

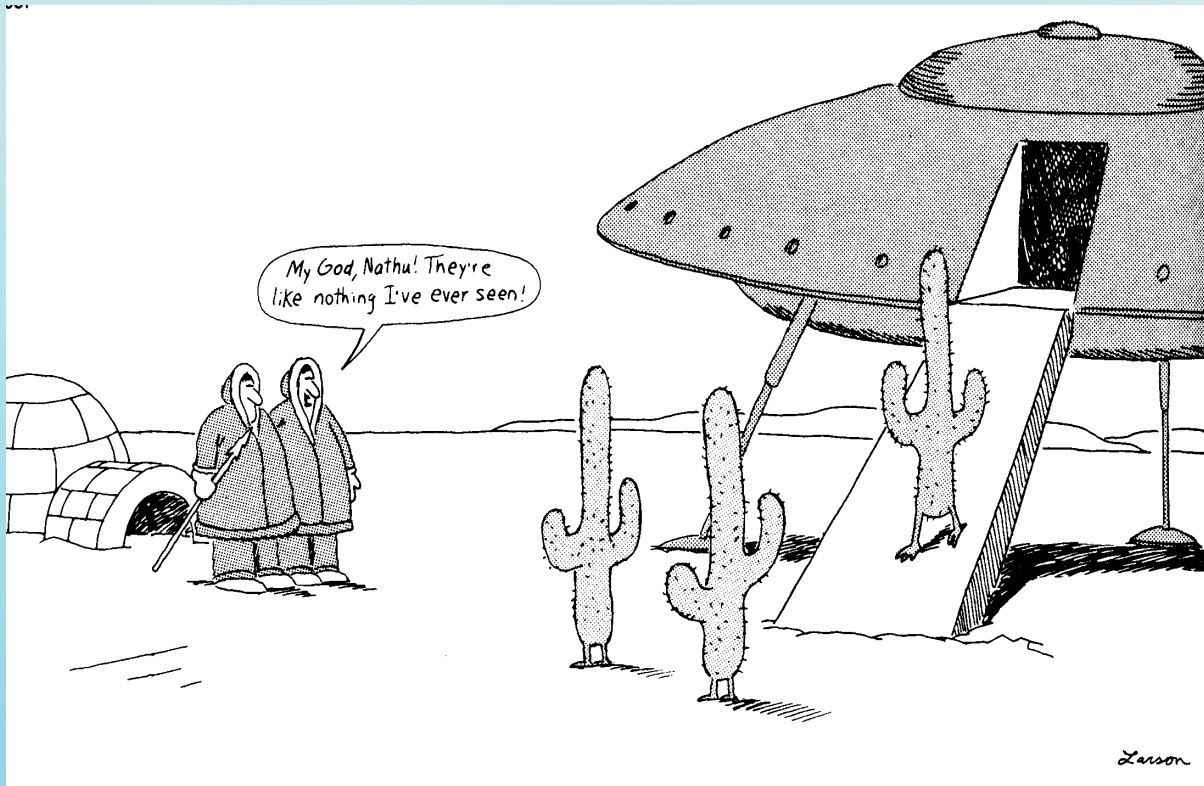
# Unnatural History of AIS in the Northeastern US

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(in a previous life)



# Invasive species



“Invasive species are non-native species that can cause harm to the environment, the economy or human health”

(<https://www.dec.ny.gov/animals/265.html>)

## Two components

- Non-native species
- Harm to the environment, the economy or human health

# Non-invasive non-native aquatic plant species

- Some aquatic plants are not native to a region, state, or waterbody but rarely if ever cause “harm to the environment, the economy or human health”
  - European four-leaf clover (European water fern) is thought to exhibit some medicinal qualities, treating inflammation, snake bites, and abscesses
  - This plant does not grow aggressively in most waterbodies
- Most states explicitly define which non-native plants are invasive



# Which plants?

## Consensus Northeast Invasive Plants

- *Cabomba caroliniana*
- *Egeria densa*
- *Hydrilla verticillata*
- *Hydrocharis morsus-ranae*
- *Myriophyllum aquaticum*
- *Myriophyllum heterophyllum*
- *Myriophyllum spicatum*
- *Najas minor*
- *Nitellopsis obtusa*
- *Pontederia crassipes*
- *Potamogeton crispus*
- *Trapa natans*

## Invasive Plants in Some States / Regions

- *Callitriche stagnalis*
- *Glossostigma cleistanthum*
- *Ludwigia pepolides*
- *Nelumbo lutea*
- *Nymphoides peltata*
- *Utricularia inflata*

