

# IMPORTANCE OF CILIATED PROTOZOA TO THE CULTURE OF THE MUSSEL *MYTILUS GALLOPROVINCIALIS* L. IN THE BAY OF MALI STON, CROATIA

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## Abstract

This study addresses the influence of ciliated protozoans on the Black Mussel, *Mytilus galloprovincialis*, in Mali Ston Bay (Croatia), an important regional bivalve farming area. A peak in bivalve larvae, mostly Mytilidae, was noted a few weeks after an intensive development of ciliated protozoans. The smallest fraction of ciliates presents a suitable food resource for larvae, whereas the larger fraction appears to be the major food source for adult mussels. These favorable nutrition conditions occur at the onset of spawning, and during the period at which larvae are most numerous.

**Keywords:** bivalve larvae, ciliated Protozoa, Adriatic

## Introduction

Mali Ston Bay on Croatia's southern Adriatic coast is one of the more important bivalve farming areas in Europe. The two main species cultured are the Black Mussel, *Mytilus galloprovincialis* (Lamarck, 1819), and the European flat oyster, *Ostrea edulis* (Linnaeus, 1758).

As filter-feeders, shellfish require an adequate supply of phytoplankton for their successful cultivation (1, 2), but non-algal food also may play an important role in their nutrition, especially when phytoplankton are at seasonal lows. For example, mussels kept in experimental marine enclosures reduced microzooplankton biomass – mainly tintinnids and oligotrich ciliates – by more than 50%.

Systematic description of the interrelations between key ecological factors and ciliate populations – with particular attention to their influence on commercial bivalve larvae – yet has not been made. The present work analyzes the spatio-temporal distribution of bivalve larvae in relation to ciliated protozoa and hydrography in Mali Ston Bay.

## Materials and methods

Weekly samples were collected from December 2001 to June 2002 at Bistrina station, in the inner part of Mali Ston Bay (42°53'N 17°42'E). Temperature and salinity were measured with a WTW multiline hydrographical probe, and samples of planktonic ciliates and micrometazoans were taken with a 5-l Niskin bottle at 2-m intervals, down to 6 m.

## Results and discussion

The inner part of the Mali Ston bay abounds with natural beds of *M. galloprovincialis*, and their larvae dominate the plankton throughout the year. Spawning is intense from February to June.

Temperature (Table 1) ranged from 6.9° to 25.1° C. Relatively low temperatures (<13°C) correlated significantly with increased numbers of bivalve larvae (Table 2) in Mali Ston Bay, as is the case in the northern Adriatic (3).

There was also a highly significant correlation between larval abundance and salinity. This is consistent with other reports (1, 3) that salinity from 35 to 36 psu is related to mass occurrence and survival of this mussel.

Food availability has, perhaps, the greatest influence on larval development. Despite the accumulated information of the influence of a diverse range of phytoplankton species of the growth and development of mussel larvae, there still are few data that address the possibility of using ciliates for food. The significant correlation between ciliate numbers and bivalve larvae (Table 2) suggests the importance of ciliated protozoa in larval nutrition: The highest protist biomass-recorded from the end of January to mid April, and which spanned the period during which the larvae of commercial bivalves were found in the plankton-consisted mainly (mean 76.5%) of oligotrich ciliates. In the presence of this high number of ciliates, the larvae presumably fed on the smallest fraction (<20 µm in size). On the other hand, according Kršinić (4), the

**Table 1. Range, mean ± SD of temperature (°C) and salinity (psu) from December 2000 to June 2001 at Bistrina station in Mali Ston Bay.**

December 2000 – June 2001								
	Surface		Depth 2m		Depth 4m		Depth 6m	
	Temp	Sal	Temp	Sal	Temp	Sal	Temp	Sal
Min	6.9	22.1	6.9	31.1	7.3	32.0	7.7	33.1
Max	25.1	36.7	25.0	37.0	24.0	37.5	23.8	37.9
Mean	13.7	33.9	13.7	34.9	13.8	35.8	13.8	36.4
SD	4.5	3.3	4.3	1.5	4.1	1.3	3.7	1.2

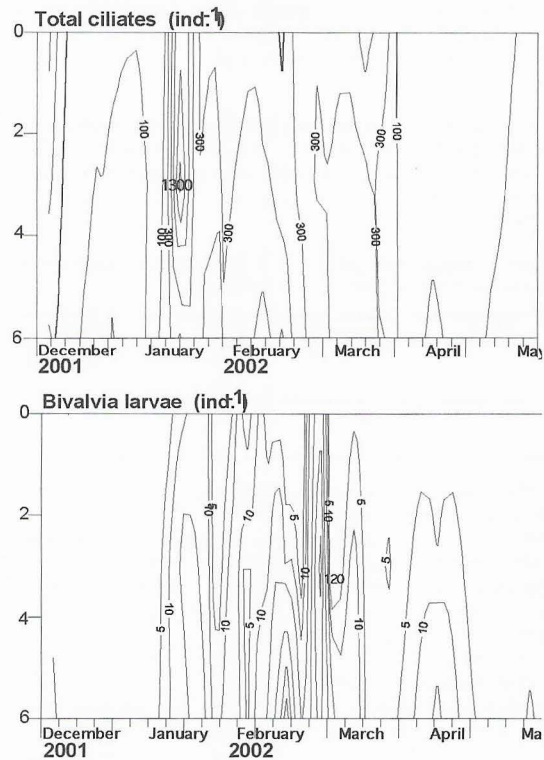
**Table 2. Pearson r-correlation coefficients between bivalvia larvae, salinity, temperature, oligotrich ciliates, tintinnines and total ciliates.**

	Temp	Sal	Olig ciliates	Tin	Total ciliates
<b>Bivalvia larvae</b>	0.544** *	0.634** *	0.233*	0.182	0.218*

(\*P<0.05; \*\*\*P<0.001)

larger size of ciliates found in winter are a major source of food for adult mussels through early spring, the time when spawning begins.

These results present circumstantial evidence that during winter and early spring ciliated protozoans play a great role in the successful culture of mussels in Mali Ston Bay.



**Fig. 1. Distribution of total ciliates and bivalvia larvae density (ind. l<sup>-1</sup>) at Bistrina station in Mali Ston Bay.**

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