

Using Grass Carp to Control Aquatic Vegetation: Practices, Uncertainties, and Consequences

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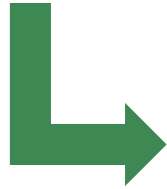
Aquatic Ecologist

Northeast Aquatic Research

Overview

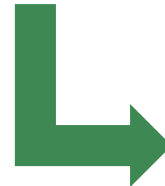
Grass Carp Basics

- Vegetation management
- Grass carp history
- Practices in NY



Stocking Uncertainties

- Surface vs. vegetated acreage
- Feeding preference
- Age and growth
- Mortality estimates



Best Practices

- Case studies
- Stocking recommendations
- Risk assessment
- Final thoughts



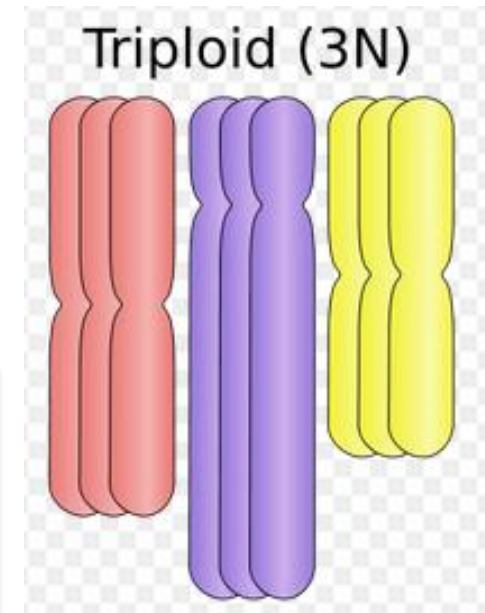
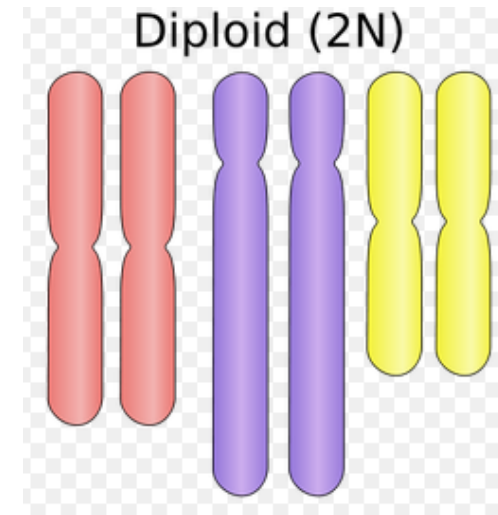
Aquatic Vegetation Management

- Need to control invasive and nuisance aquatic plant species
 - Outcompete native plants
 - Impact fisheries
 - Impact water quality
 - Declines in property values
- Limited techniques available
 - Herbicides
 - DASH harvesting
 - Drawdown



What are Grass Carp?

- *Ctenopharyngodon idella*
- Native to large coastal rivers in East Asia
- First introduced in United States in 1963 in Arkansas
 - Fish and Wildlife Service Fish Farming Experimental Station
- Fish were diploid (non-sterile) at first, until development of triploid (Sterile) grass carp in 1985
- From 1985 to 2005, more than 7 million triploid grass carp were shipped throughout the country
- Extremely effective herbivores



<https://en.wikipedia.org/wiki/Polyploidy>
May 5, 2021

Use of Grass Carp in NY State

- Hundreds of permits issued annually per region for grass carp stockings
 - Mostly in lakes with surface area less than 1 acre
 - Above 5 acres or permanent outflow: SEQRA review
 - Often need an outlet barrier to prevent escape
- 3 main stocking rates
 - 5 fish/acre: Low vegetation density
 - 10 fish/acre: Medium vegetation density
 - 15 fish/acre: High vegetation density
 - Based on surface area of entire lake



New York State Department of Environmental Conservation

Triploid Grass Carp Stocking Permit Application

Permit Duration: March 1 – November 30
Permit Fee: No fee

For more information about this license visit: www.dec.ny.gov/permits/25024.html

For Office Use Only
License #: _____

Applicant Information

*Name: _____ *Date of Birth: ____/____/____
Last First M.I. MM DD YYYY

*Address: _____
Street Apartment/Unit City State Zip Code

Business/Organization Name (if applicable) *Phone: () - - Email: _____

Pond Owner/Lessee Information (*Complete if different than above)

Name: _____ Phone: () - -
Last First M.I.

