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Present Condition of Small Pelagic Fishes in the Black Sea

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Abstract

Recent data on the fat content and abundance of sprat and anchovies are considered here along with data related to sea temperatures and phytoplankton biomass. Findings showed that significant changes in fish conditions were strongly related to environmental factors.

Key words: Sprat, anchovy, sea temperature, phytoplankton biomass, fish fat content, stock abundance.

INTRODUCTION

The situations of small pelagic fish in the Black Sea change very quickly. Therefore it is important to understand the changes that have occurred over the last few years. We would like to provide new data on sprat *Sprattus sprattus phalericus* (Risso, 1827) and anchovy *Engraulis encrasicolus ponticus* (Aleksandrov, 1927) stock condition that was obtained and published recently. This will help us understand the tendencies of such changes and their relationships with environmental factors. At the same time it will allow people to further understand situations in the Black Sea pelagic ecosystem and the small pelagic fishes at present are in the upper level of its trophic chains.

Recent results of estimation sprat and anchovy condition

Temperature and food supply are two the most important environmental factors that control stock and population conditions of mass small pelagic fish in the Black Sea (Fig.1) [1]. It is well known that in the Black Sea water temperature rose in the last decade due to global warming (Fig.2) [2]. This change strongly impacted the fat content of cold-tolerant sprat, which indicates a worsening of the fish's food supply and a decrease in fat content (Fig.3). This negative effect decreases the energy potential of the sprat population. On the other hand the rising temperature positively influenced the fat accumulation of heat-tolerant anchovy (Fig.4)

There is relationship between fat content of fish populations and their stock abundance. We demonstrate this with data pertaining to sprat populations (Fig.5). Due to the significance of food supply for the abundance of small pelagic fish we show the connection between primary fodder base (phytoplankton concentration) of the Black Sea pelagic ecosystem and total biomass of anchovy and sprat stocks during last 5 decades [3]. We compared phytoplankton concentrations in Pre-Danube shallow region of largest primary productivity [4] with the stock value of anchovy + sprat [4,5]. Data on stock value for several years are absent but there is high correlation between stock values and catch and landing of small pelagic fish for periods of 1967-1992 years [Fig.6]. We revealed close correlation between phytoplankton biomass and fish stock values (Figs. 7,8 and 9), excluding period of so named ecological crisis (1989-1992). This relationship (Q-value, Table 1) is a good indicator for estimating the connection between small pelagic fish abundance and state of primary fodder base in the Black Sea ecosystem (efficiency of fish production). This Q-value shows that situation in the Black Sea pelagic ecosystem in 2000s did not return to pre-euthrophication period (1960s) and was in an intermediate position between the 1960s and 2000s.

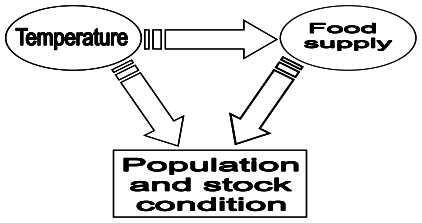

Fig. 1. Influence of temperature and food supply on population and stock condition (scheme) [1]

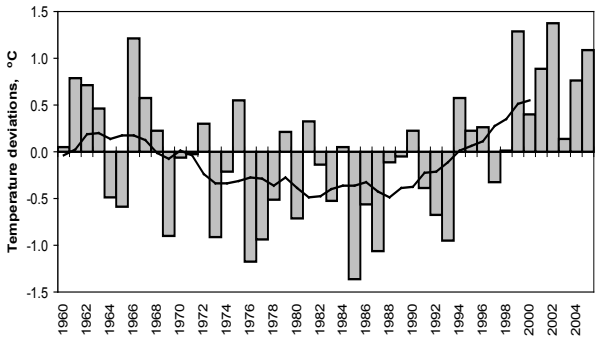

Fig. 2. Long-term deviations of annual surface water temperatures in the Black Sea off South Crimea from 1960–2005. Mean is indicated by bars; solid line indicates the data smoothed with the 11-year filter [2]

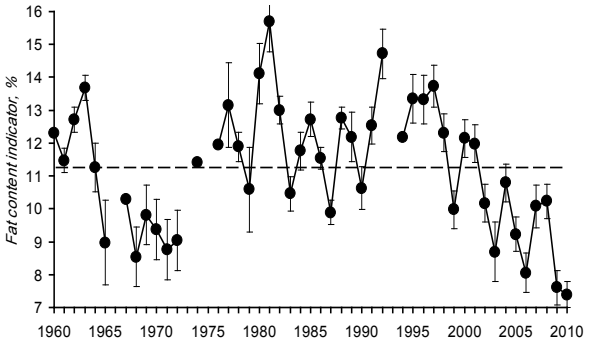

Fig 3. The dynamics of fat content in sprat population at the end of the feeding period (June-August)

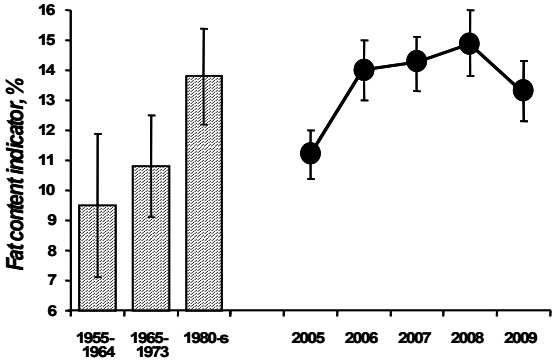

Fig. 4. The dynamics of fat content in Black Sea anchovy at the end of the feeding period (November – December)