# How Many? (of each invasive aquatic plant is found in each NEAPMS state)

| AIS Species                       |                         | # Locations in State (as of 2018-21) |    |     |    |    |    |     |    |    |
|-----------------------------------|-------------------------|--------------------------------------|----|-----|----|----|----|-----|----|----|
| Scientific Name                   | Common Name             | ME                                   | NH | VT  | RI | MA | CT | NY  | PA | NJ |
| <i>Myriophyllum spicatum</i>      | Eurasian watermilfoil   | 4                                    | 6  | 103 | 13 | 31 | 57 | 451 | 54 | 8  |
| <i>Potamogeton crispus</i>        | Curly leafed pondweed   | 1                                    | 6  | 38  | 21 | 27 | 41 | 294 | 82 | 7  |
| <i>Trapa natans</i>               | Eurasian water chestnut |                                      | 2  | 30  | 13 | 34 | 9  | 237 | 15 | 41 |
| <i>Myriophyllum heterophyllum</i> | Variable watermilfoil   | 28                                   | 74 | 2   | 88 | 64 | 41 | 89  | 4  | 1  |
| <i>Najas minor</i>                | brittle naiad           | 3                                    | 6  | 8   | 9  | 5  | 45 | 86  | 22 | 1  |
| <i>Hydrocharis morsus-ranae</i>   | European frogbit        | 2                                    |    | 13  |    |    |    | 70  | 1  |    |
| <i>Cabomba caroliniana</i>        | fanwort                 |                                      | 8  |     | 77 | 44 | 30 | 55  | 10 | 12 |
| <i>Nitellopsis obtusa</i>         | starry stonewort        |                                      |    | 2   |    |    |    | 29  |    |    |
| <i>Hydrilla verticillata</i>      | Hydrilla, water thyme   | 2                                    |    |     |    | 3  | 3  | 28  | 14 | 20 |
| <i>Egeria densa</i>               | Brazilian elodea        |                                      | 1  |     | 5  | 5  | 4  | 21  | 6  | 3  |
| <i>Ludwigia peploides</i>         | creeping water primrose |                                      |    |     |    | 1  |    | 5   | 6  | 4  |
| <i>Nymphoides peltata</i>         | yellow floating heart   |                                      |    |     | 2  | 5  | 1  | 5   | 5  | 3  |
| <i>Myriophyllum aquaticum</i>     | parrotfeather           |                                      |    |     |    | 2  | 5  | 13  | 7  | 7  |
| <i>Pontederia crassipes</i>       | water hyacinth          |                                      |    |     | 3  | 2  | 2  | 9   | 1  | 2  |
| <i>Callitriche stagnalis</i>      | pond water star-wort    |                                      |    |     |    | 10 | 1  | 1   | 21 | 17 |
| <i>Nelumbo lutea</i>              | American water lotus    |                                      |    |     | 3  |    | 1  | 2   |    | 2  |
| <i>Glossostigma cleistanthum</i>  | mudmat                  |                                      |    |     | 12 |    |    |     |    | 11 |
| <i>Utricularia inflata</i>        | inflated bladderwort    |                                      |    |     | 7  |    |    |     |    |    |

# Key Findings 1

- The majority of the AIS in the northeast have been documented in New York state, although many AIS have not yet been found
- AIS presence was much lower in New England lakes, despite an abundance of lakes in the region
- Eurasian watermilfoil is the most abundant AIS in the mid-Atlantic and southern New England, and variable leafed watermilfoil is the most abundant AIS in northern New England
- Hydrilla has not yet appeared in some New England states, but may be rapidly spreading upon introduction

\* Major vector for invasive aquatic plants

# How They Get There (Pathways)

- Commercial shipping vessels
- Recreational vehicles (including trailers)\*
- Interconnected waterways\*
- Waterfowl\*
- Intentional introductions (including ornamental and nursery plantings)\*
- Accidental introductions (when establishing wetlands)
- Aquaria releases\*
- Cultural and live food trade
- Bait buckets
- Unknown pathways or combinations of above pathways\*

In most instances we don't know when or how an invasive plant entered a specific waterbody (or a state or even a region)

# Recreational Vessels

- Recreational watercraft can move aquatic plants and animals as hitchhikers on boat propellers, trailers, hulls, sailboat keels, fishing and anchor lines, as well as within motors, live wells, and bilge water.
- In NYS, this pathway accelerated with the construction of the NYS Thruway in 1954 and the Adirondack Northway in 1962.
- It is likely that many of the aquatic invasive plants and small-bodied organisms moving within the region have been transported by recreational watercraft.
- This is the basis for most of the boat inspection and decontamination programs instituted in the Northeastern US



