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Diversity

Understanding and bridging the conservation-genetics gap in marine conservation

Annica Sandström [1,*] Carina Lundmark [1] Klas Andersson,[2] Kerstin Johannesson [3] and Linda Laikre [4]

[1]Department of Business Administration, Technology and Social Sciences, Luleå University of Technology, Luleå, 971 87, Sweden
[2]Department of Education and Special Education, University of Gothenburg, Box 300, Gothenburg, 405 30, Sweden
[3]Department of Marine Sciences, Tjärnö Marine Laboratory, University of Gothenburg, Strömstad, 452 96, Sweden
[4]Division of Population Genetics, Department of Zoology, Stockholm University, Stockholm University, 106 91, Stockholm, Sweden

Introduction

The goal to protect ecosystems, species, and genetic diversity is clearly stipulated in international agreements (e.g., CBD 1992); however, it is a struggle to realize it. Although knowledge regarding genetic diversity has increased rapidly (Allendorf et al. 2010), the incorporation of this information in conservation is hampered by a gap between genetic knowledge and how it is applied to conservation (conservation-genetics gap) (Taylor et al. 2017).

To address this gap, we previously examined Baltic Sea marine protected areas (MPSs) formed under the Helsinki Convention (HELCOM) (http://www.helcom.fi) as a case study. Genetic biodiversity is particularly neglected in marine conservation (Parsons et al. 2014; Cavanagh et al. 2016; Pérez-Espona & ConGRESS Consortium 2017), and many Baltic Sea species are especially sensitive to genetic degradation (Johannesson et al. 2011). The Baltic Sea may offer a time machine through which future developments in other marine systems, including policy implementation, can be viewed (Reusch et al. 2018). Here, we sought to synthesize key findings from previous studies (Laikre et al. 2016; Sandström et al. 2016; Lundmark et al. 2017, 2019) into a framework and to provide recommendations for how to bridge the conservation-genetics gap based on this framework.

Genetic biodiversity is a particularly urgent issue with high relevance to ecosystem resilience in the Baltic Sea, but it can also be considered a critical case of biodiversity conservation. It represents a highly complex scientific problem embedded in a multifaceted institutional context, and many challenges and obstacles associated with conservation are particularly evident in this case (Laikre & Ryman 1996). Lessons from this case should be applicable to other cases with similar, yet perhaps less complex, characteristics. Thus, we expect more general lessons about how to solve the riddles of conservation and how to improve implementation of international conventions and national policies from the Baltic Sea case.

The conservation-genetics gap has been addressed previously (e.g., Stetz et al. 2011; Hoban et al. 2013; Taylor et al. 2017), but we used a different approach that combined political and educational sciences with conservation genetics and explored how the genetics gap affects marine conservation at international, national, and regional levels. We suggest this approach is applicable to other cases.

Gap Between Knowledge and MPA Management

We quantitatively and qualitatively reviewed 240 policy documents relevant for Baltic Sea biodiversity at the international, national, and regional levels to determine how genetic diversity was treated. Although goals for conserving genetic diversity were clearly stated in international and national documents, they were rarely mentioned in regional documents (Laikre et al. 2016) (Fig. 1, stage 1).

*email annica.sandstrom@ltu.se
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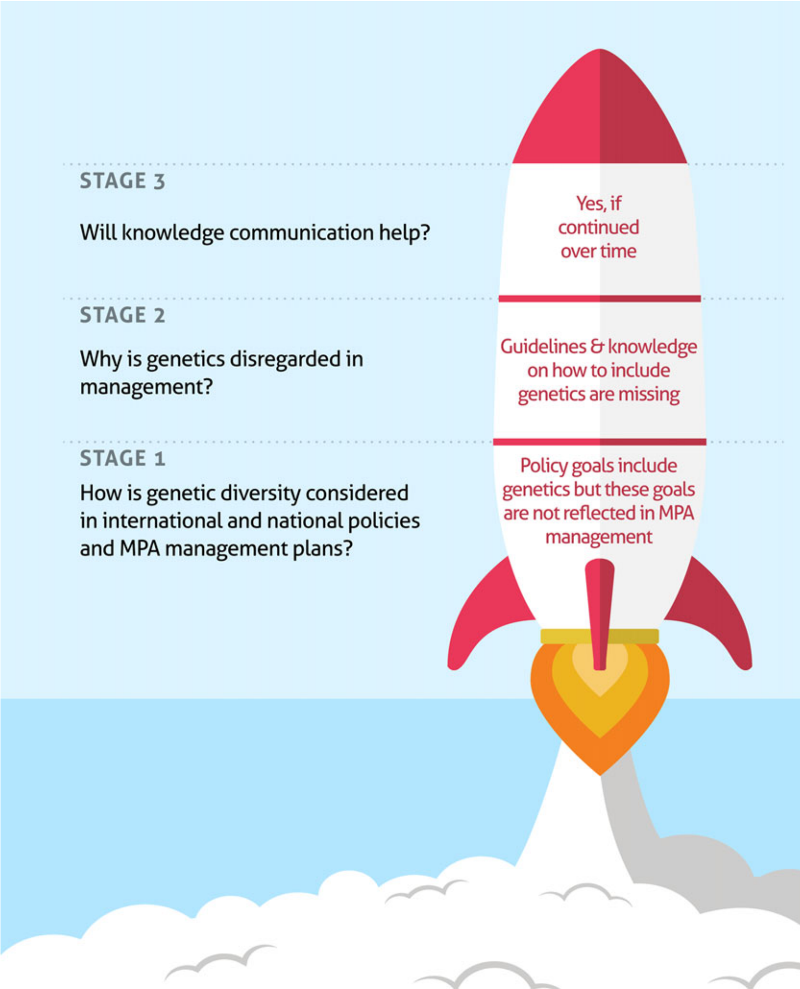

Figure 1. A three-stage approach to investigate the conservation genetics gap based on Baltic Sea marine protected area management as a case study. Illustration by J Lokrantz/Azote.

