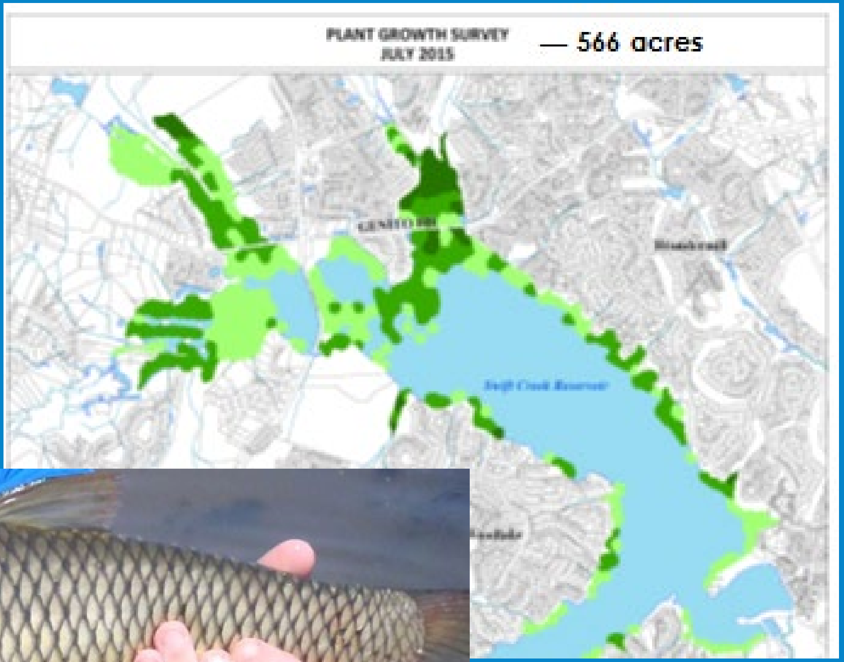
The use of grass carp to manage vegetation: balancing on the high wire



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Water Resource Services

WRS

Basic Grass Carp Info

- Ctenopharyngodon idella, native to Asia, introduced to USA
- Lives in lakes and rivers, 15-20 year lifespan typical
- Can grow to large size (5 ft, 100 lbs), usually <4 ft, 50 lbs
- Survives at 32-86 F, spawns at 68-86 F
- Triploid form sterile, grows fast, required in northeast USA
- Primarily herbivorous, but will eat small fish and invertebrates when vegetation unavailable
- Has dietary preferences – reshapes or eliminates vegetation

Stocking vs plant control

- ❖ Stocked at 10-15 fish/vegetated acre for plant removal
- ❖ Stocked at 2-5 fish/vegetated acre for reduced plants
- ❖ Prefers “soft” submergent vegetation (hydrilla, pondweeds) over coarse, gritty types (Eurasian milfoil, coontail) or floating/emergent forms (water lily, cattails)
- ❖ Smaller fish stay in deeper water to avoid predation
- ❖ Tend to school, do not disperse evenly in waterbody

