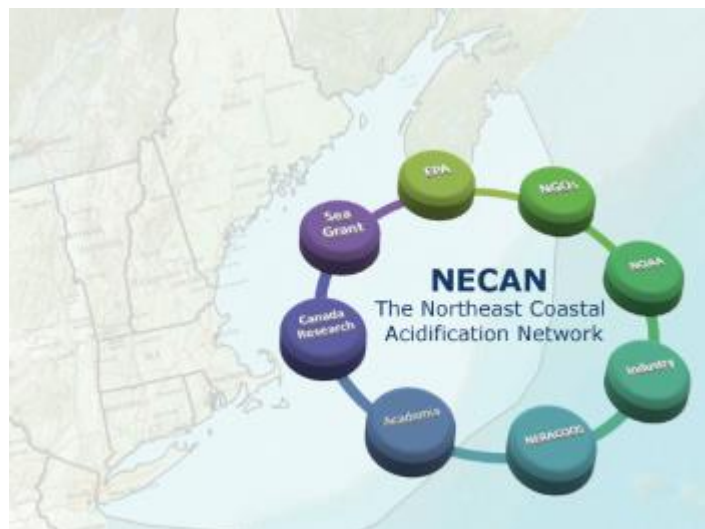


NECAN Implementation Plan

This implementation plan documents the goals and objectives for the Northeast Coastal Acidification Network (NECAN) and specific strategies and activities to address these goals.

What is NECAN?



NECAN is the leading organization for the synthesis and dissemination of regional acidification data and information. Established under the Northeastern Regional Association of Coastal Observing Systems (NERACOOS) in 2013, NECAN is a partnership among government agencies, industry, and the scientific community. NECAN also serves as a conduit through which decision makers and stakeholders can provide guidance for regional

research and monitoring. The NECAN region encompasses the coastal ocean from the high-water line out to the shelf-break from Long Island Sound to the Scotian Shelf.

NECAN's Mission

To provide scientific information to decision makers and stakeholders regarding ocean and coastal acidification and its potential environmental and socio-economic impacts to the northeast region.

NECAN's Vision

A NECAN region that is resilient and prepared to address and adapt to ocean and coastal acidification. NECAN will be an active voice in communicating potential impacts and solutions to the region.

NECAN's Role

- **Review, synthesize, and communicate** the most recent scientific, technical, and socio-economic information relevant to the economically important marine organisms potentially impacted by OCA.
- **Identify** regional priorities for monitoring, modeling, and research.

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- **Communicate** critical knowledge gaps and needs identified by stakeholders to relevant state and federal agencies.
 - **Coordinate** research designed to further our understanding of OCA impacts.
 - **Educate** the public and stakeholders on regional OCA issues.

While the work of the organization is policy-relevant, it is intended as policy-neutral and not policy-prescriptive. NECAN will not develop policy goals or be a political advocacy organization, though it may be called upon to provide information that leads to policy deliberations. NECAN will also not be a data repository but may provide links to other relevant data sources; nor will NECAN provide primary funding for monitoring or research but will help to coordinate activities funded through other sources.

Background on Ocean and Coastal Acidification

Over the past couple of decades, a growing body of literature is clearly documenting the sensitivity of a range of marine organisms to changes in ocean carbon chemistry. Based primarily on laboratory experiments, scientists have demonstrated that a broad range of organisms, from fish to phytoplankton, are sensitive to changes in CO₂ whereby fitness is frequently compromised under elevated CO₂ conditions. Especially high sensitivity appears to be endemic to marine calcifiers including scallops, clams, mussels and oysters. Such identified sensitivities are of particular concern, given that global ocean observing systems have definitively documented changes to the ocean's carbon chemistry in direct response to rising anthropogenic CO₂ through a process termed *ocean acidification*.

Global oceans are acidifying concurrent with rising atmospheric CO₂ at rates likely unprecedented in earth's history. Chemical changes in seawater as a result of the uptake of CO₂ include increasing concentrations of dissolved inorganic carbon (DIC), the production of carbonic acid (lowering of pH), an increase in the partial pressure of CO_{2,sw} (pCO_{2,sw}), and a decrease in the availability of carbonate ion. In addition to acidification from atmospheric CO₂ evasion, regional acidification in coastal waters can be influenced by variations in transport of DIC, total alkalinity (TA), and nutrients derived from local or remote sources.

