

Ecosystem Health Indicators Conference Boston, MA March 30-31, 2011: Summary and Next Steps

Summary Report Prepared by

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July 2011

POWER OF PARTNERSHIP

This conference was planned and implemented through the collaborative work led by Communication Partnership for Science and the Sea (COMPASS) and Massachusetts Ocean Partnership (MOP) working together to achieve the shared goal of science-based and stakeholder-informed ocean management. MOP contracted the facilitation and organizational services of The Keeley Group and the Urban Harbors Institute to assist in the production of this conference.



ABSTRACT

On March 30-31, 2011, the Communication Partnership for Science and the Sea (COMPASS) and the Massachusetts Ocean Partnership (MOP) hosted the 2011 Ecosystem Health Indicators Conference at the Exchange Conference Center in Boston, MA. More than 50 representatives from northeastern (Long Island Sound to the Gulf of Maine) monitoring, indicator, and resource management programs gathered to improve familiarity with indicator programs in attendance; share indicator communication methods; share lessons learned regarding end-user satisfaction of indicators and impacts on planning, policy and management decisions; explore strategies for improved short and long-term indicator program collaboration; and create a strategy for improved collaboration.

The meeting provided valuable networking opportunities and resulted in an increased awareness of indicator program activities, communication strategies, and data sources. Attendees identified common challenges and discussed collaborative opportunities to address several key issues.

Primary recommendations from the conference include development of a community of practice for indicator programs and managers in the Northeast region; identification of qualitative and quantitative reference points (benchmarks, targets for system functions, etc.) to translate/communicate thresholds to the general public, improve understanding of data use and needs of indicator programs; development of a data directory to improve understanding of data use and needs of indicator programs; and creation of an indicator significance template to primarily educate and inspire potential funders. The next action needed to implement each recommendation was developed by conference attendees.

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Advisory Group:

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July 2011

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COMMITTED TO ADVANCING SCIENCE-BASED AND
STAKEHOLDER-INFORMED OCEAN MANAGEMENT.


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I. Introduction

On March 30-31, 2011, the Communication Partnership for Science and the Sea (COMPASS) and the Massachusetts Ocean Partnership (MOP) hosted the 2011 Ecosystem Health Indicators Conference at the Exchange Conference Center in Boston, MA. More than 50 representatives from northeastern (Long Island Sound to the Gulf of Maine) monitoring, indicator, and resource management programs gathered to:

1. Improve familiarity with indicator programs in attendance;
2. Share indicator communication methods;
3. Share lessons learned regarding end-user satisfaction of indicators and impacts on planning, policy and management decisions;
4. Explore strategies for improved short and long-term indicator program collaboration; and
5. Create a strategy for improved collaboration.

The meeting provided valuable networking opportunities and resulted in an increased awareness of indicator program activities, communication strategies, and data sources. Additionally, attendees identified common challenges and discussed collaborative opportunities to address several key issues.

II. Conference Rationale and Background

Indicators, defined for this conference as “quantitative or qualitative measures that provide information about the status of or changes in natural, cultural, and economic aspects of an ecosystem,” are an important tool used by many environmental programs throughout the world. While practical for conveying information about a variety of topics, the use of indicators – regardless of what they specifically address – almost always presents a host of challenges related to indicator selection, data acquisition, communication of findings, and evaluation of results. These challenges are not unique to any one program, and thus present opportunities for collaboration among programs with similar needs.

The challenges associated with indicators, in combination with the northeast region’s range of burgeoning and mature indicator efforts, the widespread funding challenges linked to the current state of the economy, and the national movement to manage ocean resources on a regional basis, made this an ideal time to convene a conference for selected indicator programs to come together to network, learn from each other, and share ideas about ways to collaboratively address common challenges.

Funded by COMPASS and MOP, the 2011 Ecosystem Health Indicators Conference was designed in partnership with the Ecosystem Health Working Group from the Northeast Regional Ocean Council (NROC), whose work plan calls for a “workshop convening policymakers, managers and scientists to strengthen coordination and integration of regional indicator initiatives in New England”. Additionally, a committee of advisors (see [Appendix 1](#) for a list of advisors) worked to identify agenda topics, conference activities, and participants. Their decisions were guided by research conducted by the University of Massachusetts Boston’s Urban Harbors Institute (UHI) and Department of Environmental, Earth, and Ocean Sciences (EEOS). Together, these entities developed a conference to address indicator programs’ needs – with a focus on facilitating collaboration among programs operating in the northeastern United States.

A select group of indicator programs received invitations to attend the conference. The invitees were chosen to represent a wide-range of indicator programs and resource managers from well-established programs down to programs in the earliest stages of development. While all programs operated in the northeast, some operated on a national scale and others concentrated on a smaller

geographic area. These programs were managed by government entities, non-profit organizations, or academic institutions. Additionally, some programs in attendance focused more on providing data than on developing indicators. The wide-range of programs and their differing experiences and resources led to a very productive conference. A list of programs and attendees can be found in [Appendix 2](#).

III. Conference Activities

A. Conference Agenda

The conference agenda ([Appendix 3](#)) was created to reflect the needs of the programs themselves as understood through a series of in-depth interviews and pre-conference questionnaire responses (See <http://massoceanpartnership.org/wp-content/uploads/2011/02/A-Snapshot-of-Indicator-Programs-Challenges-and-Lessons-Learned.pdf> for a summary of the interviews, and [Appendix 4](#) for the pre-conference questionnaire). The conference also included the presentation of:

- An illustrative map displaying the number of conference invitees working in the same geographic areas ([Appendix 5](#))
- A list of the indicators measured by each program in attendance to help attendees identify others using similar indicators or indicators of interest ([Appendix 6](#))
- A catalog of visualization tools and strategies useful for communicating indicators - (available online at: http://massoceanpartnership.org/wp-content/uploads/2011/02/MOP_visualization_booklet_final.pdf)

B. Addressing Common Challenges of Indicator Programs

In breakout groups, participants reviewed the challenges identified through the in-depth indicator program interviews and the pre-conference questionnaire responses. These challenges focused on communication/reporting, data, management, indicator selection, and funding and partnerships. Breakout groups discussed these challenges and, in some cases, identified new issues not already on the list. Once each breakout group agreed to a comprehensive list of challenges and came to a consensus on the meaning of each, participants whittled the list down to approximately three challenges per breakout group that were both (1) highly important, and (2) leant themselves to collaborative solutions.

