Invasive Freshwater Species in Massachusetts: Biodiversity, Prevention, and Regulations

David Wong, Lealdon Langley

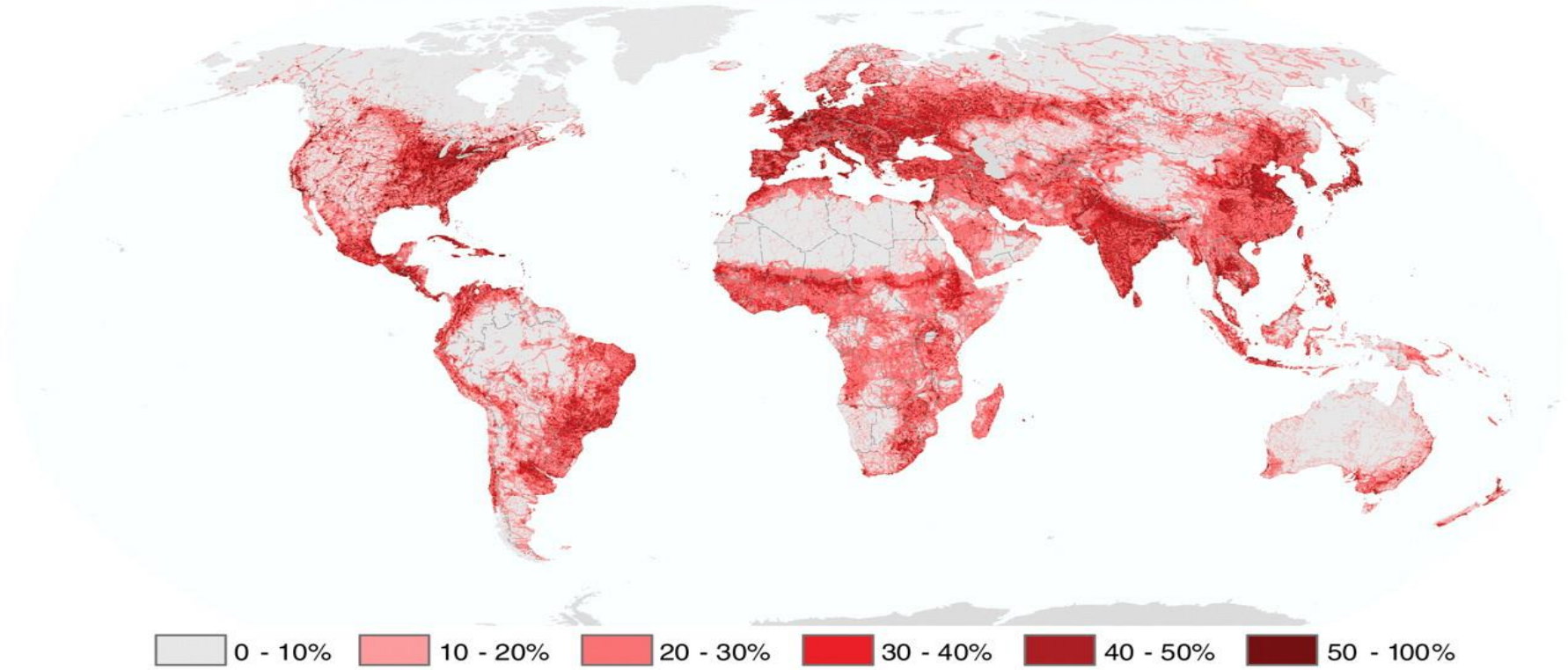
Bureau of Water Resources

Massachusetts Department of Environmental Protection

Outline

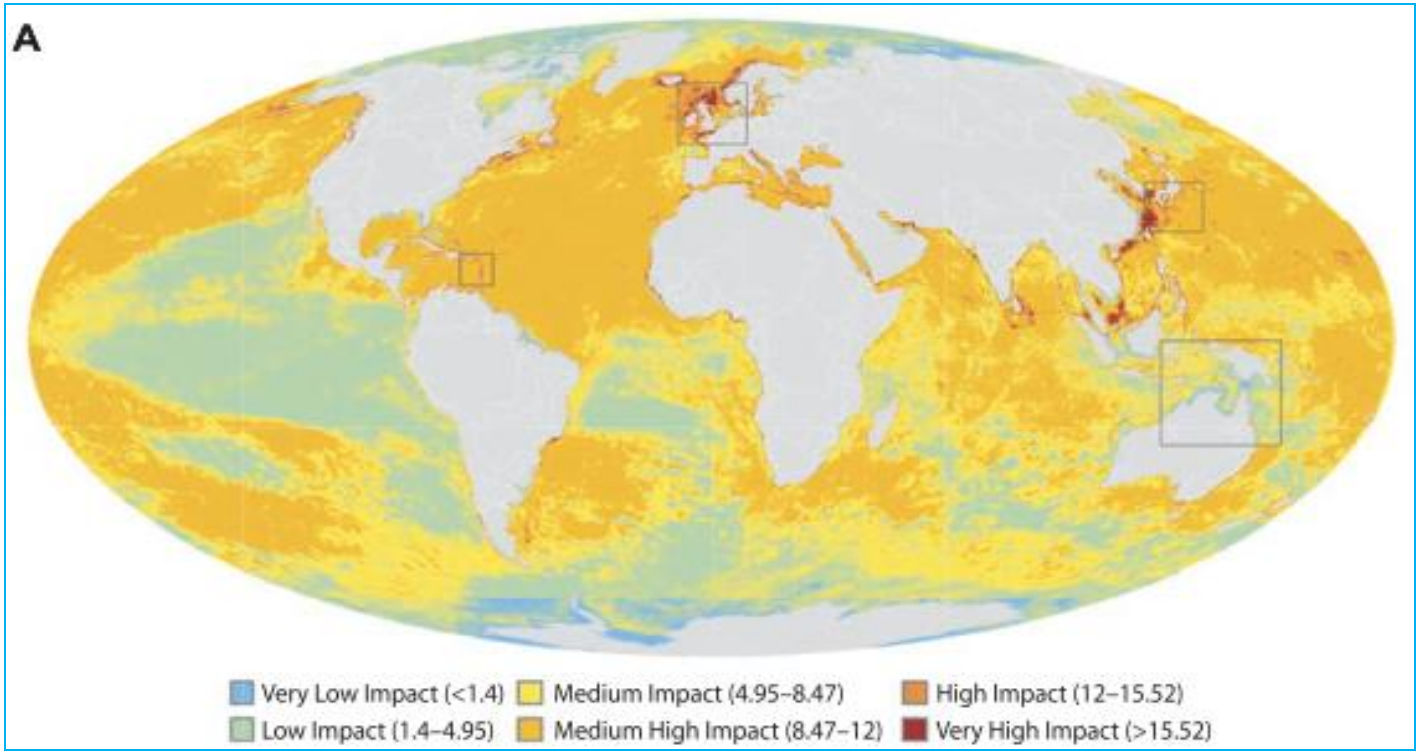
- General introduction
- Freshwater invasive Species in MA
- Prevention: physical, chemical, and biological
- Permitting requirements for invasive species control projects
- MassDEP's views on invasive species
- Recommendations for success

Human Footprint (Land)



The Human Footprint (From CIESIN at Columbia University and The Wildlife Conservation Society)

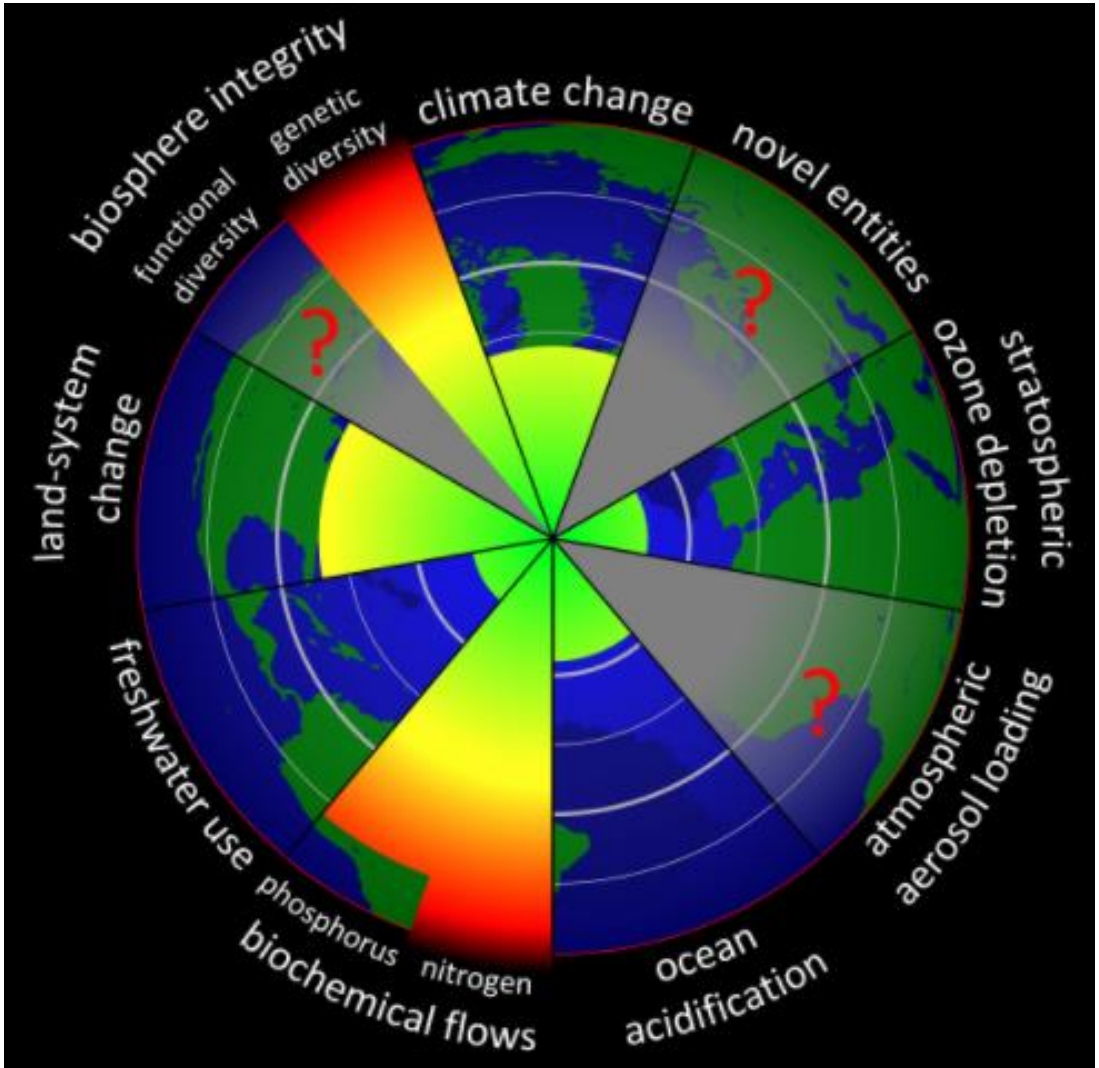
Human Impact (Ocean)



