Action Plan 11 Managing Invasive and Nuisance Species

Problem

Aquatic and terrestrial nuisance and invasive species represent a threat to endemic natural ecosystems of Buzzards Bay and its surrounding watershed. Once invasive species become established in an ecosystem, they are virtually impossible to eliminate. Therefore, management emphasis must be placed on regulatory controls and increased public awareness to prevent new introductions. Monitoring existing and identifying new invasives is an important tool in this effort by potentially helping elucidate transport pathways, and by identifying new introductions at an early stage where there may be a slight potential to eradicate them.

Goals

Goal 11.1. Minimize the potential introduction of new invasive and nuisance species to Buzzards Bay and its surrounding watershed.

Goal 11.2. Reduce the extent and limit the spread of existing invasive and nuisance species that are degrading habitats of Buzzards Bay and its surrounding watershed.

Objectives

Objective 11.1. Adopt and enforce laws, regulations, and policies that will reduce the potential spread of invasive species.

Objective 11.2. Educate the public, farmers, nursery owners, fisherman, pet storeowners, shipping industry, and other relevant sectors about individual actions that can be taken to reduce the threat of introducing invasive and nuisance species to the environment.

Objective 11.3. Fund and promote actions and studies to control and reduce existing populations of invasive and nuisance species.

Objective 11.4. Monitor existing and new invasives in order to help discern introduction pathways and to identify species in early stages of introduction where there may be a slight potential for containment.

Approaches

For the most part, once an invasive species has entered a region, little can be done to reverse its presence or control its population. Therefore, management action should focus on preventing new introductions, and to monitor existing conditions. Monitoring for the presence of introduced species is important so that scientists and managers can better discern whether shifts in naturally occurring species are likely the result of human perturbations, like pollution, or are possibly caused by predation or competition with introduced species. Monitoring can also document trends and help discern pathways of invasive migrations. This information can help inform policy decisions and regulatory formulation.

Posting maps and information about introduced species and enabling easy online reporting by residents can help achieve the objectives of this action plan. CZM and the MassBays Program have already established websites for information on marine aquatic invasives in Massachusetts[140], and residents and municipal officials of Buzzards Bay should be encouraged to use the available online tracking and reporting forms.

The most effective approach to avoiding new introductions is through education and the enforcement of existing laws, regulations, and through adoption and enforcement of new preventative measures. These efforts will not succeed unless there is increased awareness and acceptance of the problem by the public, businesses, and educational institutions. In this way, all these groups can take voluntary measures or implement best management practices to minimize the threat of introducing non-natives into the environment.

Because pathways, impacts, and the extent of introduced species has not been well documented or understood, monitoring and research is needed not only to evaluate success of control measures, but is a fundamental need to better define the extent of the problem and the viability of proposed solutions.

Costs and Financing

Better tracking, mapping, and monitoring of key invasive aquatic and terrestrial species could be achieved with annual expenditures in the tens of thousands of dollars utilizing resident volunteers, online reporting with oversight and review by wildlife scientists and biologists. More comprehensive mapping efforts, together with research into the pathways and impacts of invasives, can cost millions of dollars. Measures to control species through eradication efforts can cost thousands to hundreds of thousands of dollars per site. There is a cost to government to enforce compliance with new regulations in terms of staff, and compliance of industry with these regulations can range from negligible (e.g. species import bans) to substantial (e.g. ballast water treatment).

Measuring Success

Tracking the extent and abundance of introduced species, together with documentation of the rate of new species introductions will be the measure of the success of this action plan, as well as programmatic measures like the adoption of new regulations.

[140] At www.mass.gov/eea/agencies/czm/program-areas/aquatic-invasive-species/ and mit.sea-grant.net/mitis/.

Background

Introduced species, which are also called non-native, non-indigenous, alien, or exotic species, are those that have the potential to reproduce in large numbers and to out-compete native species for food or space. When they alter other populations, affect the natural balance of ecosystems, or damage the environment, they are more typically called nuisance, or invasive species.