The resulting collective list of important challenges included:

TOPIC	CHALLENGE
<i>Communication/Reporting</i>	Communicating indicators – need for common communication methods/tools to support program efforts; example approaches for presenting indicator results that show negative results or present difficult decisions
<i>Data</i>	Accessing data – acquiring data from others and providing data to others
	Finding data – other programs’ indicators and datasets; historical and under-used data; “lost” data (data that was collected in the past, but is not being used or not known about)
	Standardizing data – for data collection and data sharing
	Storing data – a data repository to store/share data

	Overcoming human and cultural barriers to accessing data - obtaining permission to acquire/use data
	Addressing multiple needs for indicators and data collection – related to ecosystem health/status/integrity; changing political and socioeconomic landscapes; ecosystem services; management objectives; individual and regional topics; changing management over time
<i>Management</i>	Working in the absence of regional indicator thresholds/targets to assess ecosystem health
<i>Indicator Selection</i>	Working in the absence of a larger context for indicators – a common way to select and develop indicators; a way to integrate indicators to reflect a larger geographic scale
<i>Funding and Partnerships</i>	Securing funding and support for indicators– long-term need for data collection versus short-term funding horizon for most projects; maintaining support mechanisms
	Increasing indicator visibility and awareness of indicators– communicating to funders/legislators the value of/justification for data collection and development of indicators and creating support for monitoring and indicators

The breakout groups then identified ways to collectively address some of these challenges. The resulting approaches included the development of (1) indicator thresholds for the region, (2) a regional data repository, (3) a list of indicator programs and their indicators, and (4) a template for a document about the significance of/need for indicators. These specific products were all related to a larger recommendation that programs work together to develop a “community of practice,” which is defined as “... groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly” (<http://www.ewenger.com/theory/>). This community of practice would allow for people to access the products noted above and share other useful indicator information. The following section elaborates on each of the key approaches identified.

IV. Conference Outcomes:

A. Community of Practice

The primary observation throughout the conference was the need for programs to continue working together. Attendees suggested the development of a community of practice for indicator programs and managers in the Northeast region. The goal of the community of practice is to develop mechanisms for representatives of the region’s indicator programs to access and share resources and to communicate with each other. This community of practice will promote collaboration that aims to improve programs’ abilities to achieve their management goals while also advancing the field of ecosystem health metrics.

More specifically, this community of practice will allow programs to:

1. Share resources such as data, photos, best practices, and outreach materials;
2. Initiate and continue conversations as a community of indicator practitioners;

3. Develop common resources such as a data clearinghouse, a list of indicator programs and data sets, a set of indicator threshold standards, and a suite of educational and evaluative tools to communicate the importance of monitoring and measuring various components of ecosystem health to a range of audiences; and
4. Facilitate the development and implementation of joint proposals, planning efforts, and evaluation activities.

Several examples of communities of practice currently exist in related fields and could serve as models for this community. For example, the EBM Tools Network (<http://www.ebmtools.org/>) and Storm Smart Coasts (<http://stormsmartcoasts.org/>) are stand-alone programs with highly developed virtual communities of practice maintained by dedicated staff. Each of these programs has a regularly updated website that practitioners can use to find announcements, tools, and other resources. Additionally, each of these programs has a listserv where community members can communicate with each other about upcoming events, funding opportunities, requests for assistance, and other matters of interest to the community. Both the EBM Tools Network and the Storm Smart Coasts Program rely on staff to maintain the website and post resources.

Another example of a virtual community of practice is the Environmental Communication Network (ECN) (<http://www.esf.edu/ecn/>). The ECN maintains a website through the State University of New York's College of Environmental Science and Forestry. The website contains resources for practitioners, but the highlight of this community seems to be the very active listserv where people regularly reach out to colleagues for ideas and resources. Recently, conversations on the listserv and at conferences led to the development of a formal association for environmental communication.

Though each of the aforementioned examples involves a website and listserv, neither is required for a community of practice. Additionally, many communities of practice make it a point to have conferences, workshops, and other types of in-person gatherings.

The exact format of an indicators community of practice will depend on more specific needs identified by a working group (see the "next steps" section below), as well as on resources available for the development, implementation, and maintenance of the community. While the format for the community of practice for indicator programs has not yet been developed, the following graphic shows some of its likely content and services as identified at the conference. The boxes on top are the five different *themes* for the community of practice (communication, data, etc.), and the bullet points below are *topics, content, and features* relating to those themes.

General details about the themes and topics in the graphic can be found below. Given the limited amount of time at the conference, breakout groups were only able to develop specific details and next steps for a few topics (indicator thresholds, data directory and portal, and indicator significance template). The additional details for these topics (identified with an *) can be found in subsections B, C, and D below. Next steps can be found in Section V.