We also examined why regional management plans lack genetic aspects by conducting in-depth interviews with 13 managers responsible for MPA formation and maintenance (Supporting Information). We applied the human-subjects ethical principles of the Swedish Research Council. The low priority given to genetic biodiversity was explained by managers' vague understanding of existing policy, by deficient implementation resources, such as knowledge, staff, and networks, and by their ambiguous view of the problem and how it should be handled i.e., their policy beliefs (Sandström et al. 2016) (Fig. 1, stage 2).

We explored the potential for improving knowledge and modifying managers' policy beliefs by conducting a knowledge-transfer exercise. We compared traditional lectures to deliberative discussions. Seventy-two managers participated in the study. The lectures particularly increased managers' knowledge and perceptions of genetic diversity, but the transformative effects disappeared rapidly over time (Supporting Information) (Lundmark et al. 2017, 2019) (Fig. 1, stage 3). In addition to the above, we participated in intense stakeholder interactions during the project period (bambi.gu.se/activities/baltgene-2017), produced a web page (bambi.gu.se/baltgene/), and synthesized existing knowledge on genetic diversity in the Baltic Sea for managers (Wennerström et al. 2017).

Pieces Needed to Bridge the Gap

Our findings highlighted the crucial role of regional conservation and identified pieces needed to bridge the gap between science and management: modified policy framework, implementation resources, and platforms for communication. A precondition for successful policy implementation is that regional managers understand the policy, have the capacity and resources to carry it out, and feel an urgency to do so (Lundquist 1987). This is not the case with respect to Baltic Sea genetic biodiversity.

Navigating Complex Goals and Institutions

The vague understanding about governing policies and what they stipulate among managers illustrates challenges that are typical of multilevel governance systems in which marine conservation is embedded (e.g., Bache & Flinders 2004). The system is riddled with conflicts among policies (e.g., conservation and fishery) and political and administrative bodies (e.g., international policies, European Union regulations, and national strategies [Nilsson et al. 2012]). These incongruities leave the delicate task of prioritizing goals and actions to the last link in the policy chain, that is, regional managers.

The complexity is furthered by an overlap among different types of area protection. For example, many HELCOM MPAs include Natura 2000 areas and nature reserves and are subject to different institutional frameworks. We found it was difficult to find and get access to regional management plans and that plans were missing for some areas. Our general impression was that the governing authorities lacked a comprehensive take on MPAs.

Revised policy frameworks, improved implementation resources, and new learning platforms are needed to help implementers navigate the complexity of policy goals and institutions.

Providing Clear Guidelines for Managers

The protection of genetic biodiversity must be prioritized and explained as equal in importance to the protection of species and ecosystem biodiversity, and the framework must be complemented by guiding documents that offer clear advice on how this can be done in practice. The managers we met claimed these elements were missing.

National authorities can make a big contribution by stipulating in their instructions to regional authorities the necessity to work with genetic biodiversity and by reviewing and updating guidelines and manuals on how to form new MPAs and on what to consider when developing conservation goals and updating management plans. There is an opportunity to learn from other policy areas; genetic concerns are more prominent in terrestrial policy than in marine policy (Laikre et al 2016; Sandström et al. 2016).

Researcher-developed checklists can help managers formulate, implement, and evaluate management plans. Attempts have been made, but existing guidelines are evidently unknown or perceived as irrelevant to the managers we interviewed. Exploring ways to make better use of such information (e.g., www.congressgenetics.eu; nceas.ucsb.edu/collab/12140/GeM_MainPage_1.htm; bambi.gu.se/baltgene) is strongly encouraged.

Strengthening Implementation Resources

We suggest that resources supporting implementation at the regional level must be reconsidered and significantly strengthened to enhance goal fulfillment. Managers need support in the interpretation of what the international ambitions and national goals mean in the context of their work because local adjustments to higher-level policies are always needed.

Managers in our study identified national authorities as those they turn to for knowledge and advice in cases of uncertainty. Thus, these organizations can make better use of their prominent positions. They can do much more to foster the evolution of knowledge networks of experts that support managers and take greater responsibility in updating managers' competence relative to new technologies. Responsible authorities should also reconsider other aspects of the national support structure and, for example, ensure the genetic component is integrated in national monitoring systems and easily accessible to low-level managers who lack financial resources to collect genetic information.

Constructing Platforms for Continuous Learning

Managers need to embrace the importance of genetic biodiversity in their daily work. This calls for platforms for communication between science and different groups of managers. At our meetings and educational efforts with managers, such forums were repeatedly requested, as were projects with universities, problem-based workshops, web-based tools and knowledge brokers assigned with the task to translate science to practical management advice. Our findings underline the importance of continuity in this interface and suggest institutionalized platforms rather than project-based efforts.

We encourage researchers from different fields to engage with policy makers and managers in discussions on how to upgrade the genetic component in conservation and funding organizations to support this kind of work. These discussions should depart from the conditions of everyday work at the lower levels of management and seek to identify obstacles to, but also learn from best practices on, how bridges between genetic knowledge and conservation practice can be built.

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Supporting Information

An interview guide (Appendix S1) and the survey (Appendix S2) are available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.
Supporting Information

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