



SPRING ASSESSMENT OF ZOOPLANKTON COMMUNITY IN BUTRINTI LAGOON (IONIAN SEA, SOUTHERN ALBANIA)

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SYNOPSIS

Key words:

Butrinti lagoon,
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zooplankton,
protozoa,
meroplankton.

The structure of zooplankton community in Butrinti lagoon was assessed for the first time during spring 2010 (February – April, 2010). Zooplankton samples and some physico-chemical parameters continue to be collected monthly at three stations in the lagoon. The zooplankton was represented by five holoplankton groups, such as *Protozoa*, *Copepoda*, *Rotifera*, *Cnidaria*, *Molusca* and *Amphipoda*. Protozoa prevailed over other taxonomic groups, both in abundance and species diversity. Highest zooplankton abundance was observed during March (50'158 ind/m³), with the Tintinnida being most numerous (51.3%), followed by Copepoda (22.8%). *Favella ehrenbergii* was the dominant species among other species of Tintinnida and responsible for the high abundance of zooplankton in March. The cyclopoids *Oithona* sp. and *Oithona nana* were the most abundant Copepoda species; other Copepoda species were relatively scarce, occurred only accidentally.

INTRODUCTION

Butrinti is one of the most important Albanian lagoons, located in the Ionian Sea (Southern Albania). It is a tectonic lagoon of 16.3 km², with relatively high depth (averaging 14 m). Small amount of fresh water from Bistrice and Kalasa rivers enters in lagoon in its northern part. The lagoon is connected to the Ionian sea by a channel 3.6km long, 80-160m wide and 6m deep (Peja et al., 1996; Miho et al., 2008), leading to an active communication with the sea and cause a predominance

of sea waters. Its water column is permanently stratified, showing a typical meromictic lagoon, where the upper layer (epilimnion) is almost similar to the other Mediterranean lagoons (very mixed), while hypolimnion (often down to 6 m of depth), especially in the central area, exists in a permanent anoxic state, with the temperature 16-17°C, salinity about 20-35‰ and oxygen reaching lowest levels. The bottom is characterized by anaerobic decomposition of sulfobacteria, with release of hydrogen sulfide (Miho, 1994; Miho et al., 2008). Nevertheless, unlike the other Albanian lagoons, the upper layer represents a favorable habitat for shellfish reproduction and is being used intensively during the last few decades for aquaculture of mussels (*Mytilus galloprovincialis*) with a yearly gross production of 2000 to 4500 t.

Butrinti lagoon is considered today mesotrophic with eutrophic trend, as expressed in dystrophic crises observed, especially during years 1979-83 (Miho, 1994), with negative effect especially in mussel production. It is thought that the eutrophication was enhanced by hydrological impact, such as the deviation of Bistrice and Pavlo rivers; the reduction of freshwater input decreased the water exchange in the lagoon, enhanced also by the continuous tendency of blockage of channel that connect the lagoon with the Ionian sea.

Butrinti zone and its Lagoon are considered very important not only for Albania, but also for whole region. Close to Butrinti lagoon, the Butrinti Archaeological Centre was designated first as a Cultural Monument (1948); it was then internationally recognized in the World Heritage list of UNESCO (1999). Part of Butrinti lagoon, the Archaeological Centre and some other terrestrial habitats are then nationally protected as National Park (2003) (Miho et al., 2008). Since year 2003, the National Park, Butrinti lagoon was included on the checklist of water bird sites with international importance under the Ramsar Convention. Moreover, Butrinti zone is included in the checklist of Important Plant Areas (IPAs).

While the study of phytoplankton was earlier started for the Butrinti, by MIHO (1994), XHULAJ et al. (2009), the study of zooplankton community (micro - and mesozooplankton) is only at the first steps. MIGLIETTA et al. (1997) presented a list of zooplankton species identified as cysts and eggs in sediments of Butrinti lagoon. A preliminary approach of zooplankton community will be presented here. This study is an extension of the monitoring approach, carried on by the Institute of Animal and Food Security, Tirana, related with phytoplankton and especially toxic algae, focused on mytiliculture. The knowledge on zooplankton would help to know better the most important links in the aquatic food web, useful to understand the function of ecosystems (Michaloudi, 2000).