Theory vs Practice

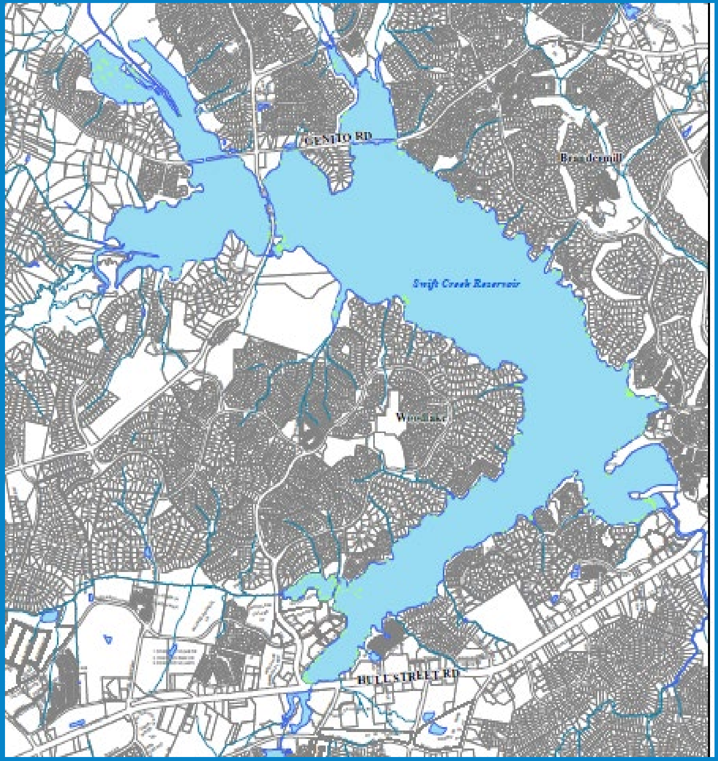
- Elimination of vegetation
  - Can definitely eliminate all susceptible vegetation with sufficient stocking, but maintaining control can be a challenge if carrying capacity exceeded.
- Control of target species
  - Can control certain species of high preference (hydrilla) but not many others (milfoil) without eliminating most vegetation
- Achieving intermediate plant density
  - Highly illusive objective; very few examples of success, usually need multiple techniques at once

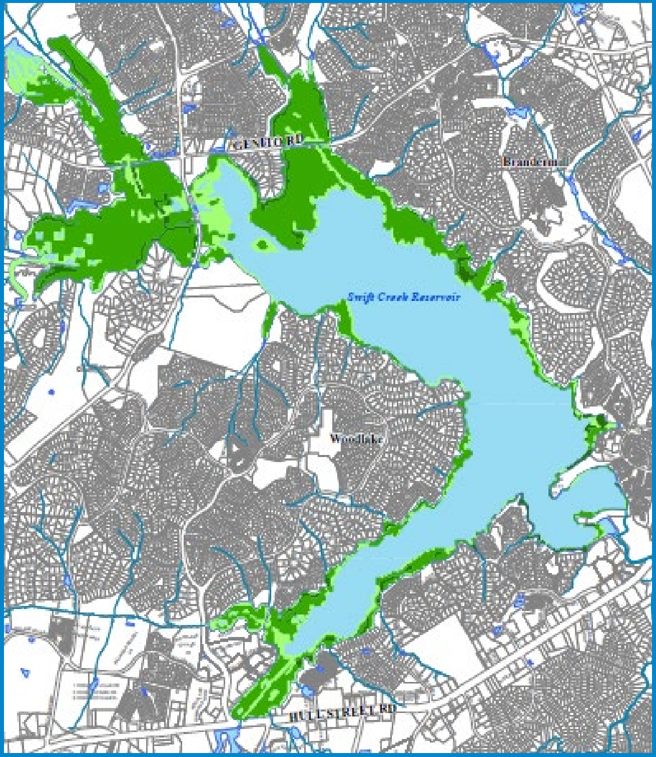
Influence on other biological components

- About half of what goes into a grass carp comes out as potentially available nutrients that support algal growth
- Seems to generate low N:P ratio; favors cyanobacteria
- Loss of vegetation disfavors some fish species (pickerel) but may favor others (bass)
- If vegetation is depleted, consumption of invertebrates and small fish may be significant, further disrupting food web

Swift Creek Reservoir as an example

- 1700 acre reservoir with 900+ acre littoral zone, primary water supply with heavily developed watershed
- Invaded around 2005 by monoecious Hydrilla, dominant plant over 842 acres by October 2010
- Need to balance water supply needs with other uses in management of Hydrilla specifically and reservoir overall





Management Constraints and Options

- Primary water supply for county utility that reports to an elected board of county commissioners
- Heavy no-contact use (electric boating) and popular fishery
- Water quality requires substantial treatment for potability
- Filtering effect of dense vegetation valued at inlets
- Use of herbicides not desirable in potable water supply
- Infested area too large for physical controls
- Grass carp known to reduce water quality
- Loss of all plants undesirable

Settled on effort to use grass carp with intent to avoid elimination of all vegetation

