SKELETONEMA COSTATUM (GREV.) CLEVE IN THE NORTHERN ADRIATIC (JUNE 1999 - JULY 2002)

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Abstract
Abundance and apparent frequency of the diatom *Skeletonema costatum* were investigated for three years (June 1999 - July 2002), at seven stations, representing the western (eutrophic) and eastern (oligotrophic) northern Adriatic Sea. The relation of *S. costatum* with transparent exopolymer particles (TEP), a possible precursor of macroaggregation, recurrent in the northern Adriatic Sea, was analysed as well.

Keywords: Skeletonema costatum, Adriatic, nutrients, TEP

Introduction

The microphytoplankton of the northern Adriatic Sea is greatly influenced by the nutrients brought with the Po River (1, 2), which are particularly high in spring (May and June) and recently, even higher in the autumn, mostly in October (3). The abundance and apparent frequency of *Skeletonema costatum*, one of the prominent blooming diatoms in the eutrophic areas of the northern Adriatic Sea, increased markedly in the 80's and 90's (4). High stickiness properties (5) and the association of this diatom with mucus macroaggregates (6) were the reasons to investigate the possible connection of the *S. costatum* with TEP.

Materials and methods

Samples were collected monthly from June 1999 to July 2002 at seven stations along a profile from the Po River Delta, Italy, to Rovinj, Croatia, at six depths (surface, 5, 10, 20, 30 m and bottom). Samples for phytoplankton analysis were preserved with Lugol's solution, buffered with sodium acetate, and counted using a Zeiss inverted microscope, with the Utermöhl settling technique. TEP concentrations were measured by the Alcian blue colorimetric method, using Xanthan Gum as an equivalent (7).

Nutrients analysis was performed with spectrophotometric methods widely used in oceanography. Salinity was measured with a Yeo-Kal MKII high precision salinometer (8).

Results and discussion

During the research period, the abundance of *S. costatum* varied from $3{,}7 \cdot 10^2$ to $2{,}4 \cdot 10^7$ cells L^{-1} (mean $2{,}5 \cdot 10^5$ cells L^{-1}, median $8{,}88 \cdot 10^6$ cells L^{-1}). Generally, the highest values and frequencies of *S. costatum* were measured in the upper layer (0-10m), at the western (eutrophic) and decreased horizontally towards eastern (oligotrophic) region and vertically with depth (Fig. 1.).

Highly significant positive correlations between the diatom and nutrients, and negative with salinity (Table 1), confirm the influence of the Po River on the dynamics of the *S. costatum*.

Significant positive correlation between the *S. costatum* and TEP, in the upper layer of the western region, was determined during the whole period. Moreover, in about 40% of cases, when the concentrations of TEP were the highest, the dominance and high abundances of *S. costatum* were marked as well. Although it was established that *S. costatum* is not a high producer of exopolysaccharide material (9), which results in the formation of TEP, our data indicates that this diatom should be investigated further in this context.

Table 1. Pearson correlations of log abundances of *S. costatum* cells with temperature, salinity, nutrients and log/c(TEP).

Region	Western					Eastern				
Depth/m	(0m, 5m and 10m)			(20m, 30m and bottom)		(0m, 5m and 10m)			(20m, 30m and bottom)	
Period/ month	X-II	III-V	VI-IX	X-II	III-V	X-II	III-V	VI-IX	X-II	III-V
Temperat.	-0.448 **	0.149	0.376	-0.388	-0.338	0.119	0.227	0.597	-0.124	-0.094
Salinity	-0.415 *	-0.655 **	-0.602 **	-0.028	0.380	-0.356	-0.517	0.023	-0.000	-0.539
Oxygen saturation	0.468 **	0.488 *	0.720 **	0.526	0.107	0.484 *	0.723 **	0.075	0.062	0.453
Phosphate	0.336 *	0.627 **	0.633 **	-0.562 *	0.229	0.415 *	0.678 **	0.697	0.798 *	-0.176
Silica	0.384 *	0.480 *	0.402	-0.537	-0.138	-0.393	-0.380	0.048	-0.112	0.312
Total inorganic N	0.439 **	0.638 **	0.341	-0.272	0.013	-0.036	0.372	0.100	-0.041	-0.123
TEP	0.405 *	0.513 **	0.711 **	0.488	0.101	0.059	0.697 **	0.408	0.435	-0.117

*(p<0,05), **(p<0,01). Correlations for lower layer, in the period VI-IX were impossible to obtain due to scarce appearance of *S. costatum*.

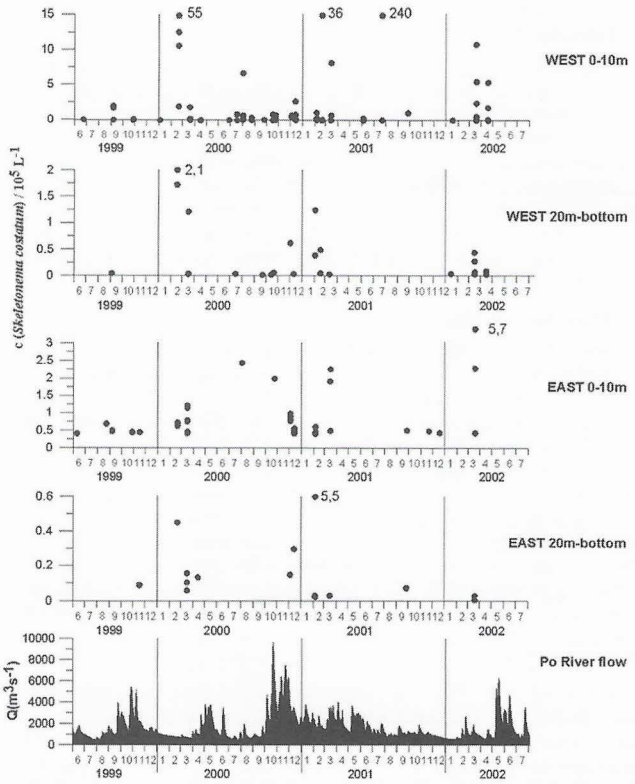

Fig. 1. Abundance of *S. costatum* (c/$10^5 L^{-1}$) during the analysed period (June 1999-July 2002) in the northern Adriatic, with the Po River flow.

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