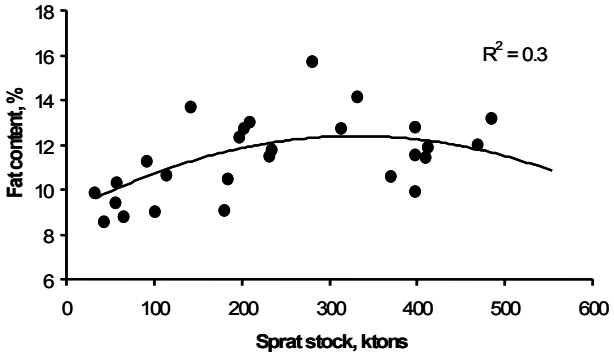

Fig. 5. Relationship between sprat fat content and stock biomass at the end of feeding period

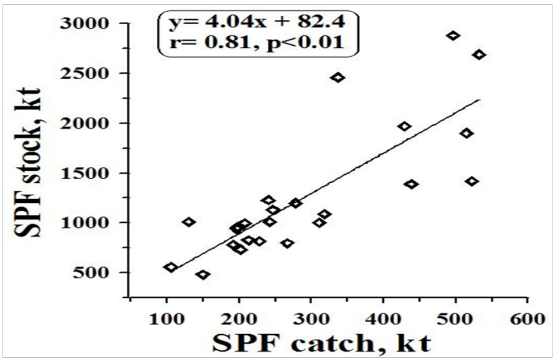

Fig. 6. Relationship between the stock abundance (biomass) and landings of small pelagic fishes in 1967 – 1994 years [3]

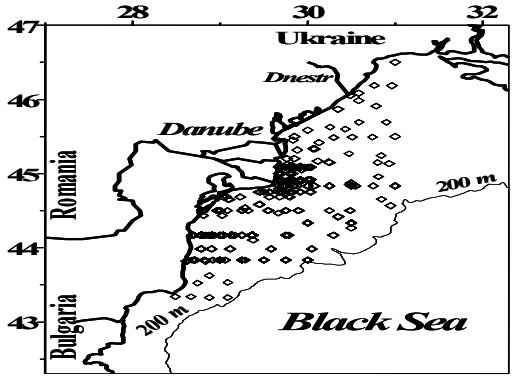

Fig. 7. Location of stations on the northwestern shelf where the phytoplankton samples were taken [3]

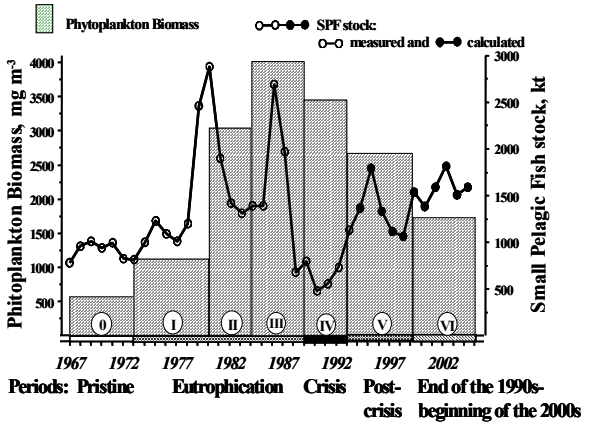

Fig. 8. Long term changes in the phytoplankton biomass on the northwestern shelf (columns) and the stock abundance of small pelagic fishes [3]Interannual periods distinguished: 0 – pre-eutrophication; I, II, III – the first, second and third eutrophycation phases; IV – environmental crisis phase; VI – current phase [3]

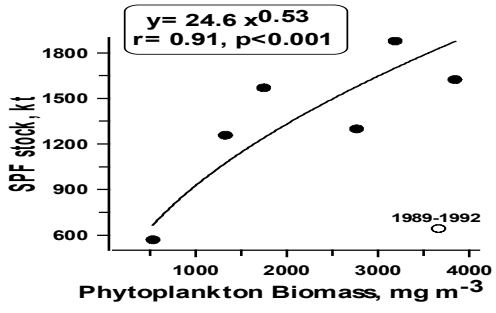

Fig. 9. Relationship between the long-term changes in the average value (biomass) of the stock of small pelagic fishes and phytoplankton biomass on the northern shelf [3]

Table 1. Characteristics of the pelagic ecosystem of the Black Sea (mean data for interannual periods) [3]. Q-value -- relation between average value (biomass) of the stock of small pelagic fishes and phytoplankton biomass

Parameter	*Interannual period*						
	0	**I**	**II**	**III**	**IV**	**V**	**VI**
	1967–1972	*1973–1979*	*1980–1983*	*1984–1988*	*1989–1992*	*1993–1998*	*1999–2004*
Stock of small pelagic fishes, thousand tons	570	1258	1877	1624	640	1300	1570
Phytoplankton biomass, thousand tons	397	1004	2740	3602	1805	1415	1574
Q–value	**1.44**	**1.25**	**0.69**	**0.45**	**0.35**	**0.92**	**1.00**

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