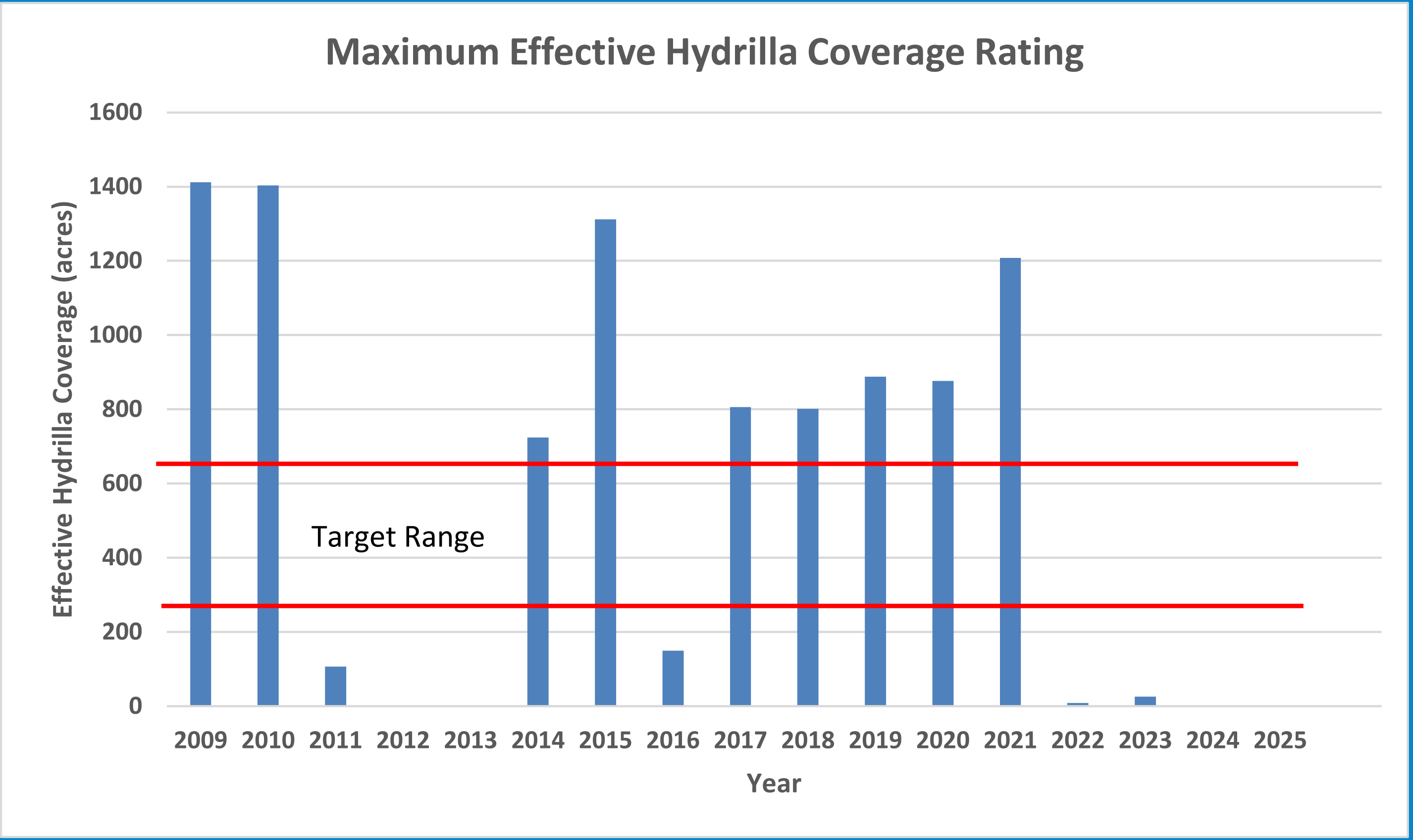
Grass Carp Stocking

- Maximum allowable # stocked in 2010
- Subsequent attempt to build multi-age population over time
- Exceeded recommended # in 2016 and 2022
- Difficult to quantify grass carp population
- Difficult to satisfy lake users with anything less than hydrilla elimination
- Political pressure trumps science-based plan

