Protecting Our Drinking Water Against Aquatic Invasive Species

MWRA Advisory Board White Paper

There has recently been a significant amount of discussion – at the staff level, agency level, amongst recreationists, and in the media – about the recent discovery of the Zebra Mussel (Dreissena polymorpha) in Laurel Lake in Lee, Massachusetts and its potential impact upon the MWRA water system.

In response to concerns relating to the potential impact on the Quabbin Reservoir, on July 16, 2009 the Department of Conservation and Recreation (DCR) placed a 45-day ban on private boating. The MWRA Advisory Board applauds DCR for having taken immediate and decisive action in response to the issue, but remains concerned about the course of action moving forward.

Since then, DCR conducted a pilot program for inspecting and decontaminating private boats (please refer to the Advisory Board's website www.mwraadvisoryboard.com for a full copy of the report on the pilot program). As part of this pilot program, 21 fishing boats were decontaminated utilizing the following steps:

1. Inspection of each boat and trailer for the presence of water, debris, mussels, and plant and animal growth performed by DCR staff under the direction of a DCR Aquatic Biologist.
2. Decontamination performed by MWRA staff under the direction of a DCR Aquatic Biologist.
3. Use of high-temperature pressure washer/steam cleaning equipment with a minimum temperature of 140° Fahrenheit (F).
4. Sealing of cleaned boats.

Based upon the experience of the pilot program, DCR then reopened the Quabbin to private boaters. The Advisory Board's main concern is that is that components of the Pilot Program were substantially weakened and the operating program in place features less stringent practices. If the pilot program was the basis for the reopening of the Quabbin, it stands to reason that the program moving forward should meet or exceed the protocols tested in the pilot program.

A major difference between the pilot program and the current operating program is that DCR has begun utilizing two private carwash locations to decontaminate boats instead of the Massachusetts Highway Department (MHD) facility used during the pilot program. Additionally, it has reduced the amount of direct oversight the aquatic biologist has been given over the decontamination.

The Advisory Board views the issue as two-fold: first, the broader topic of Aquatic Invasive Species (AIS) upon the reservoirs and MWRA waterworks system; and second, the specific issue of the potential impacts of the zebra/quagga mussel upon the Quabbin Reservoir and the MWRA waterworks system.

AIS continue to be a concern for water suppliers around the world and the MWRA is no exception. In the 1990s the Authority faced a serious threat of Eurasian Watermilfoil (*Myriophyllum spicatum*) in the Wachusett Reservoir.

As a reference, below is a list of AIS, both plant and animal, provided by the United States Department of Agriculture with additional listings from Salem Sound Coastwatch (invaders or potential invaders to New England are asterisked):

Approved Version

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MWRA Advisory Board Meeting

Aquatic Plants

- Alligatorweed (Alternanthera philoxeroides)
- Brazilian Waterweed (Egeria densa)*
- Caulerpa, Mediterranean Clone (Caulerpa taxifolia)
- Common Reed (Phragmites australis)
- Eurasian Watermilfoil (Myriophyllum spicatum)*
- Didymo (Didymosphenia geminata)
- Giant Reed (Arundo donax)
- Giant Salvinia (Salvinia molesta)
- Green Fleece (Codium fragile)*
- Hydrilla (Hydrilla verticillata)*
- Japanese seaweed (Sargassum muticum)*
- Melaleuca (Melaleuca quinquenervia)
- Purple Loosestrife (Lythrum salicaria)*
- Undaria Kelp (Undaria pinnatifida)*
- Water Chestnut (Trapa natans)*
- Water Hyacinth (Eichhornia crassipes)
- Water Lettuce (Pistia stratiotes)
- Water Spinach (Ipomoea aquatica)