Address: _____
Street City State Zip Code

Pond Location & Characteristics

*Address: _____
Street/Nearest Intersection City/Town County

*Principal Use(s) of Pond: (Check all that apply) ☐ Fishing ☐ Boating ☐ Swimming ☐ Aquaculture ☐ Other: _____

*Surface Area (Acres): _____ *Maximum Depth (Feet): _____ *Average Depth (Feet): _____

*Pond Type: ☐ Artificial/Man-made ☐ Natural ☐ Spring ☐ Stream ☐ Surface/rain water

If the pond has an outlet, identify the nearest body of water it drains into: _____

Fish Species

If applicable, list fish species in pond: _____ If previously stocked with grass carp, indicate the year and number stocked: Year _____ Number stocked _____

Plant Species/Vegetation

*Briefly describe the plant problem: _____

*Indicate the plant species and the percent coverage and density of each species in the pond:

Plant Species	Coverage (%)	Density (see descriptions to right)	Density Class/Location and Descriptions
_____	_____	<input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> High	Low = Plants scattered; small patches of dense growth may occur; fishing lure can easily be retrieved without fouling.
_____	_____	<input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> High	Medium = Intermediate between low and high.
_____	_____	<input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> High	High = Dense mats; usually obvious on surface of pond; fishing lure being retrieved is fouled.

Required Document(s)

(Must be submitted with your application)

☐ Map highlighting the location/pond to be licensed (s), etc.)

Application Checklist

(Before sending this application, please verify the following)

☐ All application fields marked with an asterisk (*) are complete?

☐ You signed and dated below.

Date ____/____/____

Use statements made on this application are punishable in accordance to Section 210.45 of the

low 45 days for DEC to review and process your application.

Applications will be returned and delay the processing of your permit.

Potential Outcomes



Low Stocking
Rate



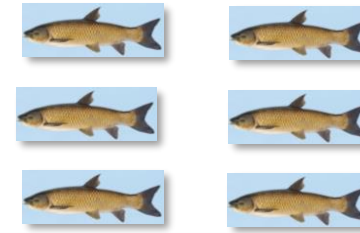
Selective feeding
Less palatable
plant dominance



Target Stocking
Rate



Control of target plant
Preservation of natives



High Stocking
Rate



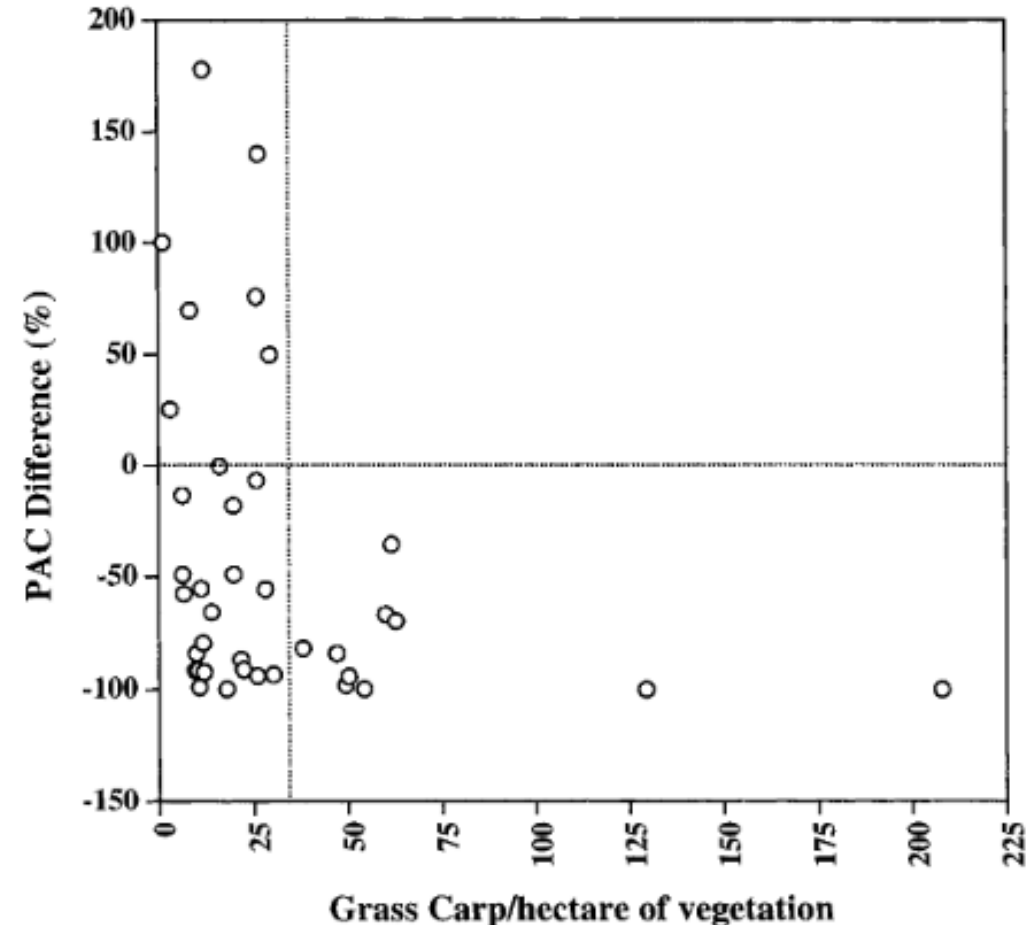
De-vegetation,
cascading effects on
fish and water quality