# Example of transport from “recreational” boats

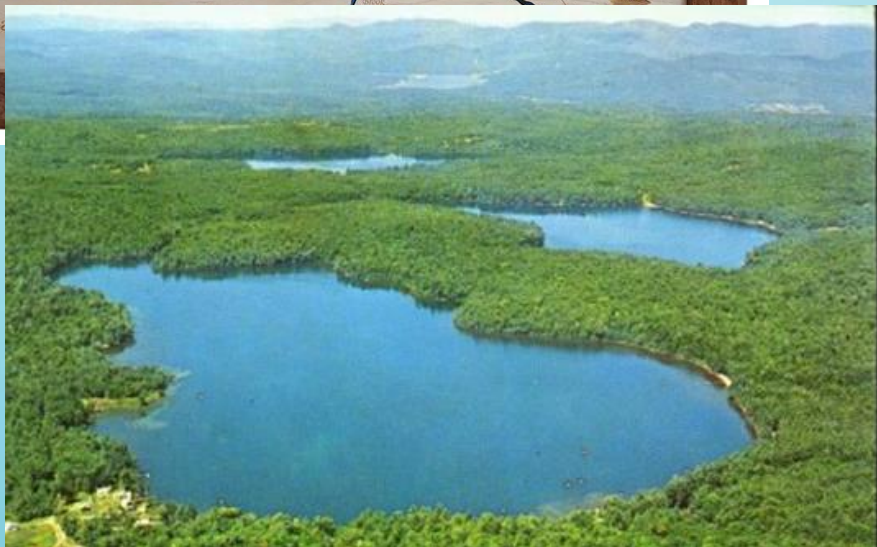
- Silver Lake in Dutchess County (NY) was mechanically harvested in the 1990s through a public access site maintained by the county Federation of Fish and Game Clubs
- Fanwort (*Cabomba caroliniana*) was found in this lake and within a few years only at the boat launch in the only adjacent harvested lake (Long Pond),
- No other lake within 40 miles had fanwort
- Other examples include water chestnut and variable watermilfoil fragments intercepted from boat launches at uninfected Adirondack lakes



# Interconnected waterways

- Canals effectively move watercraft and any hitchhiking AIS throughout the state by connecting Lake Champlain to the Hudson-Mohawk watershed, to the Great Lakes and the Finger Lakes drainage basins by the Erie and Champlain canal systems.
- AIS can also move easily from upstream to downstream through outlets of infested waterbodies to inlets of uninfested sites, whether as fragments of plants or larval forms of animals
- This is a particular problem with plants that easily fragment or even autofragment and reproduce vegetatively

# Example of transport from interconnected waterways



- Fanwort was discovered in four interconnected lakes in the SE Adirondacks in 1994, >100 miles from any other known locations
- One lake- Hunt Lake- was visited by several MA and LI boats
- Fanwort beds were found near outlet in Hunt Lake and inlets in downstream Jenny Lake, Efner Lake and Mill Pond- all downstream lakes are private with no outside boats allowed
- Not yet found in Great Sacandaga Reservoir (3 miles downstream)

# Aquaria releases

- Numerous aquatic invasive plant and animal species such as Brazilian elodea (*Egeria densa*) and Asian clam (*Corbicula fluminea*) have been sold in pet stores, through the aquaria trade, or via the Internet.
- The regulation of this practice is challenging, given the historic lack of regulatory and enforcement authority.
- In addition, these species can be difficult to distinguish from native species.
- The release of aquatic species from aquaria often occurs because the owner does not want them anymore, but does not want to kill them either.

# Example of aquaria releases



- Brazilian elodea (*Egeria densa*) commonly sold as *Anacharis* or *Elodea* (native plants) in pet stores
- Unnamed elementary school teacher in upstate NY purchased *Egeria* and placed in small fishbowls with goldfish or guppies for science class
- Fish and plants released to local pond with all good intentions to “save” them
- So far, exotic plants and fish have not survived in that pond but....

# Intentional introductions

- Invasive fish or biocontrol agents are often released into waterways, often to control other invaders, even though permits and a fish health inspection for the intentional introduction of fish or fish eggs is required.
- Anglers may also release fish caught in one part of the state into a water body in another part of the state, possibly to establish what they perceive as a desirable fishery closer to home.
- In the Adirondacks, many ponds are fragile ecosystems inhabited by unique original Adirondack strains of brook trout.
- Nonindigenous fish species introduced to these ponds can out-compete the native brook trout and possibly lead to the extinction of a unique genetic strain.