Aquatic and terrestrial invasive species represent a threat to the endemic natural resources and wildlife of Buzzards Bay and its surrounding watershed. Certain species already have affected the bay and watershed. Freshwater emergent wetland plant species like purple loosestrife (*Lythrum salicaria*) and the common reed, *Phragmities* are among the better known. In freshwater aquatic systems, introduced non-native game fish and non-native weeds like the watermilfoil (*Myriophyllum heterophyllum*) have dramatically changed many freshwater ecosystems. In marine ecosystems, the European green crab (*Carcinus maenas*) Asian shore crab (*Hemigrapsus sanguineus*, Figure 88) and the Pacific green fleece alga (*Codium fragilis)* have had profound effects on the coastal ecology and shellfishing economy of Massachusetts. Some introduced species have been around for so many centuries (e.g., the common periwinkle *Littorina littorea*, introduced with the first European settlers), they are now thought of as part of natural ecosystem. New terrestrial invaders, like the Asian longhorn beetle, have infested trees in some parts of Massachusetts, and its arrival in Buzzards Bay watershed would have a profound effect on our forests. Non-native earthworms have become widespread in the northeast, and they are already believed to be causing important changes in forest habitat (Eisenhauer et al., 2007).

Historically, marine invasives have been principally the result of transport via ship ballast water and hulls, or through the introduction of non-native species for aquaculture. In freshwater systems, past practices of stocking ponds with non-native game species has caused dramatic shifts in pond ecosystems. Introductions of certain game fishes by agencies and members of the public have endangered endemic species. In terrestrial ecosystems, escape of non-native ornamental and agricultural species has contributed to the introduction of some species. Climate changes in seasonal temperature and rainfall may facilitate the spread of some invasive species.

Once invasive species become established in an ecosystem, they are virtually impossible to eliminate. This has been particularly true of marine aquatic invasive species.

Because of these harsh realities, management action has principally focused on preventing new introductions and monitoring existing conditions and trends. Monitoring for the presence of introduced species is important. Past monitoring has been inadequate, and the pathways and impacts of introductions are poorly understood. Monitoring to document trends and discerning pathways helps to inform policy decisions and regulatory formulation. Monitoring also helps scientists and managers discern more clearly whether shifts in naturally occurring species are likely the result of human perturbations, like pollution, or are possibly caused by predation or competition with introduced species.

To better define the problem and help address the threats from marine aquatic invasives, in 2000, Massachusetts Coastal Zone Management (CZM) helped form the Massachusetts Aquatic Invasive Species Working Group consisting of a variety of state and federal agencies, nonprofit organizations, and scientists. In 2002, this group published the Massachusetts Aquatic Invasive Species Management Plan (CZM, 2002). Lists of species and other data are also available online at the Northeast Marine Introduced Species (NEMIS) website[141]. The four objectives of this plan were to:

- *Educate the public about threats from aquatic invaders and measures that can be taken to prevent their further introduction and spread.*
- *Reduce the potential for the introduction of aquatic invasive species into Massachusetts waters through preventative measures.*
- *Control the spread of established aquatic invasive species to uncolonized waters of Massachusetts.*
- *Minimize harmful ecological, socioeconomic, and public health and safety impacts from aquatic invaders that have been introduced to Massachusetts waters.*

In 2007, the state of Rhode Island Aquatic Nuisance Species Task Force undertook a similar effort and published the Rhode Island Aquatic Invasive Species Management Plan. The overarching goal of the Rhode Island plan is to "implement a coordinated approach to preventing the introduction of and minimizing the ecological and socio-economic impacts of aquatic invasive species in the marine and freshwater environments…" Additional specific goals were:

- *Prevent the introduction and establishment of aquatic invasive species.*
- *Control the growth and spread of aquatic invasive species.*
- *Abate the impacts and minimize the harmful effects of aquatic invasive species.*

[141] Lists of regional invasive species are retrieved from NEMIS.mit.edu and mit.sea-grant.net/mitis/. Last accessed April 24, 2013.

