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An investigation on some population parametres of European pilchard (*Sardina pilchardus* Walbaum 1792) in the Dardanelles

Çanakkale Boğazı'nda Sardalya balığının (*Sardina pilchardus* Walbaum 1792) bazı populasyon parametreleri üzerine bir araştırma

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Abstract

In this study, the length-weight relationship, condition factor (CF), gonadosomatic index (GSI) and meat yield of 363 European pilchard (*Sardina pilchardus* Walbaum, 1792) sampled from Dardanelles were studied between September 2001 and April 2002. The length-weight relationship was calculated as $W = 0.0172L^{2.68}$; $R^2 = 0.71$. Mean condition factor of males and females varied between 0.66-0.87% and 0.68-0.86%, while mean GSI values were 0.34-4.83% and 0.47-5.95%, respectively. Percentage meat yield of males and females were varied as 64.21-75.56 and 64.20-81.50, respectively.

Key Words: European pilchard, gonadosomatic index (GSI), condition factor, length-weight relationship, meat yield, Dardanelles.

Introduction

The global capture fisheries and aquaculture production was reported 117 million tones in 1998 (FAO, 2000). European pilchard (*Sardina pilchardus* Walbaum, 1792) which is one of the most important pelagic species in Turkey, constituted 111,572

tons of the total catch between 1996 and 2000 (Anonymous, 2001). It was reported that it was marketed 2185.1 ton in the Istanbul Fish Market from 1998 to 2001 (Tekinay *et al.*, unpublished data). However, it was retailed much less (839 ton) in the Çanakkale Fish Market between 1996 and 2001 (Tekinay *et al.*, 2002b).

Biological aspects of the European pilchard have been studied specifically in the Aegean Sea (Cihangir and Tıraşın, 1989; Petrakis and Stergiou, 1995; Akyol *et al.*, 1996; Karakayış and Toğulga, 1998; Mater and Bayhan, 1999), the Marmara Sea (Kocakaplan, 1998), Spanish waters (Perez *et al.*, 1985; Abad and Giraldez, 1993) and Portuguese waters (Zwolonski *et al.*, 2001). However, published data related the biology of this species in Dardanelles is not available currently. Therefore, this study was designed to investigate some biological characteristics such as length-weight relationship, condition factor, gonadosomatic index and meat yield of *Sardina pilchardus* in the Dardanelles.

Materials and Methods

The study was carried out on 363 specimens of European pilchard captured in the Dardanelles from September 2001 to April 2002. Fish samples were randomly collected from fish retailers. The total length of each specimen was measured in cm, and weight of body, interior organs, gonad, and carcass were determined in gram. The sex control was performed by dissection (Tekinay *et al.*, 2002a).

The length-weight relationship equation was calculated as $W = aL^b$. The condition factor (CF) was determined by using the formula $CF = W/L^3*100$. Mean gonadosomatic index (GSI) was calculated as GSI = Gonad weight/total weight*100 (Erkoyuncu, 1995). Meat yield (MY) calculated as MY (%) = (carcass weight/body weight)*100.

At the end, the data of condition factor, gonadosomatic index, and meat yield between the male and female fish were subjected

to an analysis of variance (ANOVA) and the multiple range test ($P<0.05$) of Duncan using the statistical software package Statgraphics (Manugistics Incorporated, Rockville, MD, U.S.A.) (Steel and Torie, 1960). The length-weight relationship were modeled by the statistical software package, Statgraphics.

Results

The length-weight relationship were calculated as $W = 0.0172L^{2.68}$; $R^2 = 0.71$ (Figure 1).

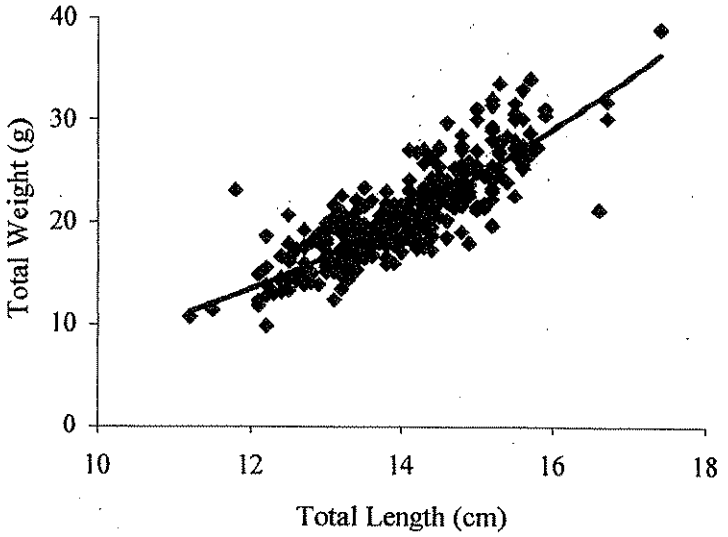

Figure 1. The length-weight relationship of *S. pilchardus* (n = 363).