Grass Carp Stocking History		
Year	# Grass Carp	Size (in)
2010	10,500	12
2011	0	0
2012	0	0
2013	0	0
2014	0	0
2015	1,000	12-15
2016	3,000	12-15
2017	0	0
2018	500	12-15
2019	600	12-18
2020	600	12-18
2021	1,250	12-18
2022	3,500	12-18
2023	0	0
2024	0	0
2025	500	12-18

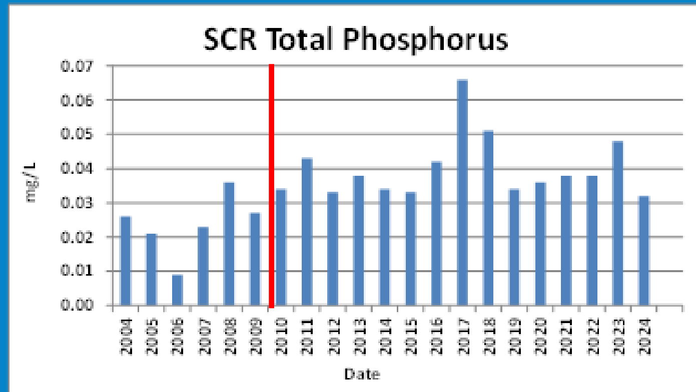
Plant Response to Grass Carp

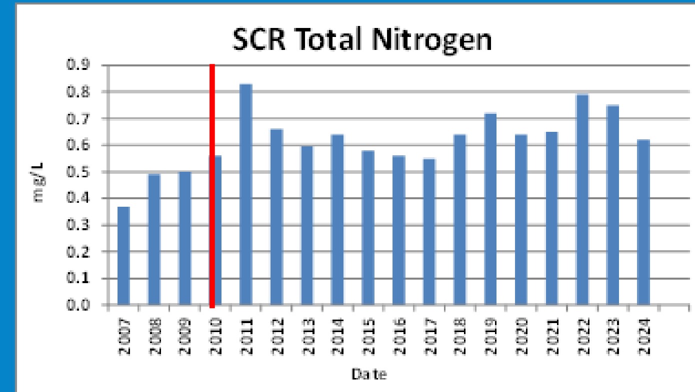
- ❖ Effective cover based on acres X density factor; mod density acres X 1.7, high density X 2.3.
- ❖ Hydrilla collapse in 2011, 2016, and 2022
- ❖ Other plants follow hydrilla pattern, never abundant

