



infernum

Interdisziplinäres Fernstudium  
Umweltwissenschaften

## Abstract:

Title: “*The ballast water management of ships – ecological problems, legal perspectives and technical solutions exemplified by introduced bivalvia in the Baltic Sea*”

Background: Ballast water is essential for ship's safety and stability. At departure ports water is taken in and kept for stability reasons during the transit. It compensates a lack of cargo or substitutes the weight of used fuel oil. After arrival it is dumped at the port of destination. Annually, billions of tons of seawater are transported around the globe. But the water does also contain non-indigenous species (NIS) which are released into a new environment. Most of them are harmless but a small minority has adverse effects. They can spread and outcompete native species or prey on them. Genetic hybridization and the homogeneity of the world's ecosystems are further potential consequences.

More than a decade ago politicians have realised that precautions have to be taken to protect ecosystems threatened by NIS. Following the precautionary principle, the International Maritime Organization, a subcommittee of the United Nations has implemented the Ballast Water Management Convention in 2004. But it took until September 2016 to achieve the required majority of signatures to ratify the convention.

Now technical treatment systems are required that reliably prevent the settlement and spread of NIS like introduced zebra and quagga mussels (*Dreissena polymorpha*; *Dreissena bugensis*), pacific oysters (*Crassostrea gigas*) and the great shipworm (*Teredo navalis*) in ecosystems like the Baltic Sea.

Methods: This master thesis is literature based and follows an inductive approach reviewing scientific papers belonging to the fields of biology, law and engineering.

Content and goal: The master thesis is subdivided into three chapters. First biological problems caused by NIS are highlighted. Second the existing legal regulations concerning the exchange and treatment of ballast water are examined and third technical solutions for the treatment of ballast water are analysed.

In a holistic approach the thesis wants to raise awareness among seafarers and shipping companies and seeks to create an interdisciplinary understanding of the complex topic “*The Ballast Water Management of Ships*” which is of vital interest not only for international shipping but also for economy, ecology, fishing industry and tourism. The thesis displays how an appropriate ballast water management for the Baltic Sea could look like by focusing on three key elements, i.e. “*ecological problems, legal perspectives and technical solutions*”.

Questions: In its biological chapter the master thesis analyses if and why NIS are a threat to enclosed seas like the Baltic and to which kind of NIS it is prone to. In the legal part it is asked which political regimes and regulations have been taken so far to protect the Baltic Sea region and what options they offer concerning ballast water management. Finally, in the technical part different treatment systems are analysed, focussing on a system, which is capable of preventing the spread of alien mussels.

Results: NIS definitely have an impact on a vulnerable and fragile ecosystem like the Baltic Sea. Zebra and quagga mussels, pacific oysters and the great shipworm were chosen as illustrative examples. However it is currently difficult to estimate to which extent they damage ecosystem structures. The Baltic Sea region and introduced neobiota like the ones above are only examples of regional repercussions of a world- wide problem – Bio-globalisation. This is why international shipping should follow the precautionary principle and treat ballast water. The Ballast Water Convention is the primary legal framework for this and effective technical systems are ready for use now. The “Ocean Protection System” by Mahle Industriefiltration GmbH serves as an example. It treats ballast water in three steps by filtering out the vast majority of marine organisms and de-activates the remaining viable NIS by ultra-violet radiation.

Key words: ballast water, ballast water management, ballast water convention, neobiota, invasive species, ballast water treatment