Intermediate Control is Desired, But Not Consistently Achieved

Grass Carp Stocking Density

- How many fish do you need for intermediate control of vegetation?
- Hanlon et al. 2000 examined stocking rates in 38 Florida lakes
 - Inflection point at 25 to 30 fish per veg hectare (62 to 74 acre) where submersed plants controlled, but not eliminated
- Bonar et al. 2002 looked at 98 lakes in Washington
 - 18% achieved intermediate control
 - Median rate for intermediate control: 24 fish per acre



Stocking Challenges: Surface vs. Vegetated Acres

- Differential stocking rates for lakes
- Surface acre is easier, but much less accurate
- Vegetated acre is more widely accepted
 - Vegetated “palatable vegetation”

Grass carp per....

- Surface Acreage
- Littoral Acreage
- Vegetated Acreage
- Vegetation Biomass



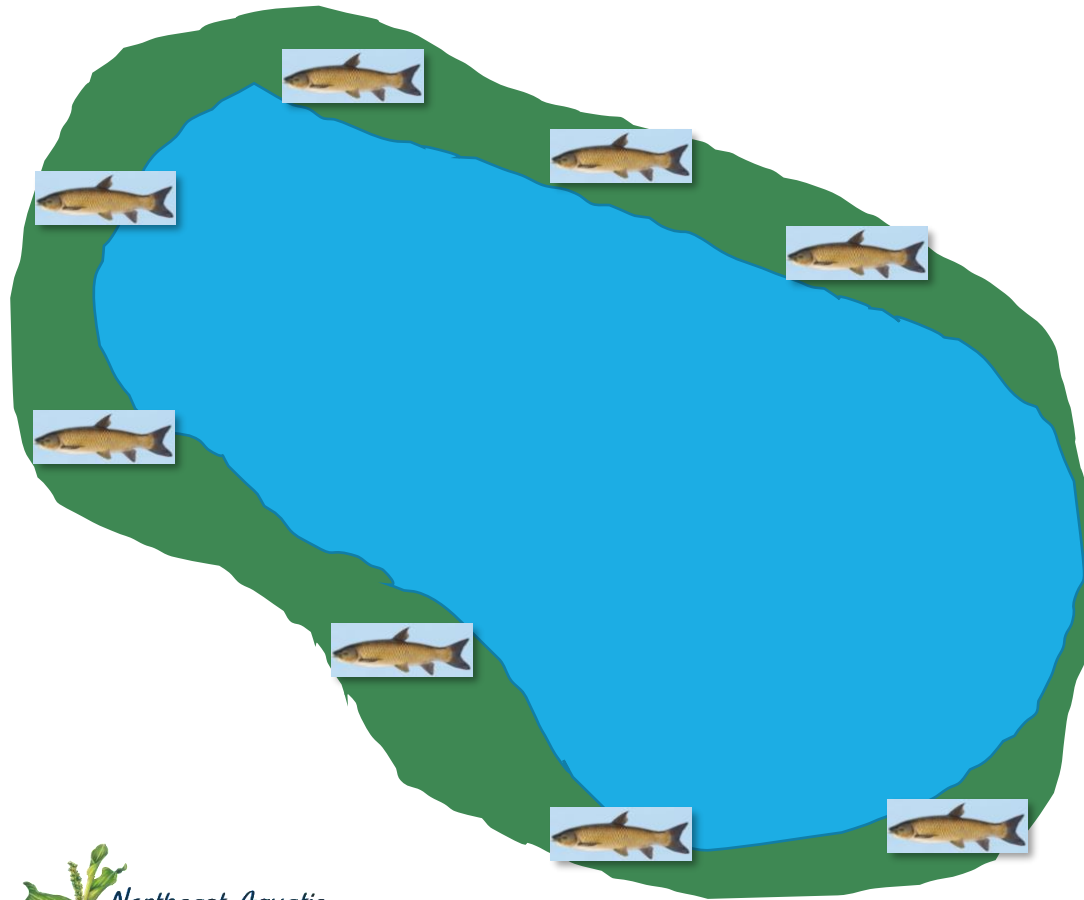
Lake Acres: 10

Vegetated Acres: 3

Total Fish: 150

Fish per Surface Acre: 15