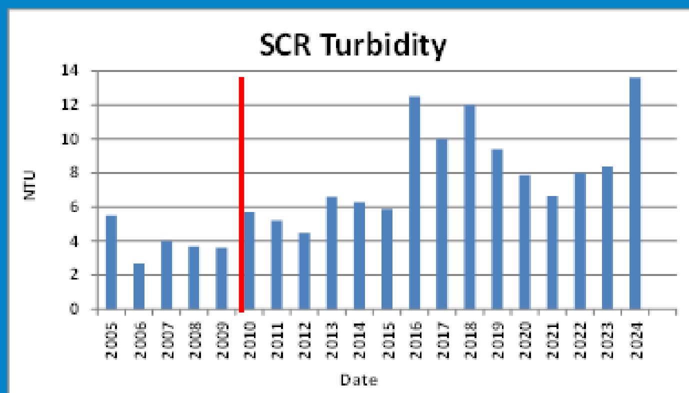


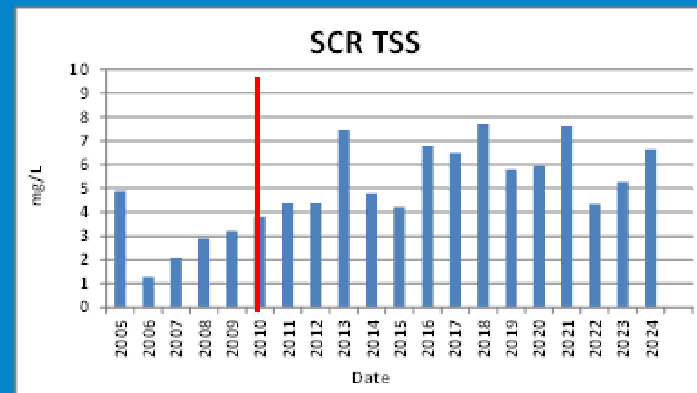
Water Quality Response to Grass Carp

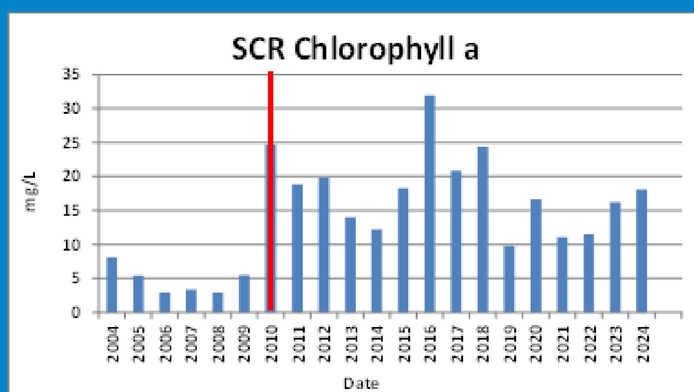
- ❖ Increase in each parameter except Secchi clarity, which declined