- Vitousek et al. 1997; Halpern et al. 2008

Challenges

Planetary boundaries (Rockström et al. 2009 and Steffen et al. 2015): The green areas represent human activities that are within safe margins, the yellow areas represent human activities that may or may not have exceeded safe margins, the red areas represent human activities that have exceeded safe margins, and the gray areas with red question marks represent human activities for which safe margins have not yet been determined



http://www.fao.org/biodiversity

Economic Cost of Invasive Species in USA

- **$138 Billion / Year**
  - **Federal Emergency Management Agency (FEMA) 2015 Budget: $ 10 Billion**

Pimentel et al. 1999

Invasive species triggers a massive loss of ecosystem services through a trophic cascade

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Author Affiliations

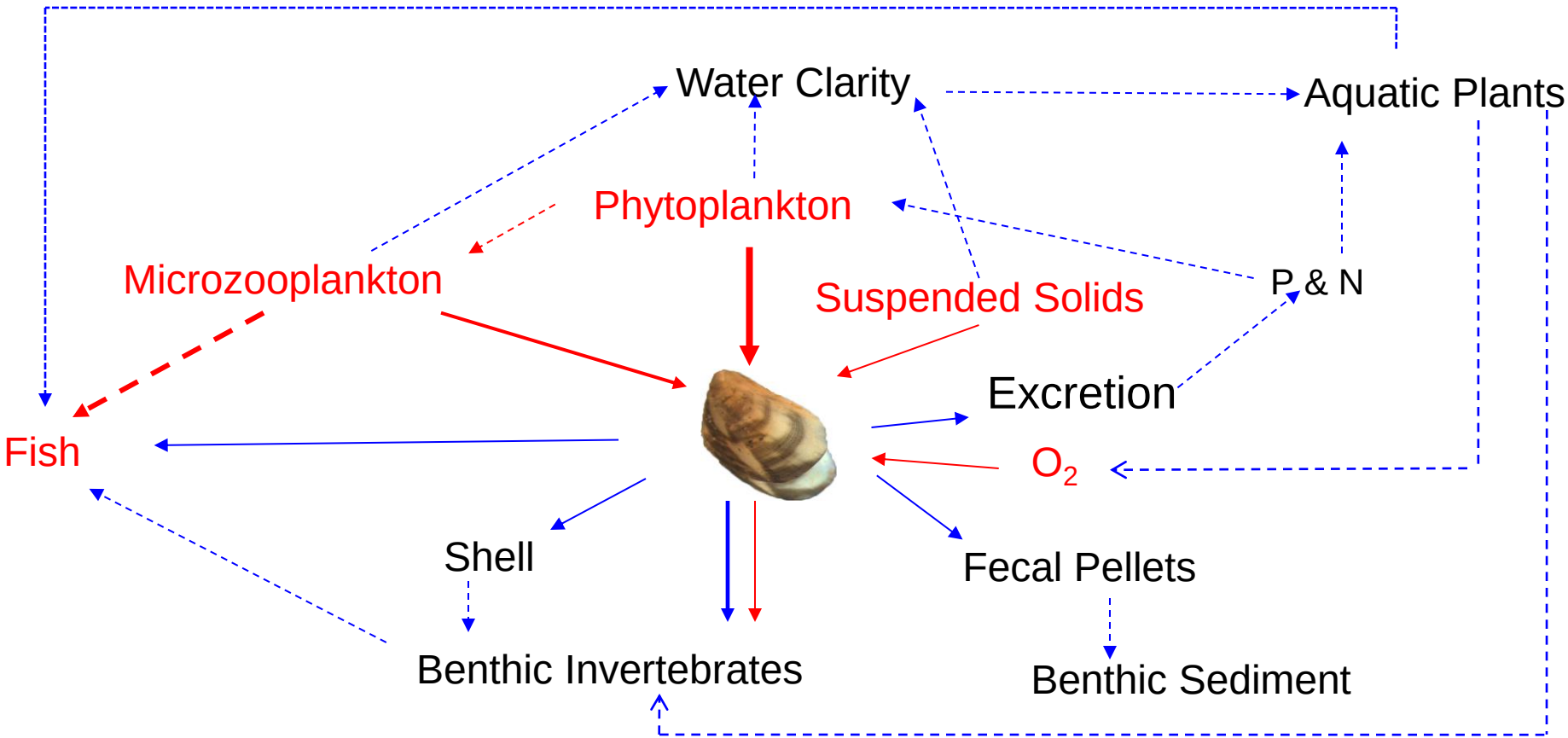
Contributed by Stephen R. Carpenter, February 17, 2016 (sent for review January 8, 2016; reviewed by Chris Luecke, David Strayer, and Norman D. Yan)

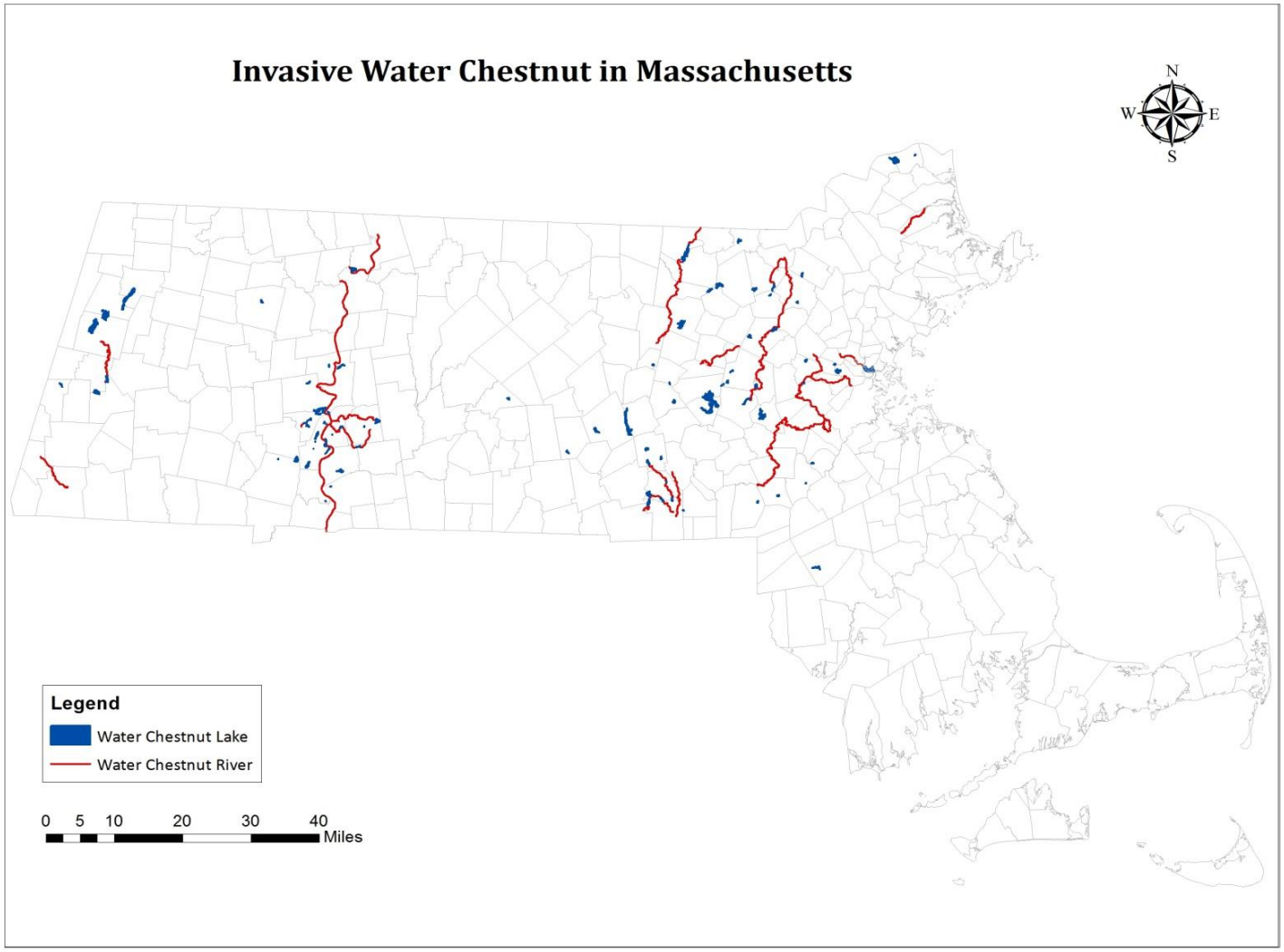
Significance

Invasive species represent a largely unquantified threat to ecosystem services. Although investment in the prevention of species invasions may sustain ecosystem services, these effects of invasions are rarely measured in monetary terms useful to decision makers. We quantify the economic damages of the degradation of an important ecosystem service, water clarity, caused by invasion by the spiny water flea. We find that the costs of restoring this service, US$86.5 million–US$163 million, are comparable with the willingness to pay for the service itself: US$140 million. This finding highlights the severity of invasive species' impacts when their damages to ecosystem services are considered. Costs of invasive species' secondary spread aggregated across many invasive species and ecosystem services may be large.