Fish per vegetated acre: 50



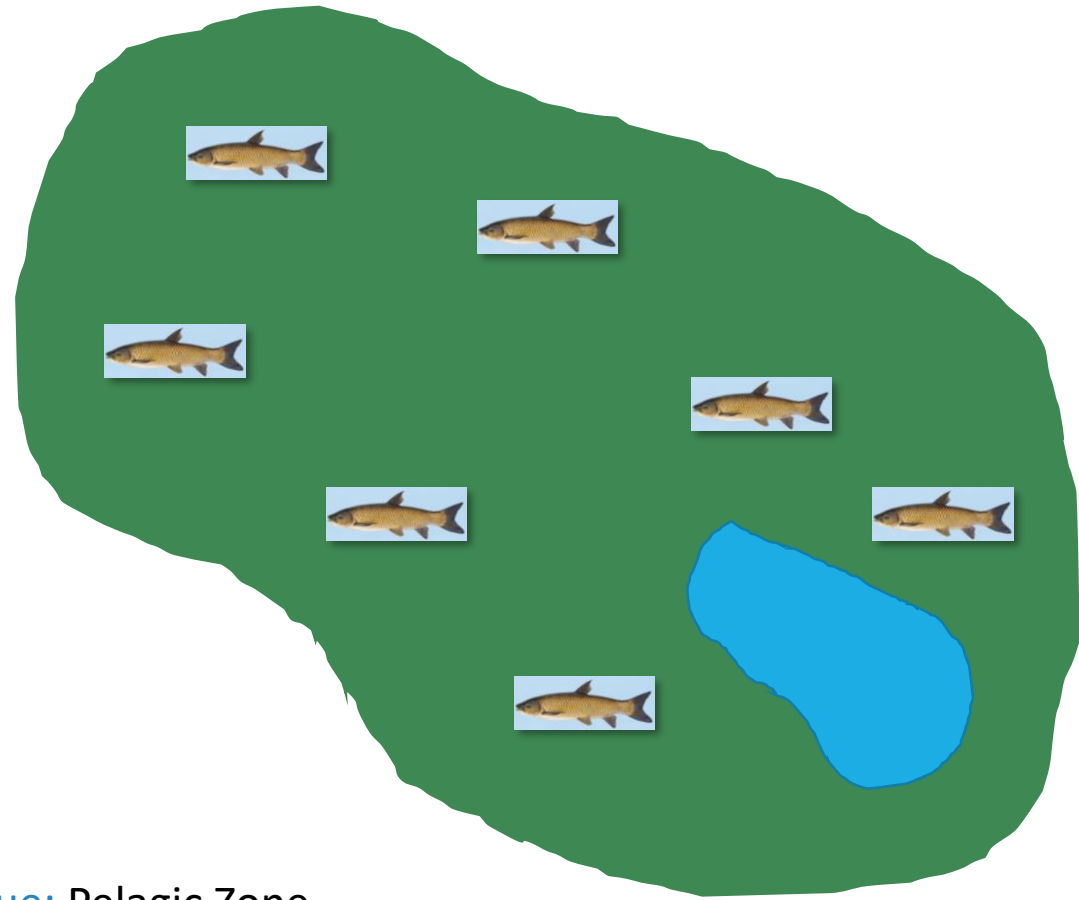
Lake Acres: 10

Vegetated Acres: 9

Total Fish: 150

Fish Per Surface Acre: 15

Fish per vegetated acre: 16.6



Blue: Pelagic Zone

Green: Littoral Zone



Stocking Challenges: Feeding Preference

- “Selective Generalists”
 - Will eat almost all aquatic plants, but have preferences for certain species
 - Like young, soft plants
- Just because plants are less preferred, does not mean they will not be eaten
 - Parrotfeather: Garner et al. 2013
 - Eurasian Watermilfoil: Van Dyke et al. 1984

Consumption Preference	Citation
American Pondweed > Dioecious hydrilla > Elodea > Egeria > Curly leaf Pondweed > Water Primrose > Sago Pondweed > Chara > Spikerush > Parrotfeather > Eurasian Watermilfoil > Water hyacinth	Pine et al. 1991
Water fern > Duckweed > Sago Pondweed > Eurasian Watermilfoil > Parrotfeather > Water Hyacinth	Catarino et al. 1997