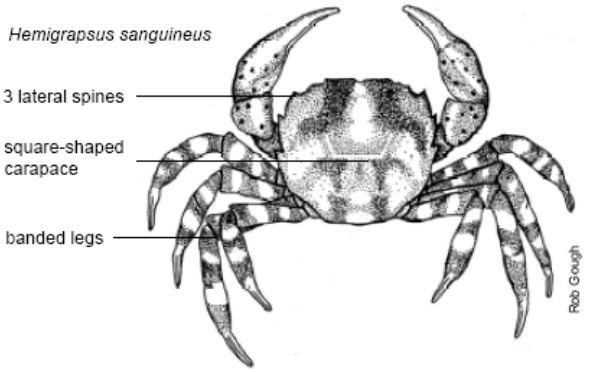
GUIDE TO MARINE INVADERS
IN THE GULF OF MAINE

Hemigrapsus sanguineus
Asian shore crab

Salem Sound Coastwatch

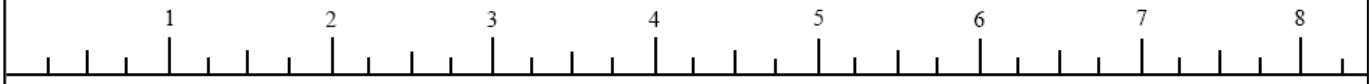
PHYSICAL DESCRIPTION

- 3 lateral spines on each side of a square-shaped carapace (shell)
- Light and dark bands on legs with red spots on the claws
- Color variable: commonly orange-brown, also green and maroon
- Carapace width up to 2 in (5 cm)
- Larger males have fleshy bulb at base of pincers



HABITAT PREFERENCE

- Occurs primarily in mid to low intertidal zones and sometimes the subtidal zone
- Tends to aggregate in high densities under rocks
- Tolerant of a wide range of salinity and temperature
- Prefers rocks and cobble but may be found in soft sediments and other habitats



GUIDE TO MARINE INVADERS
IN THE GULF OF MAINE

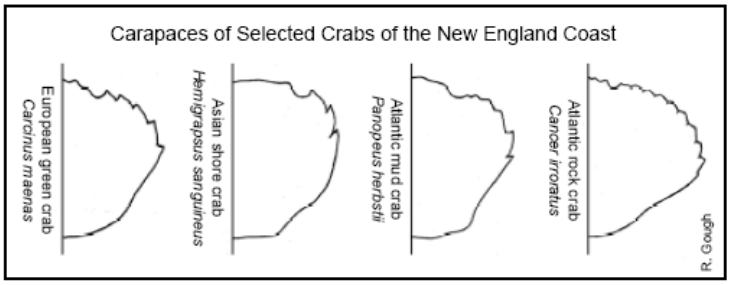
Hemigrapsus sanguineus
Asian shore crab

INVASION STATUS & ECOLOGICAL CONCERNS

Abundant in rocky intertidal habitats, *Hemigrapsus sanguineus* is a native of the western Pacific Ocean ranging from Russia, the Korean and Chinese coasts to Hong Kong, and Japan. It was first recorded in the United States in 1988 at Townsends Inlet, Cape May County, New Jersey. It is now well established and rapidly expanding its range along the Atlantic coast from Maine to North Carolina. Female *H. sanguineus* produce up to 50,000 eggs three to four times from May to September, compared to native crabs that reproduce twice a season. The larvae are free-floating for nearly a month before becoming juvenile crabs, increasing the possibility of being transported to new areas. An opportunistic omnivore, it feeds on salt marsh grass, algae, invertebrates, and larval and juvenile fishes.

SIMILAR SPECIES

Hemigrapsus sanguineus may be mistaken for several other crabs in New England, including the European green crab (*Carcinus maenas*), the Atlantic mud crab (*Panopeus herbstii*) and others. To differentiate the region's crabs, it is helpful to take careful note of the carapace (shell), particularly its shape and the number of marginal spines on each side (see figure on right).



This identification card is one of a series produced by Salem Sound Coastwatch (www.salemsound.org) highlighting introduced species that pose a threat to the marine environments of Massachusetts and the Gulf of Maine. The original development of these cards was funded by the MA EOEEA Office of Coastal Zone Management with funding from the U.S. Fish and Wildlife Service. For additional species information or to report sightings, please visit www.mass.gov/czm/invasives/monitor/reporting.htm.

CZM

Figure 88. Invasive species identification card for the Asian shore crab, developed by Massachusetts CZM.