Northeast Indicators Community of Practice

Communication

(Tools for conveying indicator messages)

- **Messaging tools** – Means (such as visualization tools) to effectively reach target audiences
- **Evaluation tools** – Strategies and tools to determine the effectiveness of messages
- **Best practices** – Communication tips recommended by programs
- **Communication services** – workshops, conferences, consultants, and other opportunities to receive help for communication
- **Indicator templates*** – Communication materials that can be easily adapted by other programs for their own use
- **Case studies** – Detailed descriptions of communication strategies, evaluations, etc. that can inform other programs about lessons learned, and can serve as models
- **Photos & visualizations** – Pictures, graphics, and other visual resources that programs can use for their own needs (including metadata)

Data

(Resources for identifying types of data and data sources)

- **Directory of programs' indicators and datasets*** – A list of indicator programs, the indicators they use, the data behind the indicators, data sources, and contact information
- **Data Portal*** – Links and/or tools for locating data and metadata

Indicator Development

(Information to help guide indicator selection and implementation)

- **Tips for evaluating the cost-effectiveness of indicators and management activities** – Means to assess the cost-effectiveness of developing/implementing specific indicators to evaluate management actions
- **Indicator selection template** – Strategies to help programs select indicators
- **Indicator threshold standards*** – Guidelines to help translate indicators into decision criteria
- **Information on new indicator initiatives** – Reports, articles, and other resources highlighting emerging indicator practices, themes, etc.

Funding

(Tips for increasing funding and reducing costs)

- **Funding opportunities** – Grants and collaborative opportunities
- **Funding resources** – helpful websites (such as grants.gov), foundation information, tips for writing good proposals, examples of successful proposals
- **Grant or outreach packet** – Templates for use in developing proposals

Community "Bulletin Board"

(Means to communicate with other practitioners)

- **Message Board** – Searchable means for posting and replying to questions and comments; announcing events; publicizing other news; etc.

B. Indicator Threshold Standards (Theme: Indicator Development)

The goal of this effort is to create a process to develop ecosystem indicator benchmarks and translate them into decision criteria. This would involve identifying qualitative and quantitative reference points (benchmarks, targets for system functions, etc.) through conducting literature reviews, discussing indicator programs' existing thresholds, identifying relevant tools, determining ways to scale thresholds up and down depending on specific situations, aligning thresholds with existing regulatory thresholds, identifying relevant stakeholders, selecting indicators appropriate for thresholds, and devising ways to translate/communicate thresholds to the general public. Potential outcomes from this effort include identifying reference points, advising on the applicability of these reference points to certain indicators, and developing a peer review process to examine new indicators.

C. Data Directory (Theme: Data)

There are several initiatives within the region working to improve access to data and metadata. This includes efforts by a working group to develop the Northeast Ocean Data Portal for coastal and marine spatial planning, efforts by NERACCOOS to improve accessibility to real time observational and biophysical time series data, and efforts by the Northeast Coastal and Ocean Data Partnership to improve access to metadata.

The goal of the data directory proposed for the indicator community of practice is to better understand data use and needs of the indicator programs so that improvements in data accessibility can be coordinated with these existing efforts. Indicator programs would also be able to better link to and inform emerging regional management needs, such as CMSP, through these efforts. The development of the data directory will involve two components:

1. A document or database describing existing data and indicators currently used by programs, as well as existing data potentially useful to indicator programs but not currently used. This might also include contact information, descriptions of how the data and indicators are used, and other useful information.
2. A data clearinghouse, coordinated with or directly linked to existing regional efforts, where people could upload and download data and metadata. As part of this, scientists should be encouraged to share applicable data.

D. Indicator Significance Template (Theme: Communication)

The goal of this effort is to develop a 2 page document explaining what indicators are, why they are important, who uses them and how they are used, and the results of these ecosystem health tools. The front of the document will include a generic description of indicators and their significance, while the back of the document will be something that each program can tailor to meet their own needs. While this document may have multiple uses, its main purpose is to educate and inspire potential funders.

It should be noted that additional details and next steps will likely be developed for the remaining topics in the community of practice graphic in the future.

V. Next steps

Conference participants repeatedly noted the lack of time and resources available to accomplish their current list of responsibilities. However, programs generally agreed that investing resources in some of these common solutions now could enhance their indicator programs and save them a great deal of time, effort, and money in the long run. Appreciating the limited resources presently available to move forward on these solutions, a series of next steps has been identified.

A. Community of Practice

The next step in advancing the community of practice is to form a working group that includes both members of the conference steering committee and planning team, as well as staff from various indicator programs. Including indicator program staff in the working group is important to ensure the indicator programs have some “ownership” of this effort, and for ensuring that the community of practice will be useful to indicator programs. This working group will convene in June, 2011 and will be charged with exploring options for the structure of the community of practice.

To determine how the community of practice should be structured, it may be useful for the working group to talk to people engaged in other communities of practice to learn about the resources needed to develop, implement, and maintain their communities. Additionally, information could be gathered about lessons learned; how/why the community is used and by whom; and other ways that practitioners engage in the community (e.g. opportunities to post resources to the website). Once the working group has researched and decided upon an appropriate format for the community of practice, they will begin to identify the necessary resources for development and implementation.

B. Indicator Threshold Standards (Theme: Indicator Development)

The next step in advancing the development of indicator thresholds is to nominate a chair, or a panel of co-chairs, to lead this effort. The chair(s) will convene a working group (in August, 2011) to begin the initial stages of reviewing existing thresholds and identifying indicators suitable for the application of thresholds. Once this background information is gathered, the working group will hold a workshop for a broader audience. The workshop will provide a platform for discussing the details behind identifying reference points and translating ecosystem indicators into decision criteria. Based on the information gathered at the workshop, the chair(s) will write a proposal to fund this effort to develop community decision on reference points.

C. Topic: Data Directory (Theme: Data)

The next step in advancing the development of a data directory is to more fully develop the list of northeast indicator programs, their indicators and the datasets supporting those indicators. An initial draft is maintained by MOP/UHI and an excerpt was handed out at the conference - see [Appendix 6](#). Concurrently, a working group, composed of individuals from several indicator programs should be formed to accomplish the following tasks:

1. Develop a statement of purpose for the data directory
2. Agree on a list of indicator definitions and classifications
3. Determine what information should be included in the directory (data types, metadata, data and metadata standards, data gaps for specific indicator needs, etc.)
4. Evaluate existing tools and directories (UCONN, ESIP, others)
5. Recommend a solution that considers suggested technology, motivations and incentives for programs to participate, and long term maintenance.