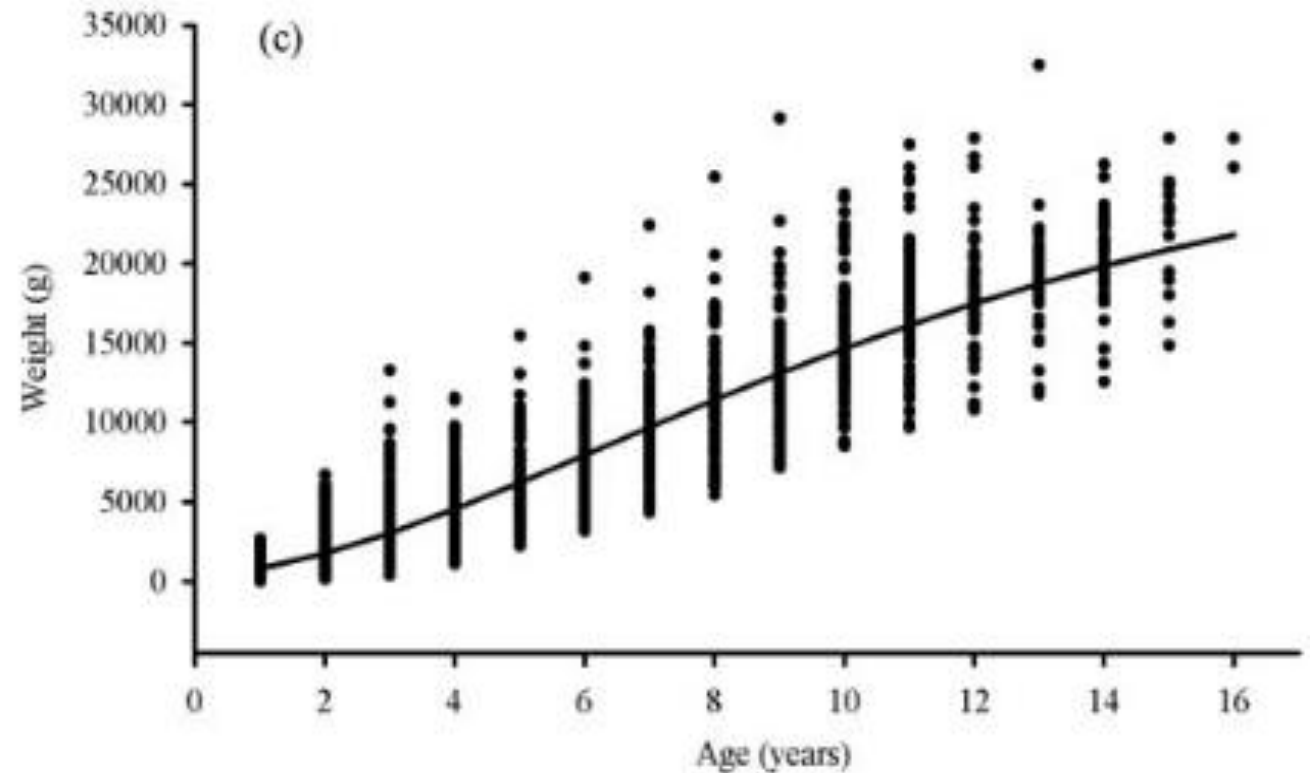


Stocking Challenges: Age and Consumption

- Two common misconceptions
 - Grass carp live 8-10 years
 - Fish up to 30 years old found (Clemens et al. 2016)
 - Older fish do not eat as much as younger fish
 - Younger carp have higher per weight consumption, not higher total consumption

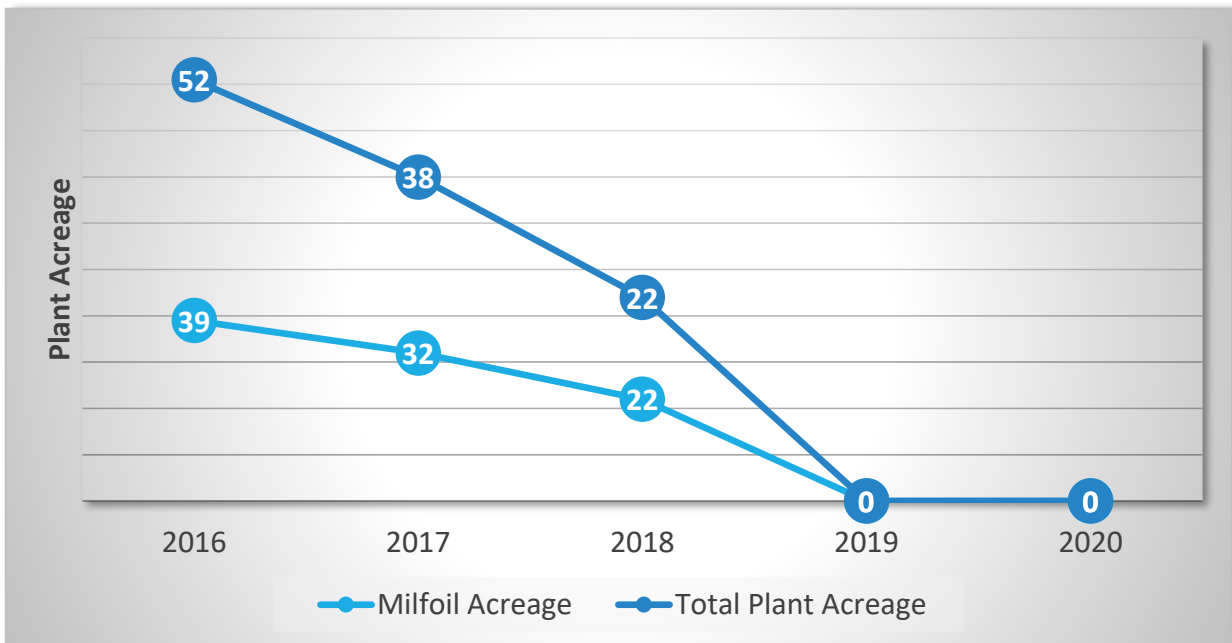
Low assimilation rate means high consumption rate (Wiley and Wike 1986)

Older fish need to consume lots of vegetation to maintain and add body weight



Squantz Pond, CT

- 266 acre lake
- Milfoil topped out in most places ~39 acres in 2016
 - 52 total plant acres
- Historical drawdown
- 585 fish stocked in June 2017
- De-vegetation in 2 years



