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## Growth Properties of Sea Bass (*Dicentrarchus labrax* (L., 1758), Perciformes: Moronidae) Live in Iskenderun Bay

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**Abstract:** This study was based on the examination of 460 European sea bass (*Dicentrarchus labrax*) individuals from Iskenderun Bay. The age compositions of the individuals varied between 0-6. The third age group was the dominant in the population. The fork length distribution ranged from 17.753 to 53.0 cm and the average weight distribution ranged from 65.784 to 1595 g. Length-weight relationship was found to be  $W = 0.0142 L^{2.9613}$  ( $R^2 = 0.92$ ). For all individuals, the minimum condition factor value was in age group VI as 1.07 while the maximum condition factor was in age-group II as 1.58.

**Key words:** *Dicentrarchus labrax*, Iskenderun Bay, growth rates, condition factor

### INTRODUCTION

Iskenderun Bay is located at the eastern part of Levantine Sea. The Bay resembling a rectangular of 65 km length and 35 km width covers 2275 square kilometers (Fig.1). The depth is ranged from 20 to 100 m and increases towards the south. Because its connection part with offshore is wide, the Bay water is not affected by deep currents or wind movement. Owing to these aspects, it has a dynamic structure Basusta<sup>[1]</sup>. From the view of economy, Labrax is an important sea-fish in Turkey as well as in other European countries. Its white flesh is quite delicious. Although there are various studies achieved in

other countries in literature, Turkey is not rich in the studies carried out on this subject. Gravier<sup>[2]</sup>, Cladrige and Potte<sup>[3]</sup>, Chi and Thong<sup>[4]</sup>, Kennedy and Fitzmaurice<sup>[5]</sup>, Guerin-Ancey<sup>[6]</sup>, Barnabe<sup>[7,8]</sup>, Bou Ain<sup>[9]</sup>, Ozelsel<sup>[10]</sup>, Zohar *et al.*<sup>[11]</sup>, Abrahamian and Barr<sup>[12]</sup>, Dando and Demir<sup>[13]</sup>, Thompson and Harrop<sup>[14]</sup>, Kelley<sup>[15,16]</sup>, Mayer *et al.*<sup>[17]</sup>, Ergene<sup>[18]</sup>, Erguden and Turan<sup>[19]</sup>.

In this study, it was aimed to determine some biological features such as growth rate, condition factor and size of *D. labrax* and to obtain some significant data to benefit optimally from natural fish population.

### MATERIALS AND METHODS

The fish were caught using gill net and longline at three definite stations on the south-east of the Bay between 2 April and 2 December. Some of the samples, especially the fishes caught while being very young, were provided by the fishermen at certain times. Figure 1 shows the general distribution of the catching locations in the studied region. The fork lengths of the samples brought to the laboratory were measured with the measuring board ( $\pm 1$  mm). Their weights were measured with a  $\pm 1$  sensitive balance. The fish scale was used to determine the age. Scale samples were prepared according to Lagler<sup>[20]</sup> which is a common method. The age reading was carried out under a stereomicroscope with a 2x10 and 4,5x10 zooming. In order to determine the age, the annulus determination way suggested by Bagliniere and Loarn<sup>[21]</sup> was followed.

The average length and weight were calculated for every age group of the individuals the age of which had

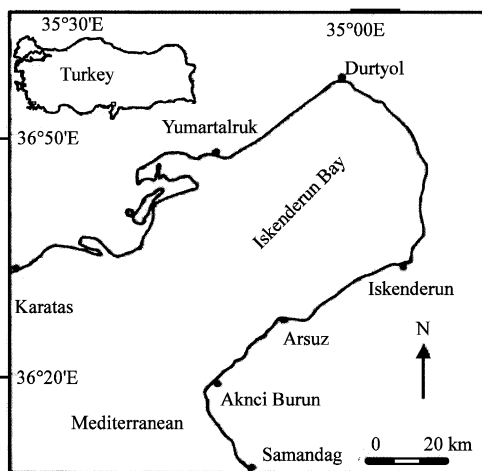


Fig. 1: General plan of the search area

been determined. For proportional length increase,  $OL = L_t - L_{t-1} / L_{t-1}$  and for proportional weight increase  $OW = W_t - W_{t-1} / W_{t-1}$  formulae were used<sup>[22]</sup>. To determine the condition factor and how fleshy the fishes were, the correlation of  $K = (W/L^3) \times 100$  given by Ricker was used<sup>[23]</sup>.

