PHYTOPLANKTON DATA OF THE KUNE-VAINI LAGOONS, LEZHA

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ABSTRACT

The present paper briefly discusses about the phytoplankton of the Kune-Vaini complex (Lezha). The samples were collected bimonthly from July 2018 to July 2019, in Ceka, Zaje, and Merxhani lagoons; quantitative samples were preserved in Lugol, while net samples in formalin. The optic microscope Motic BA310, objective100x, and a digital camera were used to determine the species. The Utermöhl method employing the inverse microscope Optica, objective 40x, and sedimentation chambers 5 ml and 25 ml was applied for the quantitative data (cell/ml). About 100species of algae, mostly pennate (50) and centric diatoms (24), and dinoflagellates (16) were found. Fewer species were observed in other groups. Ca. 10 species are known as potentially toxic, belonging to *Skeletonema*, *Amphora*, *Pseudo-nitzschia*, *Dinophysis*, *Prorocentrum*, *Oscillatoria*. Quantity of phytoplankton was relatively low; an unusual high peak was observed in Ceka in September (49,883 cells/ml) and November 2018, and another much smaller in May 2019; in Merxhani showed an unusual high peak in January 2019, and another much smaller in May 2019; the winter peak (7,525 cells/ml in January 2019) was mainly dominated by *Skeletonema costatum*, known to be toxic. Continuous monitoring of the lagoons is recommended, especially for toxic algae. Water circulation in the lagoon can enhance the biodiversity and avoid dystrophic events due to the nutrient circulation and reduced anaerobic conditions. Therefore, continuous efforts to ensure the tide exchange, as well as efforts against water pollution are strongly suggested.
***Keywords*:** Coastal ecology,Lezhalagoons, phytoplankton, toxic algae

1. INTRODUCTION

Phytoplankton organisms are the primary producers, together with submersed macrophytes and attached periphyton, and constitute the first nutrient level in lagoons, enriching them at the same time with abundant amounts of oxygen. But in certain circumstances some species can grow out of control and with toxic or harmful effects on people, fish, shellfish, marine mammals and birds(harmful algal blooms) (Hallegraeff *et al*., 2004); HABs can harm even man when consuming fish and other polluted aquatic organisms.

There is little known about the phytoplankton of the Kune-Vaini lagoons. Miho and Mitrushi (1999) carried out sporadic sampling in Ceka (probably Zaje) in June 1993, in Merxhani in May 1994, and in Ceka, Merxhani and Knalla in July 1996. The present study is the first step towards the regular assessment of the phytoplankton in the lagoon system of Kune-Vaini, and information is merely here summarized. The complete data (list of species and plates with microscopic photos) could be found in Kola (2019). The present study is part of the Master Program focused on the ecological approach of the wetland complex, financially supported by the Kune-Vaini Project (http://kunevain.com). Beside the phytoplankton, there were also assessed the aquatic vegetation (macrophytes) (Gjata, 2019), the zooplankton (Lika, 2019), and physic-chemical parameters, heavy metals (Muçaj, 2019), nutrients (nitrogen and phosphorus) and chlorophylls (Ramaj, 2019); diatoms in periphyton were also assessed (Qevani, 2020)

2. MATERIALS AND METHODS

The samples were bimonthly collected from 5 representative stations; 3 in Ceka, 1 in Zaje, and 1 in Merxhani lagoon, in July, September, November 2018 and January, March, May, July 2019, respectively. The quantitative samples were obtained using the Ruttner bottle, or directly from the boat, and preserved in Lugol in 250 ml glass bottles (CEN/TC 230/2006). In addition, Nansen net samples (25 μm mesh size) were taken for the qualitative approach, and were stored in formalin (ca. 4%) in plastic bottles (50 ml).

The diatom frustules were cleaned by boiling the plankton material in H_2O_2cc (EN13946:2003). Microscopic slides were embedded with Naphrax (1.71). The species were determined using mainly the fresh material, or permanent slides, the optic microscope Motic BA310, with objective100x, and a digital camera, and the available literature (Trégouboff and Rose, 1957; Sournia, 1978; Krammer and Lange-Bertalot, 1986-2000; Witkowski *et al.*, 2000; Hallegraeff *et al.*, 2004; Guiry and Guiry, 2019; WoRMS, 2019, Faust and Gulledge 2020). Quantitative data (cell/milliliter) were taken applying the Utermöhl method (1958) (EN 15204: 2006) involving the inverse microscope Optica, with objective 40x, and sedimentation chambers 5 ml and 25 ml. More than 400 cells were counted in total, giving a confidence 95% (±10%).