The group should consider developing a prototype data directory using a couple of the indicator programs as a pilot, and then use this prototype to elicit feedback and encourage participation.

Lastly, the working group should ensure that the data directory leverages and is coordinated with similar efforts in the region.

D. Topic: Indicators Significance Document (Theme: Communication)

The next step in advancing the indicator significance document is to convene a working group (in June, 2011) charged with reviewing examples of similar documents and outlining the content of this document. The working group will circulate the outline to the rest of the conference attendees for input, and then will revise the outline and develop content. Ultimately, as people use the document, they will be encouraged to share their visions.

VI. Conclusion

The two-day Ecosystem Health Indicators Conference highlighted the potential impacts of improved communication among indicator programs. Throughout the conference, people had the opportunity to network and share tips, challenges, and resources. These interactions led to the identification of several collaborative projects that will ultimately benefit multiple indicator programs – including a community of practice which will be the common platform for the data directory, the indicator significance template, the indicator threshold standards process, and other resources. Developing and implementing these products provides the region’s indicator programs with the opportunity to begin working together in earnest to advance the field of ecosystem health indicators. As the community becomes stronger, it may grow to include programs from outside the northeast region, and may serve as a model for other similar groups of practitioners.

Appendix 1: Conference Advisory Committee Members

Verna DeLauer (COMPASS)*

Nicholas Napoli (Massachusetts Ocean Partnership)*

Kim Starbuck (Massachusetts Ocean Partnership)*

David Keeley (The Keeley Group)*

Ru Morrison, Northeastern Regional Association of Coastal Ocean Observing Systems

Bob Bowen, University of Massachusetts Boston, EEOS Department

Jack Wiggin, University of Massachusetts Boston, Urban Harbors Institute

Caroly Shumway

Elizabeth Turner, NOAA, Coastal Ocean Program

Prassede Vella, Massachusetts Office of Coastal Zone Management

Mel Cote, US EPA, Region I

Regina Lyons, US EPA, Region I

Diane Gould, EPA, Region I

Christine Tilburg, Gulf of Maine, Ecosystem Indicator Partnership

* = Members of the conference planning team

Appendix 2: List of Attendees

Last	First	Affiliation
Baker	Jason	Massachusetts Bays Program - NEP
Bohlen	Curtis	Casco Bay Estuary Partnership - NEP
Bonifacio	Tricia	Massachusetts Ocean Partnership
Bowen	Bob	University of Massachusetts Boston
Burg	Robert	Long Island Sound Study
Callaghan	Todd	MA Coastal Zone Management
Callison	Erin	Clark University
Carlisle	Bruce	MA Coastal Zone Management
Christensen	John	NOAA Center for Coastal Monitoring and Assessment
Cote	Mel	EPA
DeLauer	Verna	Clark University/COMPASS
Dionne	Michele	Wells National Estuarine Research Reserve
Dwyer	Meggan	Marine Environmental Research Institute
Feurt	Chris	Wells National Estuarine Research Reserve
Friedland	Kevin	NOAA
Gould	Diane	EPA
Grady	Sara	Massachusetts Bays Program - NEP
Keeley	David	The Keeley Group
Kellam	Dave	Piscataqua Region Estuaries Partnership (PREP) - NEP
Kellogg	Q	Narragansett Bay National Estuary Program (NEP)
Kerr	Meg	Narragansett Bay National Estuary Program (NEP)
Kress	Marin	University of Massachusetts Boston
Latimer	Jim	National Health and Environmental Effects Research Laboratory
Leo	Wendy	Massachusetts Water Resources Authority
Lyons	Regina	EPA
McGraw	Christina	Clark University
Miller	Steve	Great Bay National Estuarine Research Reserve
Monaco	Mark	NOAA Center for Coastal Monitoring and Assessment
Morrison	Ru	NERACOOS
Moura	Stephanie	Massachusetts Ocean Partnership
Napoli	Nick	Massachusetts Ocean Partnership
Newhall	Rebecca	NOAA
Nicholson	Betsy	NOAA
Nixon	Matt	Maine Coastal Program
Pagach	Jennifer	Long Island Sound Study
Parker	Mark	Long Island Sound Study
Rex	Andrea	Massachusetts Water Resources Authority
Rozsa	Ron	NERACOOS

Last	First	Affiliation
Samalot	Lianne	Clark University
Shumway	Caroly	Independent consultant
Smith	Brooke	COMPASS
Stacey	Paul	Great Bay National Estuarine Research Reserve
Stankelis	Bob	Narragansett Bay National Estuarine Research Reserve
Starbuck	Kim	Massachusetts Ocean Partnership
Stevick	Peter	Ocean Health Index & Sentinel Species Indicator
Swasey	Jill	MRAG Americas
Tilburg	Christine	Ecosystem Indicator Partnership (ESIP)
Turner	Beth	NOAA
Uiterwyk	Kristin	Urban Harbors Institute
Van Arsdale	Eric	Brown University
Vella	Prassede	MA Coastal Zone Management
Warren	Barbara	Massachusetts Bays Program - NEP
Weeks	Hal	Shoals Marine Laboratory
Wiggin	Jack	Urban Harbors Institute

