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## **Towards effective conservation and governance of Pontocaspian biodiversity in the Black Sea region**

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## GENERAL SUMMARY

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Fresh water and brackish water ecosystems are arguably the most vulnerable ecosystems on earth, due to concentrated human developments in and around them. The Pontocaspian (PC) region located at the border of Europe and Asia contains a variety of brackish water ecosystems and unique inhabitants, the PC biota. Globally, biodiversity levels in brackish water ecosystems are low due to the lack of longevity of these dynamic habitats. However, PC biota contains many unique endemic species resulting in biodiversity hotspot in brackish settings in the PC region. Current status and trends in PC biodiversity are poorly known, however severe deterioration of PC habitats is evident in the Black Sea and Caspian Sea Basins. Furthermore, knowledge on current socio-political systems that govern the PC biodiversity management and conservation is lacking. Finally, we have little understanding on the awareness of PC biodiversity by different stakeholders. This does affect PC biodiversity conservation, but we don't know how and how much.

This thesis aims to support an effective PC biodiversity conservation regime. I use the Black Sea Basin (BSB), including the Sea of Azov as a study system and outline current status and trends in PC biodiversity and assess direct anthropogenic drivers of the PC biodiversity change. Furthermore, I investigate how legal framework and stakeholder landscape are organized to deal with PC biodiversity conservation and what major obstacles are to establish effective conservation regimes.

PC biodiversity is severely declining as a result of human action. Identified direct drivers of decline include a) damming of rivers, b) habitat modifications affecting salinity gradients, c) pollution and eutrophication, d) invasive alien species and e) climate change. Indirect drivers of PC biodiversity decline include current legal arrangements; institutional design of environmental stakeholder organizations and the governance systems, as well as the additional social variables such as funding availability for PC biodiversity conservation, institutional stability and the recognition of the need for PC biodiversity conservation. Largely, conservation measures to address PC biodiversity crisis are hampered by a) lack of knowledge on different aspects of PC biota by the public, policy makers, conservation practitioners and scientists; and b) complex socio-political landscape within which the PC biodiversity management is embedded. Specifically, knowledge on PC species identities and taxonomy, distribution, abundances, population trends, life history traits, functional roles and sensitivity to changes in the environment need to be improved. Such knowledge is urgent for informing PC biodiversity conservation planning and the relevant policy and for incentivizing conservation practitioners to participate in PC biodiversity related conservation actions.

Threatened PC biota can greatly benefit from inclusion in the existing projects, initiatives and collaboration frameworks in the Black Sea Basin. Recent developments in molecular techniques, e.g., environmental DNA (eDNA) approaches can elucidate aspects of PC biodiversity such as the trends in rare species with patchy occurrences. Molecular techniques can also greatly benefit and inform the traditional morphology-based species recognition and are absolutely necessary for solving prevailing taxonomic uncertainties. Sustainable management of the BSB, including the coastal riverine ecosystems, has a high priority for the European Union and the Black Sea neighboring countries. Many of the initiatives and projects recognize major knowledge gaps in the BSB region, habitats and biota. They intend to improve the scientific basis to understand vulnerability of these habitats. This landscape of ongoing, large-scale collaboration frameworks provides an unprecedented opportunity for integrating the assessment of PC biodiversity on national and cross-country scales. Recognition of conservation needs of Pontocaspian taxa, combined with improved financial and legal conditions are necessary preconditions for such integration initiatives.