3. RESULTS AND DISCUSSIONS

About 100phytoplanktonspecies were found in total; mostly pennate (50 (species) and centric diatoms (24 species), followed by dinoflagellates (16 species); other groups were represented with fewer species, also difficult to determine.

Considering the previous approach (Miho and Mitrushi, 1999), more than 160 species in the phytoplankton of Kune-Vaini lagoons are known in total. With the diatoms species found in the periphyton, during the same period from Qevani (2020), the total number of microscopic algae known in Kune-Vaini habitats is about 310 species, where 280 species are diatoms; the rest are phytoplankton species of different algal groups, Dinophyceae (19 species), Chlorophyceae (4), Cyanobacteria (4), Chrysophyceae (1), Euglenophyceae (1), Pyramimonadophyceae (1), Cryptophyceae (1).

Chaetoceros spp. *diverse*, *Melosira moniliformis*, *Skeletonema costatum* from centric diatoms; *Amphora* spp. *diverse*, *Navicula* spp. *diverse*, *Nitzschia reversa*, *N. sigmoidea*, *Pleurosigma angulatum*, *P. elongatum*, *Rhopalodia musculus* and *Thalassionema nitzschioides* from pennate diatoms; *Dinophysis* spp. *diverse* (ie *Dinophysis sacculus*), *Peridinium* spp. *diverse* and *Prorocentrum micans* from dinoflagellates were found in all the lagoons. Species of the genera *Euglena (Euglena viridis)*, *Synura (Synura cf. uvella),* and cryptophytes (*Rhodomonas* spp.) were found in Ceka (September and July 2019).

More than 10 species are known to be potentially toxic(Hallegraeff *et al.*, 2004), such us the centric diatoms *Ceratulina pelagica* (in Merxhani), *Conticribra weissflogii* (in Ceka) and *Skeletonema costatum* (in all lagoons, but abundant in Merxhani in January 2019).Pennate diatoms *Pseudo-nitzschia seriata*, *P. delicatissima* (both in Zaje and Merxhani), or *Amphora* species (i.e. *Halamphora coffeiformis*) and *Pseudo-nitzschia* species are capable of producing the neurotoxin domoic acid (DA), which is responsible for the neurological disorder in humans known as amnesic shellfish poisoning (ASP).Miho (1994) and Bushati (2013) said that *Pseudo-nitzschia seriata* and *P. delicatissima* are found abundant also in Butrinti. From dinoflagellates were found *Dinophysis* spp., *Gonyaulax spinifera*, *Prorocentrum cordatum* (in Ceka and Zaje), *Scrippsiella acuminate* (in Ceka). Frequently found in all the Lezha lagoons, *Dinophysis sacculus* is a toxic species associated with DSP outbreaks in Europe (Faust and Gulledge, 2020). *Oscillatoria* species (ie *Oscillatoria cf. princeps*) (cyanobacteria) were found almost throughout the period and in all the stations, but mostly in Merxhani and their toxins can harm both humans and animals (Swanson-Mungerson *et al*., 2017).

In Mediterranean lagoons, the phytoplankton dynamics is seasonal with a high peak in spring, and another smaller in autumn (Subba Rao 1981; Miho 1994; Bushati 2013).This is sometimes clearly expressed or not, depending on climatic conditions and the general condition of the ecosystem. A large peak was observed in Ceka in September and November 2018 (up to 11,857 cells/ml), and in November 2018 (up to 16,455 cells/ml), mainly with *Nitzschia* and centric species (*Chaetoceros* spp. *diverse*; another much smaller peak was in March 2019 (up to 3,102 cells/ml), mainly dominated by cryptophytes (*Pyramimonas* spp. in Ceka, and *Rhodomonas* spp. in Merxhani).

The primary productivity of Ceka lagoon was further enhanced by dense meadows of the perennial herb *Ruppia cirrhosa* (in July 2018) mixed with macrophytic algae (*Chladophora*, *Chaetomorpha* and *Ulva* species) (Gjata, 2019). Macrophyte production in shallow waters can be ten times higher than phytoplankton production (Mann, 1972). *R. cirrhosa* is common in large permanent water bodies, and in these environments, it is the only macrophyte to survive and show healthy growth in salinities above 20‰ (Verhoeven 1979; Calado and Duarte, 2000). A similar case was observed in Ceka during summer.

