Casco Bay Islands Invasive Species Monitoring Mini-Quality Assurance Project Plan

Casco Bay Estuary Partnership

## Years 3 to 6 monitoring

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Curtis Bohlen, Executive Director, Casco Bay Estuary Partnership   Date

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Jeremy Miller, Project Manager, Wells National Estuarine Research Reserve   Date
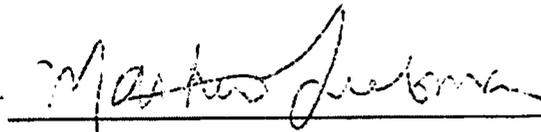
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Matthew Liebman, EPA Project Manager   Date
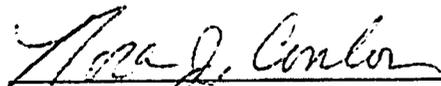
_____   8/3/2017
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1.Background

Invasive species are a global problem, with potentially high economic costs, and the potential to change ecosystem functioning and diversity.[1] This project monitors a subset of invasive species selected for their relative ease in identification, as well as their potential for negative impacts to our coastal communities and habitats. The program monitors in three distinct coastal "habitats" which are docks and marinas, tide pools, and cobble shores, in coastal waters, using protocols developed by the Marine Invader Monitoring and Information Collaborative (MIMIC).

This is a volunteer invasive species monitoring program started by Massachusetts Office of Coastal Zone Management[2] and is an adaptation of Salem Sound Coastwatch' s citizen science marine invasive species monitoring efforts, the first in Massachusetts. The program was conceived as a citizen-based complement to the intensive surveys of the Gulf of Maine Marine Invasive Species Rapid Assessment, which are conducted by a group of state, federal, non-profit and academic partners every three years.[3]

This project targets algae and benthic invertebrates, such as tunicates, bryozoans, anemones and crustaceans (e.g. skeleton shrimp or green crabs), that attach to docks, piers and hard structures in cobble shores and tide pools in coastal waters and estuaries. Docks and piers are targeted for monitoring because they are marine invasive "hot spots" where species are transported via fouling mechanisms (e.g. attached to ships), and are accessible by citizens.

The main goal of MIMIC is to provide early detection of newly arrived non-native species soon after introduction and before populations become established, as well as track the abundance and distribution of invaders already established such as the Green Crab (*Carcinus maenas)*. MIMIC data fills the gap at sites during the years the Rapid Assessment surveys are not conducted. Because marine systems are open (as compared to lakes and ponds for example), management and eradication of marine invasives once they have been found in the environment is extremely difficult. The majority of marine invasives are spread internationally through aquaculture or shipping, necessitating national or international regulatory changes rather than individual actions. But, MIMIC educates the public (e.g. boaters, fishermen, aquaculturists, teachers) on preventing the spread of marine invasives, especially the Chinese

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[1] http://www.gulfofmaine.org/state-of-the-gulf/docs/marine-invasive-species.pdf

[2] http://www.mass.gov/eea/agencies/czm/program-areas/marine-invasive-species/

[3] Reports for the 2010 and 2013 surveys are here: http://www.mass.gov/eea/agencies/czm/program-areas/marine-invasive-species/

Mitten Crab (*Eriocheir sinensis)*, which attaches to fishing gear, or tunicates that cling to lobster traps, which could be spread by power washing directly into the water.[4] In addition, MIMIC: shares information regionally by compiling and posting observations online through MACZM's Online Mapping Tool, MORIS[5]; shares data with researchers and managers; and communicates with a federal interagency task force called the Northeast Aquatic Nuisance Species (NEANS) Panel.[6]

2. Purpose of the study

This project specifically funds the Wells National Estuarine Research Reserve[7] (Wells) to train citizens to monitor invasive species at three Casco Bay Islands (Long Island, Chebeague Island, and Peaks Island) as well as on the mainland in nearby South Portland. The island sites are the only island-based monitoring stations for the State of Maine. Results from the first two years of monitoring show that island sites in Casco Bay continue to show higher abundances for several invasive tunicates, including *Didemnum vexillium, Styela clava*, and *Botrylloides violaceus*, than the mainland sites. It is unclear why, but it is hypothesized that island sites are less influenced by freshwater runoff therefore maintaining more favorable salinities for these marine species.