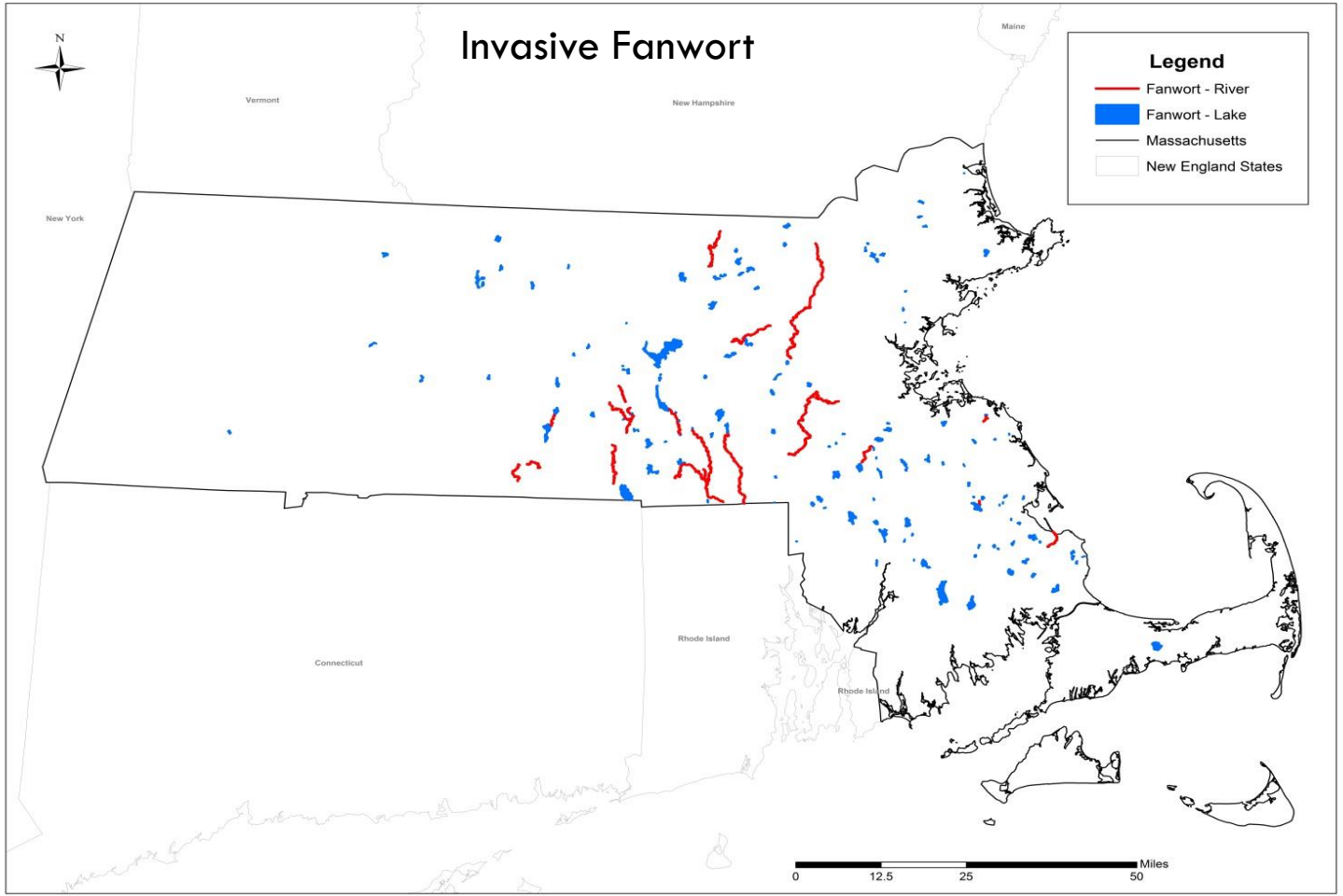
Quagga/Zebra Mussels: Ecosystem Engineers

(Wong et al. 2011)



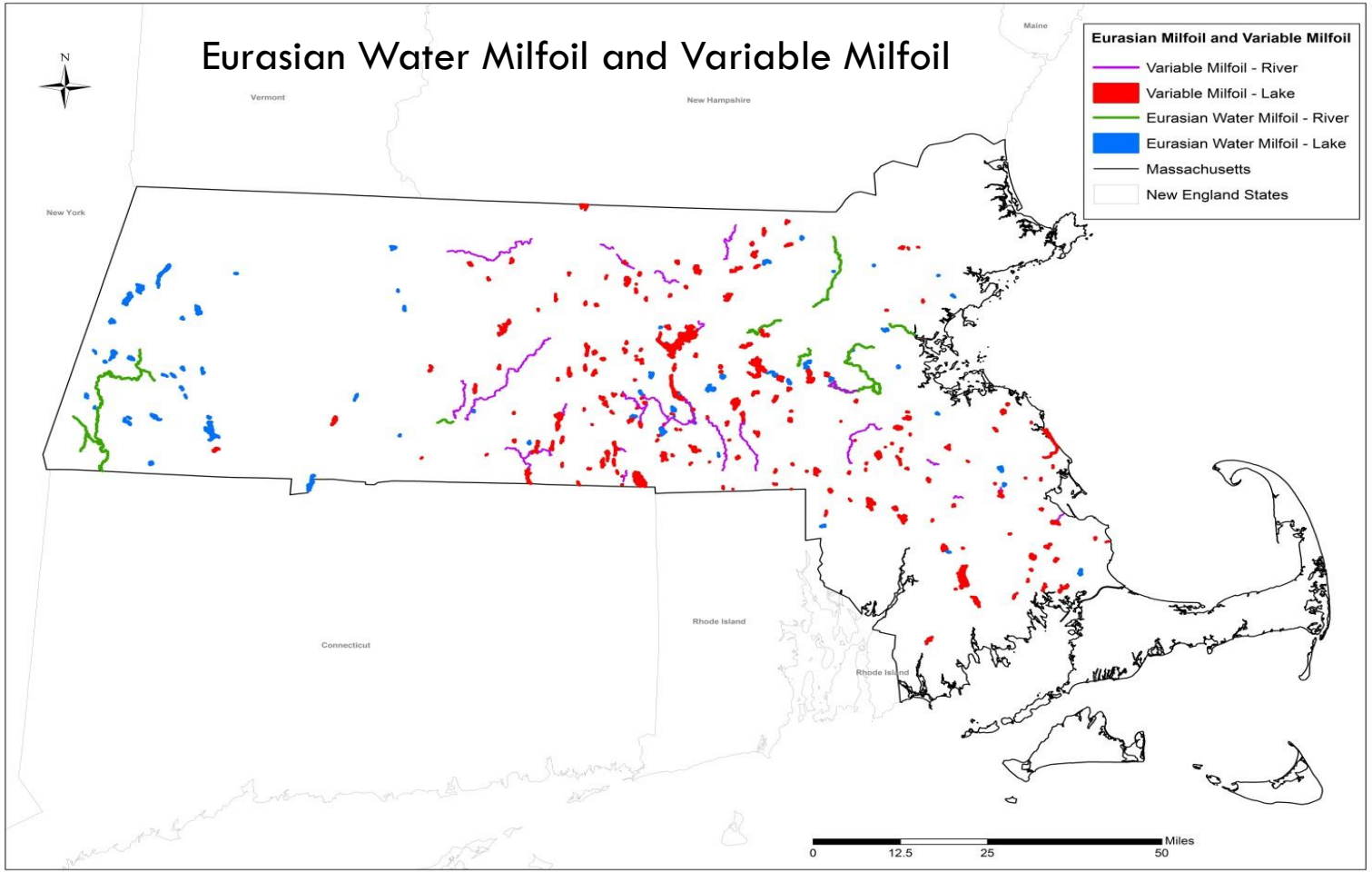

Invasive Water Chestnut in Massachusetts
N
W
E
S
Legend
Water Chestnut Lake
Water Chestnut River
0 5 10 20 30 40
Miles