MATERIALS AND METHODS

Samples for qualitative and quantitative studies on zooplankton community in the Butrinti lagoon continue to be collected monthly from February to April, 2010 at three stations (Fig. 1), and it is an on-going work. Zooplankton samples were collected at each station by vertical hauls from the interface (4 – 5 m) to the surface, using plankton net of 25 μm with a 0.25 m diameter opening and preserved in 4% formaldehyde. In each station, zooplankton samples was made up of two vertical tows and referred to the average for the quantitative assessment. Another horizontal net sample was taken for the qualitative analyses. Aliquots from diluted samples in a certain factor were prepared in the laboratory according HARRIS et al. (2000) and then analyzed for taxa identification and specimens counting using a stereomicroscope; at least up to 1000 individuals were counted. Zooplankton organisms were identified to the lowest taxa possible according ROSE (1933), CARLI & CRISAFI (1983), TREGOUBOFF & ROSE (1957), NIELSEN & HANSEN (1999) and AVANCINI et al. (2006). Density values were calculated as individuals per 1 m^3 of water column. In April the water column were sampled at six different depths of 0, 1, 3, 4, 5, and 10 m, at each station, using a Niskin bottle (2L). Species diversity was estimated using the Shannon-Weiner diversity index, (H') (Shannon & Weaver, 1949) and equitability using Pielou evenness index (Pielou, 1966). The study included hydrological parameters such as temperature, salinity, dissolve oxygen, conductivity, pH and transparency.

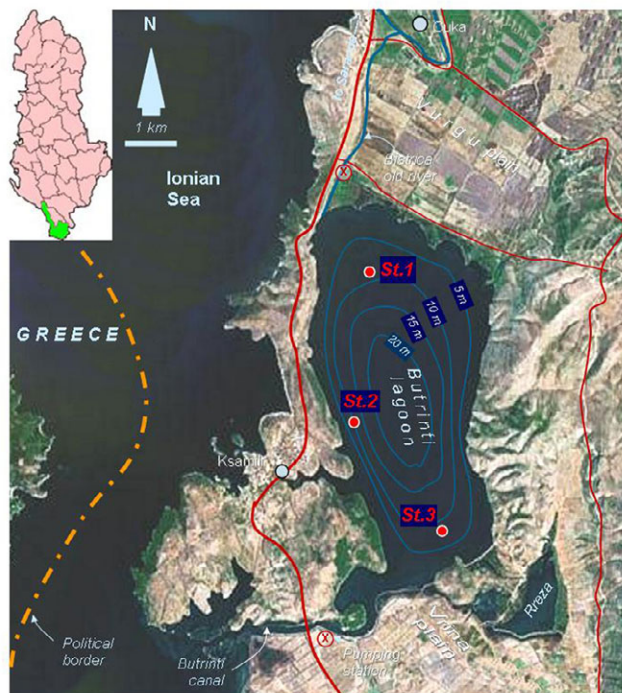


Figure 1: Map of Butrinti lagoon with sampling stations (from Miho et al., 2008).

RESULTS AND DISCUSSIONS

From the first approach, total zooplankton assemblage were represented by 27 species (holoplankton) that belong to *Protozoa*, *Rotifera*, *Copepoda*, *Molusca*, *Cnidaria* and *Amphipoda*; they constituted about 80% of total zooplankton. In table 1. the checklist of zooplankton taxa recorded in the Lagoon is shown.

The highest zooplankton standing crop was recorded in March (average value of 53'824 ind/m³) (Fig. 3B), while the lowest was found in April (average value 9'654 ind/m³). The population density in all the three sites varied from 2'707 org/m³ (station 3, April) to 75'896 org/m³ (station 2 March) (Fig. 2). Protozoa was the richest (11 species) and the most dominant of the whole zooplankton (average value of 17'291 ind/m³), forming about 54.6% of total zooplankton (Fig. 3A). Protozoa were abundant in March and February and showed an evidently decrease in April (Fig. 3B).

Protozoa were represented by *Dynophagellata*, *Foraminifera*, *Tintinnida* and *Ciliata*. Tintinnida were the most diversified (7 species) (Tab. 1) and abundant taxa forming 49.7% of total zooplankton and 95.9% of total Protozoa.

Table 1: Zooplankton taxa recorded during spring 2010 in Butrinti lagoon.