If a new introduced species is perceived to be an ecological or economic threat, a rapid response is critical for a possible successful eradication. Such an attempt is occurring in the case of the Asian Longhorn beetle where large tracts of infected forest in the Worcester area are being deforested and the wood burned to prevent the spread of the beetle. No such model has been found or implemented in the marine environment, and continued control may be a viable option only for a few species.

Major Issues

Where an invasive can be controlled or eliminated, the costs are often high, and the restoration itself may have ecological impacts. For example, the Eurasian watermilfoil (EWM) affects 14% of the roughly 700 lakes and ponds in Massachusetts, with the affected systems totaling more than 19,000 acres (DCR, 2006). To control EWM, DCR estimated the three different treatment option to have the following costs: chemical control using herbicides= $550-$750 per acre, biological control using weevils= $3,000 per acre, and mechanical control using diver-assisted, suction harvesting=$10,000 per acre, for a total cost of $7 to $120 million for this one invasive.

For the most part, once an invasive marine species has entered a region, little can be done to reverse its presence or control its population. Therefore, management action should focus on preventing new introductions and monitoring existing conditions. Monitoring can also document trends and help discern pathways of invasive migrations. Currently, the lack of data and information on propagation pathways and ecological relationships is so profound, that it may take many years of research to fully understand the impacts of introductions or the biology of introduced species so that effective control measures can be developed. Identifying solutions will therefore depend in part on commitments to funding long-term research.

Part of a solution will also depend on increased coordination of federal agencies with foreign agencies on matters of shipping procedures, ballast water handling, and the importation of produce, lumber, live animal products, and ornamental species. For example, in 2010, the U.S. EPA promulgated new rules regulating the discharge of ballast water under its NPDES discharge permit program, but the efficacy of the proposed strategy was challenged. In March 2011, the EPA announced it would promulgate new stricter rules regulating ballast water discharges. Under a settlement filed in the D.C. Circuit Court of Appeals, by 2014, the EPA will devise limits for the discharge of plankton and microbes in ballast water[142]. Neighboring states could also coordinate and implement complimentary measures on non-native

Figure 89. Various public education graphics and signs relating to introducing exotic species.

Don't Release A Pest. Film by S. Zaleski, L. Walters, and P. Grifman. USCSG-ME-03-2007(N/C).

Don't move a mussel – now it's the law, AZGFD.gov.

Look for Mussels Here, Minnesota Department of Natural Resources Invasive Species Program.

Stop Aquatic Hitchhikers, protectyourwaters.net.

Don't move firewood, massnrc.org.

garden plants that could become nuisance species. Tracking and facilitating these efforts are beyond the scope of a National Estuary Program.

Management Approaches

With respect to monitoring marine species, Coastal Zone Management and the Buzzards Bay NEP should

[142] www.upi.com/Science_News/2011/03/10/EPA-will-regulate-ballast-water-discharge/UPI-96031299798613/#ixzz1MAEhJnfk. Last accessed October 11, 2013.

work with federal agencies and scientists to monitor sentinel stations at least every three years. Buzzards Bay was surveyed through the Rapid Assessment Survey Program in 2000, 2003, 2007, and 2010 with two to four of the following sites surveyed in any particular year: Buzzards Bay Village, New Bedford Harbor, Westport Harbor, and Woods Hole.

The escape of exotics by research institutions and commercial entities may have resulted in some past introductions of marine, freshwater, and terrestrial species. Residents may have contributed to the introduction of some freshwater and terrestrial invasives. For these reasons, education of the public, businesses, and educational institutions is an important part of any strategy to prevent new introductions. Agencies could offer special certifications for businesses that implement certain practices.

The Department of Environmental Protection and the Massachusetts Department of Food and Agriculture have ongoing programs to educate the public about freshwater and terrestrial invasives, but more effort may be needed to educate the public and nurseries about that list. These agencies also have regulatory responsibilities, and they should review the effectiveness of implementation and enforcement of past efforts and recommend new laws, regulations, and policies to prohibit or regulate the sale of prohibited species or regulate other activities that are likely to lead to introduction of exotics. Agencies should enable a streamlined permitting process for rapid response control methods.