Aquatic Animals

- Alewife (Alosa pseudoharengus)* (c)
- Asian Carps f
- Asian Isopod (Synidotea laevidorsalis)*
- Asian Shore Crab (Hemigrapsus sanguineus)*
- Asian Swamp Eel (Monopterus albus)
- Bullfrog (Rana catesbeiana)
- Brush-clawed Shore Crab (Hemigrapsus takanoi)*
- Chinese Mitten Crab (Eriocheir sinensis)* (c)
- Clubbed Tunicate (Styela clava)* (c)
- Colonial Tunicate (Didemnum vexillum)*
- Diplosoma Tunicate (Diplosoma listerianum)*
- Eurasian Ruffe (Gymnocephalus cernuus)
- Eurasian Sea Squirt (Ascidiella aspersa)*
- European Flat Oyster (Ostrea edulis)*
- European Green Crab (Carcinus maenas)* (c)
- Flathead Catfish (Pylodictus olivaris)
- Lacy Crust Bryozoan (Membranipora membranacea)*
- Lionfish (Pterois volitans)
- Northern Snakehead (Channa argus)*
- New Zealand Mud Snail (Potamopyrgus antipodarum)
- Nutria (Myocastor coypus)
- Quagga Mussel (Dreissena bugensis)
- Orange or Red Sheath Tunicate (Botrylloides violaceus)*
- Orange-striped Anemone (Diadumene lineata)*
- Red Algea (Grateloupia turuturu)*
- Round Goby (Neogobius melanostomus)
- Rusty Crayfish (Orconectes rusticus)*
- Sea Lamprey (Petromyzon marinus) (c)
- Sea Squirt (Didemnum vexillum) (c)
- Spiny Water Flea (Bythotrephes longimanus)*
- Star Tunicate (Botryllus schlosseri)*

(c) indicates coastal AIS. Further research will be conducted to clarify for others on this list.

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- Tunicate (Corella eumyota)*
- Veined Rapa Whelk (Rapana venosa)*
- Zebra Mussel (Dreissena polymorpha)*

The recent discourse about the zebra mussel's introduction to Massachusetts water serves as a reminder of the importance of protecting the MWRA's water supply from all AIS in general, not merely the zebra mussel.

As evidenced by the list of potential invasives above, the issue is an important one to consider, and any preemptive and preparatory work that can be undertaken would only advance the primary goal of protecting the MWRA drinking water system. If even one of the invasives from the list were introduced to the MWRA's waterworks system, the consequences would be far-reaching, enormous, and costly to remedy.

As such, the Advisory Board believes that DCR should utilize the zebra mussel as a case-in-point to put into place action plans to evaluate current potential threats and develop methods to continue safeguarding the drinking water for the MWRA's 2.5 million consumers. A little prudence and advanced planning at a low upfront cost would be preferable to a much more costly remediation effort should any invasives be introduced to the waterworks system.

First and foremost, the Quabbin reservoir exists to provide safe, reliable, high-quality drinking water to 2.5 million consumers, and the importance of safeguarding this resource cannot be stressed enough. Moreover, it bears mentioning that given the potential effects upon the Quabbin's ecosystem and the life forms sustained within, any introduction of AIS would negatively impact recreationists as well. Despite the inconvenience to everyone and any additional costs that may be incurred, the Advisory Board believes that it is imperative to get the controls right or everybody will be impacted.

In fact, the introduction of AIS to the Quabbin would directly affect the recreationists, as well as those supplied by the MWRA, should the ecosystem and aquatic life within be compromised. Understandably, many of the recreationists have expressed concern that the Advisory Board and the communities served by the MWRA water system oppose all private boating and recreation on the Quabbin. On the contrary, the Advisory Board feels strongly that the continued availability of the Quabbin for recreational purposes is a very important issue. The Advisory Board has no desire to end the recreational uses at the Quabbin; however, the foremost concern should be the protection of the Quabbin not only as a drinking water source, but also as a recreational area. Any introduction of AIS could prove to be catastrophic for both MWRA consumers and recreationists.

For a more detailed description of the zebra mussel and its potential impact upon bodies of water a copy of DCR's "Rapid Response Plan For the Zebra Mussel in Massachusetts," prepared by ENSR International, has been attached. It should be noted that the maps in the report detailing the spread of zebra mussels are dated 2001 and are no longer accurate. In fact, the continuing spread of the zebra mussel since that time only serves to underscore how prolific and adaptable the zebra mussel can be.

CONCLUSIONS

As the DCR's report clearly shows, zebra mussel infestation of a water body constitutes a very serious situation. In fact, according to DCR, the mussels "out-compete juvenile fish for food and cling by the thousands to virtually everything in a water body - including docks, boats, other aquatic organisms, and various water intake pipes and instruments." Moreover, the ENSR Report further points out that "zebra mussels may eliminate or reduce spawning and nursery habitats of demersal fish species... [and] may lead to increased numbers of some types of fishes and losses of other types of fishes, impacting the local commercial and recreational fisheries." State House News

further highlighted in a recent article that "once zebra mussels occupy a lake, there is no proven method of eradicating them."