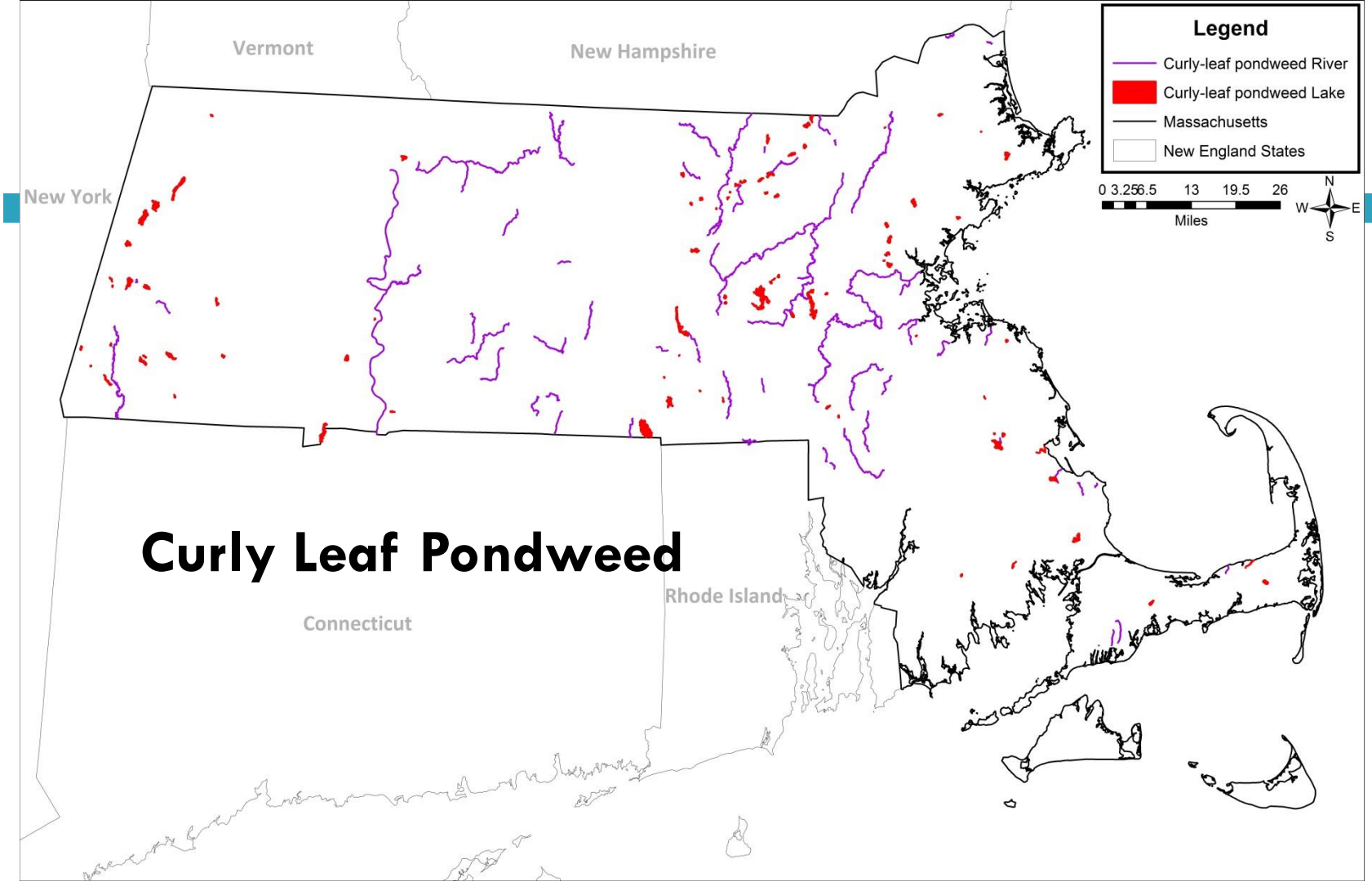
Invasive Fanwort



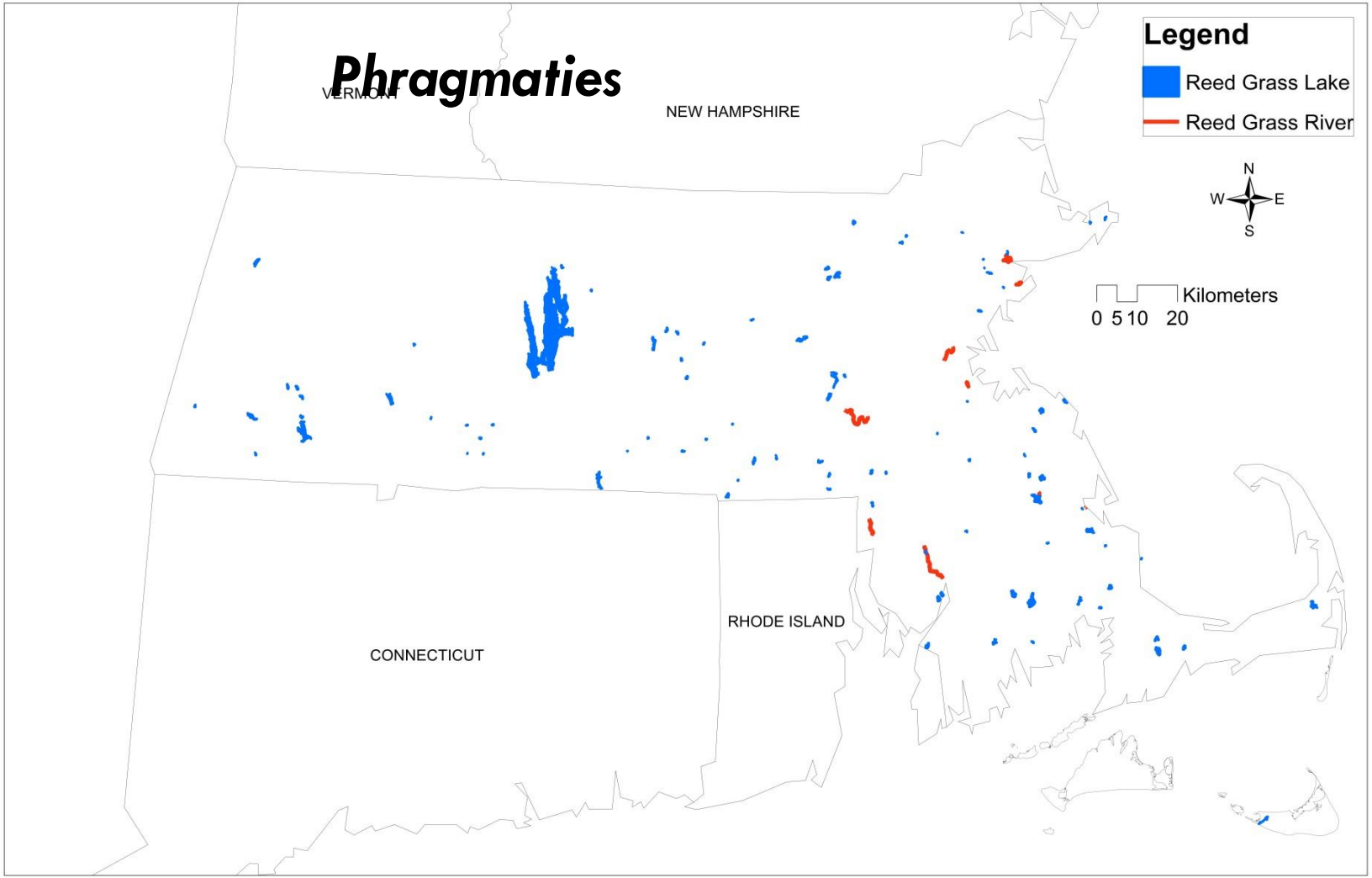
Mas

lfoil


Eurasian Water Milfoil and Variable Milfoil
N
Vermont
New Hampshire
Maine
New York
Connecticut
Rhode Island
Rhode Island
Eurasian Milfoil and Variable Milfoil
Variable Milfoil - River
Variable Milfoil - Lake
Eurasian Water Milfoil - River
Eurasian Water Milfoil - Lake
Massachusetts
New England States
0
12.5
25
50
Miles



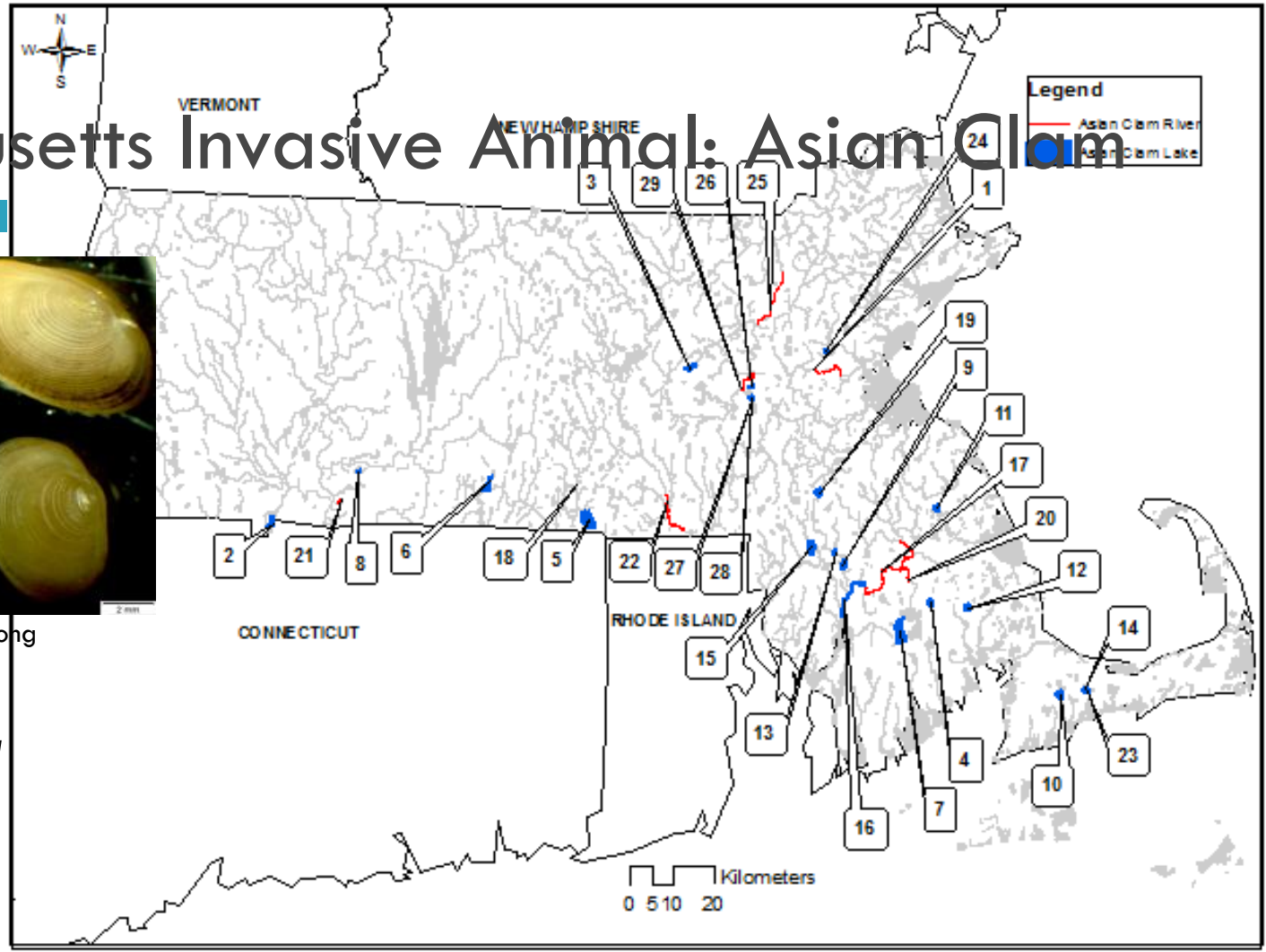
Curly Leaf Pondweed


Phragmaties
VERMONT
NEW HAMPSHIRE
CONNECTICUT
RHODE ISLAND
Legend
Reed Grass Lake
Reed Grass River
N
W
E
S
Kilometers
0 5 10 20

