November 2004 to October 2005 were used for this study. Fish size ranged in total length (TL, minimum) 15.0 cm for males, 14.2 cm for females and 14.2 cm for both sexes. The parameters a and b of the length-weight relationships were calculated as $W=aL^b$ and LWRs for males, females and the total sample population determined to be $W=0.0033L^{3.279}$, $W=0.0025L^{3.375}$ and $W=0.0027L^{3.340}$ respectively. The values for allometric coefficient b of the LWRs showed positive allometric growths in the both sexes.

LLRs were measured as $TL=a+bFL$, $FL=a+bSL$ and $SL=a+bTL$ equation in all sexes and combined. In all the samples together, LLRs are as follows: $TL=-1.3284+1.2087FL$, $FL=1.4623+0.9581SL$ and $SL=0.0000+0.8382TL$. The results further indicated that LLRs were highly inter correlated ($r^2>0.9$, $p<0.01$).

Keywords: Round sardinella, *Sardinella aurita*, length-weight relationship, condition factor, Izmir Bay, Aegean Sea.

1. INTRODUCTION

Length-weight relationships, LWRs, are important because they; (a) allow the conversion of growth-in-length equations to growth-in-weight, (b) for use in stock assessment observations; (c) allow an estimate of the condition of fish and (d) are useful for between region comparisons of life histories of a certain species (Wootton, 1990; Pauly 1993; Petrakis and Stergiou, 1995; Gonçalves et al., 1997; Binohlan et al., 1998; & Moutopoulos and Stergiou, 2002).

Relationships between different types of length (length-length relationships, LLRs), are also very important for comparative growth studies and also useful in local and interregional morphological and life historical comparisons in species and populations. In fish studies, fish length is often more rapidly and easily measured than mass. Thus information on the length-weight relationships makes it more convenient to determine mass where only the length is known. In the field, the tail flukes of fish are often cut, making it difficult to measure the total

length correctly to measure the total length. Knowledge of the standard length should allow the total length to be determined (Binohlan et al., 1998; & Lalèyè, 2006).

The aim of this study is to determine relationships of length-weight and length-length in *S. aurita* captured from Izmir Bay in central Aegean Sea and find out monthly differences in view of the parameters involved.

2. MATERIALS AND METHODS

Fish samples were collected monthly during commercial fishing trials using gillnets from Izmir Bay (Fig. 1). The study period was from November 2004 to October 2005. Gillnets used to catch *S. aurita* in Izmir bay have the characteristics below: twine thickness 210 D/3 no, multifilament mesh size (bar length) 23-25 mm, 105-210 meshes deep, hanging ratio of the float line, $E=0.67$. Gillnets are utilized as drift nets ranging from 800 to 1600 m in length. They are usually used within 5m from surface down to bottom. Mean annual temperature of sea water in Izmir bay is 18.5 C° with the lowest 10.5 C° in February and the highest 25 C° in July.

