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Importance of studying regional biodiversity of benthic marine diatoms and cyanobacteria for bioindication of organic pollution in marine environments

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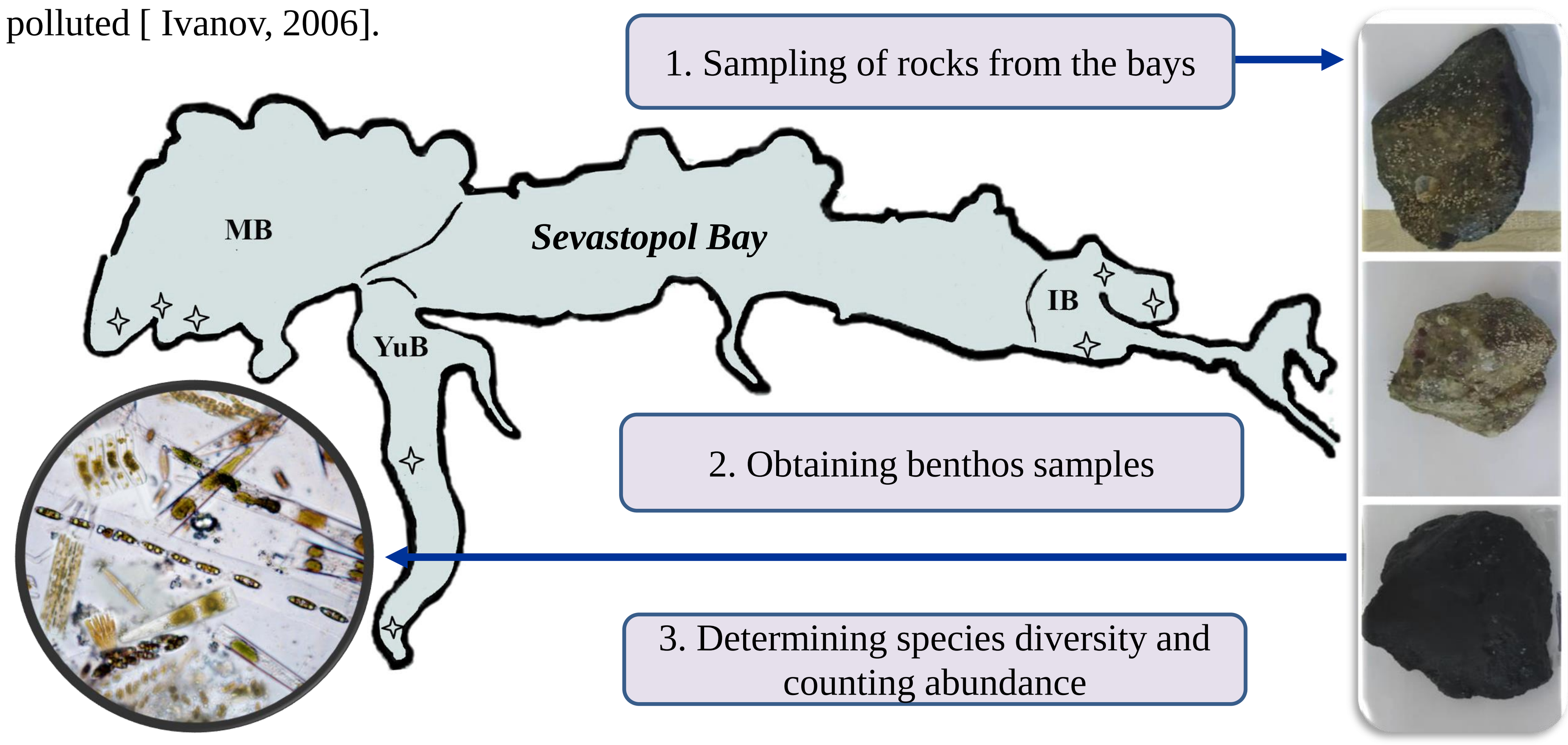
INTRODUCTION & AIM

Water quality monitoring using data on the biodiversity of living organisms has been known for a long time. A saprobic system based on lists of organic pollution indicator species is well developed for freshwaters, but not yet established for marine waters. Benthic diatoms and cyanobacteria are known bioindicators. **The aim of the study was to assess the diversity of benthic diatoms and cyanobacteria in the epilithon of the three areas with different levels of eutrophication in Sevastopol Bay, Black Sea, for their use in general water quality assessment.**

METHOD

Pollution of three areas of the bay according to long-term hydrochemical data: Martynova Bay (MB) – relatively clean, Inkerman Bay (IB) – moderately polluted, Yuzhnaya Bay (YuB) – heavily polluted [Ivanov, 2006].