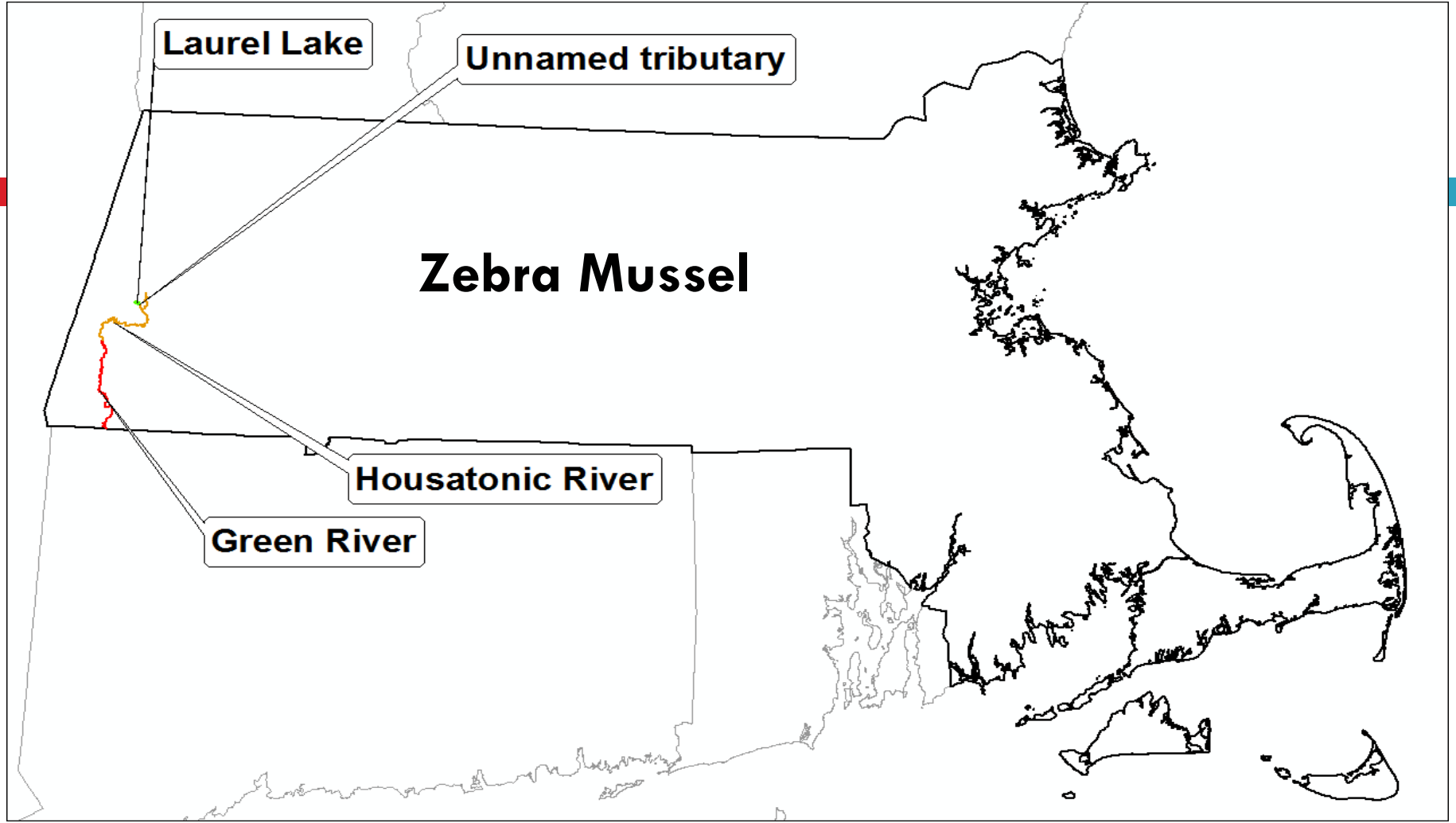
Massachusetts Invasive Animal: Asian Clam

By David Wong

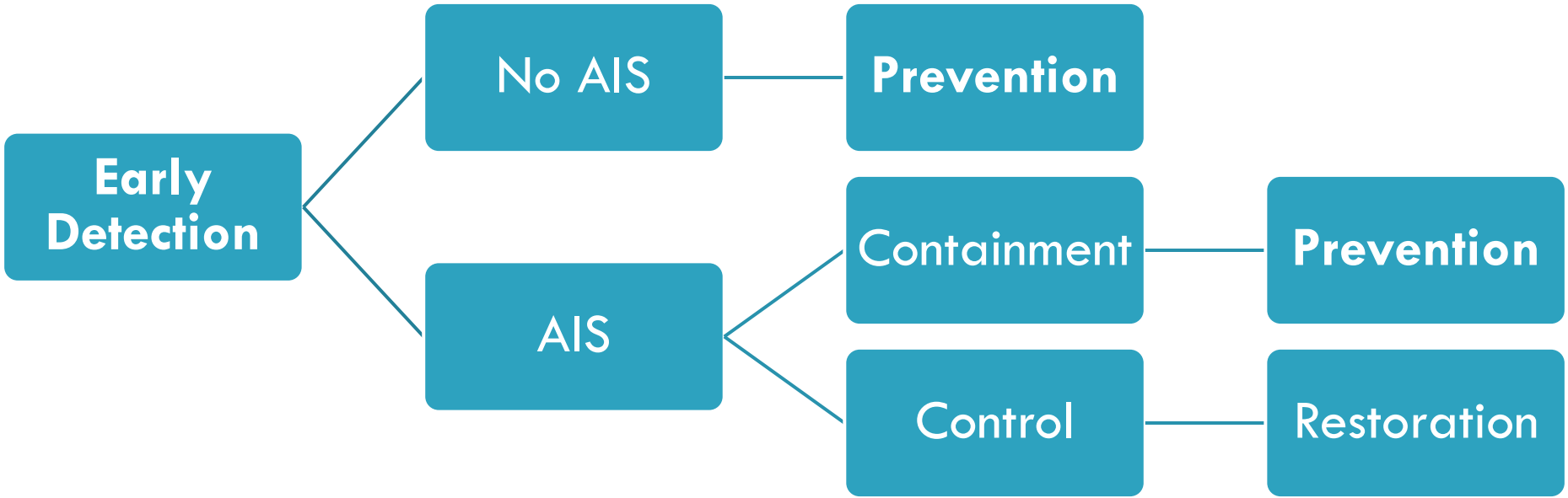
Corbicula fluminea



Asian Clam


Laurel Lake
Unnamed tributary
Zebra Mussel
Housatonic River
Green River

Integrated Pest Management



Early Detection

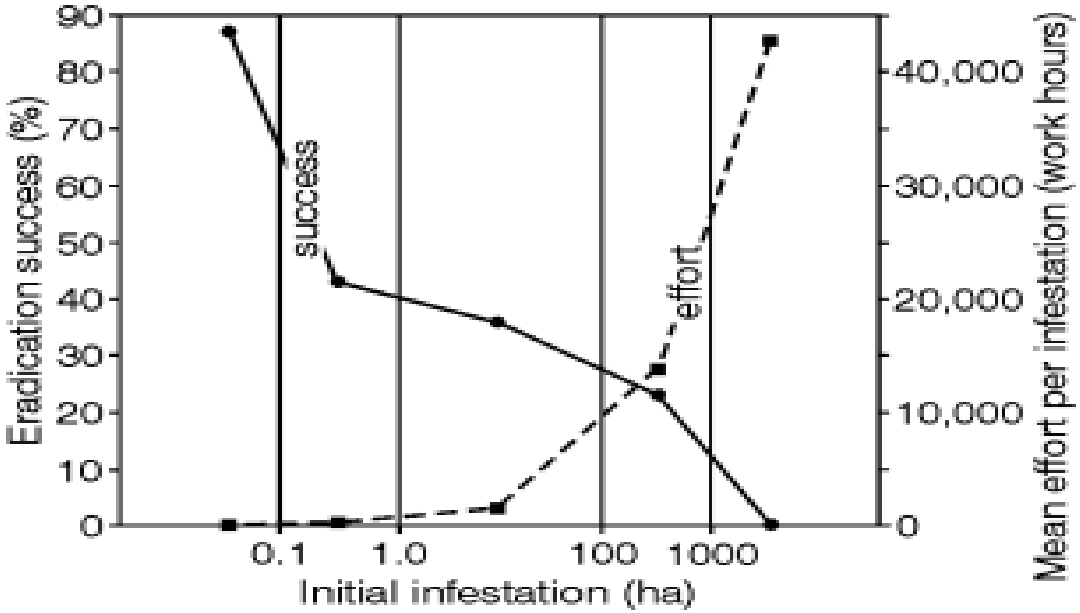
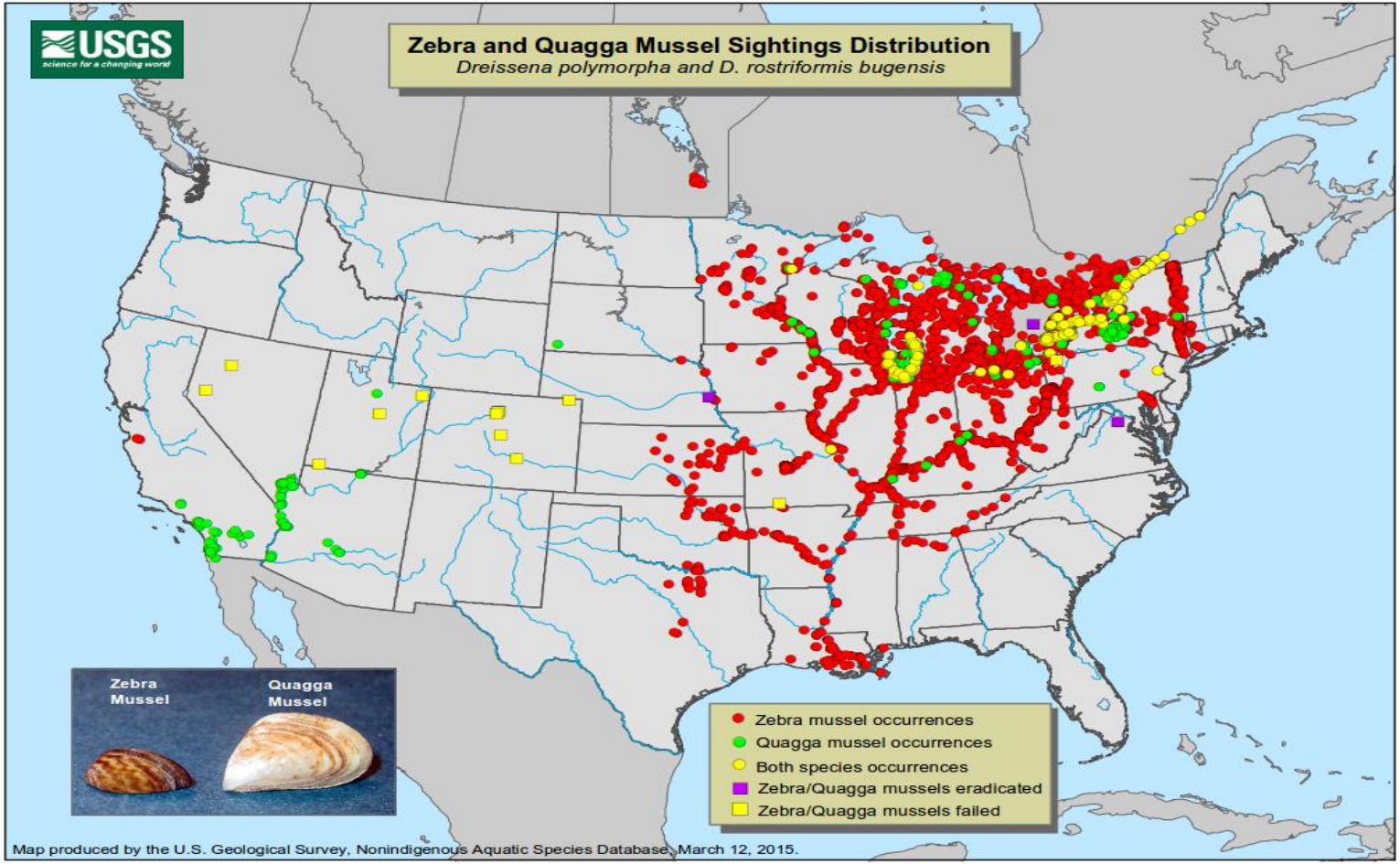
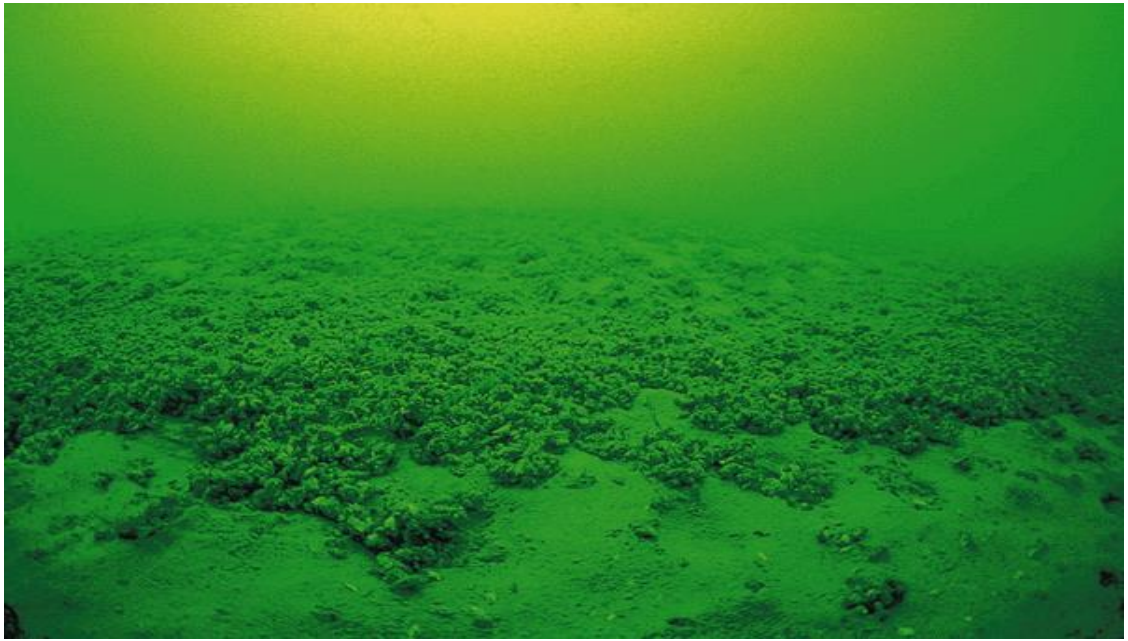