PROTOZOA	<i>Synchaeta sp.(1)</i>	<i>Oithona sp.</i>
<i>Noctiluca sp.</i>	<i>Synchaeta sp.(2)</i>	<i>Sapphirina sp.</i>
<i>Globigerina sp.</i>	<i>Keratella cochlearis</i>	<i>Oithona copepodits</i>
<i>Strombidium sp.</i>	<i>Keratella quadrata</i>	<i>Acartia clausi</i>
<i>Favella Ehrenbergii</i>	<i>Brachionus sp.</i>	<i>Acartia copepodits</i>
<i>Tintinnopsis cylindrica</i>	NEMATODA	<i>Calanus copepodites</i>
<i>Tintinnopsis campanula</i>	Undetermined	<i>Euterpina acutifrons</i>
<i>Tintinnopsis beroides</i>	PHORONIDA	Harpacticoid undetermined
<i>Tintinnopsis labiancoli</i>	<i>Actinotrocha larvae</i>	<i>Nauplii</i>
<i>Stenosemella sp.</i>	MOLLUSCA	DECAPODA
<i>Tintinnina sp.</i>	<i>Limacina sp.</i>	Larva
<i>Ciliate undetermined</i>	<i>Bivalvia larva</i>	Amphipoda
CNIDARIA	ANNELIDA	Undetermined
<i>Aurelia aurita juvenile</i>	<i>Polychaeta larva</i>	
ROTATORIA	COPEPODA	
<i>Synchaeta okai</i>	<i>Oithona nana</i>	

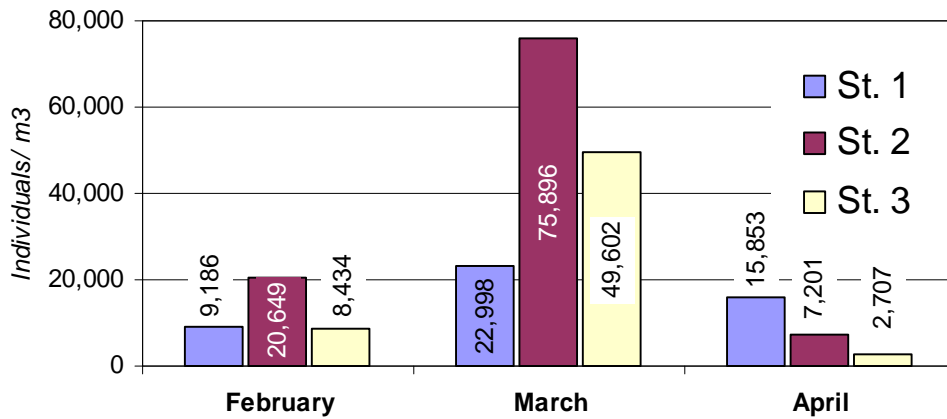


Figure 2: Quantitative values (individuals/m³) of zooplankton in three stations (St. 1 – St. 3) for the three different assessments.

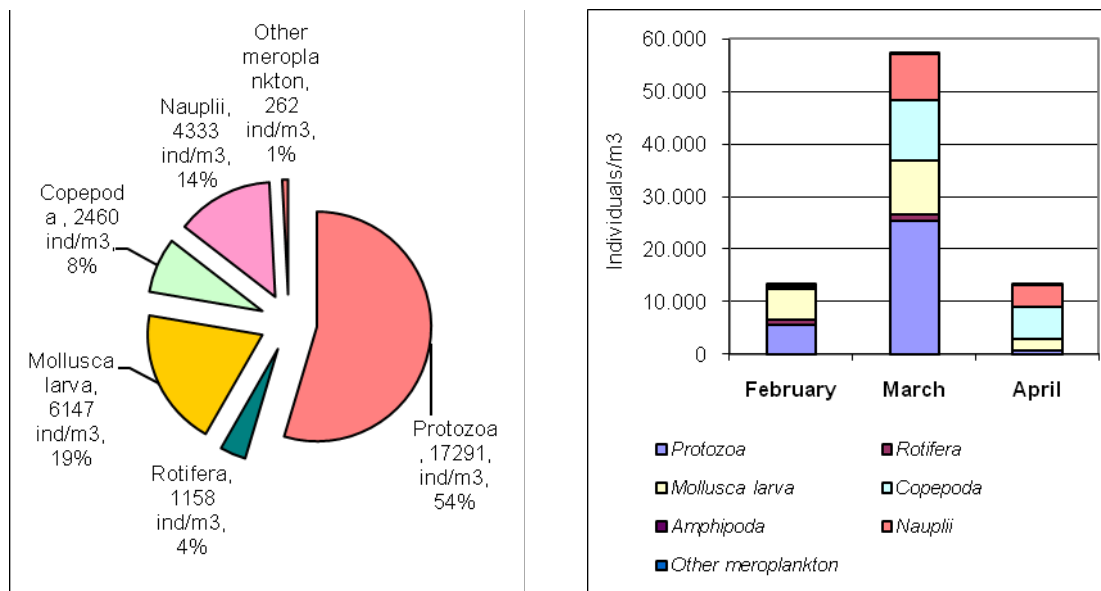


Figure 3: A) Composition of zooplankton groups, average values (individuals/m³) and related percentiles (%) of three stations in three different assessments; B) Average values (individuals/m³) of the zooplankton groups at three different stations in three different months.