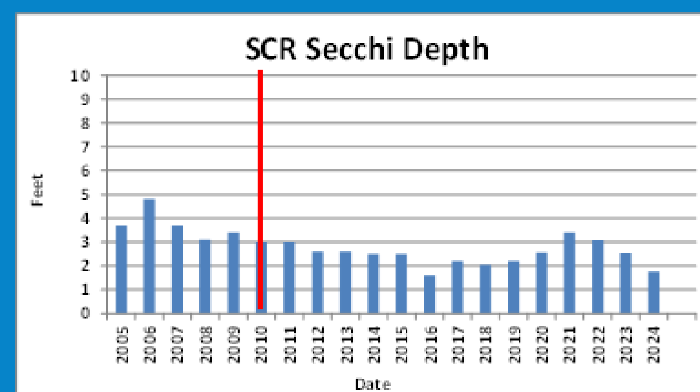






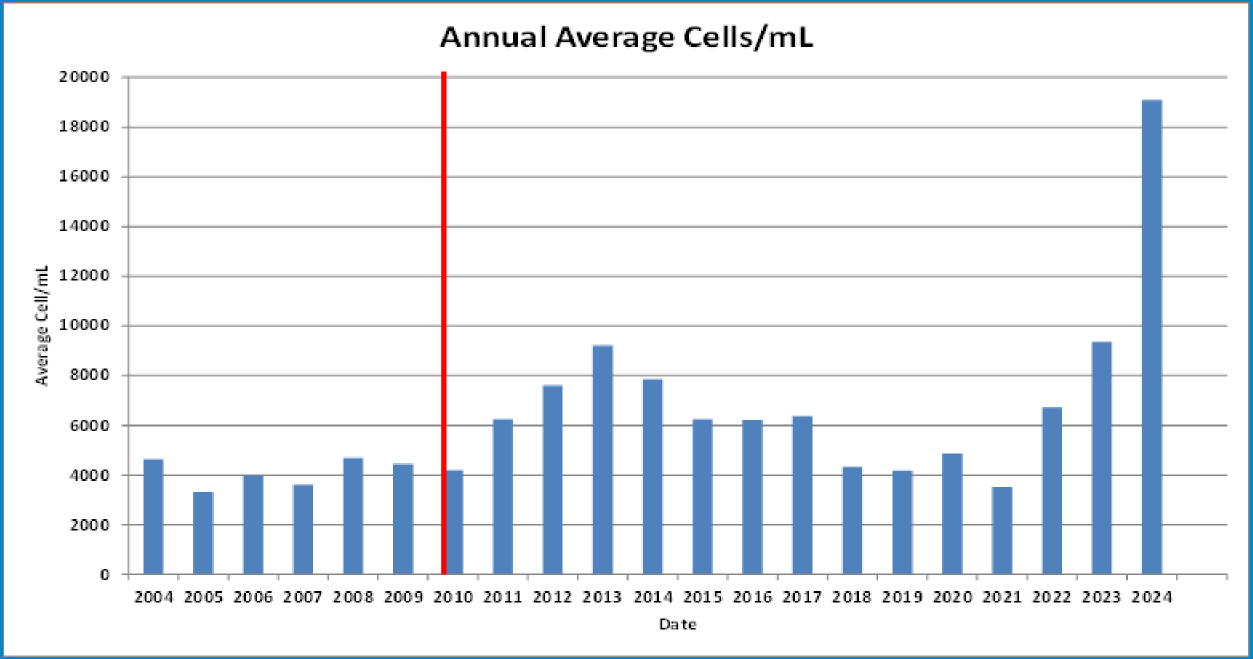


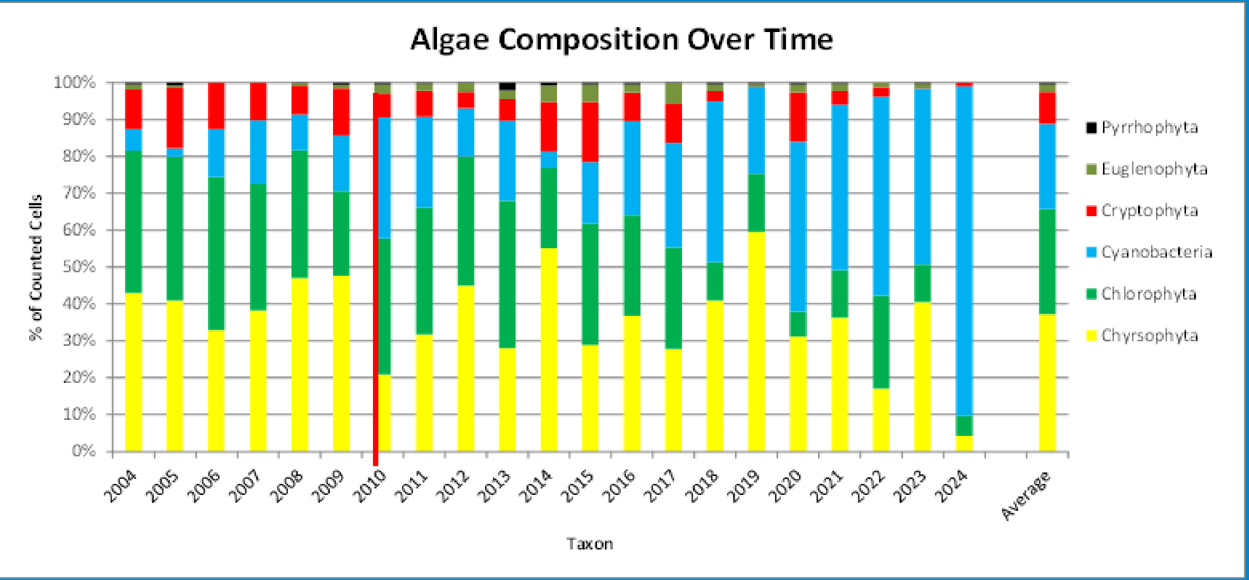




Response of Algae to Grass Carp

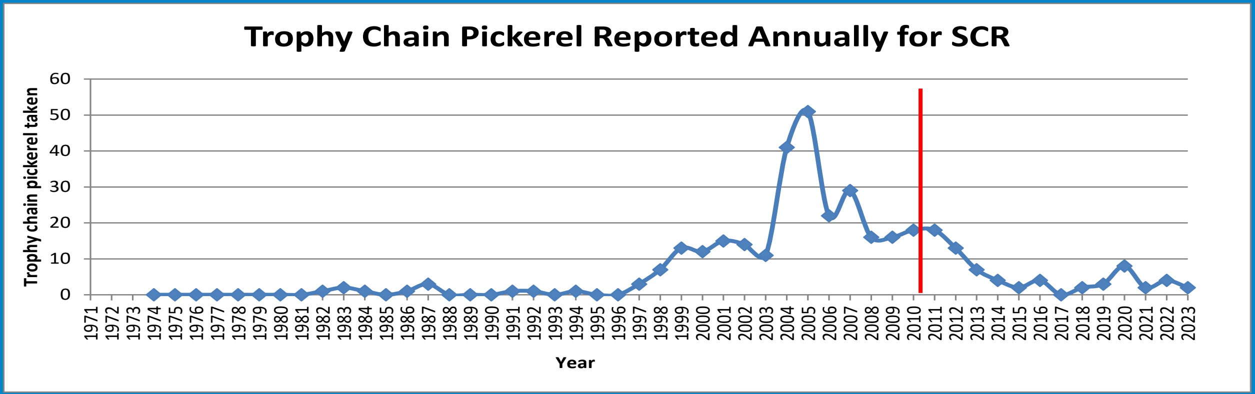
- Higher cell counts since stocking, greater portion of cyano-bacteria in counts
- Treatment handles increase, but also using algaecides and sonication in the intake bay to reduce algae in the intake water