Fig. 1 The dependence of the eradication success (%) and the mean eradication effort per infestation (work hours) on the initial size of infestations. Based on the data for eradication projects of 18 noxious weed species and 53 independent infestations in California (see Table 1). (Rejmanek and Pitcairn 2002)

Distribution of zebra/quagga mussels in the U.S.



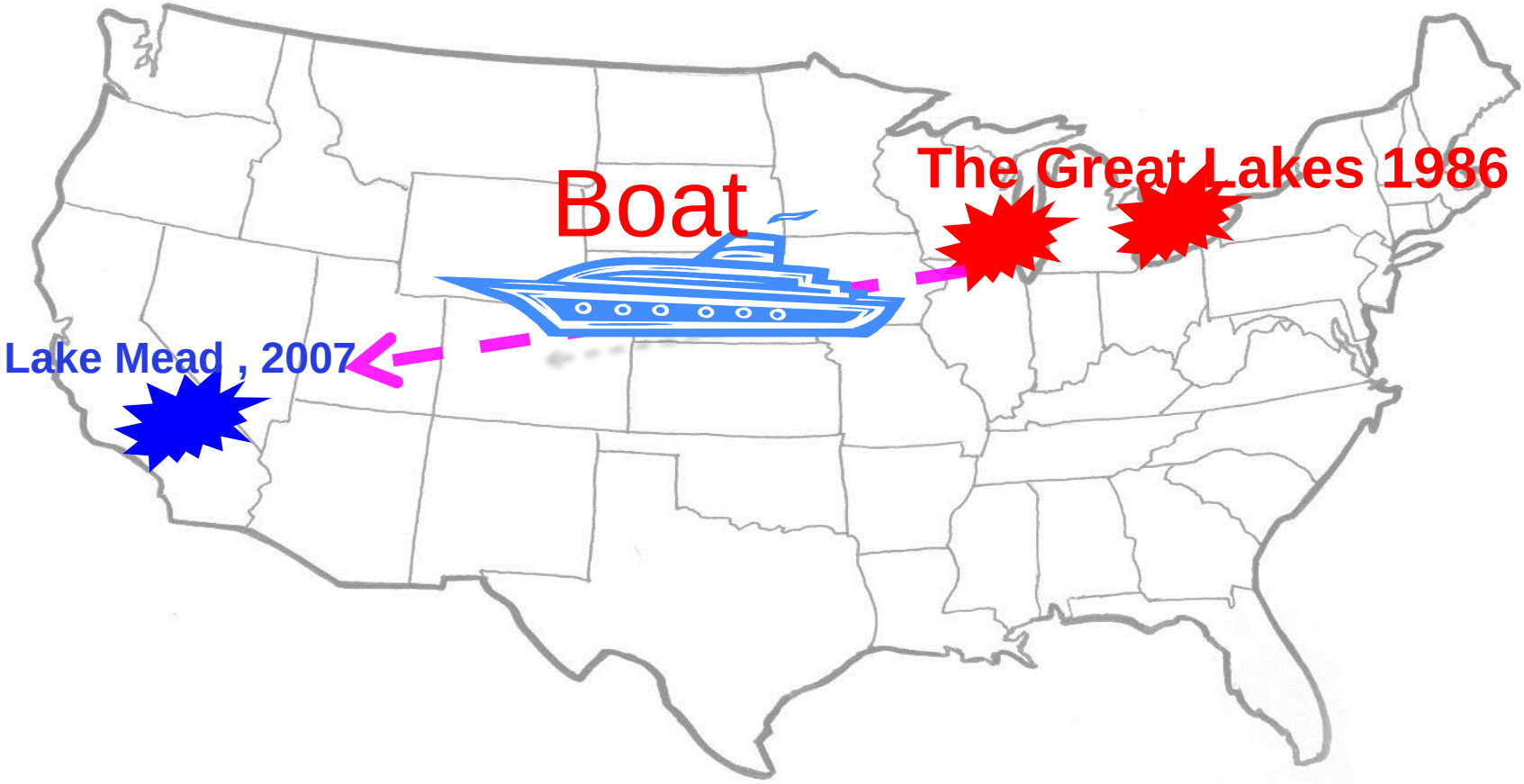
Zebra Mussel in Lake Erie



Beckman et al. 1998

Mussel bed at the bottom of Lake Mead


Great Lakes
Lake Mead
Ukraine
Southern Bug River and
Dnieper River tributaries
Atlantic Ocean
Image NASA
© 2008 Europa Technologies
© 2008 Tele Atlas
Map data © 2008 DMapas/El Mercurio
Google
38°05'01.37" N 38°46'14.90" W
Eye alt 9825.10 km