# Example of intentional introductions

- Report of Lake Ronkonkoma (Long Island NY) hydrilla (*Hydrilla verticillata*) finding resulted in extensive local media coverage
- A local resident saw reports and contacted NYS saying she purposefully introduced hydrilla into her < 1 acre pond (“Frost Mill Pond” in Mill Neck) on advice of local aquaria shop to “oxygenate” the water
- Pond owner was likely sold hydrilla marketed as *Anacharis*, easily purchased in store or on-line
- Thought to be eradicated by (single) grass carp stocking

**newsday.com**

LONG ISLAND SOUND

## Invasive water plants make inroads on Long Island

August 3, 2009 by JENNIFER SMITH / jennifer.smith@newsday.com



Not long after last month's declaration that the Peconic River was free of a pesky invasive plant called water primrose, state biologists made a disheartening discovery about 25 miles west.

A few dozen stems of hydrilla - a voracious Southern weed that has choked bodies of water across the Northeast - were growing in Lake Ronkonkoma.

Photos: Native alternatives to invasive plants

First spotted upstate last summer, hydrilla has since made inroads on Long Island, turning up at lakes in Sayville and Smithtown.

"It makes dense mats of vegetation; you can't rowboat through it," said Charles Guthrie, regional fisheries manager for the state Department of Environmental Conservation. "If it were to come in and get established in other places, it could cause real problems."

Invasive aquatic plants crowd out native flora, hurt fish by robbing water of oxygen as the plants wither and decompose, and render lakes impassable to boaters and fishermen. The discovery last month at Lake Ronkonkoma highlights the challenges that officials and environmental advocates face as they struggle to keep these invaders out of local waters. Each year, invasive aquatic plants have a nationwide economic impact of \$500 million, estimated a 2003 report from Cornell University.

Like a game of Whac-A-Mole, no sooner is one infestation contained than a new threat pops up somewhere else.



# Nursery plantings

- The water garden trade can unintentionally move AIS species into and within previously uninfected regions, either
  - through the sale and transport of mislabeled or misidentified AIS commonly mistaken for desirable aquatic plants, or
  - as contaminants attached to the transported plants or in the planting material, including soils or water
- The pioneering introduction of monoecious hydrilla in California has been attributed to contamination of a (legal) water lily stock supplied from Maryland (California Department of Food and Agriculture, 2001).

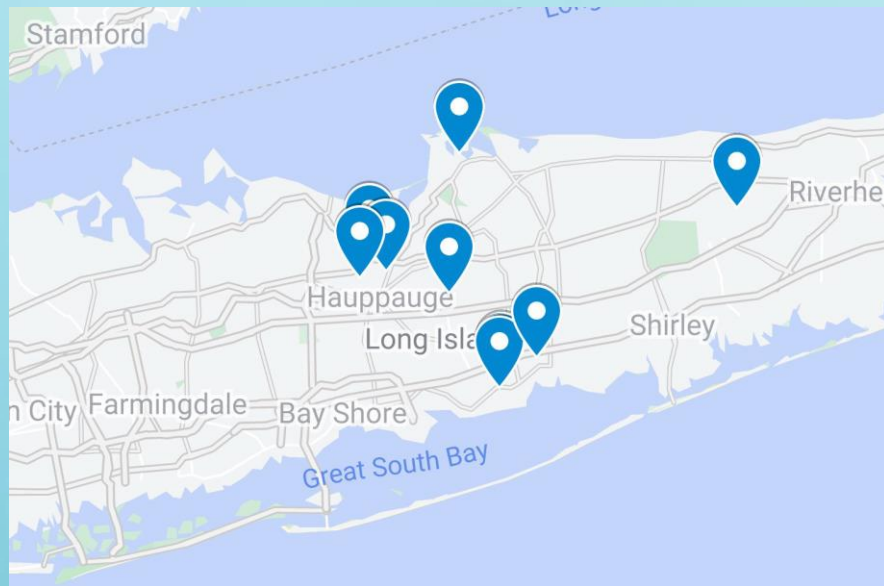


# Waterfowl

- Plant parts can attach to fur, feathers, or feet and can also be spread by animals in undigested feces.
- The movement of AIS, such as water chestnut (*Trapa natans*), may be associated with waterfowl migration, because many infested waterbodies have no public access, no private recreational use, and are isolated from other infested waterbodies.
- Local waterfowl movement may also transport plant species between unconnected waterbodies

# Example of (likely) waterfowl introductions

- The origin of hydrilla in Suffolk County in Long Island (NY) is not known, although the plants were first found in about a half dozen lakes within a few years



- All but one of these lakes have no public or private access, and most are not connected hydrologically to other infested lakes