Favella ehrenbergii was the most dominant species among Tintinnida species (Fig. 4), constituting 84.5% of Tintinnida, and 42% of total zooplankton; it is responsible for the high abundance of zooplankton in March, with the density up to 20'414 ind/m³. Zooplankton structure changed in April; *F. ehrenbergii* disappeared totally and *Noctiluca sp.* became the most dominant species, constituting up to 79.8% of the total of Protozoa, and 19% of total zooplankton.

Copepoda and their larval stages were the second most abundant group (Fig. 3A), with an average of 6'794 ind/m³, and representing 21.4% of total zooplankton. Their peak was observed in March (1153 ind/m³, 64% of total zooplankton in March) (Fig. 3B), while the lowest abundance in February (290 ind/m³). Copepoda were represented by 7 species (Tab. 1).

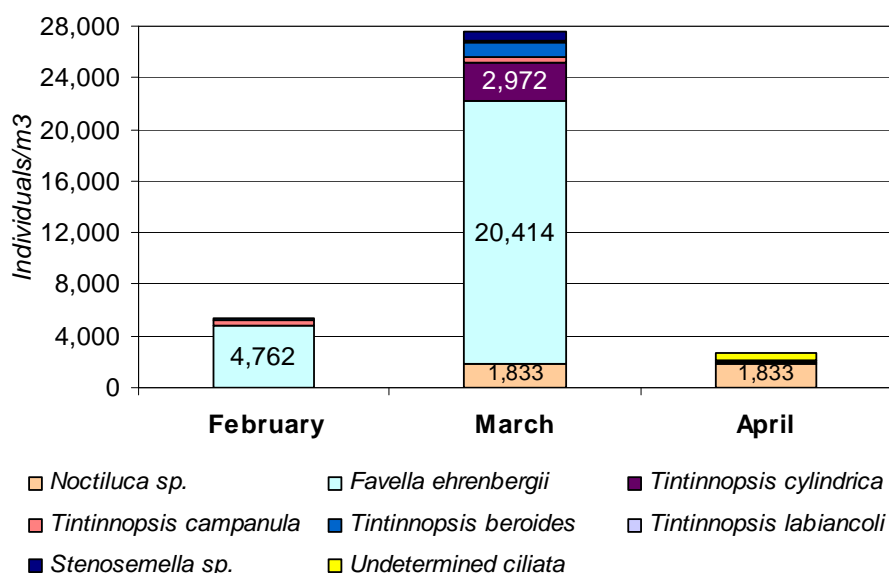


Figure 4: Composition of Protozoa species, average values (individuals/m³) of three different stations in three different months.

Among Copepoda, *Oithona sp.* was the most abundant species (34.3%) (Fig. 5), serving as major grazer of phytoplankton and a component of microbial loop preying heterotrophic protozoas, playing an important role in functioning of Butrinti lagoon. NIELSEN & SABATINI (1996) and NAKAMURA & TURNER 1997) emphasize the importance of protozooplankton on the diet of *Oithona* species.

Other Copepoda species were rarely represented, up to 1.9% of Copepoda community, and up to 0.4% of total zooplankton. Copepoda *nauplii* predominated over the adults, contributing about 63.8% of Copepoda and 13.7% of total zooplankton.

Rotifera were less frequent, constituting 3.87% of total zooplankton (Fig. 3A). This group was important only during February, occurring up to 22% of total zooplankton in station 3. Rotifera were represented by 6 species (Tab. 1) belonging to 3 genera: *Synchaeta*, *Keratella* and *Brachionus*; genus *Synchaeta* dominated in species and quantity; other two genera were relatively scarce, occurred only accidentally. Planktonic Mollusca contributed 0.1% to the total zooplankton; it was represented by one Pteropoda species: *Limacina sp.* (Tab. 1). Cnidaria was

represented only by juvenile stages of *Aurelia aurita*. Amphipoda had also a much reduced numerical importance and occurred only in April.

