Foreword

The present volume of the *Proceedings of the Estonian Academy of Sciences* contains scientific papers presented at the 9th annual seminar of the Marine Biology Department of the Estonian Marine Institute held in Pärnu on 8–9 February 2007. Among other topics we discussed the impacts of eutrophication, pollution, and biological invasions on the variability of environmental and biological patterns in the Estonian coastal sea. Other presentations mainly treated general aspects of marine biology and life history of key species. As a result of these discussions a few papers were selected to this volume focusing on the state of the art of marine research carried out at our department.

There is a great need for developing the criteria for biomonitoring studies as severe human impacts have been demonstrated in waterbodies adjacent to the large cities but likely also in isolated and seemingly pristine habitats. In order to protect coastal waters most European countries have to implement the European Water Framework Directive. According to the directive all waterbodies must obtain good water quality prior to 2015. To implement the directive, the reference (i.e. pristine) conditions and criteria for ecological status need to be defined. The establishment of a classification system for water quality assessment allows us to detect the human impacts at early stages and, thus, manage more effectively coastal habitats and protect endangered species. During the seminar an overview was given of the established functional relationships between nutrient loads and different quality elements (phytoplankton, zooplankton, phytobenthos, and zoobenthos) and we discussed how other environmental factors explained spatial and temporal variability of these functions.

Traditionally numerous presentations of the seminar focused on invasive species. Biological invasions have become one of the most prominent elements of global change, altering biodiversity and functions of natural ecosystems, and causing significant economic damage. Invasions in both terrestrial and aquatic ecosystems have shown that if successful exotic species may render previously stable systems unbalanced and unpredictable. However, only a limited number of exotics are able to establish and adapt to the conditions of recipient ecosystems. The success of establishment and the consequences of invasions are difficult to predict because of the role environmental variability plays in determining the outcomes of invasions. Large-scale environmental pressures directly affect system-specific attributes and therefore act as a filter to modulate the risk of and responses to invasions. Limitations of current models of invasions are strongly related to the scarcity of experimental data, especially for aquatic environments, on the interactive

mechanisms of abiotic environments and interspecific interactions behind impacts. Invasive species may disrupt existing interactions, establish new ones, replace interactions, and generally affect the abundance of local species and ultimately the functionality of the community. Since the last publication of materials of the annual seminar of the Marine Biology Department we have witnessed the establishment of three new nonindigenous species at the Estonian coastal range, which means there has been on average one successful invasion annually. Considering the low biological and functional diversity of the coastal ecosystems of the northern Baltic Sea such a high invasion rate undoubtedly destabilizes the integrity of our ecosystems.

Undoubtedly, the invasive *Gammarus tigrinus* Sexton is currently the most aggressive nonindigenous species in the region. Since the late 1990s and 2000s *G. tigrinus* has significantly expanded its distribution in the Baltic Sea and currently threatens the integrity of mesoherbivore assemblages in the area. Earlier studies have shown that *G. tigrinus* tolerates a wide range of environmental conditions and has low habitat selectivity and, therefore, may potentially inhabit very different types of coastal habitats. There is some circumstantial evidence that *G. tigrinus* is competitively superior over the native gammarids in European fresh and brackish waterbodies. Currently, *G. tigrinus* prevails in the waterbodies of West Estonia. The species is a dominant mesoherbivore in sheltered areas with moderate benthic vegetation but is relatively rare in exposed areas with lush benthic vegetation.

We may just speculate that this invasion is likely to have strong cascading effects through the food web. It is likely that due to higher mobility the native species are preyed more heavily by nectobenthic invertebrates and fish than the invasive species. Following the notable decline of the native gammarids in the Estonian coastal sea the prevailing predator species may suffer from lower availability of food. Because of different diets of native and invasive gammarids, a shift in the dominance of mesoherbivore communities may also have profound consequences in the dynamics of macrophytes due to the consumption of different macroalgal species. The invader may reduce the biomass of their host algae and indirectly favour those species that the native gammarids are feeding on.

In January 2006 an extensive oil spill was detected in the southwestern Gulf of Finland. Although the exponential increase in the vessel traffic suggests a high risk of oil spills in the Gulf of Finland, damages of such extent have never been observed in the Estonian coastal range before. Severe storms hindered the removal of the oil from the sea surface. According to the preliminary field survey it was estimated that approximately 10 tonnes of heavy oil stranded to the shores of Keibu and Nõva bays. In this volume we describe the effects of the oil spill on benthic plant and invertebrate communities in the area. Based on the sensitivity of benthic communities, we explore the issue how this information can be used to support decisions and negotiations on possible oil spill response actions.

The compiler of this volume is grateful to all contributors.

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