- All lakes are found in the migratory path of waterfowl



# Example of multiple pathways

- Water chestnut was intentionally (ornamentally) planted in Sanders Pond (Collins Lake) in the Capital District of NYS in 1884 by a Catholic priest travelling from Europe
- Flooding into the Mohawk River triggered extensive spread by the 1920s
- Reported in Hudson River by the 1930s
- Spread west from waterways and boats through the Erie Barge Canal system and reached Oneida Lake and the Finger Lakes region by the turn of the 21st century



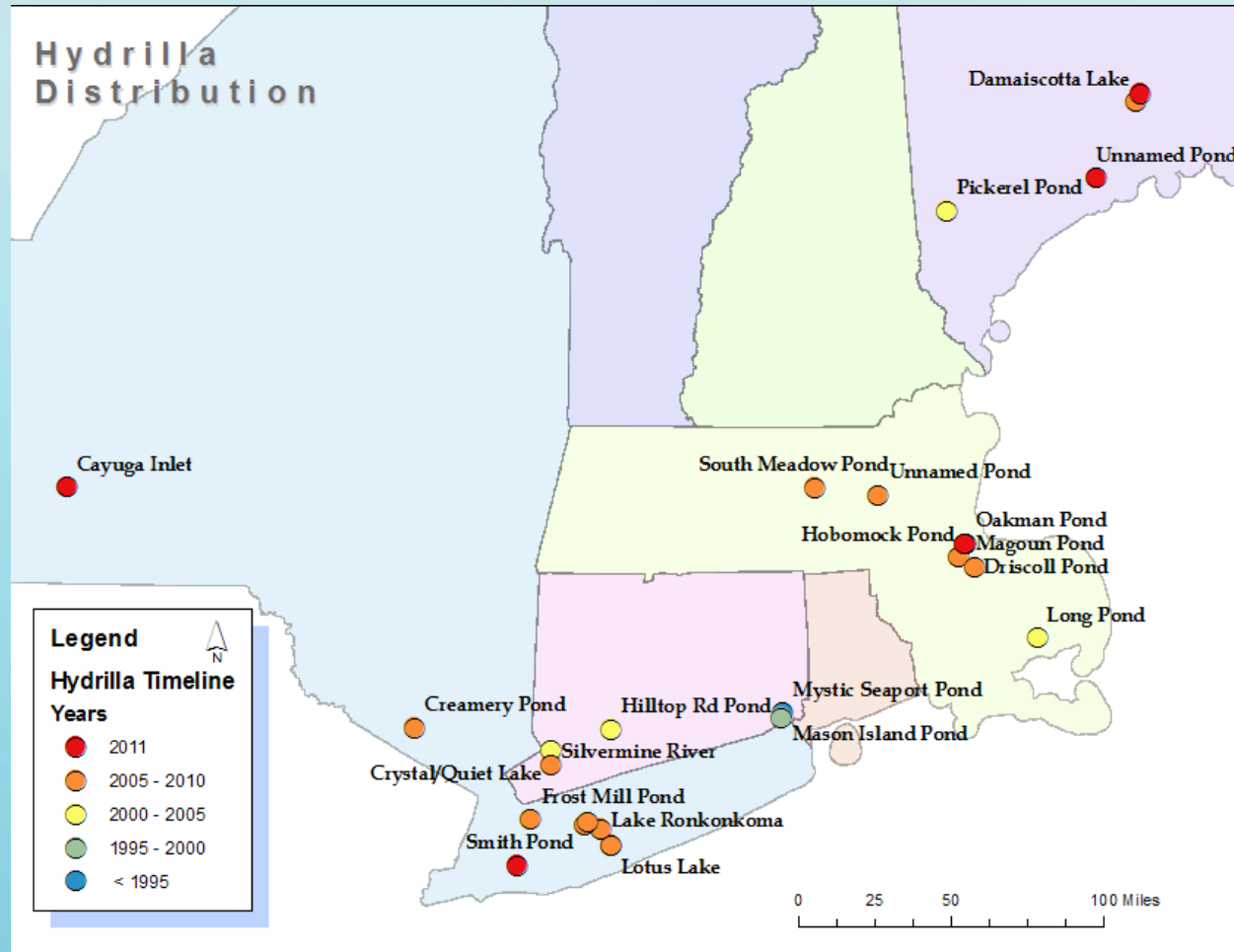
# When? (First known finding of each major invasive aquatic plant in each of the NEAPMS states)