It can be difficult—even for experts – to identify marine invertebrates with certainty, but volunteers with the MIMIC program receive yearly training, and get significant support from the state coordinators and scientific community who act as "identification experts". Wells provides annual onsite training at all the Casco Bay sites. The volunteers are given 23 Species Identification Cards for sixteen known invaders (like the star tunicate, *Botryllus schlosseri*), and seven potential invaders (like the Chinese mitten crab, *Eriocheir sinensis*). Volunteers look for these species, which were selected not only because of their status as invaders, but also because they are relatively easy to identify without the use of microscopy or dissection.

Volunteers are also encouraged to send photographs of anything unusual back to the experts who run the program. This is how the first confirmed sighting of the European Rock Shrimp in New England occurred. A long-time volunteer saw an odd-looking shrimp in a tide pool, and sent in a photograph. It took only a few days to collect live samples, and send them to an expert for identification. The species was quickly added to the list of target species for MIMIC, and

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[4] http://www.mass.gov/eea/agencies/czm/program-areas/communications/cz-tips/cz-tip-aliens.html
[5] http://maps.massgis.state.ma.us/map_ol/moris.php
[6] http://www.northeastans.org/
[7] https://www.wellsreserve.org/blog/mimic-marine-invader-monitoring-and-information-collaborative

volunteers have tracked the rapid spread of this European invader throughout the Gulf of Maine, including Casco Bay. Starting in 2016, volunteers are also encouraged to upload any photographs of observed species onto the MIMIC project page on iNaturalist which provides an additional way to verify identifications made.[8]

3. Program organization and sites monitored

The overall MIMIC Coordinator is Cristina Kennedy at the Massachusetts Office of Coastal Zone Management (MA CZM), who took over for long-time coordinator Adrienne Pappal (who manages MA CZM's Coastal Habitat and Water Quality Program). MA CZM provides guidance material, training, and overall data management for all MIMIC groups and additional funding to local coordinators.

Jeremy Miller, of the Wells National Estuarine Research Reserve, is the Maine state Coordinator for MIMIC. He has worked with CBEP and others to recruit volunteers (Table 1). He trains volunteers on-site at the beginning of the year and receives the data and reports results to MIMIC and to CBEP. Wells receives funding from CBEP for Jeremy's time and travel to and within Casco Bay. Volunteers at dozens of locations around the Gulf of Maine make the program possible. Volunteers visit monitoring sites (Table 2) once a month May through October.

Table 1. Volunteers at each site in 2017. Volunteers may change each year.

Island	Volunteers
Peaks Island	Dr. Jeanne Gulnick, Patty Wainwright, and Susan Merrow
Long Island	Kay Johnson, Marcy Tran and Hattie Tran
Chebeague Island	Beverly Johnson, Kristin Westra, and 3rd to 5th graders at Chebeague Elementary School
Southern Maine Community College*	Meghan McCuller, and SMCC Invertebrate and Marine Biology students

* Southern Maine Community College is actually not an island, but on a peninsula in South Portland, ME.

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[8] https://www.inaturalist.org/projects/mimic

Table 2. Casco Bay sites in 2017

Site Name	Island	Coordinates*	Descriptions
Peaks Tidepool	Peaks Island	43.652278°, -70.190167°	Tidepool on backshore of Peaks Island
Peaks Dock	Peaks Island	43.655589°, -70.199795°	Main Ferry Dock on Peaks Island
Long Island Dock	Long Island	43.691707°, -70.165081°	Main ferry dock on Long Island
Fowlers Beach Tidepool	Long Island	43.680674°, -70.169827°	Tidepool on Southern End of Island/Fowlers beach
Stone Pier (Chebeague)	Chebeague Island	43.751723°, -70.107985°	CTC Ferry Dock on North end of Island
SMCC Dock	SMCC, South Portland	43.650879°, -70.228285°	Southern Maine Community College Dock on Campus
Siegel's Reef	SMCC, South Portland	43.646521°, -70.226344°	Tidepool just off campus of SMCC

* datum to be determined

CBEP Management Committee member Erno Bonebakker of the Casco Bay Islands Alliance[9] provides boat and other logistical support as needed. Curtis Bohlen and Marti Blair of CBEP provide programmatic support. Other partners include the MIMIC network and taxonomic experts provided by MIT Sea Grant.