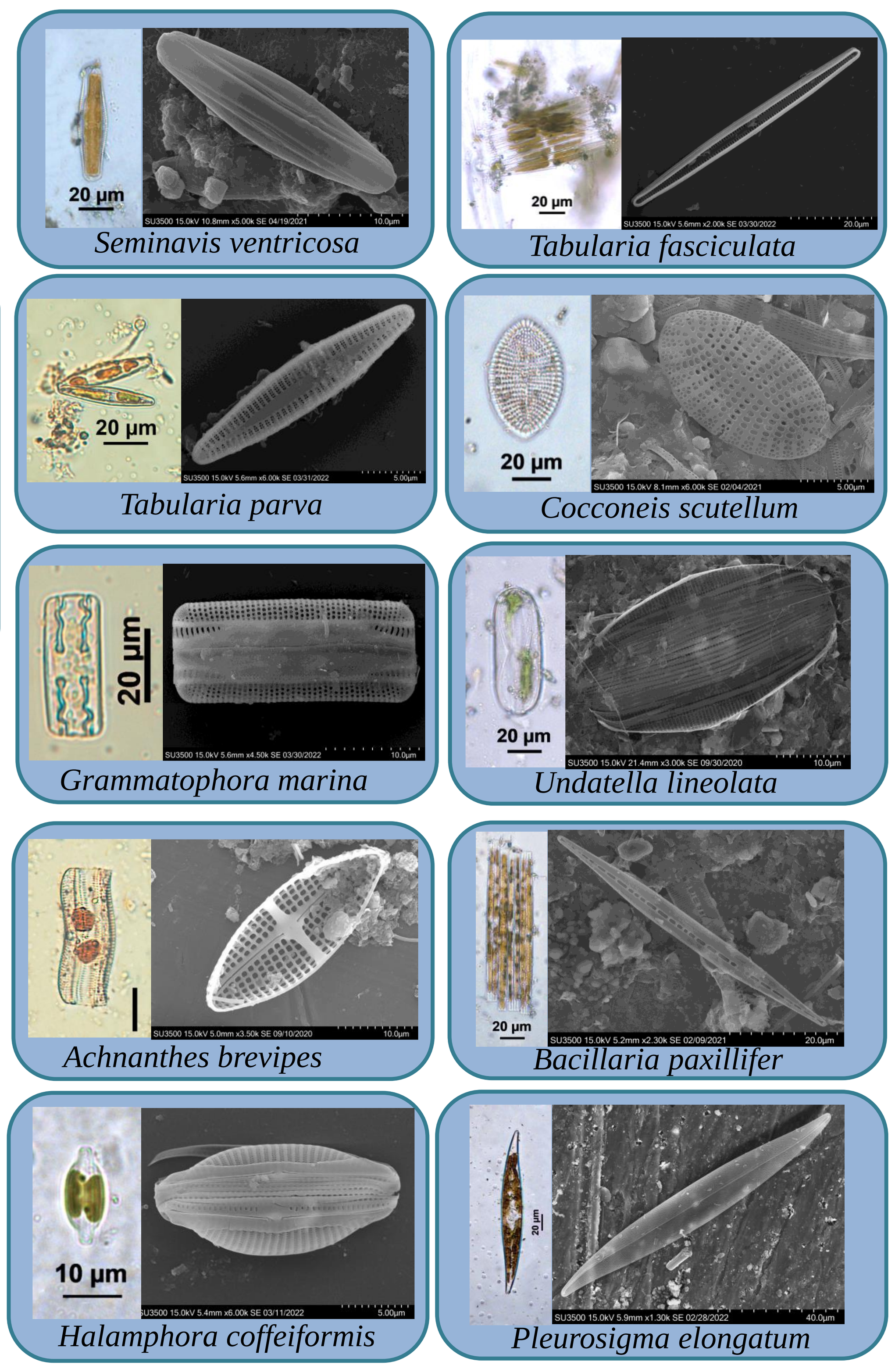


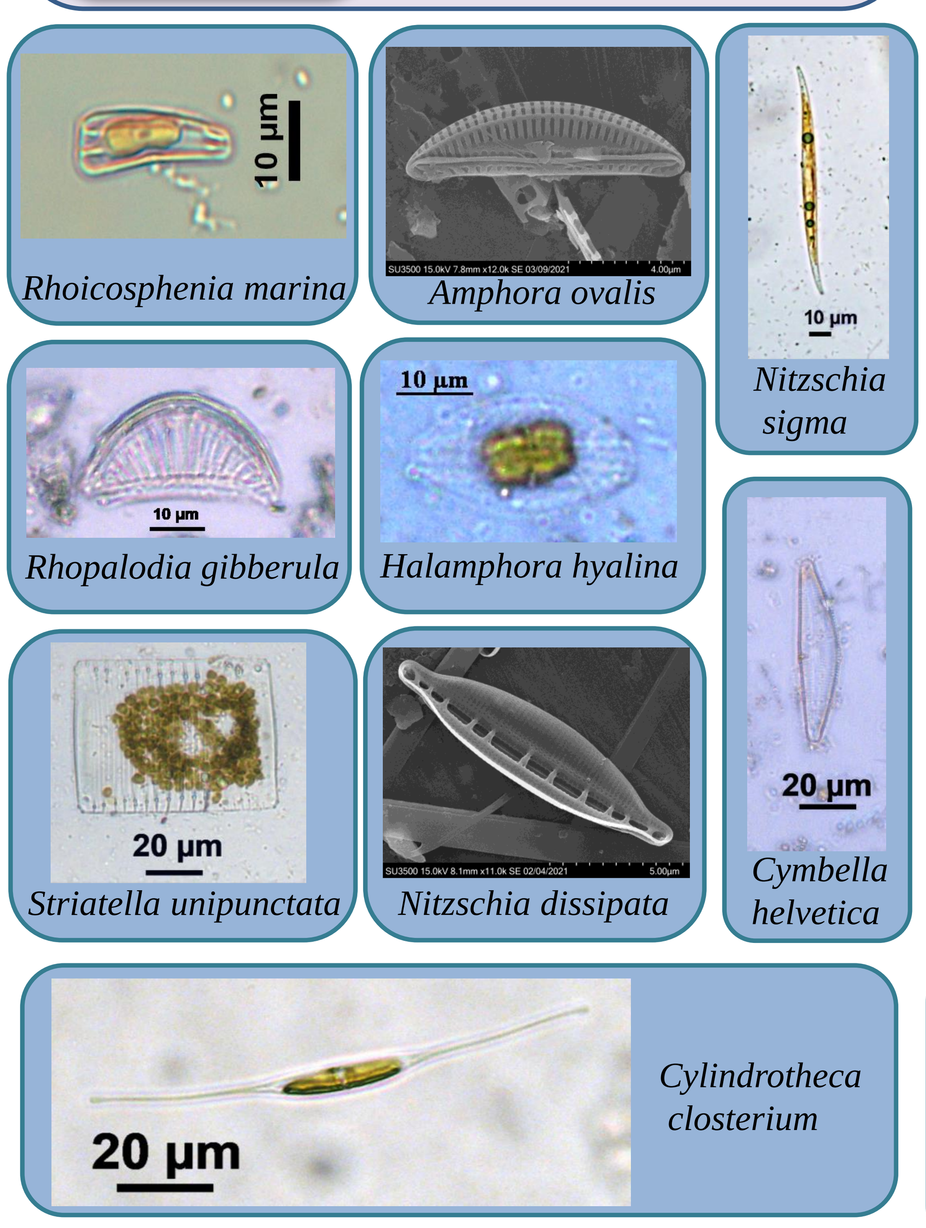
Indices of diversity were determined: Margalef (**D**), Shannon (**H**), Berger-Parker (**IBP**). The saprobic index was calculated according to Pantle & Buck's (**S**) method modified by Sládeček, using species significance indices (s_i) from literature.

