Building international research partnerships in the North Atlantic-Arctic region

Benway, Heather M.; Hofmann, Eileen; St. John, Michael

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The North Atlantic–Arctic region, which is critical to the health and socioeconomic well being of North America and Europe, is susceptible to climate-driven changes in circulation, biogeochemistry, and marine ecosystems. The need for strong investment in the study of biogeochemical and ecosystem processes and interactions with physical processes over a range of time and space scales in this region was clearly stated in the 2013 Galway Declaration, an intergovernmental statement on Atlantic Ocean cooperation (http://europa.eu/rapid/press-release_IP-13-459_en.htm). Subsequently, a workshop was held to bring together researchers from the United States, Canada, and Europe with expertise across multiple disciplines to discuss an international research initiative focused on key features, processes, and ecosystem services (e.g., Atlantic Meridional Overturning Circulation, spring bloom dynamics, fisheries, etc.) and associated sensitivities to climate changes.

Plenary talks on small- and large-scale circulation, biogeochemistry, ecosystem dynamics, biodiversity, and links to human populations set the stage for smaller group discussions, in which participants identified near-term research priorities, both within and across disciplines. Feedbacks between climate and circulation ultimately drive the biogeochemistry, marine food web dynamics, and community structure of shelf and open seas, with socioeconomic and human health implications. Changes in climate from annual to centennial scales and attendant changes in temperature, freshwater input, and wind patterns will affect physical circulation, including changes in upper ocean density, surface currents, stratification, and eddy dynamics. Cycling and transport of carbon, oxygen, and nutrients—particularly links between surface and deep processes, exchange between shelf and open ocean systems, and biological pump efficiency—are inextricably connected to the marine food web.

In addition to physical and biogeochemical controls, biological responses at the individual, species, and community levels will depend on factors such as physiological tolerance, trophic interactions, and fisheries extractions. Near-term challenges across human-natural systems in the North Atlantic–Arctic region include shifting biogeographic boundaries, increasing resource exploitation, more frequent extreme events, changes in carbon cycling, and the need for universally established marine ecosystem health metrics.

Participants identified a few high-priority research topics that cut across disciplines and would benefit from collaborative transAtlantic research. Changing habitat distribution and population dynamics of fish stocks link upper and lower trophic levels, environmental variability, and fishery-dependent societies in open ocean and coastal environments. The tight coupling between carbon cycling and plankton blooms can amplify climate perturbations, which modifies ecosystem structure and productivity. Autonomous platforms are critical for providing the increased spatial and temporal coverage needed to study bloom dynamics. Increasing freshwater input and a changing Arctic cryosphere affect water mass transport, connectivity among basins, stratification, nutrient availability, and food webs, with strong links to humans primarily via fisheries and transportation.

The primary outcome of the workshop will be an international, community-vetted science plan that offers a vision for the next phase of North Atlantic–Arctic research and provides a framework that can be used within and across nations to coordinate and conduct collaborative multidisciplinary research. The draft plan will soon be open for community comment (http://www.whoi.edu/website/NAtl_Arctic/home) and will be finalized in early 2015.

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—Heather M. Benway, Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, Mass.; email: hbenway@whoi.edu; Eileen Hofmann, Center for Coastal Physical Oceanography, Old Dominion University, Norfolk, Va.; and Michael St. John, Section for Marine Ecology and Oceanography, Technical University of Denmark