4. Methods and Protocols

The volunteers implement the MIMIC monitoring protocols, searching on piers and adjacent rocky shores for twenty-three non-native species of concern. The protocol is described in a guidance document[10], prepared by MA CZM. Generally, volunteers are trained early in the late spring or early summer. On each visit, the volunteer team (usually two to three people) records the presence and abundance of target species. A typical site is a piling or underside of a dock float at a pier, which can be viewed by leaning over and peering into the water. Site selection and monitoring protocols for each habitat are described in the MIMIC guidance document.

Handfuls of fouling organisms are gathered and sorted in trays looking for target species. Volunteers use small nets to search for epibenthic fauna such as shrimps, crabs, or isopods. Large laminated information cards with photos are used to identify species. They are available

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[9] Formerly called the Casco Bay Island Development Association
[10] http://www.mass.gov/eea/docs/czm/invasives/mimic-guide-2011-web.pdf

at CZM or Salem Sound Coastwatch.[11] Volunteers are also encouraged to record any other species, including native species, they observe and there is room on the data sheet to add in additional species that are not on the monitoring list.

Abundance is measured qualitatively using the following guidelines:
- Abundant: present almost everywhere you look
- Common: present at most of the monitoring site (present in most locations or over half of the area looked)
- Few: present, but at low abundance (found less than half of places looked)
- Rare: one to two specimens present at site
- Absent: not observed at the site

At each visit, water temperature and salinity are recorded using hand-held thermometers and refractometers, and notes are made on weather conditions and tidal stage. Results are recorded on datasheets (Figure 1, below) and sent to Jeremy Miller at Wells.

5. Schedule of the project

The volunteer team visits the same site(s) monthly for six consecutive months, from May through October. It is anticipated that this project will be funded for the foreseeable future.

6. Quality assurance and quality control

The thermometers and refractometers are calibrated by Jeremy Miller of Wells NERRS at the beginning of the year and checked by volunteers before each monitoring event. Refractometers are checked using deionized water.

Jeremy trains volunteers in the spring (May-June) before monitoring begins. He conducts a site visit (or audit) at least once a year but often visits both in the Spring and Fall.

There is no chain of custody for the datasheets, but each datasheet requires identification of the volunteer collecting the information. Jeremy will periodically call volunteers to check on any data that seem unusual or any identification that are in question. Volunteers are instructed to collect a sample and/or photographs if they are not confident in the identification. Factors used by Jeremy to identify a potential misidentification are the history of that species at the site

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[11] http://www.salemsound.org/CHIMP-inner.html

(historical abundance/presence), whether or not the species in question has close resemblance to native species, etc.

Figure 1. Datasheet used by volunteers for recording observations.

APPENDIX B: DATASHEET

Marine Invader Monitoring and Information Collaborative Datasheet*						
Date:					Observers:	
Site ID:						
Location Type (circle one): dock cobble shore tidepool other:						
Location Description:						
Begin Time:	Salinity	Water Temp		Weather		Time of Low Tide
End Time:						

Established Invaders

Scientific Name	Common name	Present (X)	Absent (X)	Quantity	Photo#	Comments
Ascidiella aspersa	Sea Squirt	[ ]	[ ]			
Botrylloides violaceus	Sheath Tunicate	[ ]	[ ]			
Botryllus schlosseri	Golden Star Tunicate	[ ]	[ ]			
Bugula neritina	Purple Bushy Bryozoan	[ ]	[ ]			
Caprella mutica	Skeleton Shrimp	[ ]	[ ]			
Carcinus maenas	Green Crab	[ ]	[ ]			
Codium fragile	Green Fleece	[ ]	[ ]			
Diadumene lineata	Striped Anemone	[ ]	[ ]			
Didemnum vexillum	"Mystery" Colonial Tunicate	[ ]	[ ]			
Diplosoma listerianum	Diplosoma Tunicate	[ ]	[ ]			
Grateloupia turuturu	Red Alga	[ ]	[ ]			
Hemigrapsus sanguineus	Asian Shore Crab	[ ]	[ ]			
Membranipora sp.	Lacy Crust Bryozoan	[ ]	[ ]			
Ostrea edulis	European Oyster	[ ]	[ ]			
Palaemon elegans	European Rock Shrimp	[ ]	[ ]			
Styela clava	Club Tunicate	[ ]	[ ]			

Potential Invaders- If found, notify MIMIC program coordinator immediately at (617)626-1218.