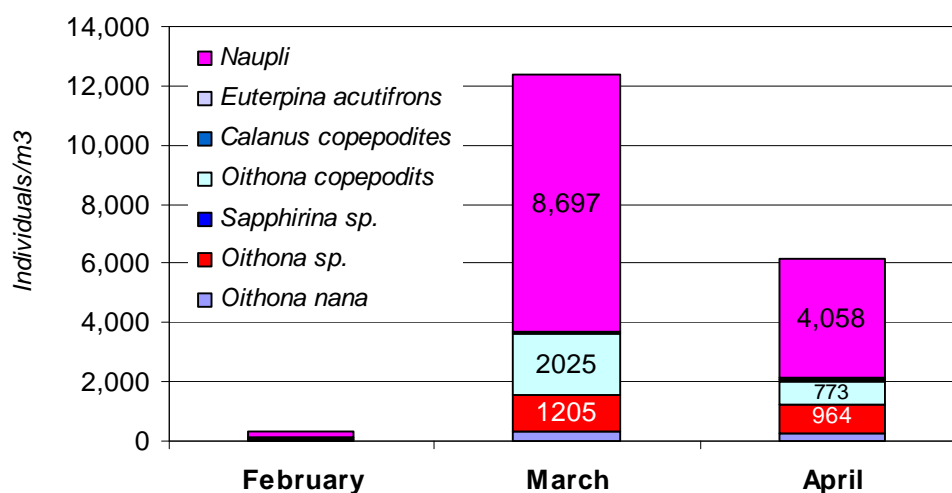


Figure 5: Composition of Copepoda species, average values (individuals/m³) of three different stations in three different months.

The meroplankton contributed about 20% of total zooplankton (Fig. 3A & B), where larva of *Bivalva* constituted 19.3% of total zooplankton and 96.9% of total meroplankton, influenced by the mussel farm, which is still active in this Lagoon. Other meroplankton groups, such as *Nematoda*, *Phoronida*, *Annelida*, and *Decapoda* were rarely represented, constituting collectively 0.8% of total zooplankton.

From the evaluation of the cyst bank in sediments of Butrinti lagoon by MIGLIETTA et al. (1997), 42 morphotypes of resting stages (benthic cysts and eggs of pelagic organisms) have been reported, of which 27 were considered as cysts of protists and 15 eggs of metazoans (8 Copepoda; 3 Rotifera; and four non identified).

The SHANNON-WEAVER (1949) diversity index and PIELOU (1966) evenness index were very similar between months; the diversity (H') ranged from 2.119 (February) to 2.358 (March) and Pielou index from 0.534 (April) to 0,546 (March). In the figure 6A it is shown the zooplankton profile (individuals/m³) after depth (m), assessed in April 2010; it can be seen easily that the highest productive is the layer 5 m of depth; among the stations, it seems that station 2 in the western part of the lagoon represent the maximum of productivity, up to 419'000 individuals/m³ (in 5m of depth).