| AIS Species                       |                         | Year of First Sighting in State |      |      |      |      |             |       |      |      |       |        |  |
|-----------------------------------|-------------------------|---------------------------------|------|------|------|------|-------------|-------|------|------|-------|--------|--|
| Scientific Name                   | Common Name             | ME                              | NH   | VT   | RI   | MA   | CT          | NY    | PA   | NJ   | NE US | US     |  |
| <i>Myriophyllum spicatum</i>      | Eurasian watermilfoil   | 2004                            | 1992 | 1962 | 2015 | 1971 | 1983        | 1940s | 1950 | 1952 | 1940s | 1942   |  |
| <i>Potamogeton crispus</i>        | Curly leafed pondweed   | 2003                            | 1984 | 1911 | 1932 | 1908 | 1943        | 1879  | 1841 | 1866 | 1841  | 1841   |  |
| <i>Trapa natans</i>               | Eurasian water chestnut |                                 | 1995 | 1942 | 2007 | 1874 | 1998        | 1884  | 1977 | 2002 | 1874  | 1874   |  |
| <i>Myriophyllum heterophyllum</i> | Variable watermilfoil   | 1968                            | 1965 | 2008 | 1973 | 1940 | 1932        | 1953  | 2010 | 2010 | 1932  | native |  |
| <i>Najas minor</i>                | brittle naiad           |                                 | 1992 | 1960 |      | 1974 | 2004        | 1934  | 1951 | 2000 | 1934  | 1930s  |  |
| <i>Hydrocharis morsus-ranae</i>   | European frogbit        | 2018                            |      | 1993 |      |      |             | 1974  | 2013 |      | 1974  | 1930s  |  |
| <i>Cabomba caroliniana</i>        | fanwort                 | 2008                            | 1957 |      | 1932 | 1895 | 1937        | 1928  | 1938 | 1901 | 1895  | native |  |
| <i>Nitella obtusa</i>             | starry stonewort        |                                 |      | 2015 |      |      |             | 1978  | 2009 |      | 1978  | 1978   |  |
| <i>Hydrilla verticillata</i>      | Hydrilla, water thyme   | 2002                            |      |      |      | 2001 | 1987        | 2008  | 1996 | 2003 | 1987  | 1970   |  |
| <i>Egeria densa</i>               | Brazilian elodea        |                                 | 2001 | 1913 | 2009 | 1939 | 1992        | 1893  | 1917 | 1990 | 1893  | 1893   |  |
| <i>Ludwigia peploides</i>         | creeping water primrose |                                 |      |      |      |      | early 1900s |       |      |      |       | 1890   |  |
| <i>Nymphoides peltata</i>         | yellow floating heart   | 2006                            |      | 1963 | 1977 | 1882 | 1900        | 1929  | 1915 | 1940 | 1882  | 1882   |  |
| <i>Myriophyllum aquaticum</i>     | parrotfeather           |                                 |      |      |      | 1917 | 2001        | 1929  | 1950 | 1890 | 1890  | 1890   |  |
| <i>Callitriche stagnalis</i>      | pond water star-wort    |                                 |      |      |      | 1911 |             | 1861  |      |      | 1861  | 1861   |  |
| <i>Glossostigma cleistanthum</i>  | mudmat                  |                                 |      |      | 2002 |      | 1992        |       | 1994 | 1991 | 1991  | 1991   |  |
| <i>Eichhornia crassipes</i>       | water hyacinth          |                                 | 1956 |      | 2009 | 1992 | 1893        | 1939  | 1993 | 2002 | 1939  | 1884   |  |