Scientific Name	Common name	Present (X)	Absent (X)	Quantity	Photo#	Comments
Corella eumyota	Tunicate	[ ]	[ ]			
Eriocheir sinensis	Chinese Mitten Crab	[ ]	[ ]			
Hemigrapsus takanoi	Brush-Clawed Shore Crab	[ ]	[ ]			
Rapana venosa	Veined Rapa Whelk	[ ]	[ ]			
Sargassum muticum	Japanese Seaweed	[ ]	[ ]			
Synidotea laevidorsalis	Asian Isopod	[ ]	[ ]			
Undaria pinnatifida	Undaria Kelp	[ ]	[ ]			

Other Species:

Notes:

Quantity Key:
Abundant (A) = present almost everywhere you look
Common (C) = present in most of the location (over half of the areas looked)
Few (F) = present, but at low abundance (less than half of the areas looked)
Rare (R) = only one to two specimens present at site
Absent (N)= not present, not observed at the site

*Adapted from Salem Sound Coastwatch.

7. Corrective responses

If misidentification is a continuing problem, another site visit is set-up with the team leader to go over species collection and identification at the site in question. Should the problem persist, a new volunteer or leader would be established at the site in hopes of aiding in future identifications. This, however, has not been an issue in the eight years Jeremy has been working with the programs. Most misidentifications only happen once, are caught, and corrected.

8. Data entry and validation

Volunteers send paper datasheets to Jeremy Miller of Wells NERR. He records information into a spreadsheet template provided by MA CZM. He also sends copies of these datasheets to MA CZM annually for back-up. Data sheets from each site are reviewed by the state coordinator as they come in for errors in identification and/or data entry. Historical data on presence/absence (as well as local knowledge of community structure), is used to determine if a species marked as present should be investigated further for verification. Visiting the sites as often as possible also allows Jeremy to gain a better understanding of the community structure at each site, which enables him to better monitor for any questionable data or identifications.

Jeremy emails completed spreadsheets to Cristina Kennedy of MA CZM during or at the end of the summer. Cristina Kennedy enters this data into a master spreadsheet (which acts as a database) that includes data from Massachusetts, New Hampshire, Rhode Island and Maine. Cristina Kennedy also conducts data validation, checking the spreadsheet against the original data sheets for completeness, incorrect entries, and for unusual observations. She flags new invaders at each site and follows up with Jeremy regarding any unusual or new observations. During the monitoring season, Cristina also reviews any observations added to the MIMIC project page on iNaturalist and makes corrections or confirms identifications. When she has reviewed an observation the volunteer is notified via iNaturalist and can correct any incorrect identifications made on data sheets.

9. Data management and reporting

The master spreadsheet is locked and protected. In order to add, edit or delete records, the administrator has to unprotect it. The spreadsheets are backed up on the MA CZM server.

Data has been posted to Massachusetts Ocean Resource Information System (MORIS)[12] through 2012, but will be updated this year with 2013 to 2016 monitoring data. The program does not produce formal reports, but updates presentations every year for its annual MIMIC coordinator's meeting conducted each spring. They are planning to produce a formal report in 2017 to reflect on the ten-year period of monitoring from 2008-2016. The CZM MIMIC coordinator is work with MA CZM's communication team to produce an online Story Map that introduces the MIMIC monitoring program and allows users to explore the data. This story map is anticipated to be released in the winter of 2018 when 2017 monitoring data can be included.

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[12] http://www.mass.gov/eea/agencies/czm/program-areas/mapping-and-data-management/moris/