Increased grazing as time goes on

Vegetation declines faster than
carp die off

Year	Fish Per Veg Acre
2016	11
2017	15
2018	21

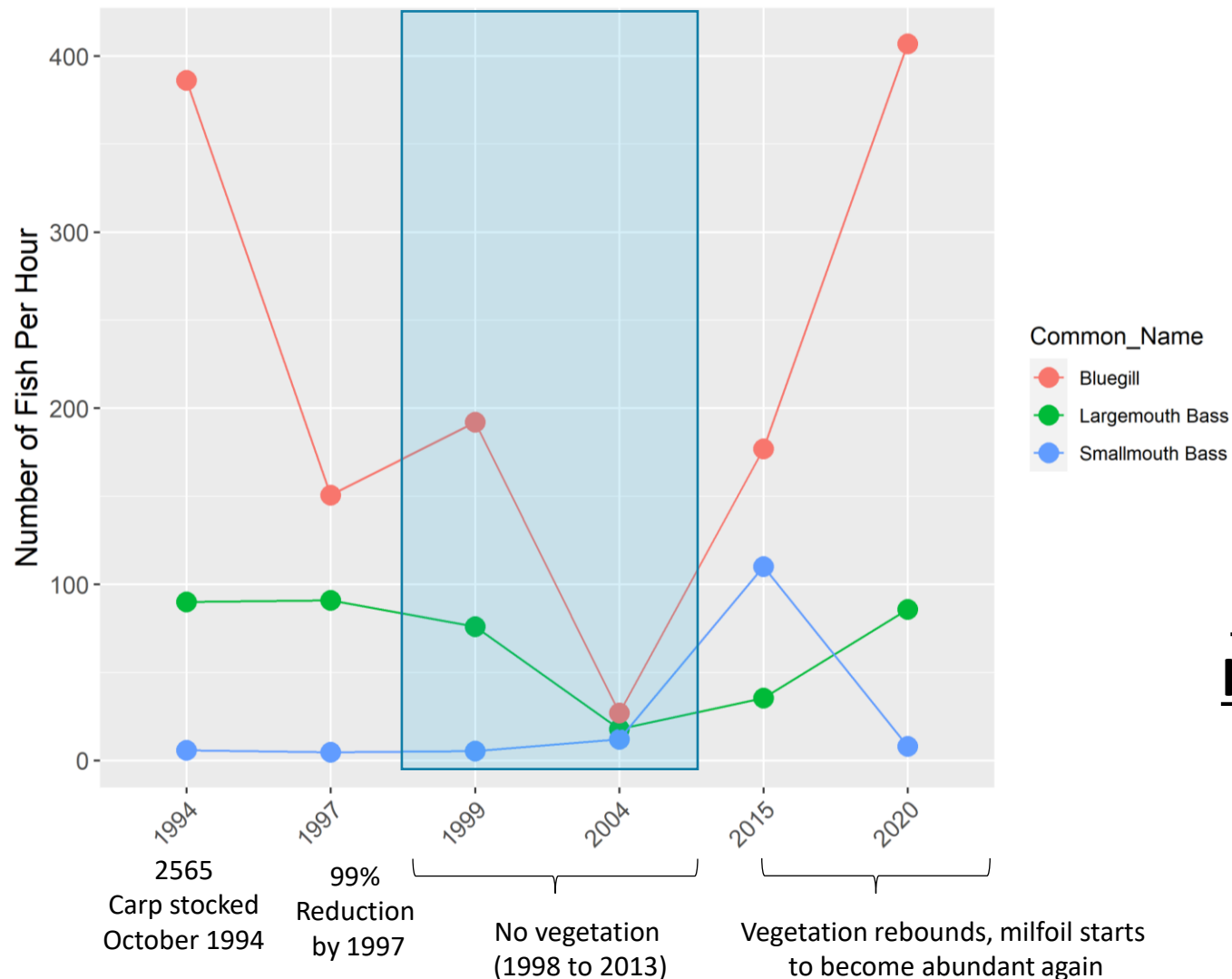
Assuming 20% Mortality

Lake Mahopac, NY

- 656 acre lake in Putnam County, NY
- Stocked 2565 carp in 1994
- Within 3 years, vegetation was completely eradicated
- Vegetation was absent for over a decade, with only sparse plants being observed until 2013
- Significant impacts to catch rates for largemouth bass and bluegill



Lake Mahopac, NY



Stocking Rate:
3.9 fish per acre

Would be
considered a low
stocking rate
by current DEC
Guidelines

Low compared to
Hanlon et al. 2000
and Bonar et al.
2002 rates



When Are Grass Carp Appropriate?

