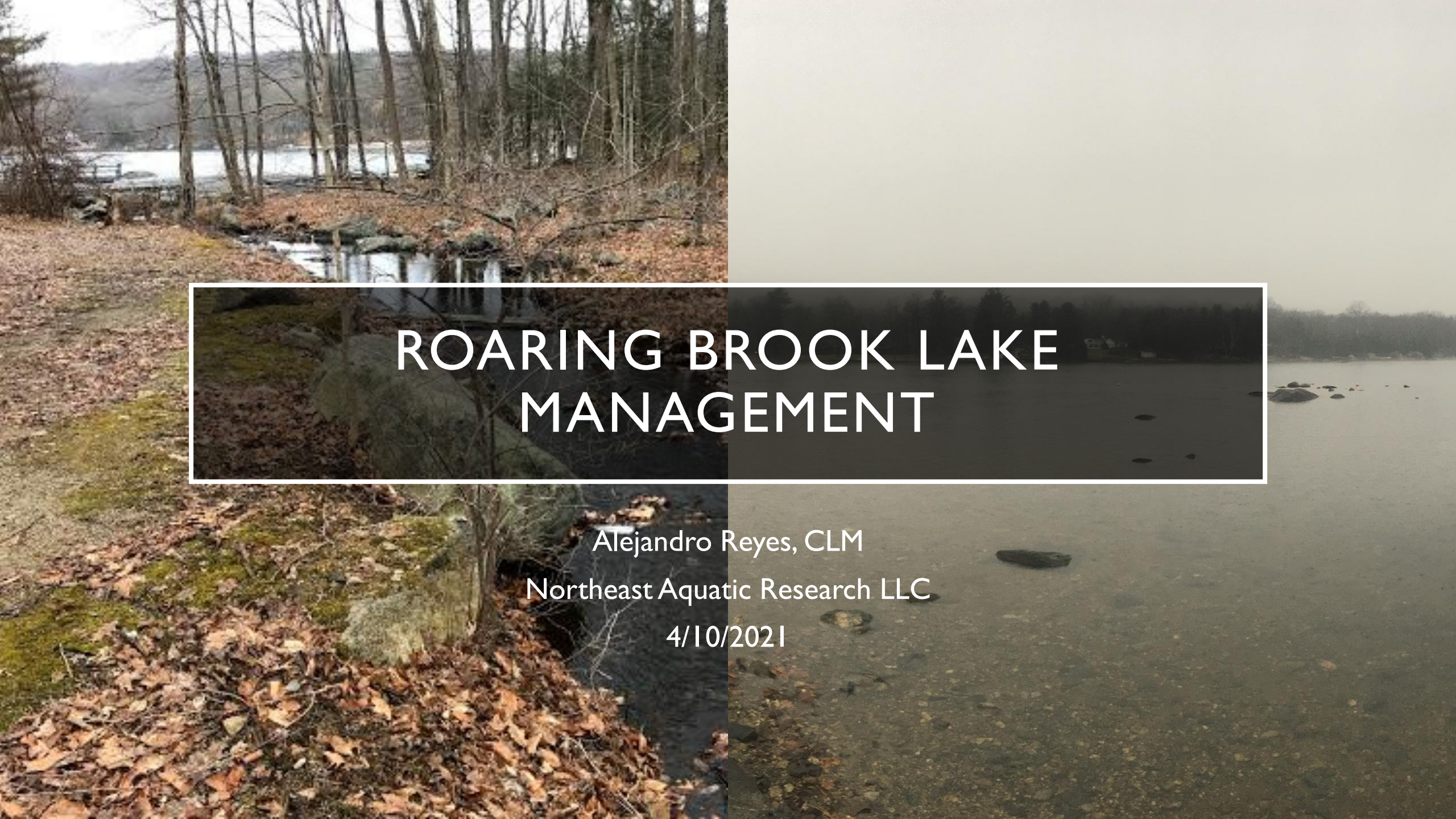


ROARING BROOK LAKE MANAGEMENT

Alejandro Reyes, CLM

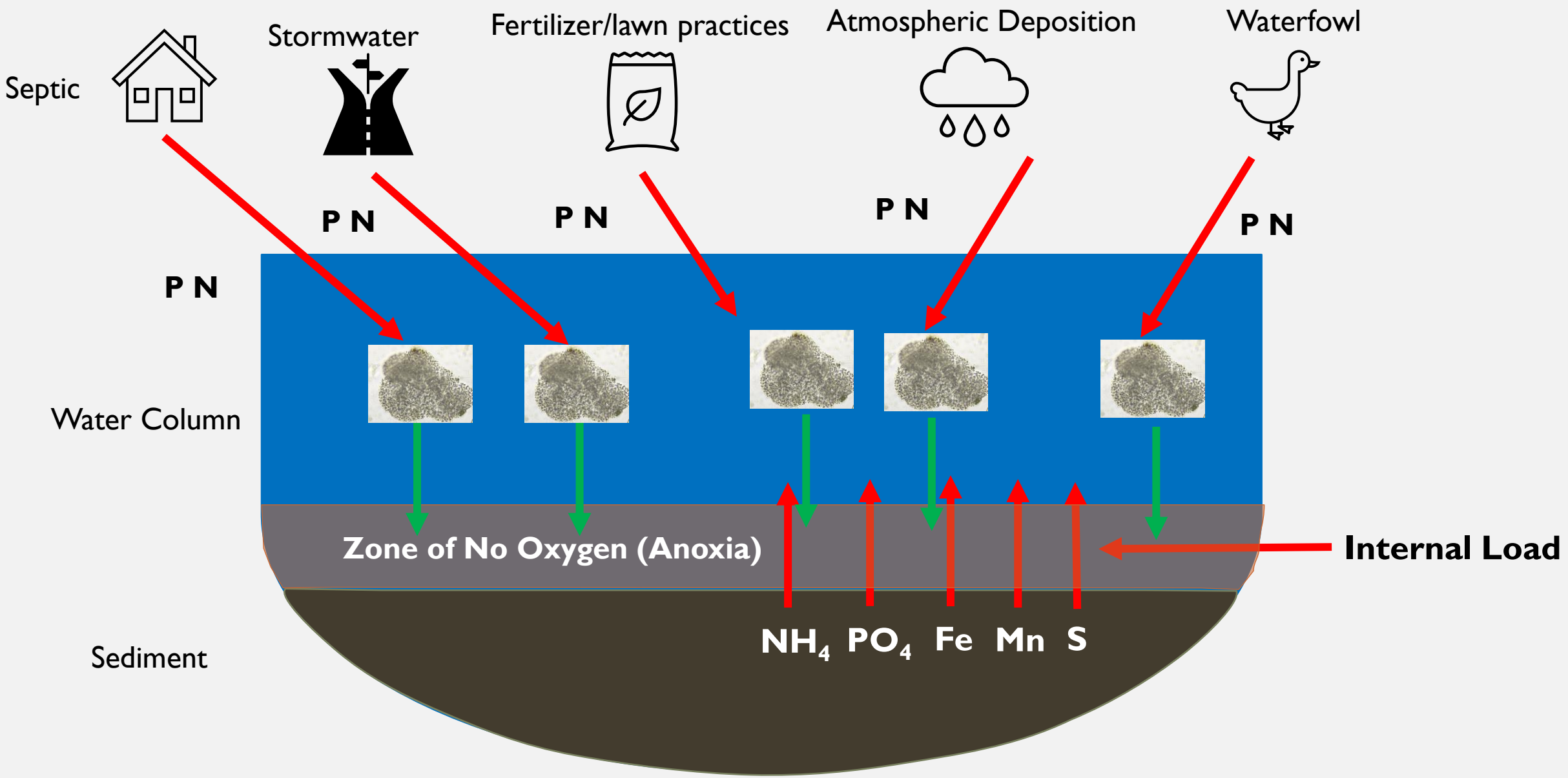
Northeast Aquatic Research LLC

4/10/2021

OUTLINE

- Introduction
- Internal Loading
- Watershed Management
- Fisheries Management

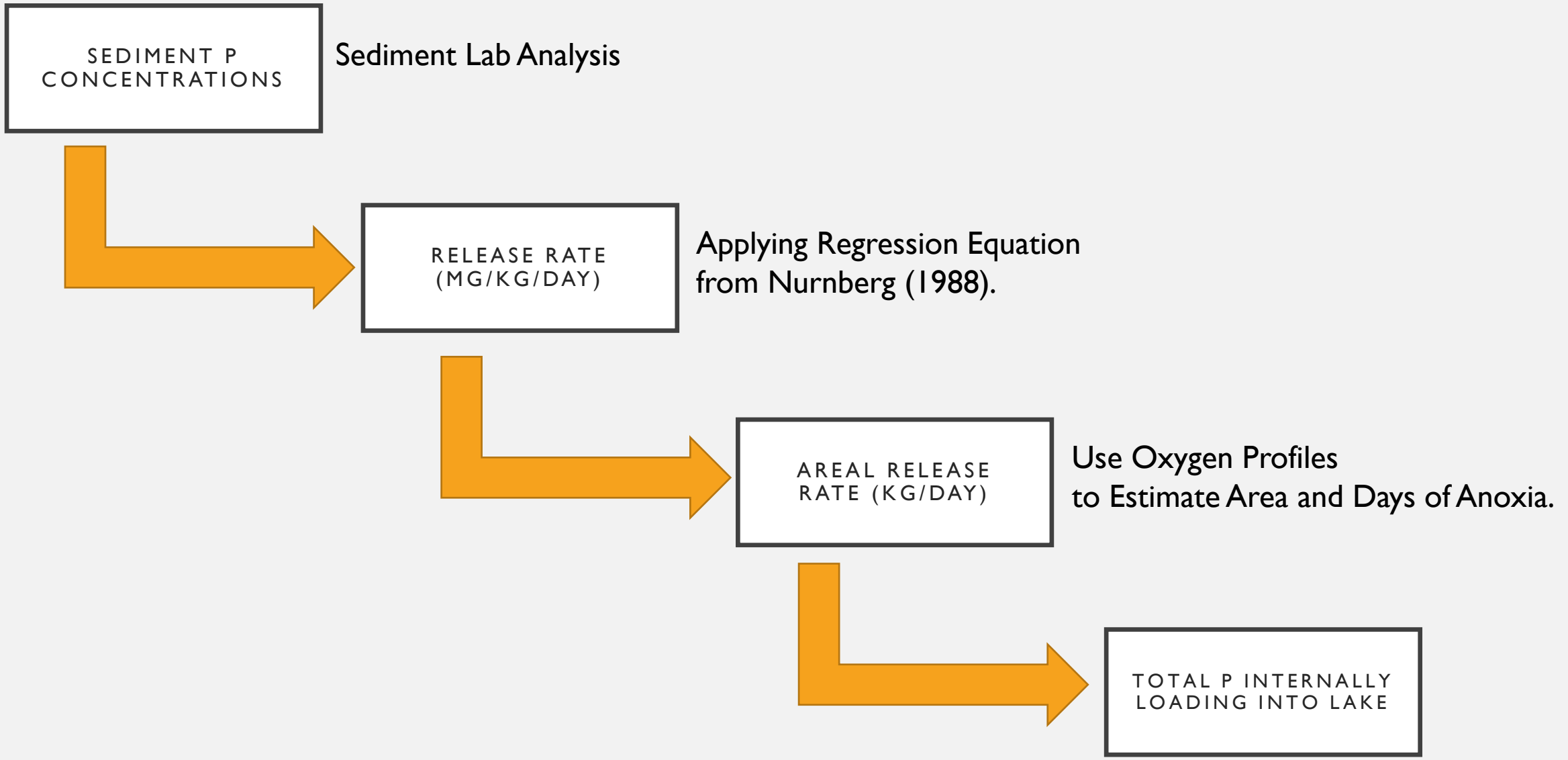
Sources of phosphorus and nitrogen



INTERNAL LOADING INVESTIGATION

- Previous nutrient budget indicates that 75.7 lbs of phosphorus entering the lake came from lake sediments.
  - Budget did not explain how it generated that number.
- 2019 monitoring showed there was areas of the lake devoid of oxygen and internal phosphorus loading was happening.
- 2020 Goal: Investigate sediment phosphorus release using real, in-lake water data and sediment nutrient concentrations.

SEDIMENT DATA



Total P Internal = Areal Release Rate * Days of Anoxia

INTERNAL LOADING RESULTS

- Estimated **241** lbs of phosphorus released annually from internal loading.
  - Anywhere from 162 to 319 lbs depending how you apply days of anoxia and if you use TP release rate or iron bound phoshorus release rate.
  - Translates to ~40-58% of total annual P load.
    - Based on previous budget for watershed
    - Previous budget had 75.7 lbs, 25% of total annual P load
  - Key factors to consider:
    - Model does not account for Oxic release
    - Internal load only happens in summer

RESULTS INDICATE THAT INTERNAL LOADING CONTRIBUTION WAS MUCH GREATER THAN PREVIOUSLY THOUGHT

INTERNAL LOADING RECOMMENDATIONS

- An updated nutrient budget should be completed incorporating on site data from streams and stormwater.
- Continued investigation into treatments such as alum or phoslock to bind sediment phosphorus.
  - Obtain price quotes for whole-lake treatments
  - Discuss in more detail with stakeholders
    - Not a commitment to perform actions