The USDA NRCS program has several initiatives that address the spread of plants that have been classified as noxious or invasive. Activities include technical and financial assistance to manage invasive species and pests; Conservation Innovation Grants that support development and implementation of innovative approaches, a Plant Materials Center that funds research and restores areas where invasive species have been removed, and programs to assist with detection, inventorying, and monitoring on private lands as part of the conservation planning process. NRCS's work to restore salt marshes assists with *Phragmites* control, and a Buzzards Bay example includes their 2005 partnership with Mass Audubon partner to restore salt marsh at Allens Pond Wildlife Sanctuary, South Dartmouth.

The Massachusetts Department of Conservation and Recreation (DCR) has several programs that address invasives (DCR, 2006) that could be expanded in the Buzzards Bay watershed. For example, the goal of DCRs Lakes and Ponds Program is to prevent further infestation of Massachusetts' lakes and ponds by exotic invasive aquatic plants, and to work towards controlling and removing existing populations of exotic invasive plants. To meet this goal DCR has implemented a Weed Watchers program where a volunteer team receives training in the identification and removal of invasive species, signs to post on boat ramps, and informational materials to distribute. The volunteers patrol their lake every other week during the summer for the presence of invasive species in key locations. If a potential infestation is found, the Weed Watchers group will work with the Invasive Species Task Force to identify the species and to develop and implement a removal plan. Results of the program and a list of monitored ponds should be made available online.

On Cape Cod, Barnstable County has several initiatives relating to invasive controls, one of which has involved AmeriCorps staff overseeing other volunteers in the physical removing invasives[143]. In the Buzzards Bay watershed, only Bourne and Falmouth are covered and there is no comparable county agency doing similar work in Bristol and Plymouth counties.

These efforts will only succeed if there are also programs to educate residents, businesses, and educational institutions on the dangers of releasing non-native species into the environment (examples in Figure 89). There is a special need to provide more education and outreach to the nursery, aquaculture, water garden, bait, and pet trades. Where population control of invasives can be implemented (e.g. *Phragmites*), better informational materials should be provided by agencies on the best practices to control invasives or restore native species, and the permitting requirements for these activities.

Residents should be educated about actions they can take such as cleaning boats and boat trailers prior to leaving a waterway, and never releasing live organisms including aquarium pets and unused live bait and bait packing materials. Residents should also be encouraged to landscape with native plants. Publications like the A Citizen's Guide to Monitoring Marine Invasive Species (Salem Sound Coastwatch, 2005) is a good model of a publication to help the public get involved with tracking invasives.

The online dissemination of information about invasive species and their distribution, together with online reporting forms can help achieve some of the objectives of this action plan in a cost-effective way. CZM and the MassBays Program have already established a website[144] for information on marine aquatic invasives in Massachusetts, and residents and municipal officials around Buzzards Bay should be encouraged to use the available online tracking and reporting forms.

[143] For example, as part of Harwich, MA "Blitz Week," over the course of a week, April 2008, 370 volunteers used loppers to remove invasive plants on a portion of conservation land, specifically removing olive shrubs, bittersweet, and honey suckle. See www.americorpscapecod.org/wordpress/wp-content/misc/Waypoint_July2008.pdf.

[144] At www.mass.gov/eea/agencies/czm/program-areas/aquatic-invasive-species/ and mit.sea-grant.net/mitis/.

Financial Approaches

The financial costs of monitoring and tracking of key species could be undertaken with modest funding if online volunteer reporting by residents and volunteers were utilized and periodic participation by scientists. The statewide cost of the periodic marine aquatic invasive species monitoring and reporting is approximately $10,000 every 3 years. The implementation of more rigorous monitoring and research efforts will require millions of dollars, especially from federal agencies. In some cases, existing agencies grant programs can be utilized. Expanded state and federal funding will be needed to evaluate the effectiveness of past abatement and control efforts.

Monitoring Success

Monitoring is needed not only to evaluate the success of control measures, but is also fundamental to better define the extent of the problem and the viability of proposed solutions. Rapid assessments like those undertaken by Pederson et al. (2005) and McIntyre et al. (2010) should be continued and repeated at least every three years. For any given site or watershed, the extent and abundance of introduced species should be mapped and the information posted on the internet. Programmatic measures, like the adoption of new regulations, should also be tracked.

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