The phytoplankton was generally low in Zaje (up to 2,457 cells/ml in May 2019), with almost seasonal dynamic, with a peak in May 2019 and one in September 2018 (Fig. 1). Dinoflagellates were relatively abundant in May, including *Prorocentrum cordatum*, known as highly toxic (Hallegraeff *et al.*, 2004). The seagrass *Zostera noltii* was found only in Zaje in July 2018, but with negligible cover, scarcely mixed with *Chladophora* and *Ulva* species (Gjata, 2019).

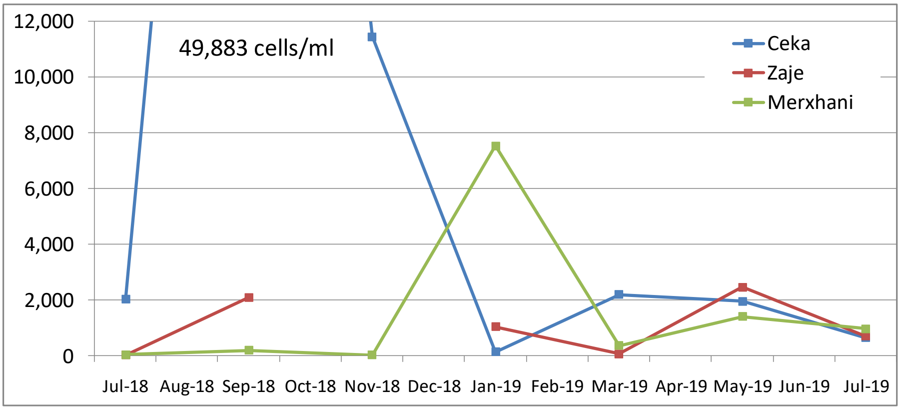

Fig. 1: Quantitative data of phytoplankton (cells per milliliter) in Kune-Vaini lagoons, during July 2018-July 2019; average value of the three stations in Ceka.

A large peak could be noted in Merxhani in January 2019 (up to 7,525 cells/ml), and another much smaller in May 2019 (Fig. 1). The winter peak was mainly dominated by *Skeletonema costatum*, known to be toxic. This ecosystem appears immediately as highly dystrophic, loaded with decomposing organic matter, and bad smell. No traces of the phanerogams were observed, only blooming of *Ulva* species, another indicator of poor water quality (Gjata, 2019). Relatively fewer phytoplankton species were found (37 species), compared to Ceka (63) and Zaje (54); it differs from what was reported by Miho and Mitrushi (1999). Moreover, other toxic algae such as *Ceratulina pelagica*, *Pseudo-nitzschia* species, or *Oscillatoria* species (cyanobacteria) were observed. Worth to mention that in Ceka we assessed the phytoplankton in three stations, and respectively only 1 station in Zaje and Merxhani.

Phytoplankton in Ceka and Merxhani showed an unusual dynamic, probably due to scarce water exchange, water oxygenation and nutrient circulation. Permanent water body in Ceka is also shown from the dense presence of the phanerogam *Ruppia cirrosa*. Relatively high content of nutrients (nitrogen and phosphorus) was assessed by Ramaj (2019), too. Average value of total phosphorus (TP) was 88.91 for Ceka, 66.31 for Zaje, and 56.57 µg/L for Merxhani. Also, the average content of total nitrogen (NO_2 + NO_3) was higher than the 'very highlimit (>8 µmol/L)' set by EEA (2017): 10.72 for Ceka, 21.59 for Zaje, and 9.90 µmol/L for Merxhani. This combined also with the dense presence of green algae (*Ulva* species), tolerant to pollution (known as nitrophyl species), and low IPS values calculated by Qevani (2020), all represent an evidence of the surrounding impact in all three lagoon ecosystems (through the two Pumping Stations in Shengjini and Tale, the related tide channels and the Drini delta). Continuous monitoring of the lagoon complex is recommended, especially for toxic algae.

ACKNOWLEDGMENTS

The present study was supported by the Kune-Vain project (http://kunevain.com/), funded by UNEP, GEF and the Albanian Government. Field trips, the chemicals, glassware, literature and master fee were granted. We are also grateful for the cooperation and support given by the Administration of the Protected Area, Lezha, and for the cooperation between our group of experts and students.

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