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Changes in jellyfish populations during mucilage event in Izmit Bay (the northeastern Marmara Sea).

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Summary
In recent years, the Marmara Sea has been undergoing profound changes, as mucilage formation and jellyfish bloom. Mucilage aggregates were observed in 2007-2008 periods in the Marmara Sea, especially in Izmit Bay and considerably affected all the ecosystem. Increasing jellyfish bloom has become a problem for the Marmara Sea due to effect on fisheries. *Mnemiopsis leidyi*, *Beroe ovata*, *Chrysaora hysoscella* and *Liriope tetraphylla* are important invasive species in the Sea. While *Mnemiopsis leidyi* and *Aurelia aurita* were found in summer periods, *Pleurobrachia pileus* was presented from late spring to August. The maximum abundance of *Mnemiopsis leidyi* was observed in August 2008 (58 ind.m^{-3}) in western part of the bay. Jellyfish species was disappeared in the end of summer and mucilage aggregation was observed on October in Izmit Bay. As known, jellyfish blooms during a living or dead life cycle influence the nutrients cycling through the release of dissolved organic matter and nutrients, and this may have triggered the mucilage formation in Izmit Bay. In conclusion, jellyfish species in the Marmara Sea should be investigated in order to predict potentially their effects on mucilage formation.
Key words: Jellyfish, Izmit Bay, mucilage aggregation, abundance.

Introduction

The Marmara Sea has permanent two-layered water system and plays significant role on biodiversity of the Black Sea and the Aegean Sea. In recent years, the Sea has been undergoing profound changes, in terms of jellyfish bloom and mucilage formation. The Ctenophore *Mnemiopsis leidyi* was introduced into the Marmara Sea in early 1990s and effected all the ecosystem (Isinibilir *et al.* 2004; Isinibilir 2012). *Beroe ovata*, *Chrysaora hysoscella* and *Liriope tetraphylla* are other important invasive species in the Sea (Isinibilir 2012; Isinibilir *et al.* 2010). Latest studies showed that quantities of jellyfish have been increasing in the Marmara Sea in the last decade (Isinibilir *et al.* 2010). Mucilage events are characterized represented by the appearance of jellyfish aggregates suspended in the water column and produced by various marine organisms under special seasonal and trophic and meteorological conditions (Innamorati *et al.* 2001). First mucilage aggregates were observed in the Marmara Sea in October 2007 periods all water column of the Marmara Sea (Aktan *et al.* 2008). But it was denser and longer duration in Izmit Bay, which is affected by intense industrial activity, and which has a weaker circulation compared to the Marmara Sea. Izmit Bay located in the northeastern part of the Marmara Sea, is one of the most polluted areas in the Marmara Sea. In this study, we focused on spatial and seasonal distributions of three jellyfish species (the indigenous *Aurelia aurita*, *Pleurobrachia pileus* and the invaders *Mnemiopsis leidyi*) in Izmit Bay.

Materials and methods

Jellyfish samples were collected vertically during daytime, by a WP2 closing net (157 mm mesh, 0.5 m diameter) from bottom to the surface in Izmit Bay at monthly with one haul at 3 stations from April 2008 to December 2008. Samples were identified and measured immediately on board.

Results and Discussions

Total jellyfish abundance was observed in August due to high quantity of *Mnemiopsis leidyi* (figure 1). While *Mnemiopsis leidyi* and *Aurelia aurita* were found summer periods, *Pleurobrachia pileus* was present from late spring to August. However, *Beroe ovata,* found in the bay in previous years (Isinibilir 2012), was found in September with only one individual in the Izmit Bay. The maximum abundance of *Mnemiopsis leidyi* was observed in August 2008 (58 ind.m^{-3}) in western part of the bay. Jellyfish species was disappeared in the end of summer and mucilage aggregation was observed in October. Mean abundances of total jellyfish in autumn 2008 were lower as compared to 2001-2002 values (Isinibilir 2012).

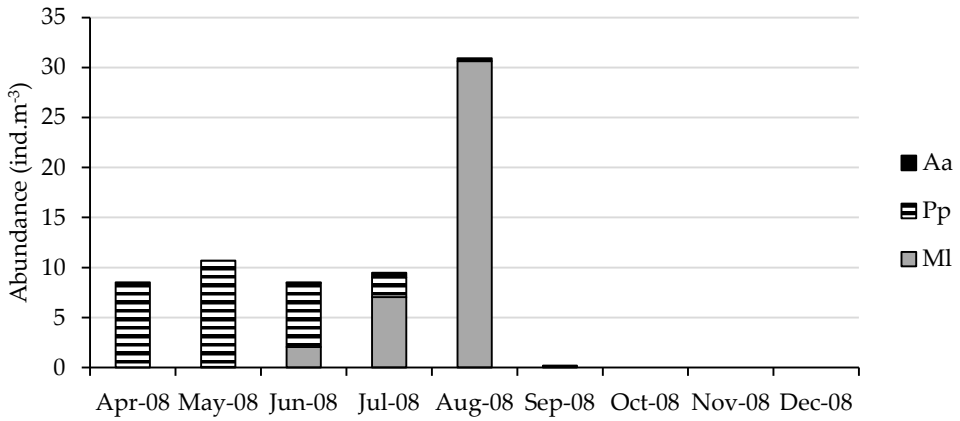

Figure 1. Seasonal fluctuations of *Mnemiopsis leidyi, Pleurobrachia pile*us and *Aurelia aurita* in Izmit Bay during 2008 mucilage period.

In 2007-2008 mucilage periods, mucilage aggregates was characterized by high values of diatoms and dinoflagellates density and bacterial activity (Tüfekçi *et al.* 2010). It is known that inorganic nutrients excreted by jellyfish populations provide a small but significant proportion of the N and P required for primary production by phytoplankton and excretion of dissolved organic matter may also support bacterioplankton production (Pitt *et al.* 2009). Decomposition of jellyfish blooms may result in a large release of inorganic and organic nutrients in Izmit Bay. In conclusion, jellyfish species in the Marmara Sea should be investigated in order to predict potentially their effects on mucilage formation.

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