- “Southern model”
 - Extremely large man-made impoundments*
 - Low natural diversity*
 - High invasive plant coverage
 - To the point where other control methods are cost prohibitive
 - Target plant highly preferred*

***Unlike Northeastern Lakes**

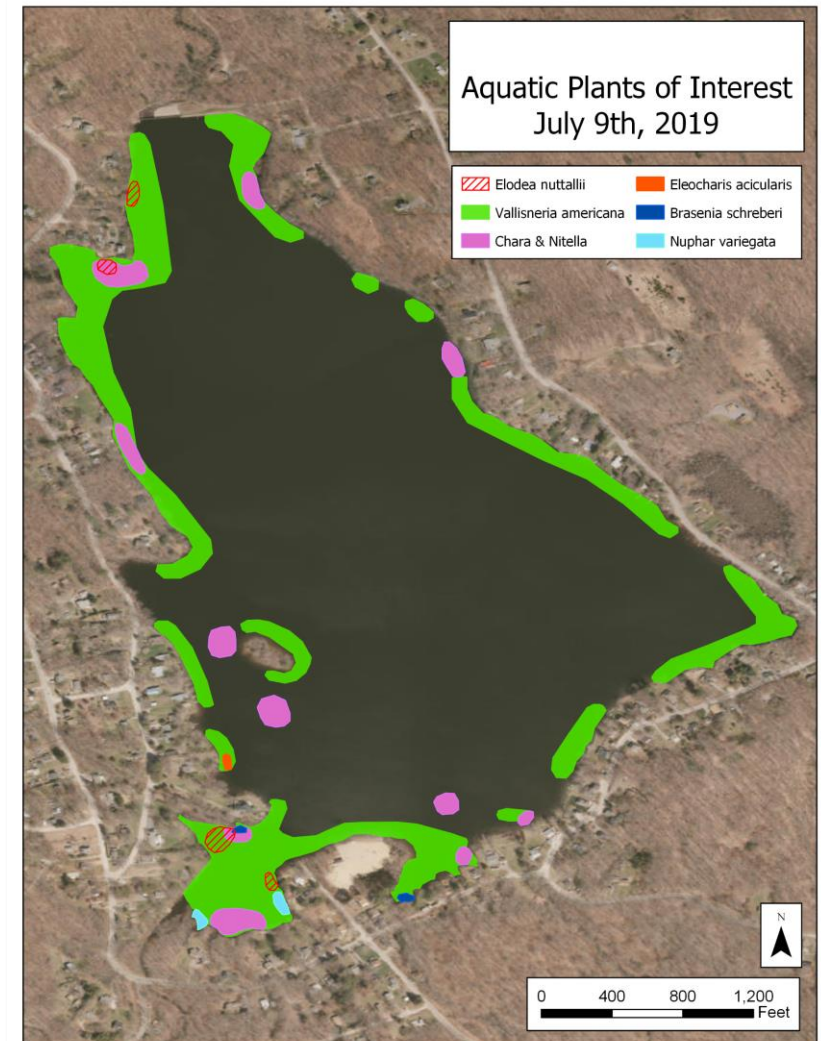
Still, conservative stocking rates and integration of alternate techniques are used



Only re-stock if plant survey indicates either no change or increase in total plant abundance

If You Are Going To Use Grass Carp....

- Provide DEC with best available information
 - Current detailed aquatic plant survey
 - Total vegetation acreage
 - Coverage and density of each species
 - Rare and endangered plants
- Risk Management
 - How do I prevent deleterious impacts?
- Integrate with alternate techniques
- Habitat evaluation and restoration
- Deciding when to re-stock?



Final Thoughts

- Overstocking and understocking leads to undesirable outcomes
- Intermediate control of vegetation is desired, often difficult to achieve
- Significant uncertainties hinders ability to predict accurate stocking rate
 - Overwhelming majority of research from southern states
- More research is needed into NE grass carp populations to home in on effective, intermediate stocking rates
 - Mortality rates
 - Age and growth
 - Vegetation preference
 - Lag times



Questions?



Citations

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