

## THE BALTIC SEA - A FIELD LABORATORY FOR INVASION BIOLOGY

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### Abstract

Since the early 1800s, about 101 NIS have been recorded in the Baltic Sea. In this brackish sea (salinity range from less than 2 to approximately 20 PSU) horizontal and vertical gradients provide the nonindigenous species of different origin an extended repertoire of hospitable conditions. Several ecological functions of the non-native animals are new (and hence unique) for the species-poor Baltic Sea ecosystem. A review of the research into invasion biology in the Baltic Sea countries reveals a timeline from first records of single new species toward more sophisticated studies in invasion biology.

### 1 Introduction

The Baltic Sea is a young, and in a historical perspective, environmentally unstable sea. After the latest deglaciation, freshwater periods alternated with conditions, slightly more marine than what is prevailing today. Around 7,000 BP, the Baltic became brackish. Consequently, most animal and plant species living in the Baltic Sea are postglacial immigrants, many of them living close to their salinity tolerance limits.

The Baltic is the world's largest brackish-water sea area (382,000 km<sup>2</sup> or 415,000 km<sup>2</sup> with the Kattegat included), and this semi-enclosed water body is isolated from the North Sea by both geographical and ecological barriers: sill depth is 18 m; the salinity drops from 20-24 PSU in the Kattegat to 6-8 PSU in the Baltic Proper and further to 1-2 PSU in the inner parts of the large gulfs (Gulf of Bothnia and Gulf of Finland). The water is strongly stratified, especially in the Baltic Proper. Temperature conditions vary from boreal Atlantic in the southwestern areas of the sea to sub-Arctic in its northernmost part. The Baltic Sea area (i.e. Kattegat and Belt Sea, Arkona Basin, Baltic Proper, major gulfs, adjacent brackish-to-fresh water lagoons and inlets) represents a chain of sub-regions, well defined by their geomorphological configuration, hydrological regime and biogeographical composition of their biota. These horizontal and vertical gradients influence not only the native biota, but provide also the nonindigenous species (NIS) of different origin an extended repertoire of hospitable conditions. There is scientific proof of inoculation events that have taken place at particular sites, along the whole salinity gradient of the Baltic Sea, from Kattegat in the west to the diluted, innermost parts of the Baltic. Thus, the present Baltic Sea represents an ecological continuum, being a result of significant natural alterations during the past 10,000 years of its postglacial history. During the last two centuries, human-mediated introductions have added a new dimension to this continuum (Leppäkoski & Olenin 2001). In the Baltic Sea countries