Gulf and shelf waters of the Northeastern US and Maritime Canada receive significant freshwater input both from rivers and melting sea ice, which yields waters with a reduced buffering capacity making them uniquely vulnerable to acidification relative to many other regions. In addition to the continual long-term increase in anthropogenic CO₂, decadal trends in precipitation, nutrient loading, warming or

water mass exchange combine to generate regional differences in ocean acidification rates in the northeast coastal ocean. For example, Salisbury and Jonsson (2018) recently demonstrated how raising temperatures and salinity in the Northeast confounds efforts to observe ocean acidification caused by CO₂ uptake. Coastal nutrient loading or eutrophication is attributable to land- and atmospherically-derived nutrient fluxes that promote intense autotrophic production with subsequent CO₂ evolution and pH reduction via heterotrophic respiration (Gledhill et al., 2016; Cai et al. 2011). These coastal anthropogenic perturbations to natural processes are collectively known as coastal acidification and include acidic river discharge (Salisbury et al. 2008), atmospheric fluxes of acidic and alkaline compounds occurring predominantly in coastal regions (Doney et al. 2007).

As a result, coastal acidification sites generally exhibit higher frequency variability and considerably greater dynamic range relative to ocean acidification (Waldbusser and Salisbury 2014) and have the potential to benefit from local remediation activities. Acidification within the coastal environment is often dominated by short-term episodic events measured on sub-annual or even sub-daily time-scales, which are transposed over the long-term secular changes. Many harvestable species potentially sensitive to acidification reside within these complex coastal waters.

The Northeast may be particularly susceptible due to the region's social and economic dependence on calcifying organisms such as clams, oysters, mussels and lobsters – in many regions on single species without much diversity in their fishery. We have a long history of connection with our coastal ocean, especially with our marine resources which are a strong part of our cultural identity. Among the many industries that could be affected by ocean and coastal acidification are commercial fishing, shellfish harvesting, aquaculture, seafood distribution and the tourism related to all of the above. People operating businesses in those industries need objective information to help them prepare for and respond to the impacts. Policymakers and resource managers are beginning to address ocean and coastal acidification, and they require high-quality scientific information for decision-making. In turn, the scientific community needs input from stakeholders and decision-makers to design effective monitoring and research strategies to develop resilience strategies for the region. NECAN is a vital part of that as it provides an ongoing regional forum for the synthesis of the latest scientist, stakeholder and participant observations and needs.

NECAN Functions

NECAN has several functions, outlined in this implementation plan, which include objectives for each of the four working groups: Education and Outreach, Industry, Management and Policy, and Science.

-Education and Outreach Working Group

The Education and Outreach (E&O) Working Group provides a collaborative platform for ocean and coastal acidification educators to inform each other and their community about OCA. Additionally, the E&O Working Group provides educational resources to stakeholder groups, such as citizen science monitoring groups.

Actions and Goals for the Education and Outreach Working Group

- Review and update Education and Outreach page on NECAN website
 - Include link to citizen science webinars and workshops
 - Shell day information
- Continue to organize and implement Shell Day
 - Include any follow up reports, review, or data
- Provide regional OCA information and document stakeholder needs
- Raise awareness of key issues related to OCA
- Hold educational stakeholder workshops dependent on need and opportunity
 - Assess needs of region, industries, or economic sectors
 - Educator outreach as needed or requested
- Maintain reference library on NECAN website by incorporating new publications
 - Joint action with the Science Working Group
- Create a space in the OAIE to share information and promote collaboration.
 - Possibly with a unique tag or team for the E&O WG so posts can be easily found.

Past Accomplishments

- Hosted two Citizen Science webinars in March and April 2018 to discuss the role of citizen scientists in OCA monitoring.
- Following the webinars, three workshops were held in Connecticut, Maine, and Massachusetts to meet with citizen science monitoring organizations and discuss the difficulties in monitoring OCA, best practices, data storage and sharing, and opportunities for collaboration.
- Planned, organized, and implemented a regional, single-day, citizen science water sampling event in Maine, New Hampshire, Massachusetts, Connecticut, Rhode Island, and New York in August 2019.

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- Hosted a webinar series in 2019 highlighting projects funded through NOAA Sea Grant following the release of research and monitoring priorities by NECAN through state-of-the-science workshop, scientific synthesis, and white paper. All four webinars are available on the NECAN website.
 - Follow up from 2018 Conceptual model workshop
 - Visualizing Ocean and Coastal Acidification Locally (VOCAL) models created for Northeast Region, Mid-Atlantic Region, Policy, and Industry. All available on the NECAN website.

-Industry Working Group

The Industry Working Group facilitates communication between industry members (including aquaculturists and fishermen) and the NECAN Steering Committee to help determine what concerns industry members may have and to assess what role, if any, acidification might play with regard to current and anticipated challenges for the region.

Actions and Goals for the Industry Working Group

- Create a sub-committee to analyze results from the fall 2018 industry survey
 - Create survey report
- Broadly distribute the survey report to state and federal funding and management agencies.
- Develop communication and messaging strategy for industry
 - Work with Science Working Group to develop an infographic on the impacts of OA on cultured and harvested species
 - VOCAL
 - Include overview of the science and drivers of OCA specific for industry
 - Industry newsletter, Links to local news stories on the website?
- Continue attending beneficial stakeholder events (MFF, MLA, NACE, etc.)
- Plan a follow up survey for 2020-2021 to reassess industry questions and research priorities.