$$S = \frac{\sum_{i=1}^{N}(s_i \cdot h_i)}{\sum_{i=1}^{N} h_i}$$

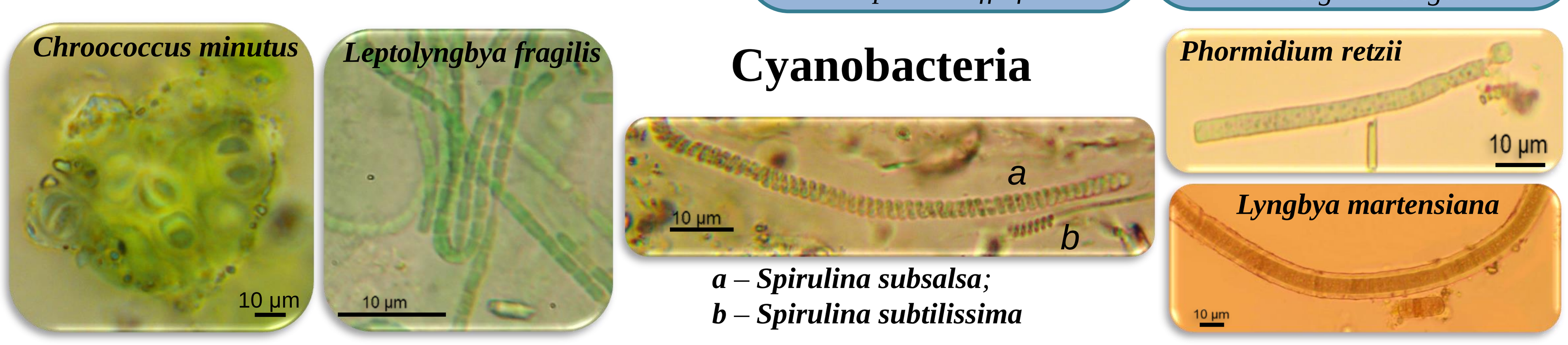
where **N** – is the number of indicator species and h_i is the relative abundance of the **i**-th species.

Indicator species. Bacillariophyta





Cyanobacteria



a – Spirulina subsalsa;
b – Spirulina subtilissima

RESULTS & DISCUSSION

A total of 63 diatoms and 20 cyanobacteria species were found in Sevastopol Bay, from them 21 and 6 were saprobionts, respectively. Based on diversity indices, it was found that the most favorable conditions for both diatoms (H=2.65; D=7.67; IBP=0.28) and cyanobacteria (H=1.83; D=2.2; IBP = 0.25) were in the MB. The worst conditions were formed in the YuB: for diatoms H=2.24; D=5.17; IBP=0.28; for cyanobacteria: H=1.04; D=0.67; IBP=0.5.

Table 1. Values of diversity indices of benthic diatom (DIA) and cyanobacterial (CB) epilithic communities of the three coastal waters area of the Sevastopol Bay.

Study area	Margalef Species Richness Index (D)		Shannon index (H)		Berger-Parker Dominance Index (IBP)	
	DIA	CB	DIA	CB	DIA	CB
MB	7.67	2.20	2.65	1.83	0.185	0.25
IB	7.23	1.00	2.66	1.20	0.196	0.40
YuB	5.17	0.67	2.24	1.04	0.28	0.50

The diatom saprobic index showed that waters of MB belong to the β-mesosaprobic: S_{MB} = 1.9. Meanwhile, S_{YuB} = 2.2 (β-α-mesosaprobic) and S_{IB}=2.5 (α-mesosaprobic). Therefore, the IB area is the most polluted, which is not in accordance with the obtained diversity indices and hydrochemical data. In the case of cyanobacteria, the results of the saprobic index estimates were also not in agreement with the long-term data from the hydrochemical analyses: water in MB is more polluted than in IB, but in fact MB is the cleanest.

