Coping with Complexity in Baltic Sea Risk Governance: Introduction

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Modern society is confronted with the grand challenge of coping with complex socio-environmental risks such as human-induced climate change and hazardous chemicals, typically characterized by scientific uncertainty, socio-political controversy, and ambiguity. This is true not least for the marine environment and for the Baltic Sea, one of the most polluted marine ecosystems in the world.

This complexity may relate to multifaceted and uncertain sources and ecosystem responses, ambiguous and controversial scientific advice, or multi-level and multi-actor interactions and communication barriers. All in all, this challenges conventional risk assessment, risk management, and risk communication. Evidently, new strategies for coping with complexity seem to be a key prerequisite for sustainable governance of socio-ecological systems.

The aim of this special issue is to describe and analyze the governance of complex socio-environmental risks with a focus on the Baltic Sea. Like the topic of interest, our approach is heterogeneous. The variability in topics and methodology of the individual articles are motivated by two underlying assumptions. First, we are convinced that methodologically pluralistic as well as inter- and trans-disciplinary approaches are required. This is linked to our second assumption that there are more profound differences between various risks than the conventional parameters (probability and harm) suggest, for example, the type and magnitude of impact, the degree of reversibility, and the form of complexity. Going back to Greek mythology, this can be exemplified with the risk and complexity connected with two well-known artifacts, the Sword of Damocles and Pandora's Box. Clearly, the possible negative outcomes are quite extreme in both cases, but whereas Damocles' dilemma can be relatively well captured by conventional risk assessment and management, the irreversibility in the case of Pandora's Box requires new forms of analysis

and governance, for example a precautionary approach. Although simplified, these cases are illustrative metaphors for two socio-environmental risks in the Baltic Sea, namely large-scale accidental oil spills and invasion of exotic species, respectively. Our point here is that governance of complex socio-environmental risk is context dependent and might require quite different approaches for various types of risks.

The distinction between governing and governance may seem unproblematic, where the former primarily comprises command and control mechanisms and the latter a wide spectrum of actors influencing eventual outcomes. However, this distinction is quite complex, as leadership by governments may be required in order to structure participatory processes. For example, governmental organizations play leading roles in regulating marine transport and coordinating adaptation to climate change. Participatory processes and stakeholder involvement are on the other hand shown important for at least two reasons. First, knowledge not considered by science may fruitfully be brought into decision-making processes, as seen for example for time and place-bound fishermen's knowledge on sizes and fluctuations of local fish stocks. Second, stakeholder participation in management processes may improve implementation by increasing legitimacy particularly when managing ambiguous risks.

Risk management has traditionally been almost exclusively based on risk assessment in combination with economic implications. It is shown in this special issue that the relation between scientific knowledge and political decision-making is more complex than commonly thought. Ambiguity may be caused not only by stochastic components and knowledge gaps, but also by individual, social and contextual factors. It is clear that societies' responses to various threats to the environment and to human health

are not only based on tangible data on probabilities and level of harm, but also on how the risks are framed and communicated, how they relate to social and cultural norms and how the risks and effects are distributed among different groups of people. For example, risks related to consumption of fatty fish from the Baltic Sea with high concentrations of hazardous chemicals have to be balanced against positive health effect from eating fish and subjective values stemming from consumption of traditional food. In a rather different context, macro factors such as level of economic development and individual socio-economic status is shown to affect risk perceptions, and fertility rates in Russia seem to have been substantially affected by changes in how individuals have assessed future risks related to socio-economic conditions after the collapse of the Soviet Union.

Complex risks and problems require a more sophisticated iterative approach to risk assessment and risk management than what traditional expert-driven approaches, often set out in policies, offer. This should naturally not be interpreted as an argument against science-based management. Science is central, but often needs to be complemented by academic perspectives from social sciences as well as the humanities. Furthermore, under scientific ignorance, science-based management fails and precautionary strategies, guiding the understanding of uncertainty, offer important complements. Likewise, aspects related to stakeholder participation, communication and increased involvement of civil society, and other concerned representatives all need to be addressed in many cases.

We think that the improvement of risk governance in the Baltic Sea region requires moving from holistic perspectives and the formulation of an ecosystem-based approach

in theory, to actual implementation in practice. There is a need to identify environmental risks, define appropriate levels of stakeholder involvement, assess needs for local knowledge, identify key actors and their respective interests, evaluate socio-economic impact and normative implications in particular problem areas in order to improve sector integration, and build a basis for a holistic, and often precautionary, ecosystem-based management approach.

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