Mean condition factors (CF) of males and females were varied between 0.66% - 0.87%; and 0.68%-0.86%, respectively (Table 1; Figure 2). Mean CF for both sexes were highest in April. The lowest CF values of male and female fish were detected in January and December, respectively. There was no significant difference in the CF of female sardines in September 2001 and March 2002. Furthermore, the CF of male was not significantly different in September, March, and April (Table 1).

Table 1. The condition factor of *Sardina pilchardus* (±: standard error). Values in each column with different superscripts are significantly different (P< 0.05).

	Female		Male	
Months	N	CF	N	CF
September	13	0.79 ± 0.02^{c}	10	0.85 ± 0.02^{c}
October	46	0.73 ± 0.01^{b}	20	0.70 ± 0.01^{b}
November	21	0.70 ± 0.01^{ab}	20	0.69 ± 0.01^{ab}
December	47	0.70 ± 0.01^{ab}	21	0.66 ± 0.02^{a}
January	24	0.68 ± 0.01^{a}	35	0.67 ± 0.01^{ab}
February	18	0.71 ± 0.01^{ab}	12	0.69 ± 0.01^{ab}
March	14	0.80 ± 0.02^{c}	6	0.83 ± 0.02^{c}
April	22	0.86 ± 0.01^{d}	7	0.87 ± 0.02^{c}

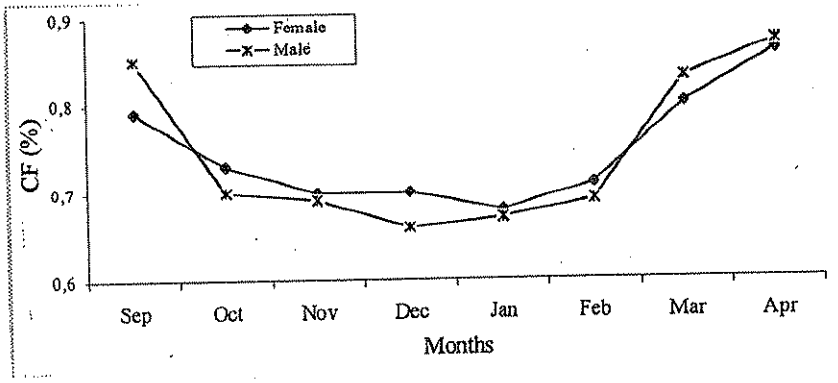

Figure 2. Mean condition factor values of ***Sardina pilchardus***.

Mean GSI (%) of males and females varied between 0.34 - 4.83; and 0.47 - 5.95, respectively (Table 2; Figure 3). The lowest and the highest value for males were recorded in September (0.34) and January (4.83), respectively. Similarly, the lowest and the highest GSI of females were detected in September (0.47) and

January (5.95), respectively. The mean GSI of female recorded in November, December, and February were not significantly different (P> 0.05).

Mean meat yield (%) of males and females were between 64.21 - 75.56 and 64.20 - 81.50, respectively. Mean meat yield of males (71.20 ± 0.87) and females (72.24 ± 0.32) were found to be significantly different (P< 0.05).

Table 2. Gonadosomatic index of *Sardina pilchardus* (±: standard error). Values in each column with different superscripts are significantly different (P< 0.05).

	Female		Male	
Time	N	GSI (%)	N	GSI (%)
September	13	0.47 ± 0.06^{a}	10	0.34 ± 0.06^{a}
October	46	1.10 ± 0.08^{ab}	20	0.62 ± 0.12^{a}
November	21	4.62 ± 0.22^{d}	20	3.07 ± 0.22^{c}
December	47	4.82 ± 0.26^{d}	21	3.13 ± 0.38^{c}
January	24	5.95 ± 0.45^{e}	35	4.83 ± 0.38^{d}
February	18	4.56 ± 0.40^{d}	12	3.74 ± 0.49^{c}
March	14	3.22 ± 0.26^{c}	6	2.52 ± 0.39^{bc}
April	22	1.62 ± 0.21^{b}	7	1.28 ± 0.37^{ab}