**RESULTS**

**Age composition :** The age composition of 460 *D. labrax* individuals caught from three different stations in Iskenderun Bay was shown in Table 1. The age distribution of *D. labrax* samples ranged from 0 to 4. The age-group 3 composed of the 26.3% of the whole age distribution. This group was followed by the age-group 4 (20.65%) and the age-group 2 (18.69%), respectively. The age-group 5 and 6 were represented with too low percentages in the population (Table 1).

**Age-length relationship :** The fork length values of the *D. labrax* individuals of Iskenderun Bay varied between 15.5 and 54 cm. Apart from the age-group IV, the differences in other age groups were significant ( $p < 0.05$ ) as a result of  $t^2$ -test employed to determine the significance control (Table 2).

According to Table 3, the maximum yearly length increase was determined in the age-group III as 5.47 cm and the minimum increase was in the age-group I as 2.09 cm. The highest proportional length increase was 0.3940 in the age-group VI and the lowest was 0.1178 in the age-group I.

**Age-weight relationship :** The maximum and minimum average body weight values of 460 *D. labrax* individuals caught from Iskenderun Bay were calculated in view of their age groups. The lowest body weight was 40 g whereas the highest was 1700 g. As a result of  $t$ -test employed for value control, the differences among age groups except for ages IV and V were determined to be significant ( $p < 0.05$ ) (Table 4). The age-weight relationship of *D. labrax* was given in the Table 4.

As a result, (Table 5) the maximum annual weight increase was 996.67 g in age VI and minimum was 21.18 g in age I. It was also determined that the maximum proportional weight increase in individuals was 1.6675 in the age IV and the minimum was 0.3192 in the age-group I.

**Length-weight relationship :** The length and weight values of the *D. labrax* individuals were shown in Table 2 and 4, and the length-weight relationship was pointed out in Fig. 2. A correlation of  $W = 0.0142FL^{2.9615}$

Table 1: The age distribution percentages of *D. labrax*

Age group	N	%
0	64	13.91
I	82	17.82
II	86	18.69
III	121	26.03
IV	96	20.65
V	9	01.95
VI	2	00.43
Total	460	100.00

Table 2: Fork length values of *D. labrax* age groups (mm) and statistical values control

Age	N	Fork length (cm) (min-mix)	Mean fork length	SE	p-value
0	64	15.5-18.7	17.74	0.1025	-
1	82	19-21.2	19.83	0.05.887	<0.05
2	86	19.2-26.7	23.25	0.3163	<0.05
3	121	25.5-31.1	28.72	2.7814	<0.05
4	96	28.3-35.8	32.79	0.1583	<0.05
5	9	36-42	38.02	0.6753	<0.05
6	2	52-54	53	1	<0.05

Table 3: Annual and proportional length increase of *D. labrax* age groups

Age	N	Mean fork length (cm)	Annual length increase	Relative length increase
0	64	17.74	-	-
1	82	19.83	2.09	0.1178
2	86	23.25	3.42	0.1724
3	121	28.72	5.07	0.2352
4	96	32.79	4.07	0.1417
5	9	38.02	5.23	0.1594

Table 4: Weight values of *D. labrax* age groups (g), average weight difference among individuals and statistical value controls

Age	N	Weight (g) (min-max)	Mean weight	SE	p-value
0	64	40-97	65.71	1.2576	-
1	82	70-100	86.89	0.8827	<0.05
2	86	117-313	199.36	5.0907	<0.05
3	121	190-431	309.93	5.0951	<0.05
4	96	324-530	412.95	5.1171	>0.05
5	9	525-640	598.33	17.353	>0.05
6	2	1490-1700	1595.0	10.05	<0.05

Table 5: Annual and proportional weight increase of *D. labrax* age groups

Age	N	Mean weight (g)	Annual weight increase	Relative weight increase
0	6	65.71	-	-
1	82	86.89	21.18	0.3223
2	86	199.36	112.47	1.2943
3	121	309.93	110.57	0.5546
4	96	412.95	103.02	0.3323
5	9	598.33	185.38	0.4489

( $R = 0.92$ ) was found between the length and weight of the individuals caught from Iskenderun Bay (Fig. 2).