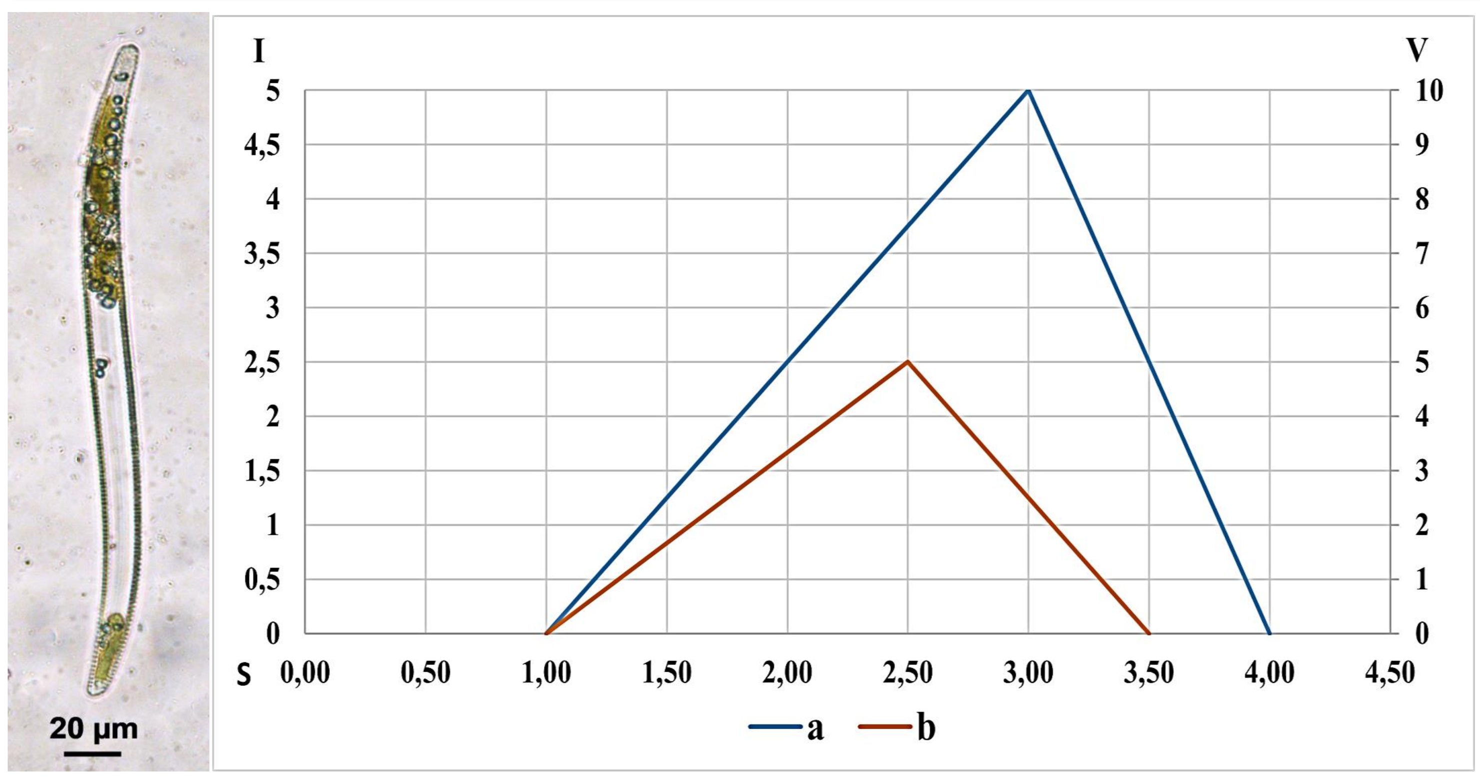
Table 2. Estimation of the degree of water organic pollution in the studied areas of the Sevastopol Bay by the Plante-Buck (S) modified by Sládeček, calculated using the indicators of species significance.

Study area	DIA	CB
MB	1,9 β-mesosaprobic	1,75 β- mesosaprobic
IB	2,5 α-mesosaprobic	1,42 o-β- mesosaprobic
YuB	2,2 β-α-mesosaprobic	-

CONCLUSION

Consequently, it is necessary to create a checklist of diatoms and cyanobacteria, to calculate indices of indicator species with consideration of regional features.

FUTURE WORK / REFERENCES



V – saprobic valence; **I** – indicative wight; **S** – extended saprobic index.

The original extent of S is indicated below. The curves of the saprobic valence are approximated to triangles.

Figure 1. A part of the scale of saprobity (accordgin to Pantle & Buck, 1955 extended) showing the position of the species *N. sigmoidea*: **a** – these study, **b** – by Sládeček, 1986.

Figure 1 shows two graphs of the position of the species *N. sigmoidea* on the saprobity scale, one of which is based on the data obtained, and the second from literature data (Sládeček, 1986). At the same time, the s_i index values for *N. sigmoidea* in our conditions increased from 2.5 to 3.
Thus, the results obtained indicate the need to identify species with indicator properties and calculate indices of their significance, taking into account the regional characteristics of marine ecosystems.

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