HABS MANAGEMENT

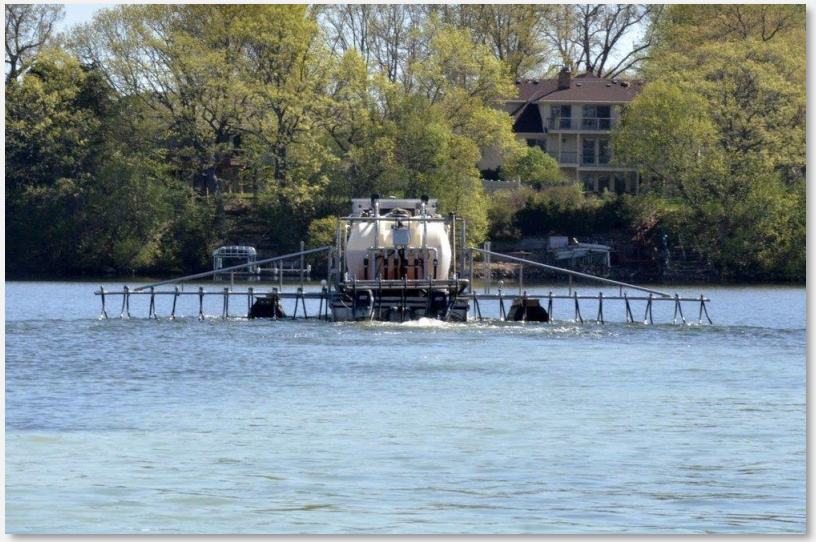
- Managing nutrients is key for HABS management
- Need to address both external and internal load, cannot manage them independent of each other

You can sewer the entire lake community, install every BMP possible and have perfect lawn practices, but if the internal load is too severe, lake recovery will be severely delayed

INTERNAL LOAD MANAGEMENT

ALGICIDES

PHOSPHORUS BINDING



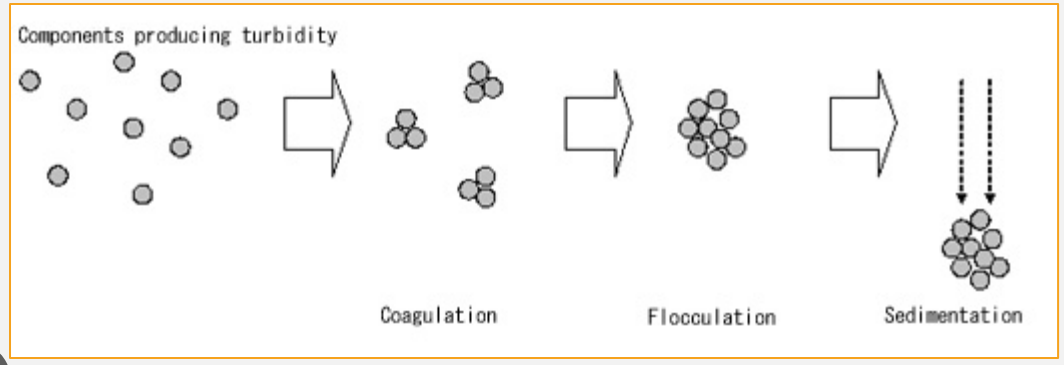
AT SOME POINT, INTERNAL LOAD NEEDS TO BE DEALT WITH

CIRCULATION/AERATION

ALUMINUM SULFATE

- What is Alum?
  - Aluminum sulfate + water → aluminum hydroxide + hydrogen ions

    (lowers pH of water, which is why buffering solution needed to stabilize pH)
  - Aluminum hydroxide precipitates as a flocculent material, has a high capacity to bind free phosphate ions
  - Initially used as drinking water treatment technology
  - Also used to reduce phosphorus outputs from wastewater treatment
  - Has been used around the world in lake restoration for 40yrs but better technology and more successful treatments in last 15yrs.



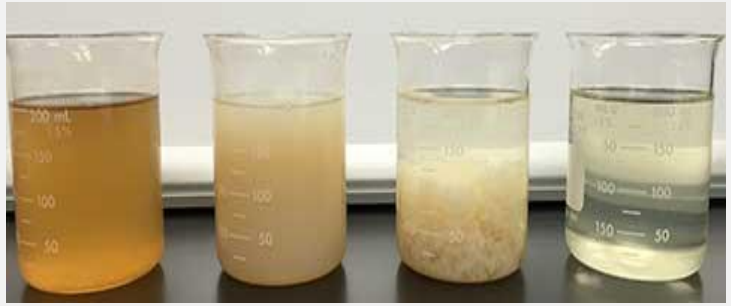


Photo demonstrates flocculation and water clarity process (http://www.devrkenterprises.com/coagulant-chemicals.htm)

PUBLIC OPTION ABOUT ALUM IS GOOD, NALMS STANDS BY USAGE

- Alum treatments featured in 2018 NatGeo article

  https://www.nationalgeographic.com/environment/2018/10/aluminum-sulfate-clears-polluted-lakes-algae-blooms/

- North American Lake Management Society (NALMS) Alum position paper http://z0ku333mvy924cayk1kta4r1-wpengine.netdna-ssl.com/wp-content/uploads/2016/05/NALMS-Alum-Position-Statement.pdf

  1. "Safe and effective,
  2. Applications need to be designed and controlled to maintain appropriate pH
  3. Useful in cases where watershed phosphorus reductions not adequate nor timely."

