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# Seasonal and interannual dynamics of microzooplankton abundances in the Gulf of Trieste (Northern Adriatic Sea, Italy)

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ABSTRACT

Abundance and composition of microzooplankton were studied over a 15 years period (from March 1986 to December 1990 and from July 1998 to December 2010) in the Gulf of Trieste (Adriatic Sea, NE Mediterranean Sea). Sampling was conducted biweekly-monthly at the surface at the historical station C1, 200 m offshore (bottom depth 17.5 m). Aloricate ciliates dominated in both periods (median 117 and 243 ind. $L^{-1}$ in the first and second period respectively) while tintinnids were more abundant in the first period (median 55 ind. $L^{-1}$*vs* 16 ind. $L^{-1}$). For heterotrophic dinoflagellates there are no data during the first period and in the second one they represented the second major group. Micrometazoans remained almost constant over time. In the first period all microzooplankton groups showed a maximum in April, while in the last period the peak has shifted to September. This is particularly evident for both aloricate ciliates and micrometazoans. Tintinnids, that in the past had the absolute maximum in spring, in the second period maintained the only, lower peak in October. Tintinnids in the first period were constituted by 27 species and dominated by the genera *Tintinnopsis*, *Stenosemella* and *Salpingella*. In the last 10 years we registered a dramatic decrease in abundance, paralleling an increase in species (40) with some "new entries" as well as the almost complete disappearance of genera *Helicostomella*, *Favella*, *Coxiella* and *Steenstrupiella*. The observed changes of the seasonal dynamics of microzooplankton abundance, as well as of the tintinnids composition over the long period considered in our study, might suggest a climatic forcing together with the known anthropogenic oligotrophication of the entire North Adriatic.



## 1. Introduction

Over the last few decades, microzooplankton (broadly heterotrophic planktonic organisms spanning 10–20 μm to 200 μm) assumed a pivotal role in the marine pelagic food web as studies demonstrated its importance in transferring biomass and energy from the microbial to the grazing food web. Recently, Calbet and Landry (2004) stated that grazing of microzooplankton represents the major loss term for phytoplankton cell growth across a broad range of ocean regions and habitats. In the Gulf of Trieste Fonda Umani and Beran (2003) and Fonda Umani et al. (2005a) demonstrated the crucial role of this heterotrophic size class in controlling microphytoplankton biomass, but also its effect on nano- and pico-sized fractions.

Previous studies in the Adriatic Sea showed that microzooplankton is an important zooplankton fraction, characterized by different abundances along the basin (Bojanić et al., 2006a, 2006b; Coats and Revelante, 1999; Fonda Umani et al., 2005b, 2010; Kršinić and Grbec, 2006). Tintinnids, or loricate ciliates, are the most investigated component of microzooplankton communities in the Mediterranean Sea (Dolan et al., 1999, 2002; Dolan, 2000; Modigh and Castaldo, 2002; Kršinić and Grbec, 2006; Sitran et al., 2007, 2009; Fonda Umani et al., 2010). However tintinnids comprise only a minor part of the ciliates (Margalef, 1963; Dolan, 2000; Fonda Umani et al., 2005b) as naked ciliates are normally the most abundant component of microzooplankton, although information on their species composition is scarce (Modigh, 2001; Fonda Umani et al., 2005b; Bojanić et al., 2006a, 2006b). Although it has been assumed that the microzooplankton community is dominated by ciliates, heterotrophic dinoflagellates can be a significant component of the biomass and they can compose >50% of microzooplankton stocks (Fonda Umani et al., 2005b; Sherr and Sherr, 2007). Heterotrophic dinoflagellates play an important role in the food web for their great potential to consume large preys (Calbet, 2008). Ciliates typically feed selectively at a predator-prey size

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