

THE REPRODUCTIVE NICHE OF SARDINA PILCHARDUS Walb.

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Results from several ichthyoplankton surveys of *Sardina pilchardus* Walb., in relation with the optimum environmental conditions under which Sardine spawns, have been studied and compared with additional data from five locations in the Aegean Sea, in order to elucidate the reproductive niche of this species.

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Les résultats de quelques campagnes ichthyoplanctoniques relatives à *Sardina pilchardus* Walb. en relation avec les conditions optimales de reproduction de cette espèce, sont discutés et comparés avec les données obtenues dans 5 autres secteurs de la Mer Egée, afin d'élucider la niche reproductive de ces espèces. Les concentrations les plus fortes des oeufs de Sardine sont toujours trouvées à des faibles profondeurs jusqu'à 100 mètres, mais les périodes reproductives et les fluctuations optimales des températures et des salinités ne paraissent pas avoir un effet déterminant sur la reproduction de cette espèce. On doit, par conséquent, considérer que d'autres facteurs du milieu contribuent à la maturation et à la ponte, facteurs agissant entre les périodes reproductives.

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Sardina pilchardus Walb. is a well known winter breeding species whose reproduction occurs all over the Mediterranean, the Western European and the North Western African coasts of the Atlantic Ocean. The northern limiting latitude, where reproduction takes place, seems to reach the south coastal waters of England and the South Western North Sea.

A comparison of the environmental factors, reported by several authors from the aforementioned regions, that is, the spawning depth, the period of the year and the optima of temperatures and salinities, has been made in order to clarify the reproductive niche of this species.

Results and Discussion.

Table I, presents data from the different reproduction sites, on the spawning depth of *Sardina pilchardus*. The spawning depth limit

TABLE I

<i>spawning region</i>	<i>author</i>	<i>mean depth at spawning areas</i>	<i>depth limit</i>
Western Aegean Sea	Yannopoulos et al., 1978	60 m.	
Western Aegean Sea	Yannopoulos et al., 1973		100 m.
Sea of Marmara	Demir et al., 1961, 1969	25- 65 m.	65 m.
Adriatic Sea	Karlovac, 1967, 1969	100 m.	150 m.
Gulf of Lion	Aldebert et al., 1970		
	Aldebert et al., 1971	80-100 m.	100 m.
	Lee, 1966	35- 70 m.	100 m.
Alboran Sea	Massuti, 1955	100 m.	150 m.
Atlantic Ocean, Plymouth, England	Demir et al., 1974	37- 74 m.	

seems to be around 100 meters.

Table II, shows the spawning period during the year. It could be noticed that even if there are approximate similarities, since the species is a winter breeding one, the data in existence vary considerably within the various regions and they do not fit together very well as far as the beginning and the expiration of the reproductive function is concerned. On the other hand there is an almost complete lack of information about the period that the maximum densities of *Sardina pilchardus* eggs may usually be obtained.

Table III, gives data on temperature and salinity and the ranges at which the denser concentrations have been calculated. It is noticeable that some of the optimum ranges do not overlap and some others are quite wide so that it is really impossible to define the proper temperature and salinity at which reproduction should occur.

Discussing the various data obtained from five locations of the Aegean Sea, (Yannopoulos et Yannopoulos, 1978), it was concluded that the egg patches with the maximum densities were found at regions with depths varying from 40 to 90 meters. Temperature and salinity

TABLE II

spawning region	author	<i>Sardina pilchardus</i> Walbaum. Eggs	
		present	max density
Western Aegean Sea	Yannopoulos et al., 1978	November-May	
Eastern Aegean Sea	Demir, 1969	December-July	
Black Sea	Svetovidov, 1952		
	Vodyanitsky et al., 1954	July-August	
Sea of Marmara	Demir, 1969	November-July	
Adriatic Sea	Karlovac, 1969c	October-May	December-February
Gulf of Lion	Lee, 1966	September-March	
	Lee et al., 1967		
	Aldebert et al., 1977	December-March	
	Aldebert et al., 1971	September-June	December-February
Atlantic Ocean, Plymouth, England	Demir et al., 1974	all the year	June-July October-November
Atlantic Ocean, Morocco	Furnestin et al., 1959	fall-spring	winter

optimum ranges did not overlap, as for instance the ones from the Thermaikos Gulf (15.5 - 17.5 °C, 33.0 - 35.8 o/oo) and the Saronikos Gulf (13.6 - 14.6 °C, 38.3 - 38.5 o/oo). Oxygen varied within the same range at all locations while the chl-a concentrations presented great variations among the five vicinities and were not correlated with the egg maximum densities.

Conclusions.

The following conclusions may be drawn:

The spawning depth limit seems to be around 100 meters.

The spawning period varies considerably during the year, at the different regions.

Optimum ranges of temperatures and salinities do not generally overlap so it is rather impossible to conclude about common ones, applicable

TABLE III

<i>spawning region</i>	<i>author</i>	<i>temperature °C</i>	<i>salinity o/oo</i>
Western Aegean Sea	Yannopoulos et al., 1978	optima 12.4-17.5	33.0 -38.8
Sea of Marmara	Demir et al., 1961	surface 8 -23 below 30 m. 14 -15	23 -26 38.5
Adriatic Sea	Karlovac, 1967	11.4-19.3 optima 11.4-15.7	34.43-38.40 36.15-37.56
Adriatic Sea, open	Karlovac, 1969	15.2-15.4 Dec. opt. 16.0 Feb. opt. 13.8	38.28-38.43 37.71 37.78
Adriatic Sea, canals Jugoslavia	Karlovac, 1969, 1974	14.6-14.8 Dec. opt. 15.9 Feb. opt. 13.5	37.75-37.96 37.45 37.36
Gulf of Lion	Aldebert et al., 1971 Lee, 1966	10.7-18.0 optima 11.5-14.0 11.3-21.1 lower limit 11.0	36.90-38.30 37.6 -38.3 36.08-38.20 36.0
Atlantic Ocean, Plymouth, England	Demir et al., 1974	10.0-16.0 optima 12.0-15.0	35.00-35.30
Atlantic Ocean, Morocco	Furnestin et al., 1959	15.5-20.0 optima 16.0-18.0	

to all reproduction sites.

The eutrophication of a certain region, as concluded from the Aegean Sea data, does not have a direct influence on the egg laying of *Sardina pilchardus*.

If the environment is responsible for stimulating egg deposition of *Sardina pilchardus*, then, this function must be initiated by factors not specified yet.

Similar problems have appeared from studies on other species, (Smith et Lasker, 1976).

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