Past Accomplishments

- Industry Survey - 2018
- Industry webinar series - July to December 2018
- Presentation and stakeholder feedback at NACE - January 2019
- In-person industry working group meeting - January 2019
- Develop an Industry Working Group page on the NECAN website
 - Links to industry and Sea Grant webinars, OAIE, Newsletter
 - Working group mission, members and bios

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- Survey report
 - Link to newsletter stories pertinent to industry

-Management and Policy Working Group

The Management and Policy Working Group provides information on ocean and coastal acidification to inform individuals involved in OCA policy and provides a collaborative platform for these individuals.

Actions and Goals for the Management and Policy Working Group

- Provide input to state commissions in the region.
 - Maine - Commission occurred prior to formation of NECAN, but NECAN steering committee members were members of the commission
 - New Hampshire - Provided information on coastal acidification and local drivers (presentations by Beth Turner and Joe Salisbury in 2017)
 - Massachusetts - members of MPWG commented on legislation forming commission, the commission is still in formation
 - Rhode Island - member of MPWG is on RI commission
 - Connecticut - no action yet on a state commission
 - New York - member of the MPWG is tracking progress of commission, will reach out if NECAN input is needed
- Revisit January 2017 workshop recommendations on monitoring to develop new and updated recommendations.
 - With the help of the Science Working Group
- Continue to foster cross-state/regional approaches to policy
 - Coast to Coast OA Alliance Meeting, September 2019
 - Gulf of Maine 2050, November 2019
- Pursue opportunities to publish editorials and other public-facing communication related to OCA management and policy

Past Accomplishments

- NECAN members provided input to NH commission and some are on Maine and Rhode Island commissions
- Assisted in augmenting existing programs to expand efforts to include OCA.
- Used research results to develop and promote adaptation and mitigation strategies.
- Assisted in developing materials for communicating OCA drivers and impacts to managers and policy makers in conjunction with the Education and Outreach Working Group and others, 2019-2020

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- Visualizing Ocean and Coastal Acidification Locally (VOCAL) models created for Northeast Region, Mid-Atlantic Region, Policy, and Industry. All available on the NECAN website.

-Science Working Group

The NECAN Science Working Group will foster coordination and identify priority needs for regional research, modeling, and monitoring which can help inform state and federal agency engagement on regional acidification. Strategically guided monitoring can better serve stakeholder near-real time data information needs, characterize key regional processes, and validate regional models that can be used to identify important geographic areas most at risk from acidification in U.S. and Canadian waters off the Northeast Atlantic coast. Some key processes that targeted observing efforts need to better resolve include quantifying the role of coastal sources of carbon or nutrient enrichment, which can exacerbate global ocean acidification trends in regional coastal waters. Real time access to monitoring activities can also provide stakeholders with critical information about current conditions in the variable environments of the coastal ocean. Furthermore, long-term sustained monitoring offers an important means to track the rate of regional acidification.

Actions and Goals for the Science Working Group

- Re-establish the Science Working Group
 - Review and refine membership list
 - Update the official 'ask' with specific call to action
 - Review implementation plan
 - Update monthly on the OAIE
 - Initiate quarterly calls
 - Plan an in-person meeting with working group members
- Review and update OA science for the NECAN region.
 - Review state of the science and reflect updates as part of the White paper for Gulf of Maine 2050 conference
 - Conduct monthly literature reviews for NECAN relevant new findings
 - Contribute to reference library on NECAN website
 - Incorporate new publications
 - Joint action with Education and Outreach Working Group
- Identify and communicate key gaps limiting our predictive capabilities to generate now- and fore-casts for the region (e.g. mapped fields of Physical circulation)
- Translate industry and stakeholder needs derived from the Industry Working Group into science requirements.

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- Inform and review outreach strategy developed by the Education and Outreach Working Group
 - Provide webinar series topics for 2020 that highlight emerging regionally relevant new findings and address industry and stakeholder interest
 - Review and provide web page content for the Science Working Group page on the NECAN website
 - Working group plan, mission, and goals
 - Direct link to OAIE news feed
 - Updates in science, link to references page
 - List of regional research expertise, researchers and what they are working on
 - List of working group members

Past Accomplishments

- Created a list of existing monitoring capabilities (Gledhill et al., 2016).
- Wrote a scientific synthesis (Gledhill et al., 2015) and Technical Memo (Gledhill et al., 2016) summarizing regional research results.
- Maintained reference library on NECAN website by incorporating new publications.
- Used research results to develop and promote adaptation and mitigation strategies.

Summary

NECAN has made significant progress in the short time it has been in existence. In order to continue this progress, the NECAN Steering Committee and Working Groups will work towards accomplishing the specific actions detailed above to ensure that the NECAN region is prepared to address and adapt to ocean and coastal acidification (OCA).

Acknowledgements

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