Boat
The Great Lakes 1986
Lake Mead , 2007

Boat

Photo by David Wong

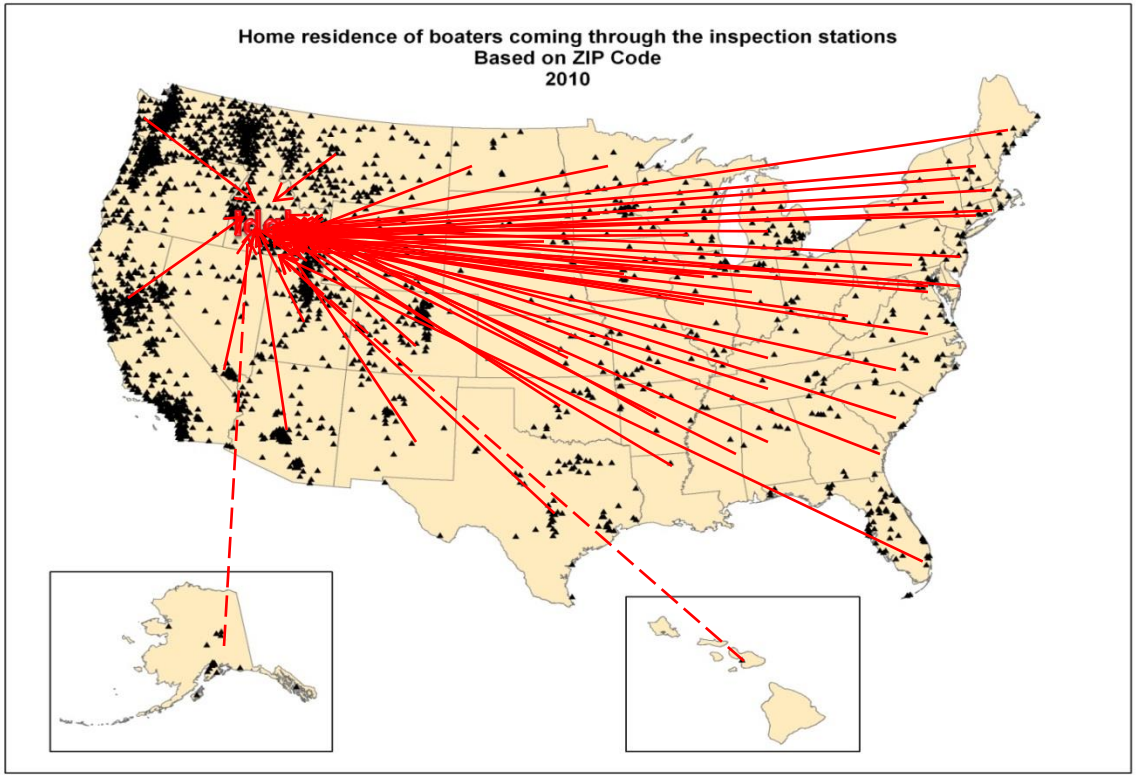
AIS Spread to Inland Waters

Aquatic Invasive Species Spread to Inland Waters

- The spread of AIS to the inland water bodies of North America is most likely be attributed to the **unintentional overland transport of trailered boats** contaminated with the invasive organisms into an uninfested body of water (Bossenbroek et al. 2001; Johnson et al. 2001; Leung et al. 2006).

Photos by David Wong and MNDNR

Recreational Boating in Idaho



(Ferriter and Anderson 2015)

Prevention: **C**heck **C**lean **D**rain **D**ry

Types	Methods
Physical/Mechanical	High Pressure Wash Hot Water Spray Mother Nature
Chemical	Bleach/Chlorine NaCl/KCl
Biological	Inspectors Dogs

High Pressure Boat Washing Station

Power Wash: 3000 PSI

Hot Water: 140°F

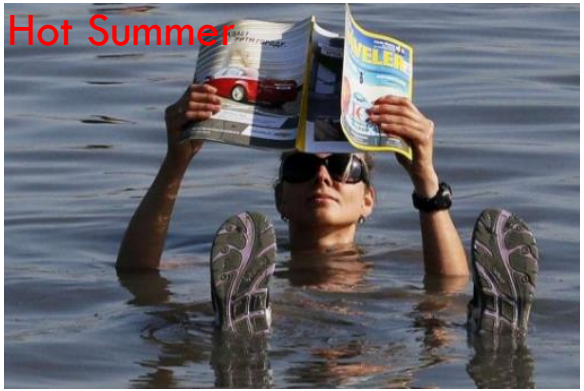
Time: 10 Seconds

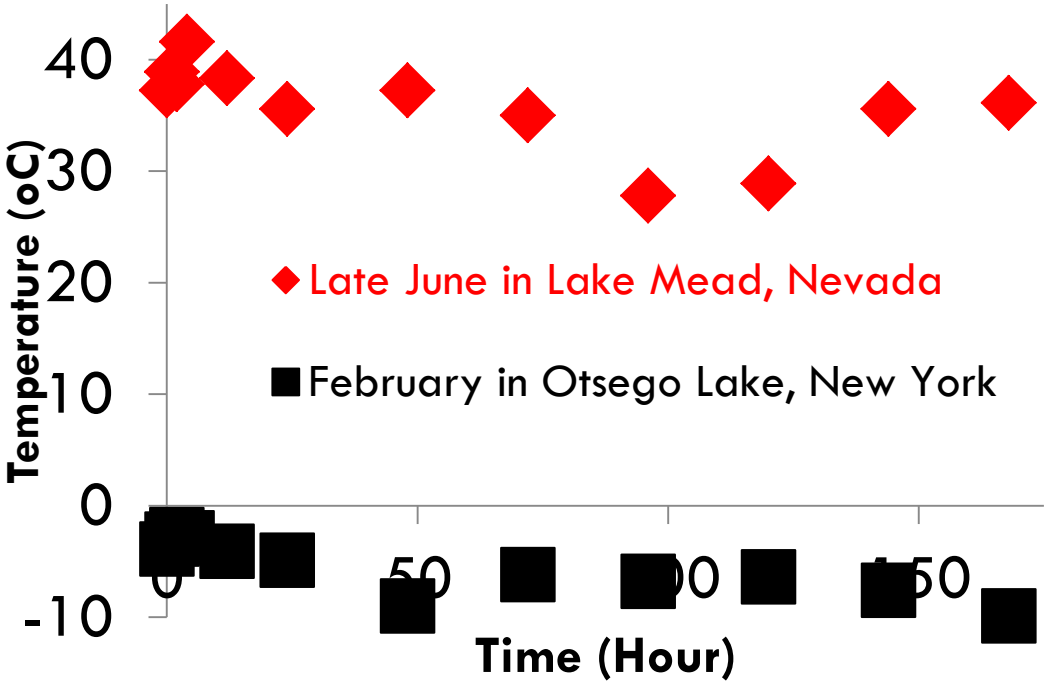
(Morse 2009; Comeau et al. 2011)

High Pressure Boat Washing Station

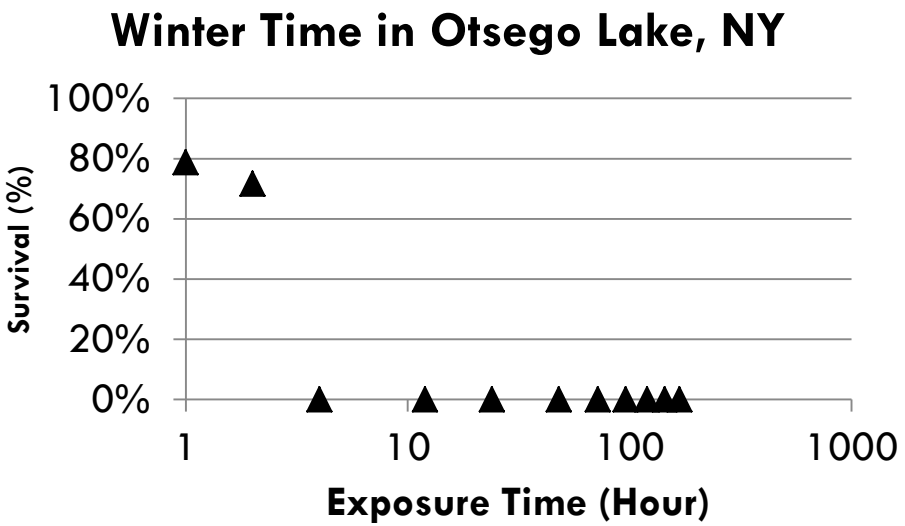
Expensive: > $30,000/Station

Mother Nature

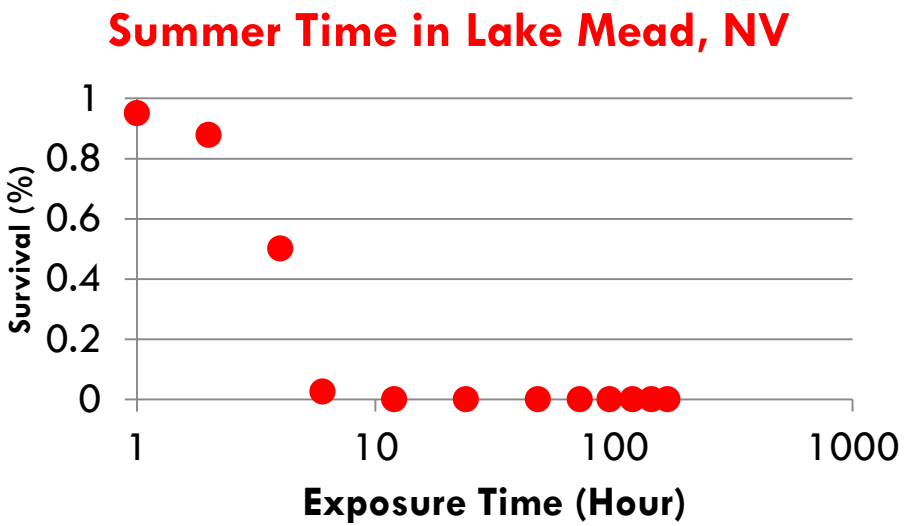




Mother Nature



SUNY Oneonta/MassDEP

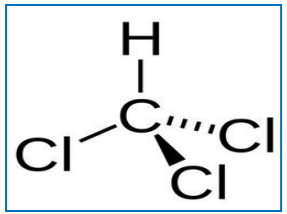


National Park Service

Mother Nature Helps

Chemical: Traditional Chlorination/Bleach

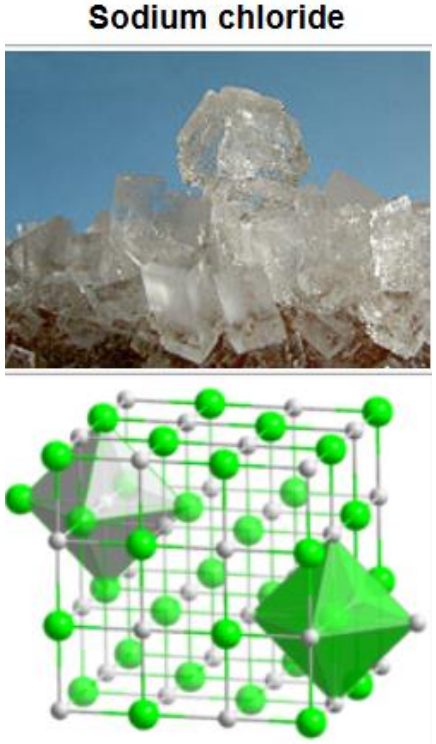
Water, Facility, and Boat Chlorination



Trihalomethane

Corrosive to pipe
Destructive to biota
Chlorine NPHDES Permit

NaCl

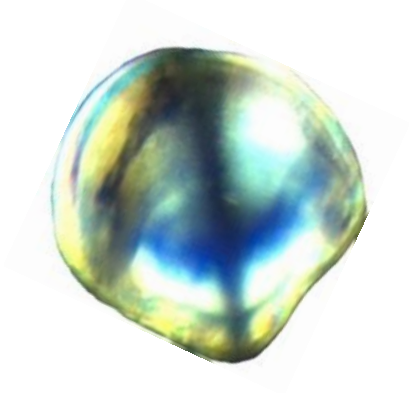

Sodium chloride


MORTON
IODIZED SALT
THIS SALT SUPPLIES IODIDE, A NECESSARY NUTRIENT
NET WT. 26 OZ. (1 LB., 10 OZ.) 737 g


ROCK SALT

Biological: Inspector

Detector Popeye



80-280 um

Photo by David Wong

Regulatory Considerations for AIS Management

Today's take home message

- Apply early
- Create flexibility in applications and permits to revise area for treatment and for techniques
- Address access points, staging, personnel and licensing/certifications
- Seek extensions to keep permits current