- Avoid Alum fish toxicity by maintaining neutral pH of lake water (~7) using sodium aluminate buffer

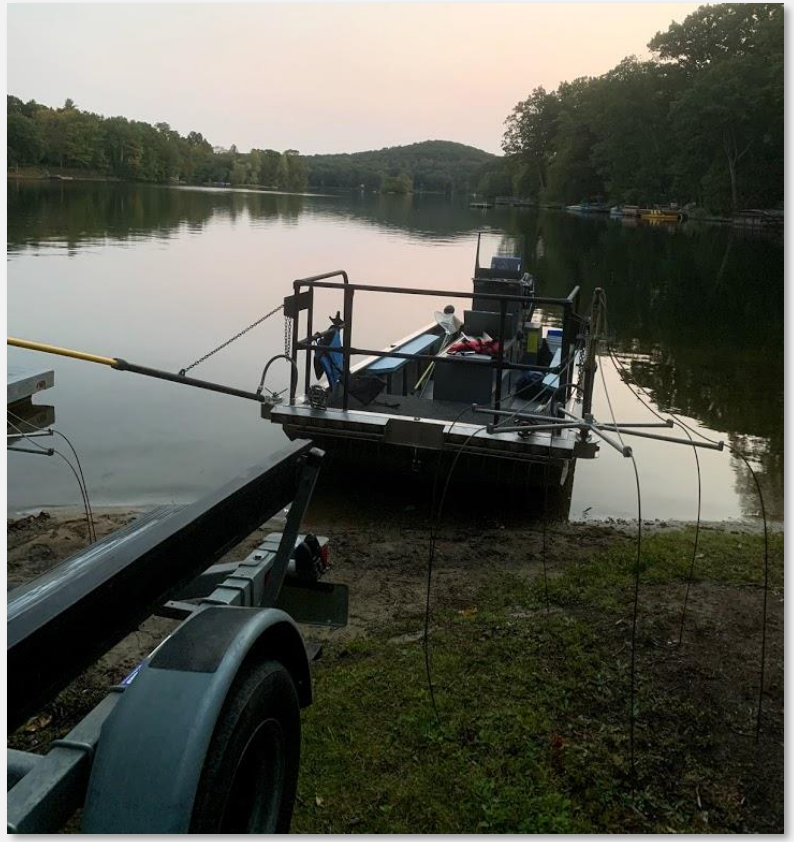
PHOSPHORUS BINDING: PHOSLOCK

- Phoslock
  - Lanthanum modified bentonite
  - Relatively new product (2010)
  - Extremely low toxicity
    - No pH swing issues as in Alum, no buffering needed
  - Potential for use for in stream applications – Eutrosorb

$$La^{3+} + PO_4^{3-} = LaPO_4$$

FISHERIES SURVEY

- 2020, Roaring Brook Property Owner's Association requested a survey of the lake's fish population.
- No previous survey done on lake.
- Survey was done on September 22nd, 2020 in conjunction with SUNY Cobleskill fisheries department.
- Small electrical current stuns fish, brought on board to length and weigh. Fish are released unharmed.
- Analysis focused on fish presence and abundance, size distribution and relative weight.



RESULTS: CATCH PER UNIT EFFORT

Common Name	Scientific Name	Count	CPUE
Largemouth Bass	Micropterus salmoides	254	115.79
Bluegill	Lepomis macrochirus	233	260.58
Yellow Perch	Perca flavescens	40	44.73
Redbreast Sunfish	Lepomis auratus	34	38.02
Pumpkinseed	Lepomis gibbosus	20	22.37
Brown Bullhead	Ameiurus nebulosus	7	7.83
Black Crappie	Pomoxis nigromaculatus	6	6.71
Triploid Grass Carp	Ctenopharyngodon idella	5	2.28
White Catfish	Ameiurus catus	2	2.24