Appendix 3: Conference Agenda

2011 Ecosystem Health Indicators Conference

Agenda

Day 1: Wednesday, March 30th, 2011

9:00	Breakfast
9:30 – 10:30	Welcome and setting the context of the conference (<i>Nick Napoli, MOP; Verna DeLauer, COMPASS; David Keeley, Facilitator; Jack Wiggan, UHI/UMass Boston</i>)
10:30 – 11:15	Plenary: Improve familiarity of indicator program activities
11:15 – 11:30	Break
11:30 – 12:15	Plenary continued - Improve familiarity of indicator program activities
12:15 – 1:15	Lunch
1:15 – 2:00	Plenary continued - Improve familiarity of indicator program
2:00 – 2:15	Breakout Instructions (<i>David Keeley</i>)
2:15 – 3:30	Breakout session #1: Challenges Affecting Indicator Programs
3:30 – 3:45	Break
3:45 – 4:15	Presentation: State of the Estuaries - Communication Strategies for Environmental Indicators (<i>Dave Kellam, Piscataqua Region Estuaries Partnership</i>)
4:15 – 4:45	Using research tools to improve communication about indicators and ecosystem health (<i>Verna DeLauer and Eric Van Arsdale, Brown University</i>)
4:45 – 5:00	Closing (<i>David Keeley</i>)
5:00 – 6:30	Reception (appetizers and beverages will be served)

Dinner on your own in Boston

(A list of recommended restaurants in the area can be found in your conference folder)

Day 2: Thursday, March 31st, 2011

7:30	Breakfast
8:30 – 8:45	Welcome and review agenda for the day (<i>David Keeley</i>)
8:45 – 9:15	Plenary: Setting a regional context (<i>Mel Cote, Environmental Protection Agency</i>)
9:15 – 9:30	Breakout Instructions (<i>David Keeley</i>)
9:30 – 10:45	Breakout session #2: Explore Strategies for Improved Collaboration
10:45 – 11:15	Break
11:15 – 12:00	Plenary: Determine Priority Collaboration Areas (<i>David Keeley</i>)
12:00 – 1:00	Lunch
1:00 – 2:15	Breakout session #3: Identify Implementation Strategies for Enhanced Program Collaboration
2:15	End of conference; participants fill out evaluations

Appendix 4: Pre-Conference Questionnaire

Pre-conference questionnaire

Purpose: To maximize our time together and to ensure we are developing a program that is responsive to your needs, please complete and return this brief pre-conference questionnaire **by Tuesday, March 8th**.

Through this pre-conference questionnaire, we would like to identify your biggest challenges and potential areas of program collaboration. We will use the questionnaire responses to design the breakout sessions on Day 1 (see attached agenda). In these sessions, we will explore the challenges shared by the programs. On Day 2, we will identify strategies that address one or more of these challenges. Working together, we will select the most promising of these strategies and develop implementation plans.

In sum, your responses to these questions will help us to better understand your interests, refine the agenda, and provide the basis for discussion at the conference.

Questions:

- 1) What is the biggest challenge you face in meeting the goals of your indicator program?
- 2) How might you work with other indicator programs to address your biggest challenge and what resources are needed to do that?

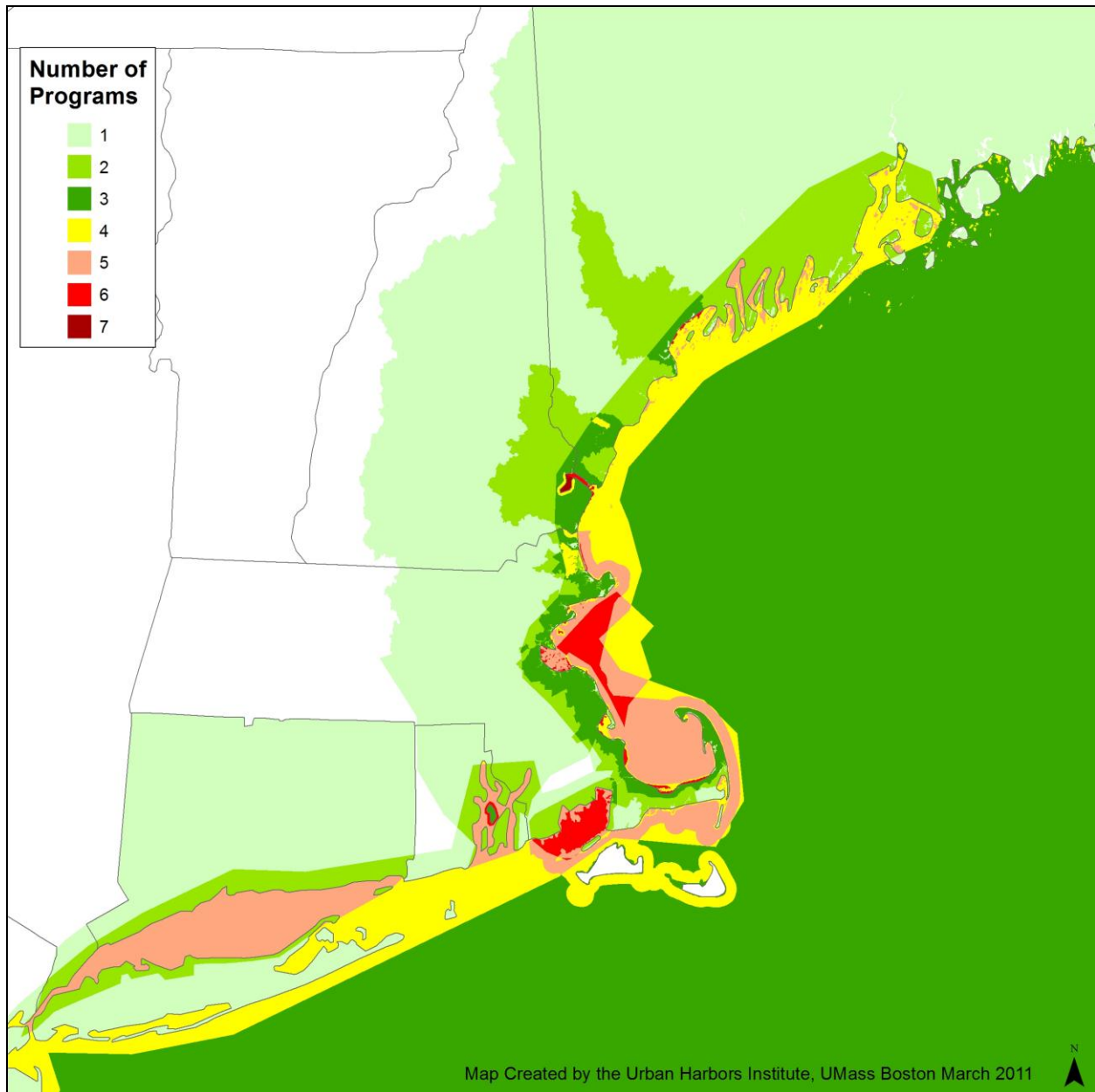
Based on in-depth indicator program interviews and a 16-month steering committee process, we plan to focus the conference on two themes:

- *Data use and accessibility*
- *Communication and reporting of indicators*

- 3) We plan to have a breakout session on each of these themes. Which session would you want to attend? (Please note: if more than one representative from your program is attending the conference, you may want to split up between the two breakout session themes)
- 4) Other than the challenge you identified in Question 1, are there other challenges or issues affecting your program that you would like to discuss at the conference?
- 5) Please describe any successful collaboration that your program has had with others that might inform broader New England indicator program collaboration.

Appendix 5: Illustrative Map of Program Overlap

Number of conference invitees (indicator programs) working in the same geographic areas.



Appendix 6: List of Program Indicators

Program Indicators

In order to better acquaint everyone with the programs at this conference, we have put together a list of the indicators each program uses. Where possible, the indicators were reviewed by program personnel (an * denotes those programs whose indicators were not at least preliminarily reviewed). While many programs at this conference do have lists of indicators, a handful of programs are either developing indicators, exploring the possibility of developing indicators, or collecting/providing data not used internally as indicators. For those reasons, indicators are not listed for the following programs:

- Ocean Health Index
- Shoals Marine Laboratory
- Fish and Wildlife Service
- Plum Island Long-Term Ecological Research Site
- Narragansett Bay National Estuarine Research Reserve

Casco Bay Estuary Partnership

- Shellfish beds
- Bay water quality
- Inland and estuarine water quality
- Mussels
- Sediments
- Contaminants of Emerging Concern
- Interior forest habitat
- Eelgrass
- Waterbirds
- Invasive species
- Climate change, Sea level rise, and Ocean acidification
- Conserved lands
- Impervious surface
- Stormwater
- Swimming beaches
- Population
- Stewardship and community engagement
- Combined Sewer Overflows

Center for Coastal Monitoring and Assessment (NOAA)*

Contamination levels in mussels and oysters – for the following contaminants:

- Aluminum
- Antimony
- Arsenic
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Silicon
- Silver
- Thallium
- Tin
- Zinc

Coalition for Buzzards Bay*

- Nitrogen Pollution
- Bacteria
- Toxic Pollution
- Forests
- Stream Buffers
- Wetlands
- Eelgrass
- Bay Scallops
- River Herring

Ecosystem Indicator Partnership

- Air temperature trends and anomalies
- Locations of tidal restrictions
- Precipitation trends and anomalies
- Sea level change
- Nitrogen loading
- Muscle tissue contamination
- Extent of eelgrass
- Shellfish Sanitation Data
- Chlorophyll a concentration (phytoplankton biomass)
- Dissolved oxygen
- Sediment triad data
- Extent of salt marsh
- Secchi Depth
- Impervious surface coverage
- Population Density
- Amount of leased acres for aquaculture
- Economic value of aquaculture
- Employment Density
- Point Sources

Great Bay National Estuarine Research Reserve

- Dissolved Oxygen
- Salinity
- pH
- Turbidity
- Water temperature
- Nutrients
- Temperature
- Barometric Pressure
- Relative Humidity
- Wind speed and direction
- Photosynthetically active radiation
- Chlorophyll a

Long Island Sound Study

- Water quality index
- Chlorophyll a
- Frequency of hypoxia in bottom waters
- Area of hypoxia
- Duration of hypoxia
- LIS point source nitrogen-trade equalized loads
- Estimated Nitrogen Load from all CT Sources
- Sediment organic carbon concentration
- Sediment delta 13C
- Sediment Delta 15N
- Lead concentrations in sediment basin
- Heavy metals in sediment
- Contaminant trends in Mussel Watch sites
- Sediment quality index
- Increases in population and sewage
- Wastewater treatment plants meeting toxicity standards
- Industrial chemical discharges
- Eelgrass abundance
- Horseshoe crab abundance
- Lobster abundance
- Oyster harvest
- Hard Clam harvest
- Bluefish abundance
- Winter Flounder Abundance
- Summer Flounder Abundance
- Tautog Abundance
- Striped Bass Abundance
- Weakfish Abundance
- Scup Abundance
- Shad & Herring in Long Island Sound
- Surface Water Temperature in LIS
- Cold-water Species Richness Trend
- Warm-water Species Richness Trend
- Least tern abundance
- Colonial waterbirds
- Osprey nesting adults
- Piping Plover Nesting Adults
- Development in the LIS Watershed
- Percent Forest Cover in Connecticut
- Watershed Population Levels
- Watershed Management in CT and NY
- Open Space Preserved in the LIS Watershed
- Beach Closure Days
- Number of vessel pump out stations
- NDA coverage
- Beach debris collected
- Floatable debris
- Approved shellfish acreage
- Coastal habitat acres restored
- River miles restored
- Lobster landings
- Lobster license/permit trends
- Herring runs at streams with no further upstream fishway projects
- Forage Fish Survey
- Fish Biomass Index
- Herring runs at streams with upstream planned fishway projects
- Atlantic Salmon restoration in the CT River