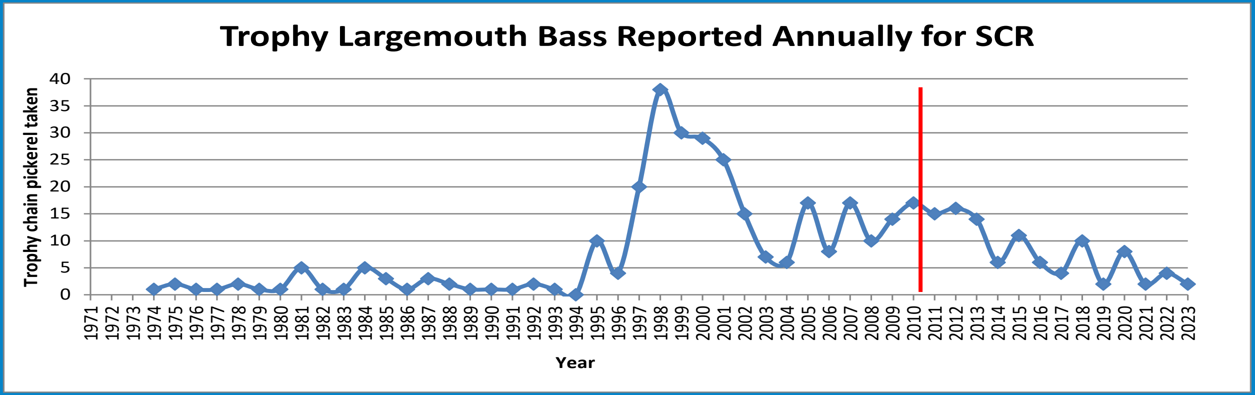




Fish Response to Grass Carp

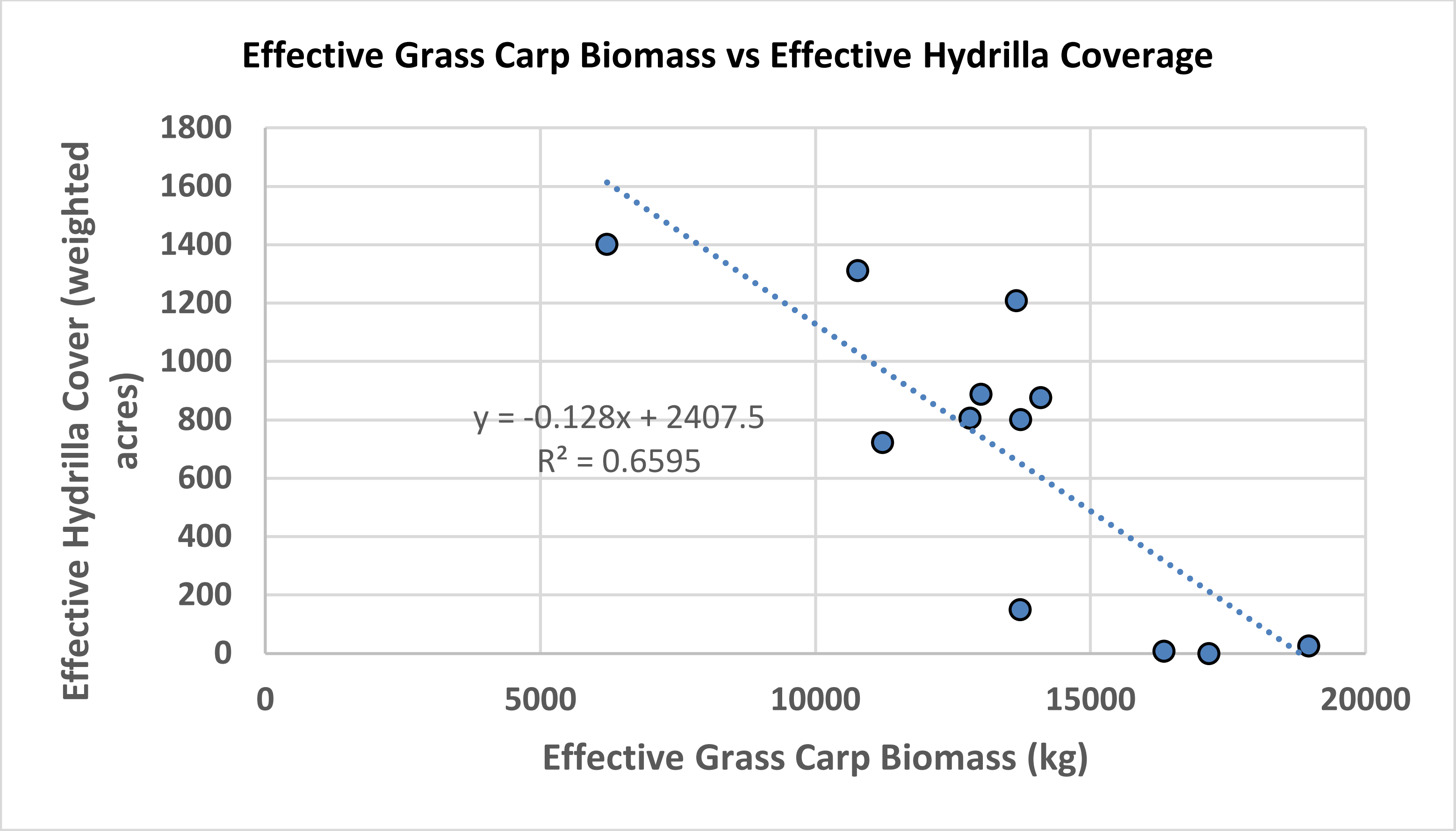
- Trophy fisheries for pickerel and bass declined, but not coincident with grass carp stocking
- Other population metrics not conclusive; CPUE has declined for pickerel, increased for gizzard shad, and varied for bass, crappie, yellow perch, and redear sunfish
- It is apparent that the fish community is not very stable and grass carp are not a positive force





Grass Carp vs Hydrilla: Real Data

- Hydrilla collapse expected beyond about 14,000 kg of GC
- Very narrow range of GC biomass leads to desirable intermediate condition; very hard to achieve and maintain



Conclusions

- Inherent variation in biological controls makes achievement of a narrow range of desired conditions very difficult
- Political pressure for more rapid results stymies gradual adjustment to approach desired conditions without crashes
- Water quality declined as expected, increasing treatment needs for the water utility while not consistently satisfying lake users
- Algae and the portion of the algae community represented by cyanobacteria have increased with grass carp stocking
- The fish community has not benefitted from grass carp stocking, but clear indication of damage is lacking

The End

Well, it seemed like a good idea after the first one…

QUESTIONS?