

Natural History of Sole (*Solea vulgaris* L. 1758) in the Amvrakikos Gulf (Greece)

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INTRODUCTION

Sole, *Solea vulgaris* L., is an important commercial species of flat-fish, which contributes to the fisheries in estuaries, backwaters and inshore areas. It ranges from Senegal to Norway, along the eastern coast of the Atlantic Ocean, the Mediterranean Sea and the southwestern Black Sea (Whitehead *et al.*, 1986). The species is very common in Greek seas, living on soft bottom at depths ranging from 5 to 80m, and it is actively exploited, mainly by coastal fisheries. Several authors have summarized and discussed the occurrence and life history of the species in the Mediterranean Sea, but no relative information is available of Greek seas. The purpose of this work was to investigate certain aspects of the life history of sole in the Amvrakikos gulf (Greece).

MATERIAL AND METHODS

Between December 1986 and March 1987, monthly samples of sole, amounting to 237 specimens, were obtained from trammel net catches. All nets were 1.2m deep by 200-250m long and had 3 panels of mesh 40-(16-17)-40mm from knot to knot. The duration of fishing varied between 10 and 14 h. Total length (TL) to the nearest mm, weight to the nearest g, sex and gonad maturity, when possible, were recorded. Age was determined by otolith reading. Mortality estimates were calculated by the catch curve method of Pauly (1983).

RESULTS

A length-frequency distribution of 237 soles based on the total length at capture, over the study period, is illustrated in Fig.1. Since the size of the sample and the sampling period were small, all data were combined. Both sexes were combined, since no difference in length was found between them. The TL distribution ranged from 9.0 to 35.0cm, whilst the major peak of abundance was in the length range 21.0-31.0 cm. The

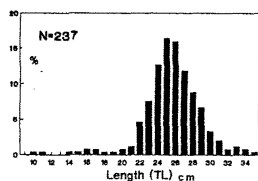


Fig. 1. Length frequency distribution of sole (1986-1987)

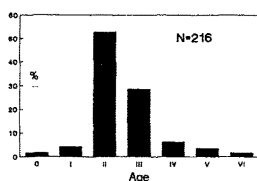


Fig. 2. Age distribution of sole in the Amvrakikos Gulf (1986-1987)

presence of young sole, 9.0-21.0cm, representing age group 0+ and I+, was very low, not exceeding 13%.

The age distribution of sole, presented in Fig.2, shows that the longest size grouping included fish with ages ranging from 0 to VI years, whilst the age groups II and III were represented by over 80%. The scarcity of $+11$ can be attributed to the selective action of the trammel nets used and to the dispersal of fish according to maturity or their ecology in different parts of the gulf.

The relationship between total length (TL) in mm and otolith radius (R), obtained with 211 individuals, was: $TL=66.2+3.66XR$ (correlation coefficient 0.954).

TABLE I. Back-calculated TL in mm of sole from the Amvrakikos Gulf

Age group	Number of individuals	Length at capture	Calculated length at end of year					
			I	II	III	IV	V	VI
I	10	180.9	164.3					
II	113	241.6	171.7	221.5				
III	62	266.1	170.4	223.2	250.9			
IV	14	283.9	168.8	219.2	250.8	296.6		
V	7	299.9	172.9	227.3	258.6	282.2	296.3	
VI	5	330.0	173.1	228.0	262.4	291.7	312.2	326.8
Average length			170.8	222.2	252.1	277.2	302.9	326.9
Number of individuals			211	201	88	26	12	5

The growth parameters were obtained from the length at time of capture for all fish aged 0-VI (sexes combined) and used to calculate the von Bertalanffy equation. The asymptotic length was found 348.8 mm, the growth coefficient (K) was 0.38, and the "age" at which the fish would have length zero if they always grew according to the equation (t_0) was equal to -0.41.

The length-weight relationship was developed using the general equation $W=aL^b$, where W weight in g, and L length in mm. No significant differences was found between sexes (analysis of covariance test). During the course of the survey, a total of 237 fish was weighed and the computed length-weight relationship (sex combined) was $a=0.000003$ and $b=3.172$.

As sampling was not representative over the whole year, the estimated mortality refers to the winter months, which are also those of the reproduction. A length converted catch curve based on the total catch was used to calculate total mortality (Z) = 0.769 (Pauly, 1983). An empirical estimate of the natural mortality (M) = 0.26 was obtained using Pauly's equation (1983). Thus, the exploitation ratio was computed, $E=0.75$, indicating that the fishing pressure on the sole stock in the area was rather high. The reproduction in the Amvrakikos Gulf takes place between December and March. Some immature individuals were caught in summer.

REFERENCES

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