Pumpkinseed

Largemouth Bass

Redbreast Sunfish

Grass Carp

White Catfish

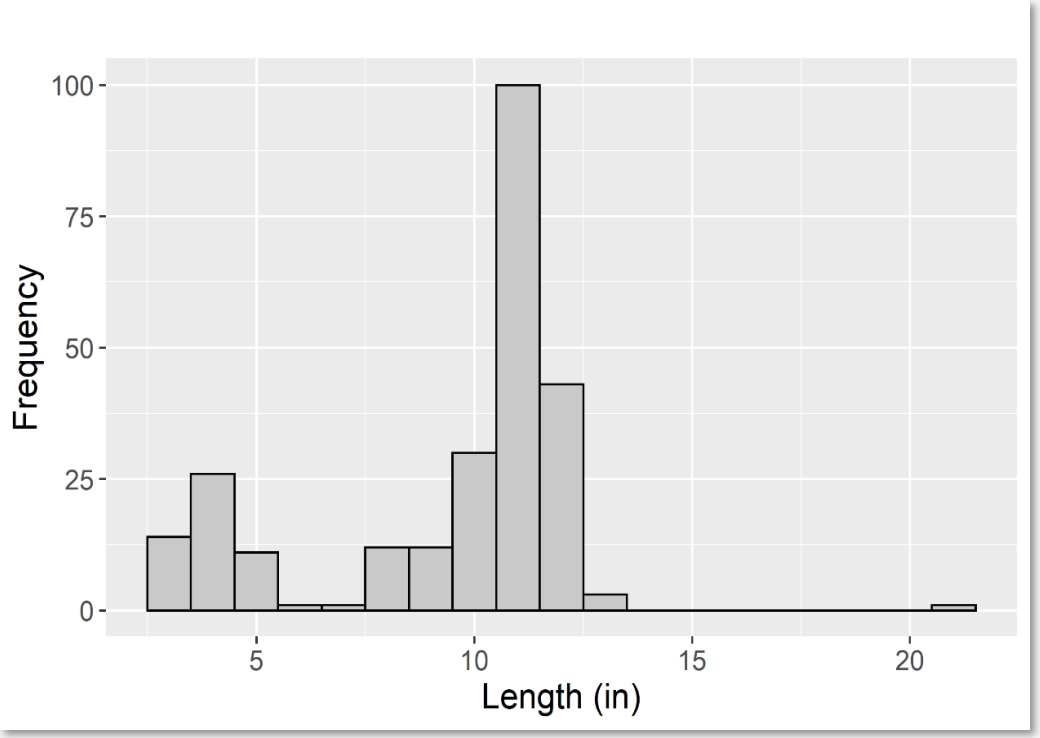
Black Crappie

Yellow Perch

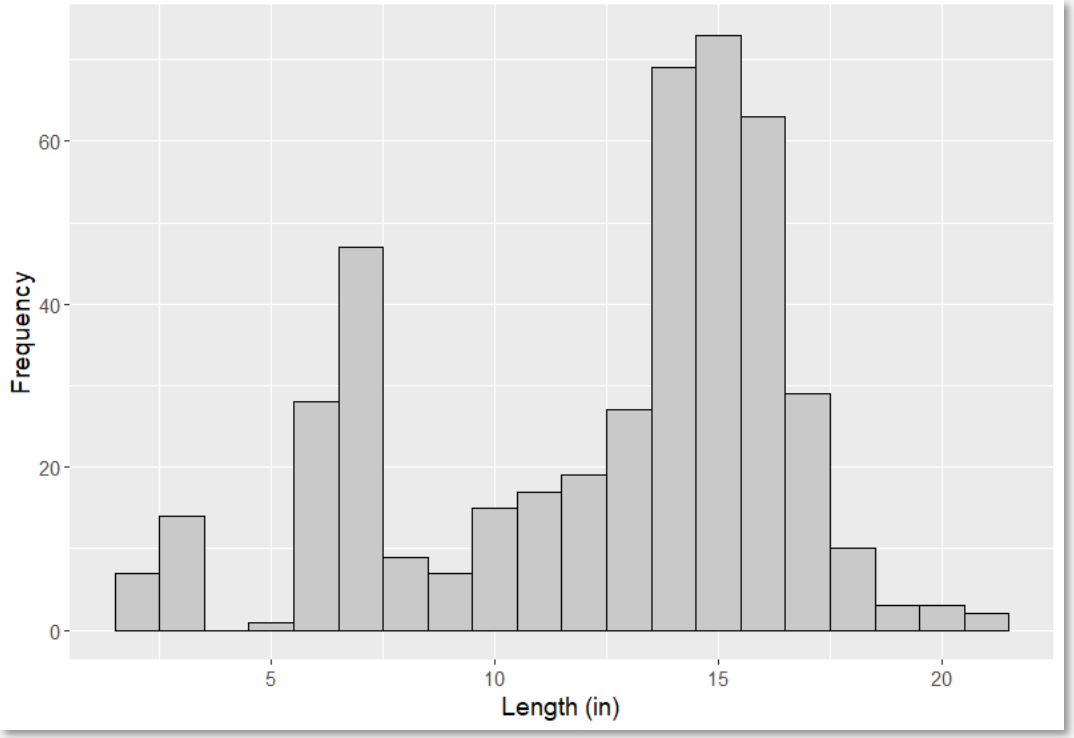
Brown Bullhead

LARGEMOUTH BASS SIZE STRUCTURE

Majority of bass between 10-12 inches



Local lake with multiple size classes of fish

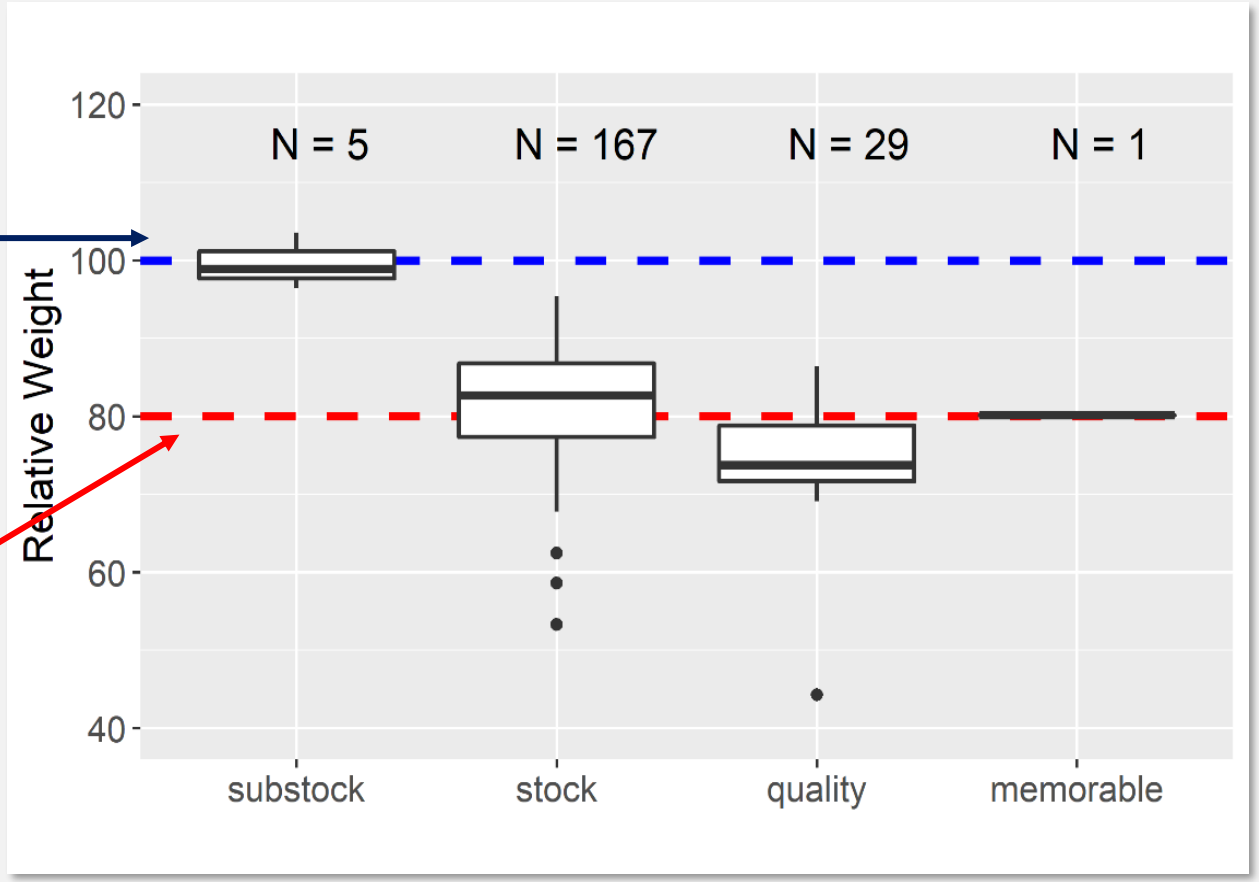


LARGEMOUTH BASS RELATIVE WEIGHT

- Relative weight of largemouth bass low in the stock (8-12 in) and quality (12-15 in) size ranges.

Plump Bass

Skinny Bass



FISHERIES CONCLUSIONS

- Largemouth bass population is overcrowded
  - High abundance
  - One major size class
  - Low relative weight
- Current stocking of baitfish has not translated into bass weight
  - Bass need ~8-10 lbs of food to gain 1 lb of body weight
  - ~150 lbs of fathead minnow, 350 rainbow trout (~0.5 lbs) = 325 lbs of bait.
  - Spread among just the fish we caught = 0.16 lbs of growth per fish
    - Not including yellow perch, crappie and walleye.