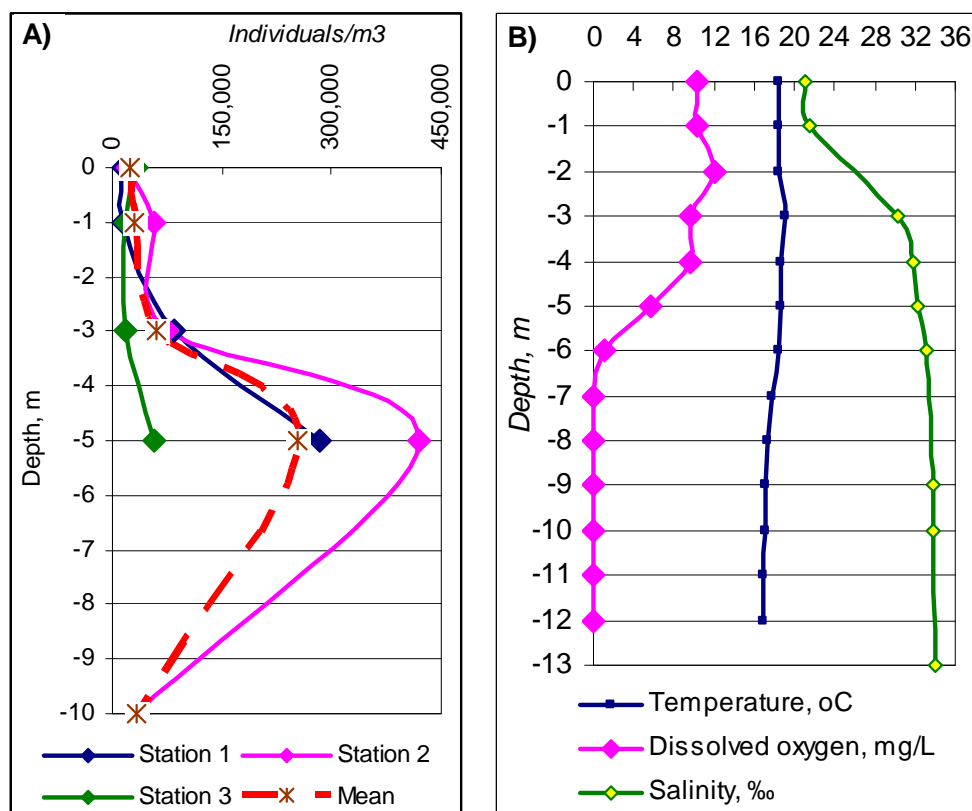


Figure 6: A) Zooplankton quantity (individuals/m³) after depth (m) in April 2010; B) Vertical distribution of the main physic-chemical parameters (temperature, °C; dissolved oxygen, mg/l; salinity, ‰), in April 2010.

Physico-chemical parameters did not show any pronounced difference between three stations. Temperature of surface water had a typical spring pattern; it ranged from 10.3°C in February and 18.5°C in April. Salinity in surface ranged from 16-21‰; the maximum is reached in April while the lowest average value of 16‰ in March that corresponded to the heavy rain period. To evidence some information about the special meromictic conditions of Butrinti lagoon, we report three profiles of temperature, salinity and dissolved oxygen after depth profiles measured in April 2010 (Fig. 6B). The vertical profile of salinity indicates a pronounced difference between surface and bottom water, the surface water had low salinity, varying between 21–30‰, while the near bottom water demonstrated higher salinity (30.7-34‰). The vertical profile of temperature changed within a very narrow range (1.7°C) from the top to the bottom of the water column. The upper layer is saturated in dissolved oxygen (10.29-12.00 mg/l) and then rapidly decrease, reaching zero values by depth 7 m; the highest average value of oxygen was 12.0 mg/l, recorded at the depth 2m. In the anaerobic state of the hipolimnion, the activity of sulphobacteria seems high, and often sulfides appear and increase toward the bottom (Miho, 1994). Vertical distribution of salinity shows that the lagoon was well

stratified in April and no marked mixing occurs between the upper and lower water, resulting in a two layer system, epilimnion and hypolimnion, as evidenced by other published data, i.e. by PANO et al. (1984), KABO (1990-91), etc. The pH values always, fluctuated within alkaline side at a narrow range of 8.23 at the surface and 7.83 at the 10 m depth. The transparency (Secchi disk) was always relatively low; the mean values oscillated from 2.3 m to 2.5 m

CONCLUSION

From the first observation of zooplankton community in Butrinti lagoon, three main zooplankton groups were identified *Protozoa*, *Copepoda* and *Rotifera*, where *Protozoa* prevail over other zooplankton groups both in abundance and species diversity.

Tintinnida were usually represented by the highest number of species and frequently encountered. Peak in total zooplankton abundance was recorded during March, caused mainly by high abundance of Tintinnida *Favella ehrenbergii*. Density of *F. ehrenbergii* rose evidently in March and disappeared totally in April. Among Copepoda, *Oithona sp.* was the most abundant species serving as major grazer of phytoplankton and a component of microbial loop preying heterotrophic protozoas, playing an important role in functioning of Butrinti lagoon.

The high abundance of larvae of Bivalva (*Mytilus galloprovincialis*) marks the meroplankton as a very important component of zooplankton in this lagoon, influenced by active aquaculture in this lagoon.

The present study will be considered as the first comprehensive study on zooplankton in Butrinti lagoon and will represent a contribution to other biological studies on zooplankton, management and exploitation of this lagoon. A more complete study on the seasonal distribution and abundance of zooplankton from Butrinti lagoon would require a series of samples collected periodically for a long-term period. Our study of zooplankton, carried on in joint research with the group of aquatic Botany, Institute SUV, related with the phytoplankton, will help to know better functioning of the food webs in the ecosystem; it will allow solving eventual dystrophic crisis and continuous sustainable management of the lagoon resources.

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