**Condition coefficient :** The maximum, minimum and average condition values for *D. labrax* individuals with reference to age groups were given in Table 6. Of all individuals, the highest condition value was found as 3.15 in age III and the lowest value was found as 0.83 in the

Table 6: Condition values of *D. labrax* age groups

Age	N	Measurement			p-value
		limits (Min- Max)	Mean	SE	
0	64	0.83-1.75	1.1769	0.016	-
1	82	0.92-1.27	1.1142	0.008	<0.05
2	86	0.96-3.15	1.5862	0.039	<0.05
3	121	0.83-2.26	1.3083	0.028	<0.05
4	96	0.83-2.01	1.1713	0.024	<0.05
5	9	0.86-1.22	1.0886	0.035	<0.05
6	2	1.06-1.08	1.0713	0.009	<0.05

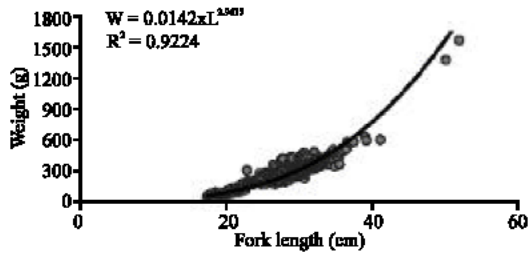


Fig. 2: Weight-length correlation of *D. labrax* individuals

age-group I. As a result of the *t* test, the difference found for age groups in all individuals was significant ( $p < 0.05$ ) (Table 6).

### DISCUSSION

It was determined that the ages of the individuals living in Iskenderun Bay varied between I and VI. With reference to the highest age group proportions of their studied regions in Mediterranean coasts, Barnabe<sup>[7]</sup> stated that age II was approximately 58% in Sete (Mediterranean coast of France); Stequert<sup>[24]</sup> declared that age I was nearly 44% in Archon (Atlantic coast of France) and Bou Ain<sup>[9]</sup> reported that age II was 28% in Tunisia (Mediterranean coast)<sup>[7,9]</sup>.

In this study, comparatively different results were obtained concerning the age groups. In addition to natural deaths, the deaths stemmed from fishers' attitude such as the catching device preferences, excessive fishing especially in migration and spawning seasons can determine this age composition. As the number of boats increases, the fishing intensifies in the country. As it was determined through a lot of researches, the fishing density leads to some significant changes in the amount of species, and, related to these, the morphological and genetic differences. That the number of the fish whose ages were between 0 and IV was found to be very high and the number of those V and IV years old was too low shows that there is a catching pressure on this species. Excessive fishing can cause many morphological changes in growth rate, body length and weight, sexual maturation time, sexual maturation age, fecundity and spawning time for this species.

The total length values for *D. labrax* of Mediterranean coasts found by Gravier<sup>[2]</sup> and Bou Ain<sup>[9]</sup> look similar to the values found through this study. It seems that the total values found for *D. labrax* living in Mediterranean Coasts (Egypt) by Rafail<sup>[25]</sup>, in Irish coasts by Kennedy and Fitzmaurice<sup>[8]</sup> and in Marseille, Mediterranean coasts of France, by Guerin-Ancey<sup>[6]</sup> have similarities with the fork length values of those living in Iskenderun Bay<sup>[8]</sup>.

Particularly, in the studies carried out for coastal waters by Kennedy and Fitzmaurice<sup>[5]</sup>, Barnabe<sup>[8]</sup>, Stequert<sup>[24]</sup>, Rafail<sup>[25]</sup> and Boulineau<sup>[26]</sup> the growth was seen to be slow. This slowness can be observed because of the fact that the Mediterranean Sea waters are poor in nutrients and its heat and salinity rates are comparatively high. Furthermore, the environmental and geographical condition of the studied region and climatic factors can affect the growth rate considerably.

The annual length increase of 460 *D. labrax* individuals caught in Iskenderun Bay raises regularly. As for the relative length increase, although it is high at first ages, it decreases at 4 and 5 ages. Annual weight increase is lesser at the age group II compared to the groups II and IV. Proportional weight increase is lesser at the older age groups. It was also determined that males grow more slowly compared to females. The growth speed is fairly high for the first age in warm seas. However, since the sexual characteristics develop at this stage and the energy is spent for gonad development, this speed decreases at the second age<sup>[27]</sup>. In addition to this, while protein metabolism plays an effective role at early ages, the carbon-hydrate metabolism becomes effective at older ages, which leads to a weight growth<sup>[28]</sup>.

It is urgent that authorities should take necessary measures to prevent catching of the young members of *D. labrax* family, which have fairly high economical value. As long as there are no significant interventions, living marine sources, which can survive and renew themselves constantly, will continue to be very rich food sources and merit for economical income of for nations.

Since an extensive fishing especially affects the age distribution of *D. labrax* living in Iskenderun Bay, it is also vital that the individuals younger than three ages, which haven't developed the sexual maturation, yet, not be caught. The search of the growth features of *D. labrax* living in our coasts will help to some other searches to be carried out in other coasts.

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