- Two potential pathways
  - Remove largemouth bass
  - Embrace other parts of the fishery
    - Great bluegill, pumpkinseed and yellow perch fisheries
  - Depends on what the Roaring Brook Lake Community Values

SUMMARY

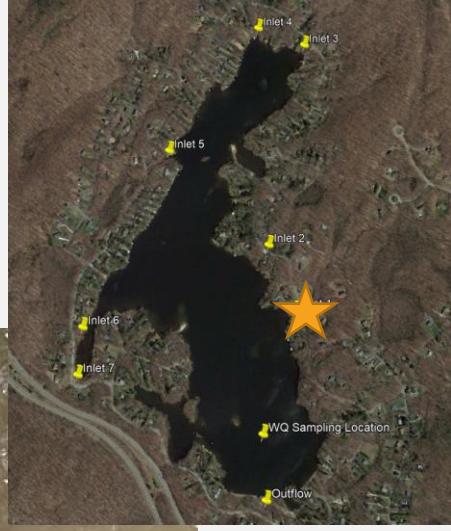
- Internal loading is more important than previously thought
  - 40-58% of total load versus previous estimate of 25%
- Need to consider internal loading control techniques
  - Specifically, phosphorus locking technologies.
  - Circulation can be investigated, but often not as effective at reducing P as phosphorus locking technologies are.
  - Start process early, prepared for when NY approves the use of these technologies
- Focus on watershed fixes while preparing to deal with internal load.
  - Septic system pumpout/inspection and replacement
  - Stormwater fixes (Detailed in 2019 monitoring report)

Addendum:

SPECIFIC RECOMMENDATIONS FOR DRAINAGE SITES AROUND ROARING BROOK LAKE

INLET 1

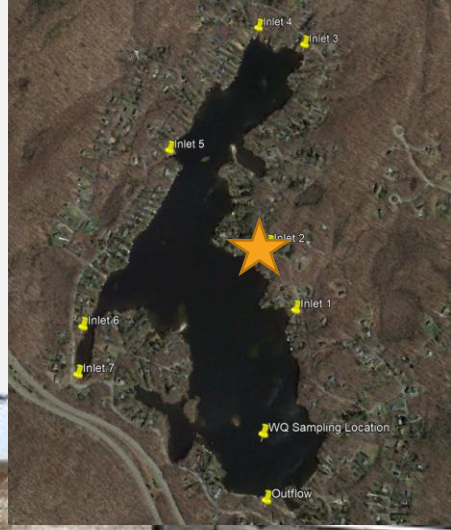
Suggested Action: Look to mitigate runoff from the north and south sections of lakeshore drive. Take samples north of roaring brook rd. to further pin down sources of pollution.



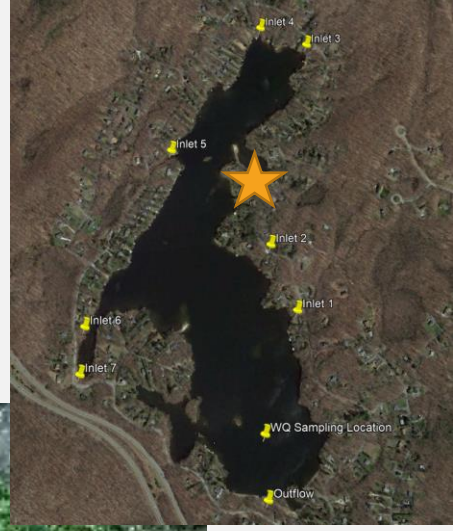
Note the slightly turbid water plume in the stream during a rain event in June 2020.

INLET 2

Suggested Action: Install a sediment filter at the catch basin. This will help trap sediment and prolong filling in the stream before it enters the lake.



ALPINE PLACE



Suggested Action: The catch basin across the street leads into a small dry detention basin before stormwater flows into the lake. Currently, the basin has a significant amount of sediment buildup that can compromise infiltration. This basin should be cleaned out to increase storage capacity.

MOON BEACH

Slightly to the north of moon beach, a pipe with flowing water directly in the lake was discovered with iron flocculant. Most likely this floc is from the pipe corroding over a long period. Water with either high nitrogen or phosphorus concentrations were found flowing out of the pipe on three separate occasions.

Suggested Actions: Contact homeowner where pipe is located to discuss possible remediation actions.

District Access at Inlet 2

The district access at inlet 2 has a bank that is eroding. High water levels and wave action has carved out a part of the bank which will add more sediment into the lake.

The slope of the beach also lends itself to high stormwater flows, especially in early spring, when ground vegetation is not thick and cannot slow down water.

Suggested Action: Repair this erosion by either grading out the slope or putting some sort of retaining wall (stone or earthen) to limit erosion.