Preparing for a Northwest Passage: A Workshop on the Role of New England in Navigating the New Arctic
The University of New Hampshire. March 25-27, 2018

EXECUTIVE SUMMARY

The rapid warming of the Arctic and melting of Arctic sea and land ice has ramifications around the globe. Shipping routes through an ice-free Northwest Passage in combination with modifications to ocean circulation and regional climate patterns linked to Arctic ice melt affect trade, transportation, coastal ecology and hydrology, human-built infrastructure, demographics and cultural identities, fish and wildlife, energy resources, and air and water quality -- not only in the Arctic but also in mid-latitude coastal regions such as New England. With profound changes on the horizon, this is a critical opportunity for regions such as New England to prepare for the uncertain yet inevitable economic and environmental impacts of Arctic change.

A regional workshop, "NNA Convergence: Preparing for a Northwest Passage – the Role of New England in Navigating the New Arctic" (NSF #17443460), hosted by the University of New Hampshire (UNH) on March 25-27, 2018, gathered expertise and talent from academic and external partners throughout New England and beyond involved in Arctic research. The workshop paired two of NSF's 10 Big Ideas, *Navigating the New Arctic* and *Growing Convergence Research at NSF*[1], to discuss the socio-economic and environmental links between New England and the Arctic. The workshop adopted a convergent framework, considering the methods and conceptual frameworks from the social sciences, the experimental and modeling tools of the physical and life sciences, and the solution-driven problem solving of engineering.

I. Workshop Goals and Objectives

The goal of the workshop was to *assess the socio-economic and environmental links between Arctic change and New England, identifying transformational convergence research initiatives to anticipate, prepare for, and adapt to future impacts and opportunities.* The specific objectives of the workshop were to:

1. **DEVELOP A VISION** for how Arctic change might impact New England over the next several decades (opportunity, risks, and hazards) and recommend future convergent research priorities linking Arctic change and New England
2. **ESTABLISH A REGIONAL NETWORK** to encourage multi-institutional convergence research projects
3. **IDENTIFY SPECIFIC CONVERGENCE RESEARCH INITIATIVES**, core collaborative teams, topics for review papers, and follow-up plans in line with NSF Navigating the New Arctic (NNA).

Discussions were designed to develop strategies for conducting scientific research that will best inform decision-making and sustainable communities in anticipation of Arctic change. Particular emphasis was given to concerns unique to New England and its relationship with the Arctic. The anticipation was that identifying specific research problems ripe for convergent approaches will enable the development of innovations in observing systems and modeling efforts, as well as strategies for engaging a range of communities and interest groups throughout the planning, implementation, and evaluation of future research initiatives.

[1] NSF defines Convergence Research as research driven by a specific and compelling problem requiring a deep integration across disciplines.

II. Workshop Findings and Recommendations

i. Overarching Goals

Guest speakers, panel presentations, and round-table discussions focused on three broad topics: Transportation and Infrastructure, Living Resources, and Coastal Dynamics. Plenary discussions based on these sessions identified the following strategic imperatives to link New England and the Arctic through the convergence of knowledge, technology, and society:

- **PREDICT SCENARIOS** of viable regional economies in New England and in the Arctic under conditions of Arctic change, including what these new economies will provide for people on scales from small towns to cities and how they will change socio-ecological and cultural systems.
- **STRATEGICALLY BALANCE** the role of science in engaging with commercial interests as well as environmental ethics and social justice.
- **FULLY ENGAGE STAKEHOLDERS** in the design and execution of research. Include traditional knowledge and citizen science in an effort to understand the scale and rate of change of inter-linked systems in the Arctic and connected regions.
- **FORM A REGIONAL NETWORK** to provide distinctive leadership in supporting science and informed decision-making.
- **TRAIN THE NEXT GENERATION** of convergence researchers and Arctic leaders in twenty-first century skills that value diversity and inclusion.

ii. Establishing a New England Arctic Network (NEAN)

The consensus among workshop participants is that a regional, multi-institutional network based in New England can uniquely address links between Arctic change and the North Atlantic Arctic region. This *New England Arctic Network (NEAN*) will combine the wealth of academic expertise in Arctic research across New England with researchers, stakeholders, and external partners concerned with environmental, economic, and social impacts, providing an ideal community for anticipating and responding to Arctic change and its impacts on the eastern coast of North America. This regional network in affiliation with other nascent networks in Canada and Europe will foster connections and research collaborations among people living and working throughout the North Atlantic Arctic region. Participants identified the following characteristics and objectives for this network:

- **INCLUSIVE MEMBERSHIP**, engaging university researchers and a diversity of representation from businesses, governments, nonprofit organizations, and coastal and indigenous communities.
- **OPEN COMMUNICATION** and the exchange of information and resources, including online collaborative tools that foster new Arctic research collaborations based on community needs.
- **SOLUTIONS-ORIENTED APPROACH** for activities with an applied component, including participatory research methods.
- **HOLISTIC METHODOLOGY** involving research, scholarship, communication, and engagement that is international, interdisciplinary, and inclusive.
- **ENGAGE COASTAL COMMUNITIES** from New England to the Arctic, including indigenous groups. Recognizing a need to expand beyond New England to Canada and other countries around Atlantic, the anticipation is for New England network to grow into a *North Atlantic Arctic Network (NAAN)*

iii. Themes and Initiatives for Research and Scholarship

The New England Arctic Network will bring researchers (physical and biological scientists, social scientists, engineers, and humanists), educators, artists, governments, businesses, and not-for-profits into the design, implementation, and communication of solutions-driven scientific research, enabling convergence research initiatives across disciplines, institutions, and sectors. Following are the mission, high-priority themes, educational initiatives, and some example convergence research projects to guide the development of this network:

MISSION

Study and respond to links between Arctic change and North America's East Coast, with a particular focus on the North Atlantic, New England, and the Gulf of Maine.

THEMES

1. Hazards related to increased shipping and resource extraction in the North Atlantic Arctic region (e.g., oil spills, disruption of ecosystems, and socio-economic and environmental shocks to coastal communities).
2. Socio-economic and environmental impacts of increased shipping and tourism on coastal communities with implications for environmental ethics and social justice.
3. Risk assessments for coastal communities, informing response to sea level rise and coastal erosion, adaptive management for fisheries and wildlife, and environmental and cultural stewardship.
4. Physical and social infrastructure needs, including the role of adaptive technologies such as smart sensors, scientific decision support, and collaborative governance.
5. Innovative strategies for data synthesis, information transfer, and co-learning among researchers, operators, and decision makers that incorporate traditional knowledge, citizen science, and participatory research.
6. Enhancement of quantitative and qualitative observations to fill data gaps, with a particular focus on biogeophysical marine observations as well as disruptions to socio-ecological systems from the Gulf of Maine to Baffin Bay.

EDUCATIONAL INITIATIVES

1. Design multi-institutional courses that adopt progressive problem-based pedagogy and blended learning.
2. Use the New England Arctic Network to expand student opportunities for field research throughout the North Atlantic Arctic Region.
3. Enhance diversity among the next generation of Arctic leaders, with a particular focus on providing educational opportunities for underrepresented groups and indigenous communities from both New England and the Arctic.
4. Collaborate on outreach activities to educate the "lower 48" about the global impacts of Arctic change.

EXAMPLE CONVERGENCE RESEARCH PROJECTS

1. Perform integrated assessments for socio-ecological scenarios associated with the expansion of ports, shipping, and tourism linking New England and the Arctic. Can strategic investments at local, state, and regional scales improve equitable distribution of benefits (e.g., the best location for ports)?
2. Develop the cyberinfrastructure necessary to anticipate and respond to hazards from shipping and resource extraction that affect local communities and ecosystems. Promote efforts to link datasets from natural and social sciences to provide better options for decision-making.
3. Fill in gaps and synthesize datasets to understand how ocean circulation, salinity, and nutrient loading in the North Atlantic will change as a result of Arctic ice melt. Predict the impacts of the changing marine environment on biological productivity, fisheries, community resilience, livelihoods, and cultural heritage.
4. Prepare for real-time knowledge transfer from New England to Arctic communities on a variety of social, environmental, and technology issues. Use social network analysis, social media, and evolving technologies to enhance information transfer.
5. Conduct community-driven studies of coastal erosion and impacts to ecosystem services from permafrost thaw, sea level rise, and extreme weather. Bring together charting and ocean mapping, bioaccumulation, human censusing, displacement options, political consensus, satellite, remote and in situ monitoring on ocean and land. Pursue case study, comparative, and historical research to anticipate societal response. Develop low cost and autonomous sensors (remote observations) and low cost and robust tools (citizen science).

Chapter 4 of the workshop report presents a comprehensive discussion of Findings and Recommendations and catalogues a more extensive list of specific and compelling science questions and societal challenges linking New England and the Arctic. Each initiative will require a deep integration across disciplines to design the objectives, methodology, implementation, and assessments needed to achieve solutions.

The complete workshop report along with contact information for the New England Arctic Network are available at the following website:

https://mypages.unh.edu/ne-arctic-convergence