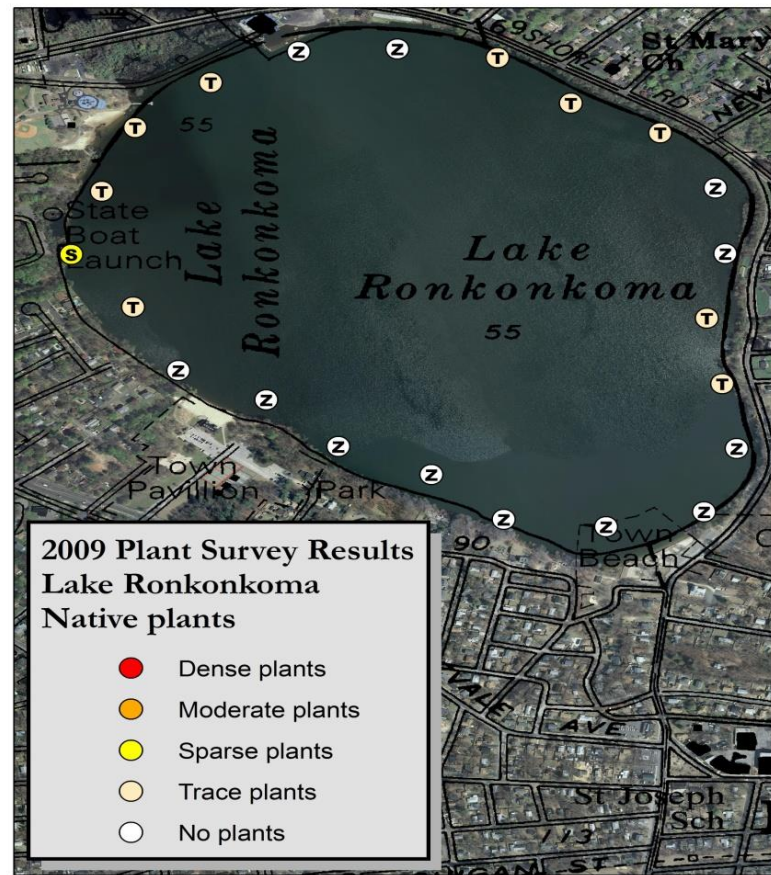
## Key Findings 2

- Several of the first US recorded incidences of AIS have been found in the Northeast, ranging from the mid-1800s to the early 2010s (2020s)
- The majority of the commonly defined AIS plants in the Northeast were first observed in New York state
- It is likely that a combination of many waterbodies (lakes, streams, Great Lakes, estuaries and ocean), many people, heavy waterbody usage, and multiple roadways traversing the state contributed to New York state as the epicenter for AIS in the northeast
- Although the New England states are rich in lakes, AIS introduction was lagged (or has not yet occurred) in many of their lakes

# Spread within a region or state- Hydrilla in New England

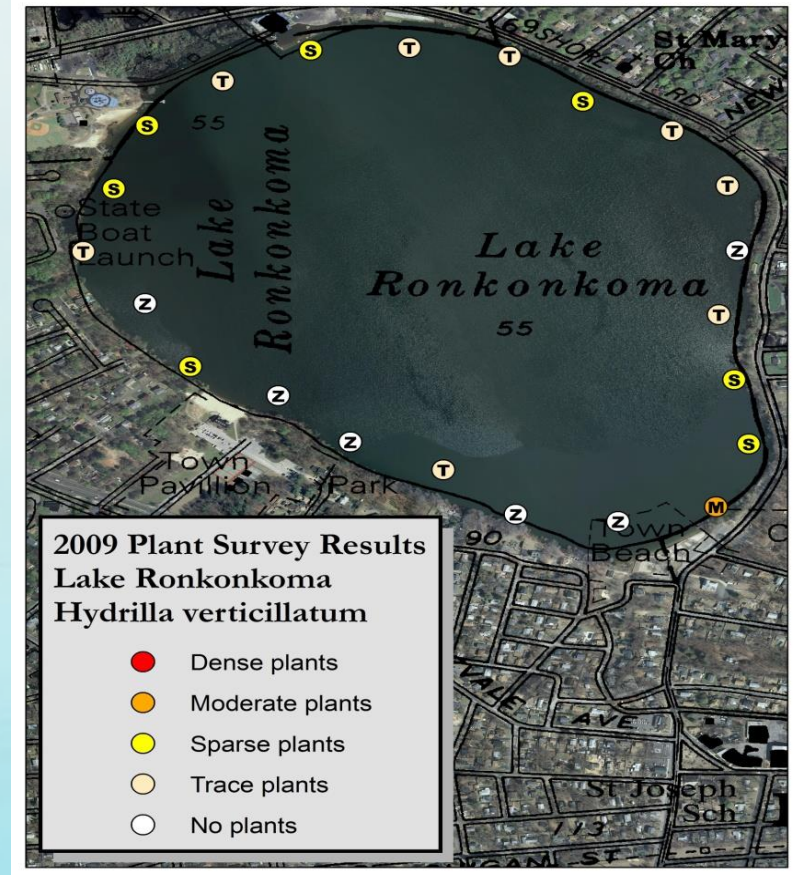


- Prior to 2011, all hydrilla occurrences in New England and the Mid-Atlantic (the first 25 or so sites) were within about 40 miles of the Atlantic Ocean
- The Cayuga Inlet, Erie Canal, Broome County (NY) and other findings suggest hydrilla range is expanding away from the coast

