Ecology of gelatious plankton: With emphasis on feeding interactions, distribution pattern and reproduction biology of Mnemiopsis leidyi in the Baltic Sea

Comb jellies were a relatively obscure group of zooplankton, until Mnemiopsis leidyi invaded the Black Sea in the 1980’s with cascading effects on several ecosystem levels including commercial fisheries. This native to the east coasts of America triggered large public and scientific attention as a result of this invasion and its ecological and economic impacts. In 2005, when M. leidyi was sighted in Northern Europe for the first time, similar consequences were feared. The aim of my PhD project was to understand the potential impact of M. leidyi on the Baltic Sea ecosystem and constrain on its dispersal. Specifically, the project investigated (i) direct and indirect effects of M. leidyi on the Baltic cod population in its most important spawning ground, (ii) factors governing the spatial and temporal distribution of M. leidyi eggs, larvae and adults in the Baltic and, (iii) M. leidyi reproduction and its effect on population development. The approach involved 13 monthly monitoring cruises from high saline Skagerrak to low saline northern Baltic regions, in situ and laboratory controlled reproduction and feeding experiments, molecular analysis for species verification, and statistical modeling. The low feeding rates and passive negative selection of cod eggs in experiments demonstrate that M. leidyi does not pose a direct threat to the Baltic cod population at the environmental conditions characteristic for its spawning ground. Furthermore, the drastically reduced reproduction rates observed under low salinities suggest M. leidyi is not likely to compete with cod recruits prey. Spatial and temporal surveys show highest abundances during October, with a consistent absence of adult and larval M. leidyi in the northern Baltic. Abundances in the Kattegat were 60 times higher than in the central Baltic, suggesting that the M. leidyi population in the central Baltic is dependent on advection from high saline areas. This interpretation is consistent with the low reproduction rates measured and a low fraction of up-growing animals in the central Baltic. While adults were not observed from April to June in high saline areas, M. leidyi larvae were present throughout the year. It remains unclear where M. leidyi overwinters but high saline areas appear to be important in the annual establishment of the population. Laboratory and in situ reproduction experiments confirmed that fecundity is a major contributor to M. leidyi’s invasion success, although salinity is regulating, and possibly restricting, its range expansion in Northern Europe. Maximum reproduction rates are shown to be attained at low food concentrations, helping reconcile the high population densities observed in localized areas despite low food concentrations. An unexpected discovery was that the arctic relict ctenophore Mertensia ovum, thought to be restricted to the northern Baltic, also occurs in the high saline Kattegat/Skagerrak during winter and spring. Interestingly, in the northern Baltic the M. ovum population consists exclusively of larval-sized animals that are actively reproducing and maintaining a self-sustained population. Natural selection can favor early maturation at small size when mortality rates are high, and our results are consistent with this hypothesis. Currently, M. leidyi has established itself permanently in high and intermediate saline areas in Northern Europe. While the ecological impact of M. leidyi in the central Baltic appears to be limited concern, the environment in other European waters should be more favourable to their populations. In these areas, it is suggested that M. leidyi constitutes a potential threat to fisheries through resource competition with fishes.

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Contributors: Jaspers, C., Kiørboe, T.
Number of pages: 130
Publication date: 2012

Publication information
Place of publication: Charlottenlund
Publisher: DTU aqua. National Institute of Aquatic Resources
Original language: English
Electronic versions:
Research output: Research › Ph.D. thesis – Annual report year: 2012