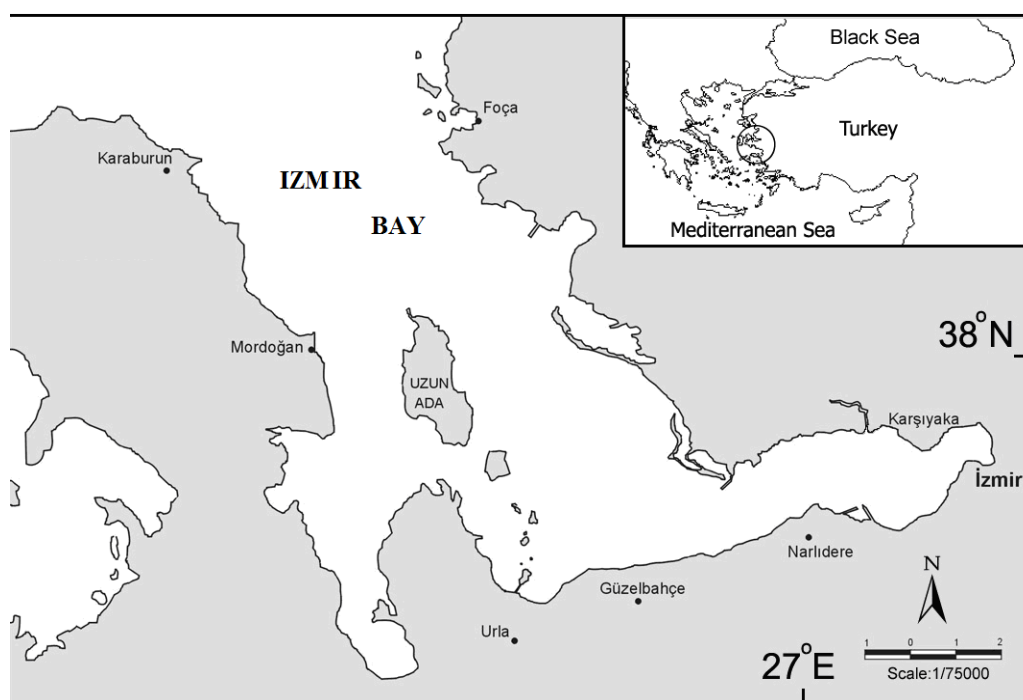


Figure 1 Sampling locality of *Sardinella aurita* in Izmir bay (central Aegean Sea) .

3. RESULTS AND DISCUSSION

Length-weight and length-length of *S. aurita* inhabiting Izmir Bay of central Aegean Sea in Turkey were estimated by sexes and sampling time. All relationships were found to be significantly linear in all cases.

A total of 1948 individuals were sampled during the study period and the shortest, 14.2 cm TL and the longest, 28.5 cm TL individuals obtained in August. It was determined that 52.4% of the fish were female (n=1014), 47.5% male (n=921) and 0.07% immature (n=13). Because immature individuals did not reach adult body shape, length-weight relationship was not measured (Froese, 2006). The sex ratio was not significantly different from parity ($\chi^2=4.469$; $p<0.01$). female:male ratio was calculated as 1:10. Erkoyuncu (1995) and Avşar (1998) pointed out that female:male ratio may vary between 1:1 and 1:1.3 in a typical population. The values obtained in our study were within the reasonable range expected for a natural population.

Monthly length-weight relationships for males, females and the total sample population were determined as $W=0.0033L^{3.279}$, $W=0.0025L^{3.375}$ and $W=0.0027L^{3.340}$ respectively (Table 1). The b value was used in the length-weight relationship as the indicator of the growth type of *S. aurita*, to find out whether there deviation from isometric growth had occurred between the sexes and among the sampling times. Monthly LWRs of *S. aurita* presented in Table 1 show that the calculated allometric coefficients vary between 2.121 (May) and 3.777 (February) in males and between 2.350 (October) and 3.762 (December) in females.

As expected, an allometric relationship was observed between length and weight of the species. In males, allometry was closer to isometry, however total population found a positive allometry including males and females. Gonadal development affected the relationship between length and weight of the individuals positively, of females in particular. The t-test was used to compare a significant distinction between the calculated slope (b) values and the cube of the length (Table 1). Male and female individuals did not exhibit a significant difference during spring summer and autumn months, however they showed a significantly defined variation especially in winter months, which was found to be caused by the fact that gonads mature in winter when the slope value of female individuals was highest in particular. On the other hand, slope values (b) of males began to increase in autumn to reach maximum in winter in the same way as in females. In winter months, abdomen of the fish increased most just because of gonadal development, with a even more positive allometric growth. The intercept a values diminished in winter for both female and male individuals as compared to the rest of the year. The index of length-weight pointed to winter months when reproduction occurs intensively and condition is minimum.

All allometric coefficients (b) estimated in this study were within the expected range 2.1-3.7, and according Benegal and Tesch (1978); Koutrakis and Tsikliras (2003) allometric coefficients may range from 2 to 4.