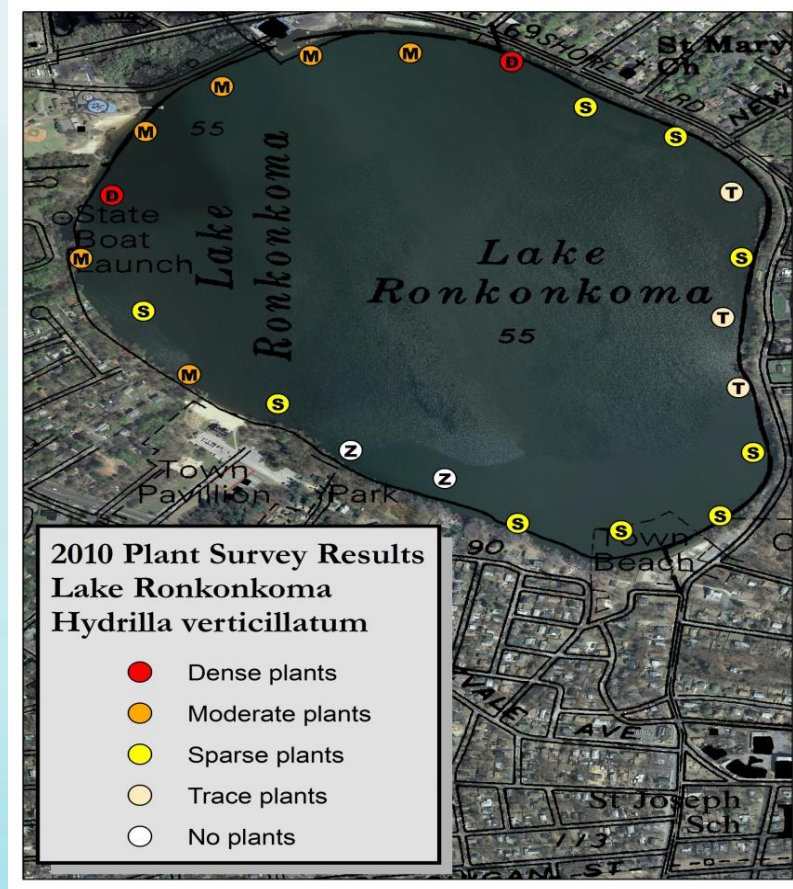
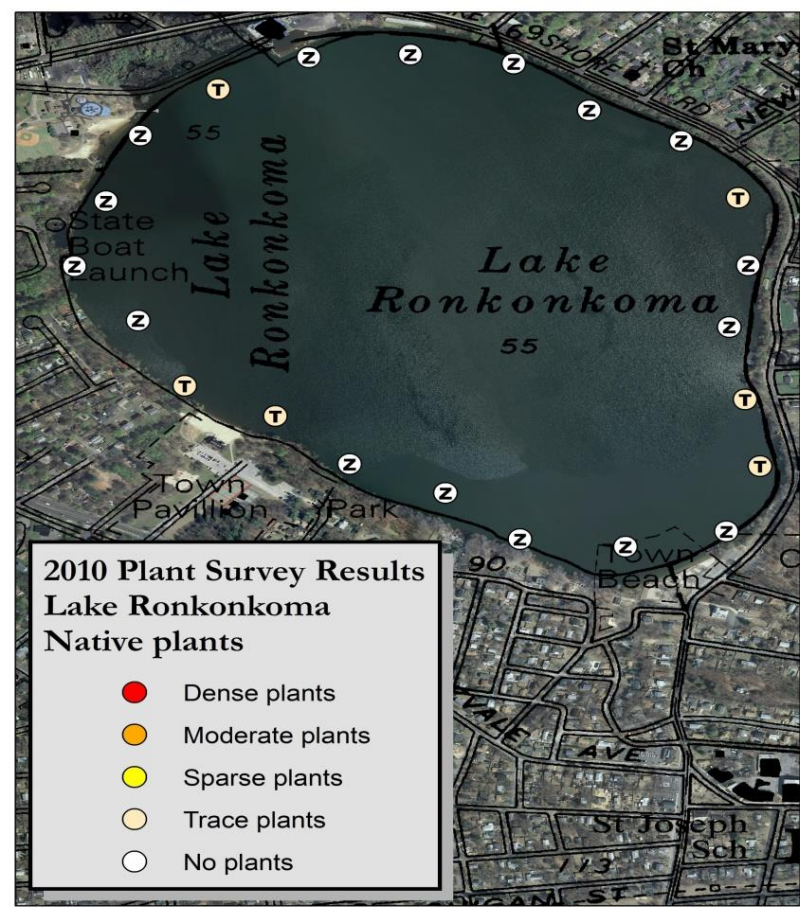


Spread within  
a waterbody:

Lake  
Ronkonkoma



- 2007 plant surveys by DEC DOW- essentially no plants found
- 2009 plant surveys conducted by DEC Region 1 Fish and Wildlife staff indicated that few aquatic plants are found in lake
- Hydrilla was limited to trace or sparse growth in a few locations along the shoreline



- By 2010, hydrilla expanded significantly from 2009, particularly along the northern and western shoreline near the boat launch (> 3 acres of plants growing to lake surface)
- Hydrilla found in appx. 90% of the littoral zone, to depth of 12 feet, occupies 10-15% of lake area)
- May provide important habitat not otherwise available