Moreover, the 100th Meridian Initiative Boating Guide notes that "trailered boats are the primary way that Quagga/Zebra mussels are introduced to unconnected water bodies." Therefore, the introduction of the zebra mussel in Laurel Lake (in Lee, Massachusetts) represents exposure to the Quabbin through any trailered boats that may be utilized in both bodies of water.

Because the Quabbin is the water supply for 2.5 million consumers, a zebra mussel infestation could have devastating and long-reaching consequences upon the MWRA service area.

DCR has pointed to research that argues that the Quabbin's water would not provide optimal conditions for zebra mussel viability, largely due to low levels of calcium. However the ENSR report points out that "zebra mussels are known to adapt to aquatic ecosystems with chemical parameters outside of the ideal range." Combined with their remarkable ability to proliferate – each mussel can produce 30,000 eggs a day or 1 million in an entire summer – this could provide a deadly combination. At that rate of reproduction any adaptation to the Quabbin's conditions could occur fairly rapidly.

As an example of the adaptability of the zebra/quagga mussel, a recent University of Nevada, Reno study has proven that the quagga mussel can reproduce in the low-calcium water of Lake Tahoe. Advisory Board staff contacted Dr. Sudeep Chandra and obtained a copy of this report, also available on the Advisory Board's website (www.mwraadvisoryboard.com). In addition to demonstrating that the quagga mussel can reproduce in what was previously thought to be an unsustainable environment, Dr. Chandra's report referenced research from 1994 in which the zebra mussel had demonstrated the ability to survive in water containing no calcium. The research at the time "suggested that the mussels survived by mobilizing calcium from shells to maintain critical levels of blood calcium for muscle function." (See page 10 of Lake Tahoe study.)

As noted before, the zebra mussel discussion is only one piece of the larger issue of Aquatic Invasive Species. DCR and the MWRA have an opportunity to use the zebra mussel situation to reevaluate and prepare protocols to address this larger issue of invasives.

The Advisory Board recommends that DCR not only target the current zebra/quagga mussel situation, but also the larger topic of AIS by undertaking the following four categories of actions:

Testing / Monitoring

It is important to know the effect of Aquatic Invasive Species on the MWRA reservoirs, and offer these recommendations:

1. DCR staff should fully inspect the MWRA reservoirs for all Aquatic Invasive Species or potential for Aquatic Invasive Species.

2. MWRA staff should further test and develop any additional protocols protecting the reservoirs from the potential introduction of any Aquatic Invasive Species.

3. MWRA staff should develop and conduct scientific analysis of the viability of any Aquatic Invasive Species for survival in the reservoir system, using where possible independent organizations, resources, and institutions such as the Water Environmental Research Foundation (WERF) and UMass.

Restricting Boating

The fundamental responsibility is to protect the drinking water; to this end, it is critical to restrict private boats at the Quabbin.

4. If there is any chance, remote or otherwise, of AIS, immediately ban all private boats.

In the event that private boats are not banned:

5. Restrict the use of private boats to Quabbin-only boats after proper sanitizing protocols have been followed. Continue to investigate options for on-site storage of Quabbin-only private boats.

6. DCR should purchase and utilize additional rental boats to further support access of fishermen to the Quabbin.

Costs

Ratepayers should not bear the burden of the costs associated with decontamination procedures.

7. Moving forward, all costs associated with sanitation procedures for Quabbin-only private boats should be revenue-neutral to ratepayers.

8. Enter into a Memorandum of Agreement between the Commonwealth and the MWRA that in the event that zebra mussels do infiltrate the Quabbin that the Commonwealth will assume all costs and liabilities related to their removal.

Understanding Consequences and Responsibilities

It is important to understand the scope of the potential problem and know what entity has the ultimate responsibility for the protection of the watershed.

9. MWRA should conduct a financial analysis and forecast on the damage to, and the cost to remediate, the MWRA Integrated Waterworks System should any of the Aquatic Invasive Species listed above be introduced to the system.

10. Within 60 days, MWRA should obtain a legal opinion that clearly delineates decision-making authority between DCR and MWRA to take actions protecting the reservoirs; additionally, the legal opinion should recommend necessary changes that would facilitate and strengthen the MWRA's ability to protect the reservoirs.