Marine Environmental Research Institute

- Marine mammal tissue contamination
- Harbor Seal numbers and haul out use
- Fouling community prevalence
- Phytoplankton
- Chlorophyll-*a*
- Dissolved oxygen
- *Enterococcus*
- Nitrate
- pH
- Salinity
- Water Temp
- Tide
- Turbidity
- Wind speed and direction
- Relative humidity
- Air temperature
- Precipitation
- Cloud cover

Massachusetts Bays Program

- Solids discharged
- Sediment Oxygenation
- Water Column Nitrogen, Chlorophyll, and Dissolved Oxygen
- Wastewater Quality
- Water Quality
- Fish and shellfish
- Sediment contaminant concentrations
- Biodiversity of animals living on or in the sea floor
- Oxygen penetration.
- Blue mussel contamination
- Shellfish landing trends
- Trends in open space coverage
- Trends in wetland coverage
- Trends in agricultural land coverage
- Trends in forest coverage
- % of land as impervious surface
- Protected open space
- Recreational open space
- Eelgrass distribution
- Presence and abundance of invasive species
- Number of North Atlantic right whales
- Abundance and diversity of organisms
- *Enterococcus*
- *E. Coli*
- Changes in tidal hydrology
- New habitat for salt marsh species
- Change in plant communities
- Trends in residential development coverage
- Trends in commercial development coverage
- Number of beach closings or public advisories
- Number of permitted discharges
- Amount of discharge permitted

Massachusetts Ocean Management Plan

- Expansion of the range of watched invasive species
- Change in mean sea level rise
- Change in Sea water temperature
- Fish population assessment (through use of metrics such as biomass of species, volume of fisheries landings, mean length of fish sampled, and # individuals)
- Change in fish, mollusks, and crustacean species within existing SSUs:
1) change in total biomass/abundance;
2) change in distribution of biomass/abundance across species
- # of actions in science framework initiated/implemented
- Change in location and/or extent of core habitat for whale species
- Change in abundance of whale species in the planning area
- Change in location and/or extent of core and important habitat, and abundance for bird species
- Change in fish, mollusk and crustacean communities within existing SSUs
- # and areal extent of management areas: SSUs, areas designated for a particular use, and areas designated for multi-use
- % of required state energy produced from renewable energy in planning area
- Resources expended for implementation of plan and science framework
- Mitigation funds paid to the Ocean Use Trust Fund
- # of projects proposed/permitted in SSUs
- # of projects proposed/permitted in use areas and areal extent, by type
- Number of actions in science framework initiated/implemented
- Economic value of aquaculture operation
- Economic value of fisheries (commercial)
- Economic value of fisheries (recreational)
- Economic value of and total production capacity of offshore renewable energy
- Economic value of recreational boating

Massachusetts Water Resources Authority

- Enterococcus bacteria
- Winter Flounder liver contamination: flounder livers are tested for levels of lead, mercury, cadmium, copper, nickel, silver, zinc, chromium, PAHs, PCBs, DDT, and ten other pesticides
- Winter Flounder filets contamination: mercury, PCBs, DDT, and seven other pesticides are also measured in the edible flounder fillets
- Prevalence of liver disease in Winter Flounder
- Blue Mussel contamination: test for lead, mercury, PCBs, PAHs, DDT, and ten other pesticides
- Lobster contamination: tests the tail and claw meat for contaminants. The hepatopancreas (tomalley) is also tested for these, and for lead, cadmium, copper, nickel, silver, zinc, chromium, and PAHs.
- Water temperature (surface and bottom)
- pH
- Salinity
- Dissolved oxygen
- Water clarity
- Nitrate
- Suspended solids
- Fecal indicator bacteria
- Algae
- Sediment contamination,
- Benthic community
- Secchi Depth
- Seasonal river discharge (Merrimack and Charles Rivers)
- Southerly (upwelling) wind stress
- Seasonally averaged wind speed
- Average winter air temperature
- Zooplankton community structure
- Fecal coliform
- E. Coli
- Ammonium
- Silicate
- Phosphate
- Phytoplankton community structure
- Nutrients (colored dissolved organic matter)
- pH threshold
- Fecal coliform threshold
- Residual chlorine threshold
- cBOD threshold
- PCBs threshold
- Plant performance/violation threshold
- Flow threshold
- Total nitrogen load threshold
- Floatables threshold
- Oil and grease threshold
- Bottomwater threshold
- Chlorophyll threshold
- Nuisance algae threshold
- Sediment (RPD depth) threshold
- Sediment toxic contaminants threshold
- Benthic diversity threshold
- Benthic opportunistics threshold
- Flounder tissue contamination (Chlordane, Dieldrin, DDT, PCB and Mercury) thresholds
- Flounder (liver disease) threshold
- Lobster contamination (Chlordane, Dieldrin, DDT) thresholds
- Mussel contamination (PCB, Lead, Mercury, PAH, DDT, Dieldrin, Chlordane) thresholds
- Hard bottom habitats
- Substrate type
- Sediment drape
- Hard bottom species (groups and individuals)

Narragansett Bay National Estuary Program*

- Hypoxia
- Chlorophyll
- Beach Closures
- Shellfish Restrictions and Closures
- Fresh Waters Impaired by Bacteria
- Fresh Waters Impaired by Dissolved Oxygen
- Fresh Waters Impaired by Nutrients
- Chloride in Lakes
- Low Flow
- Estuarine Fish
- Invasive Species
- Wetlands
- Seagrass Beds
- Land Cover/Land Use Change
- Impervious Surfaces
- Water Quality Improvement Actions
- Environmental Expenditures
- Environmental Reporting