Permitting may be required under

- Wetlands Protection Act
- Section 401 of the Federal Clean Water Act
- MGL Ch. 111, § 5E for Herbicide Applications

Law and Regulations

- **"No person shall remove, fill, dredge or alter any…[wetland]without filing a Notice of Intent…including such plans … necessary to describe such proposed activity and its effect on the environment and without receiving and complying with an order of conditions…" MGLc131, Section 40**

- **"Any activity …within …(a resource area) which will remove, fill, dredge or alter that area…requires the filing of a Notice of Intent…", 310 CMR 10.02(2)(a)**

Law and Regulations

- **Activity means any form of …the discharging of pollutants; the destruction of plant life; and any other changing of the physical characteristics of land. 310 CMR 10.04**
- **Alter means to change the condition of any Area Subject to Protection under M.G.L. c. 131, § 40. Examples of alterations include …**

(b) the lowering of the water level or water table;

(c) the destruction of vegetation;

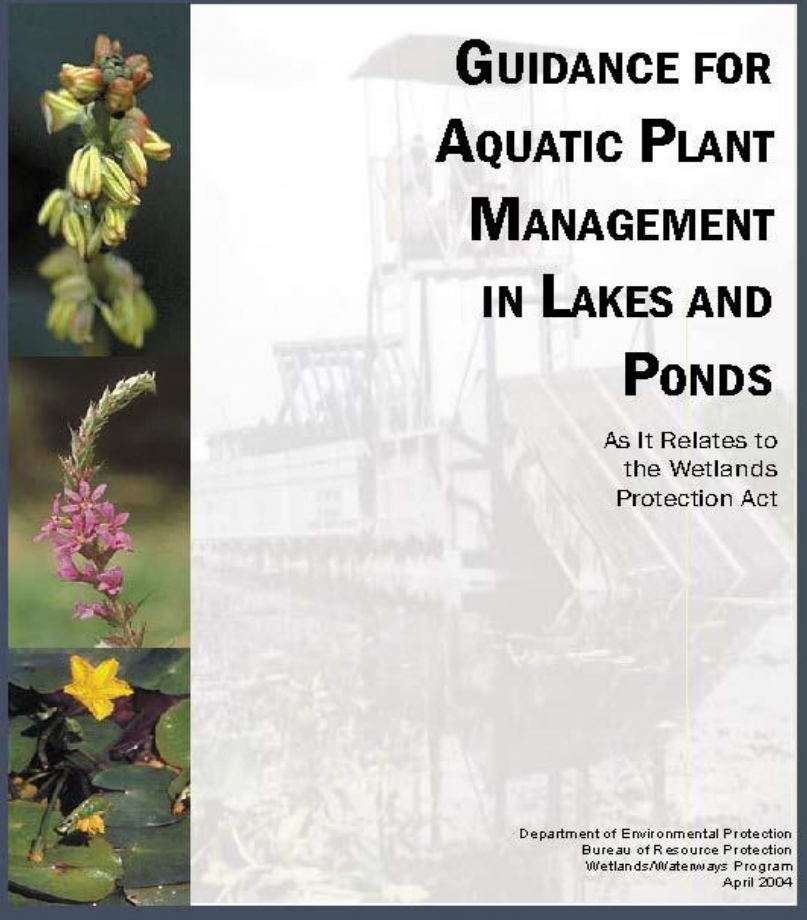
(d) the changing of water temperature, biochemical oxygen demand (BOD), and other physical, biological or chemical characteristics of the receiving water.

Ecological Restoration Projects

- Wetlands Regulations give "Limited Project" status to Ecological Restoration Projects.
- Types of Ecological Restoration Limited Projects include those that will improve the natural capacity of a Resource Area(s) to protect the interests identified in M.G.L. c. 131, § 40
- Such projects include…the removal of aquatic nuisance vegetation to retard pond and lake eutrophication, the thinning or planting of vegetation to improve habitat value… in-stream habitat enhancement…

Eutrophication and Aquatic Plant Management in Massachusetts
Final Generic Environmental Impact Report (GEIR)

- Projects requiring state permits or receiving state funding that exceed MEPA environmental thresholds do not require MEPA filings if the proposed control technology is covered in the GEIR.
- GEIR covers:
  - Dredging – Sediment removal
  - Drawdown – Water Level Control
  - Harvesting, Hydroraking and Handpulling – Direct Plant Removal
  - Benthic Barriers – Plant Covering
  - Dyes and Surface covers – Light limitation
  - Biological Control
  - Herbicide Treatment – Chemical Control



- Applicants proposing a limited project under 310 CMR 10.53(4) must demonstrate that the project will improve the natural capacity of a resource area(s) to protect some or all of the interests of the Wetlands Protection Act (WPA)
- Best management practices (BMPs) to address pollutant loads contributed by the watershed should be commensurate with the size of the project and could include: working with local officials and others in the community to develop watershed management plans; educating area citizens; constructing, maintaining, and monitoring structural BMPs; upgrading septic systems and other wastewater treatment facilities; employing erosion control measures; and/or implementing local lake protection bylaws.

Guidance on Aquatic Plant Control

AIS management plans should include:

- need for AIS control including data on extent of infestation in proposed work area
- Specific location of proposed work
- Measures to avoid adverse effects
- Time of year of treatment
- Identification of staging area for equipment laydown depicting wetland resource areas, avoidance measures, erosion and sedimentation control, etc.

Minimization measures for techniques requiring drawdown

- Some techniques require drawdown of water body, e.g. freezing, dredging, benthic barriers
- Follow guidelines for minimizing impacts:
  - on aquatic organisms
  - drawdown rate to avoid downstream flooding
  - streamflow by-pass, maintaining minimum flow
  - re-filling water body, etc.

Minimization measures for techniques requiring drawdown

- Gradually reduce water levels over 2 to 3-week period (i.e. between November 1 to December 1) to allow wildlife to move to deeper water, locate alternate lodge sites, or relocate food caches prior to ice formation and substrate freezing; and to minimize impacts to fish spawning and other non-target organisms that may have water level requirements for reproduction.

Water Quality Certification for Dredging

- Applications for WQC for dredging (BRP WW 07, 08, 09) get filed with MassDEP's Boston office.
- The Order of Conditions serves as the Water Quality Certification (WQC) for Projects with less than 100 cubic yards of dredging and less than 5000 square feet of wetland impact
- Projects > 100 cy of dredging or 5,000 sq ft of impact to BVW or LUW require individual WQC
- Discharge of dredged or fill material to an ORW specifically identified in 314 CMR 4.06(1)(d) (e.g. vernal pools, within 400 feet of a water supply reservoir, and any other area so designated) is prohibited unless a variance is obtained under 314 CMR 9.08.

Herbicide Application Permit

- Application of herbicides to aquatic systems requires WM04 Permit for Herbicide Application on Aquatic Systems is required. See: http://www.mass.gov/eea/agencies/massdep/service/approvals/brp-wm-04.html
- obtained after an Order of Conditions has been issued by conservation commission.
- Chemical treatments must be performed by an applicator currently licensed (in the aquatic weed category) by the Massachusetts Department of Food and Agriculture Pesticide Bureau.
- General Use Herbicides requires licensed applicator
- Restricted Use Herbicides require applicator to be Certified by DAR
- Robert Kubit @ Robert.Kubit@state.ma.us or (508) 767-2854

Chemical control requires permitting under the WPA (Wetland Protection Act) and a License to Apply Herbicide(s) to the Waters of the Commonwealth (BRP WM 04)).

- A license is required for application of chemicals to water bodies for the control of nuisance aquatic vegetation, with certain exceptions as are detailed on the BRP WM 04 application form. Pursuant to MGL Ch. 111, § 5E

- Chemical treatments to Bordering Vegetated Wetlands and Salt Marsh require WM04 permit

- General use pesticides require applicator is currently **licensed** by the Massachusetts Department of Agricultural Resources Pesticide Program in the aquatics category

- Restricted use pesticides require applicator is currently **certified** by the Massachusetts Department of Agricultural Resources Pesticide Program

Permitting under the MGL Ch. 111, § 5E
License to Apply Herbicide(s) to the Waters of the Commonwealth (BRP WM 04)

BRP WM 04 license:

- Must be in possession of the appropriate pesticide credential issued by the Department of Agricultural Resources;
- Chemicals used for treatments must be currently approved for use in the state by the Pesticide Bureau; and
- The final Order of Conditions or Negative Determination of Applicability must be obtained prior to treatment.
- Recommended that the Order of Conditions require a copy of the approved BRP WM 04 license be submitted to the Conservation Commission prior to the commencement of work.
- License applications can be obtained from the DEP Web site and must be submitted at least 30 days prior to the proposed date(s) of treatment

  https://www.mass.gov/how-to/wm-04-herbicide-application

Potential Environmental Concerns for the Application of Herbicides

- Potential to result in fish kills due to low dissolved oxygen under the following circumstances:
  - high water temperature
  - high plant biomass
  - shallow nutrient-rich water
  - high percentage of the lake to be treated
  - closed or non-flowing system.
- Mitigation measures may be warranted for herbicide treatments. Review the herbicide chapter of the FGEIR (final Generic Environmental Impact Report) for the specific herbicide proposed

Success!

- Apply early
- Create flexibility in applications and permits to revise area for treatment and for techniques
- Address access points, staging, personnel and licensing/certifications
- Seek extensions to keep permits current

Questions?

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