ARCTIC BIODIVERSITY

ISTAS workshop session :

Marine Biodiversity: From Individuals to Pan-Arctic

Authors

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Overview

The Arctic Ocean harbours an ice driven ecosystem which is characterized by multiple unique life forms with highly adapted life histories, ecology and physiology, which enables them to survive in the extreme conditions and strong seasonal changes. The Arctic Ocean is currently one of the key regions where the effect of climate change is most pronounced. Massive reduction of sea ice thickness and extent will result in large cascading changes for the entire Arctic ecosystem and will affect all levels of marine biodiversity from taxonomic and genetic to functional, physiological and community diversity.

Shifts in biodiversity can directly and indirectly affect resources and ecosystem services. Any change in biodiversity is therefore of critical concern. An increasing human presence in the Arctic requires that we have good knowledge of marine biodiversity on multiple temporal and spatial scales and how it will respond to multiple pressures. These scales should include: biological scales, ranging from genetics to organisms and populations; spatial scales, ranging from local through regional to pan-Arctic; and temporal scales, ranging from seasonal and interannual to decadal. Importantly, there needs to be integration and connections between these various scales. Within this framework, microbial and benthic ecosystems, deep sea regions and sea ice associated (sympagic) habitats, as well as the winter period and adaptations to low temperature were identified as the major knowledge gaps. Ultimately, we need to unify and integrate indicators and monitoring systems to be able to track impacts of biodiversity changes, as well as the response of biodiversity to pressures and environmental change within the Arctic marine system.

Fig. 1. Expected Arctic biodiversity changes in response to recent changes in non-Arctic species distributions and/or in Arctic species population sizes that have been attributed to global climate change (Peeken, based on Bluhm et al. 2011). Photo credit: Carin Ashjian, WHOI, Hauke Flores, Ilka Peeken, Björn Rost, Sebastian Menzelall AWI, AWI-web site, Magnus Elander, CC BY-NC-ND 4.0, ITAW/Carsten Rocholl, Rolf Gradinger, Website: Centre for Marine Biodiversity (CMB).

Framework questions

- How can we best contribute towards a better understanding of the present Arctic marine biodiversity?
- How is biodiversity related to ecosystem function and ecosystem services on multiple temporal and spatial scales?
- How is Arctic biodiversity responding to multiple and cumulative pressures?
- What is the resilience, plasticity and adaptation capacity of the Arctic marine species?

The ISTAS interdisciplinary and international workshop (Integrating spatial and temporal scales in the changing Arctic System: towards future research priorities) was organized in October 2014 by the Arctic in Rapid Transition (ART) network at the IUEM in Plouzané, France. The overarching objective of the workshop was to bring together Arctic scientists of different areas of expertise and experience level in order to discuss future research priorities for the Arctic Ocean and adjacent coasts from an early and mid career researchers' perspective. This set of priority sheets summarizing the workshop's discussions is one of the contributions of the ART network to the 3rd International Conference on Arctic Research Planning (ICARP III) in Japan.

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RESEARCH PRIORITIES
APPROACHES AND RECOMMENDATIONS

▶ Increase biodiversity knowledge on spatial scales, especially in deep sea and sympagic ecosystems and on a pan-Arctic scale

- Integrate and connect scales: Local – Regional – pan-Arctic.
- Fill spatial gaps, especially for the sea-ice associated ecosystems, and the deep-sea pelagic and benthic systems.
- Integrate confirmed species absence data into up-to-date biodiversity inventories.
- Improve methods to combine field data and remote sensing data.
- Integrate traditional and modern tools and improve technological capability to fill some of the above identified gaps.
- Build international knowledge exchange and partnership platform for pan-Arctic integration.

▶ Expand biodiversity knowledge on temporal scales, with special focus on the dark/winter season and building multi-decadal time series

- Include year-around studies that cover the dark season.
- Emphasize the importance of monitoring/time series and continue to build on existing time-series.
- Focus on the full life histories.

▶ Improve biodiversity knowledge on microbial communities and benthic ecosystems including molecular approach

- Apply modern tools to existing samples.
- Approach existing monitoring programs to include microbial and benthic sampling.
- Expand current pan-Arctic sampling network (Circumpolar Biodiversity Monitoring System).

▶ Integrate functional and physiological diversity with taxonomic and genetic diversity: biological traits, cold and dark adaptation

- Understand responses, adaptations and resilience of species to environmental change.
- Describe physiological tolerance limits of species, their plasticity and adaptation capacity.
- Focus on the full life histories: do different life stages respond differently and does this change over multiple generations?
- Integrate the existing functional trait knowledge in a pan-Arctic trait-database.

▶ Develop indicators for response(s) to pressures and changes

- Establish key drivers that control the rapid transition of Arctic ecosystems.
- Integrate the effects of multiple and cumulative stressors.
- Include more biological data in new and existing models.
- Integrate among disciplines (e.g., chemistry, oceanography, and ecology; see also ART priorities 'Arctic Oceanography').
- Identify what causes the biggest negative effects for the human society?

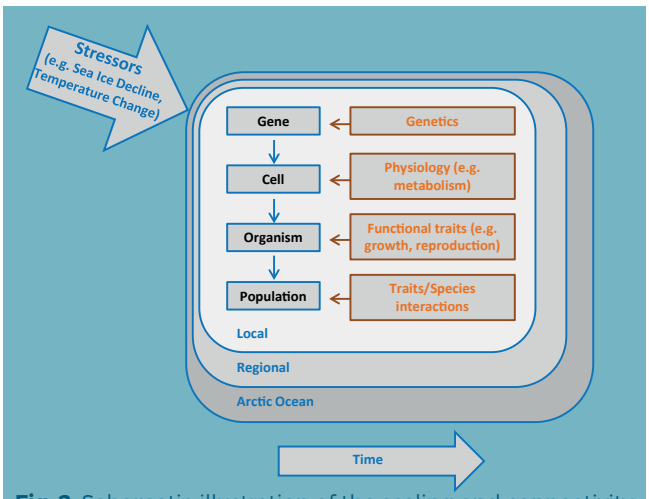

Fig. 2. Schematic illustration of the scaling and connectivity affected by climate change induced stressors.

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