National Marine Fisheries Service

- Atlantic Multidecadal Oscillation
- North Atlantic Oscillation
- Thermal Habitat 5-15°C
- Salinity
- Gulf Stream NW
- Labrador Current
- Thermal Habitat <4°C
- Thermal Habitat >16°C
- River Discharge
- Wind Stress
- Temp
- Stratification
- Population
- Income
- Landings, Other Fish
- Landings, Crustaceans
- Landings, Mollusks
- Landings, Small Pelagics
- Number Groundfish Vessels
- Landings, Principal Groundfish
- Relative Abundance, Small Pelagics
- Relative Abundance, Other Fish
- Relative Abundance, Crustaceans
- Relative Abundance, Elasmobranch
- Zooplankton Biovolume
- Thermal Preference
- Relative Abundance, Ground Fish
- Relative Abundance, Mollusks
- Species Richness Fish
- Mean Length
- Elasmobranch to Demersal Ratio
- Mean Trophic Level Survey
- Pelagic to Demersal Ratio
- Ratio of Small to Large Zooplankton
- Mean Trophic Level Catch Fish
- Primary Production Required, Landings
- Mean Trophic Level Catch
- Continuous Plankton Recorder Color Index

NOAA Ocean and Coastal Resources Management Division

- Overall condition of coastal waters
 - a. Water quality index
 - b. Sediment quality index
 - c. Coastal habitat index
 - d. Benthic index
 - e. Fish tissue contaminants index
- Number of non-native species detected in tidal waters
- Proportion of Federal Disaster Declarations occurring in coastal states and territories
- Proportion of coastal Federal Disaster Declarations directly related to coastal hazards
- Total estimated cost of all billion-dollar weather disasters related to coastal hazards
- Population in the coastal zone
- Percentage of the population residing in the coastal zone
- Five-year change in the population of the coastal zone
- Population density in the coastal zone
- Land cover change in coastal watersheds
- Freshwater use in the coastal zone
- Percentage of the economy attributable to the coastal zone
- Value of coastal zone tourism and recreation
- Percentage of employment in the coastal zone
- Percentage of coastal zone employment dependent on coastal and ocean resources
- Number of coastal zone establishments dependent on coastal and ocean resources

Piscataqua Region Estuaries Partnership

- Acre-days of Shellfish Harvest Opportunities in Estuarine Waters
- Trends in Dry-Weather Bacterial Indicators Concentrations
- Tidal Bathing Beach Postings
- Violations of Enterococci Standard in Estuarine Waters
- Freshwater Bathing Beach Postings
- Shellfish Tissue Concentrations Relative to FDA Standards
- Finfish and Lobster Edible Tissue Concentrations Relative to Risk Based Standards
- Trends in Shellfish Tissue Contaminant Concentrations
- Sediment Contaminant Concentrations Relative to NOAA Guidelines
- Trends in Sediment Contaminant Concentrations
- Benthic Community Impacts due to Sediment Contamination
- Annual Load of Nitrogen to Great Bay from WWTF and Watershed Tributaries
- Trends in Estuarine Nutrient Concentrations
- Trends in Estuarine Particulate Concentrations
- Exceedences of Instantaneous Dissolved Oxygen Standard
- Exceedences of the Daily Average Dissolved Oxygen Standard
- Trends in Biological Oxygen Demand (BOD) Loading to Great Bay
- Percent of the Estuary with Chlorophyll-a Concentrations greater than State Criteria
- Area of Oyster Beds in Great Bay
- Density of Harvestable Oysters at Great Bay Beds
- Density of Harvestable Clams at Hampton Harbor Flats
- Area of Clam Flats in Hampton Harbor
- Standing Stock of Harvestable Oysters in Great Bay
- Standing Stock of Harvestable Clams in Hampton Harbor
- Abundance of Shellfish Predators
- Clam and Oyster Spatfall
- Recreational Harvest of Oysters
- Recreational Harvest of Clams
- Prevalence of Oyster Disease
- Prevalence of Clam Disease
- Salt Marsh Extent and Condition
- Eelgrass Distribution
- Eelgrass Biomass
- Anadromous Fish Returns
- Abundance of Wintering Waterfowl
- Protected Conservation Lands
- Protected Conservation Focus Areas in the Coastal Watershed
- Restored Salt Marsh
- Restored Eelgrass Beds
- Restored Oyster Beds
- Impervious Surfaces in Coastal Subwatersheds
- Rate of Sprawl – High Impact Development

Wells National Estuarine Research Reserve

- Dissolved Oxygen
- Salinity
- pH
- Turbidity
- Chlorophyll
- Nutrients
- Temperature
- Barometric Pressure
- Relative Humidity
- Rainfall
- Wind speed and direction
- Photosynthetically active radiation
- Marine Mammals
- Birds
- Amphibians and Reptiles
- Fish
- Invertebrates
- Emergent and submerged vegetation
- Invasive species
- Benthic communities
- Nekton/plankton communities

Appendix 7: Collaboration Continuum

Collaboration Continuum: Indicators and monitoring

Developed by David Keeley

	Cooperation	Coordination	Collaboration
Description	An informal relationship. Working or acting together, exchanging information, being in harmony, taking turns, being polite	A more formal relationship. The combining of groups to make a unit. Involves joint planning, division of roles, efforts to make efficient use of resources (avoid duplication) and of time, working toward a shared goal	Emphasis on power-sharing, responsibility and authority for change. Equal partners, share effort, resources and decisions concerning a common goal with the intent to increase the likelihood of success. Share objectives and ownership of the results. Long-term relationship.
Examples of activities	Exchanging publications, being on email list-serves, responding to inquires for ideas from other programs	Prepare joint funding proposals, advocate for region-wide monitoring, program staff develop tools together, joint communications to users,	Jointly fund monitoring tasks, operate joint data gathering efforts, blurred boundaries, provide support to each other,