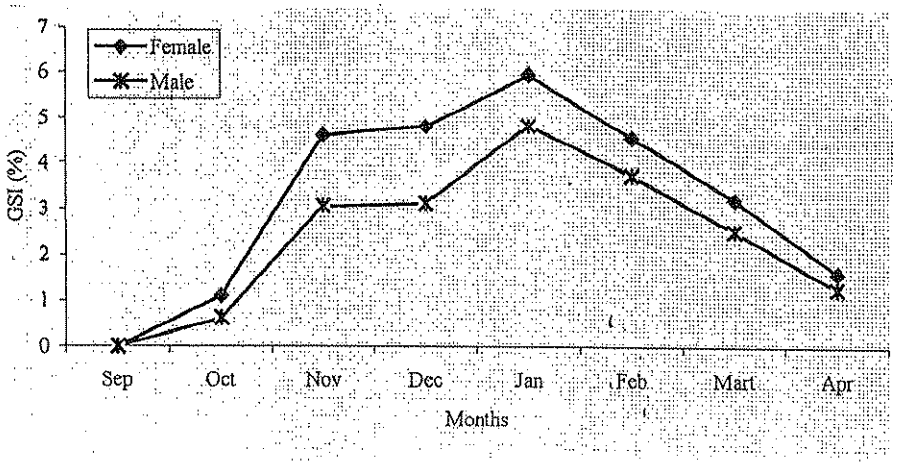

Figure 3. Gonadosomatic index of *Sardina pilchardus*.

Discussion

The present study has clarified some biological characteristics of *Sardina pilchardus* caught in Dardanelles (Çanakkale) region between September 2001 and April 2002.

The slope of the length-weight relationship of *Sardina pilchardus* was calculated as 2.68 in the Dardanelles which is in agreement with the slope (2.75) reported by Petrakis and Stergiou (1995). On the other hand, Karakayış and Toğulga (1998) and Mater and Bayhan (1999) most recently reported higher slopes (3.21 and 3.36, respectively) of length-weight relationship. From the results, it can be indicated that the European pilchard displayed an isometric growth response in Dardanelles.

Highest mean condition factor of both sexes were estimated to be in April, and the lowest values were in December and January, respectively (Table 1; Figure 2). Present findings, however do not support some previous investigations probably due to the natural discrepancies in abiotic conditions. For instance, Perez *et al.*, (1985) reported the mean condition factor attaining the maximum level in December and October. Cihangir and Tıraşın (1989) stated that the highest mean condition factor for both sexes in Edremit Bay and İzmir Bay reached the maximum level in October and May, respectively. In a different study, Akyol *et al.*, (1996) determined the highest mean condition factor in June in İzmir Bay. Finally, Zwolonski *et al.*, (2001) found the highest value in February in the same species.

The highest and lowest GSI values for both sexes were determined in January and September, respectively (Table 2, Figure, 3) which were similar to the data published by Perez *et al.*, (1985), Cihangir and Tıraşın (1989), Akyol *et al.*, (1996), and Zwolonski *et al.*, (2001). There was an inverse relationship between the mean GSI and CF of *Sardina pilchardus* since the energy requirement for spawning is likely to be met by the liver stores or abdominal tissue.

Mean meat yield of male and female calculated in the present work were 71.20% and 72.24%, respectively. We were unable to make

discrepancies in abiotic conditions. For instance, Perez *et al.*, (1985) reported the mean condition factor attaining the maximum level in December and October. Cihangir and Tıraşın (1989) stated that the highest mean condition factor for both sexes in Edremit Bay and İzmir Bay reached the maximum level in October and May, respectively. In a different study, Akyol *et al.*, (1996) determined the highest mean condition factor in June in İzmir Bay. Finally, Zwolonski *et al.*, (2001) found the highest value in February in the same species.

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Mean meat yield of male and female calculated in the present work were 71.20% and 72.24%, respectively. We were unable to make comparison since no study has been apparently available on the meat yield of the European pilchard.

It can finally be suggested that the regulation of fishing period should be re-organized providing the beginning of restriction from January in Çanakkale including Saros, Bozcaada and Gökçeada territories to preserve the European pilchard stocks in the region. More defined studies by consideration of more factors such as age and chemical composition are required to comprehend the present data.

Özet

Bu çalışmada, Eylül 2001-Nisan 2002 tarihleri arasında Çanakkale Boğazı'ndan avlanan 363 adet sardalya balığının boy-ağırlık ilişkisi, kondüsyon faktörü (%), gonadosomatik indeks (GSI) (%) ve et verimi (%) parametreleri incelenmiştir. Boy-ağırlık ilişkisi; $W = 0{,}0172L^{2{,}68}$, $R^2 = 0{,}71$ olarak hesaplanmıştır. Kondüsyon faktörü değerleri erkek bireylerde % 0,66 ile 0,87; dişi bireylerde ise % 0,68 ile 0,86 arasında; GSI ise, erkek bireylerde % 0,34 ile 4,83; dişi bireylerde % 0,47 ile 5,95 arasında değişmiştir. Et verimi oranları erkek bireylerde % 64,21 ile 75,56; dişi bireylerde ise % 64,20 ile 81,50 arasında saptanmıştır.

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