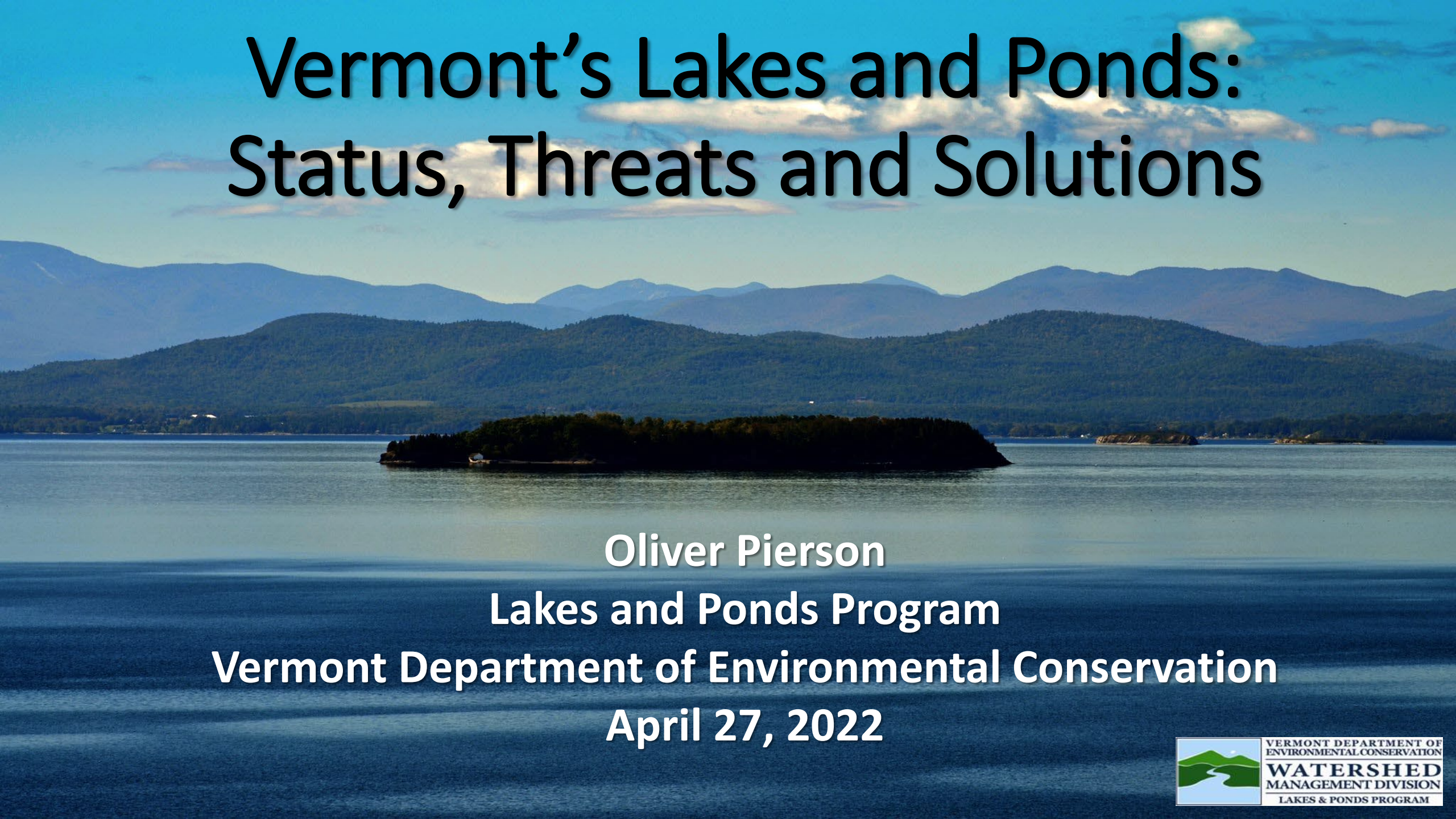
Vermont's Lakes and Ponds: Status, Threats and Solutions



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VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATERSHED MANAGEMENT DIVISION
LAKES & PONDS PROGRAM

Presentation Overview

1. Status of Vermont's Lakes & Ponds

2. Principal Water Quality & Lake Management Challenges

3. Existing VT DEC Efforts to address challenges

4. Solutions / Recommendations for VT Legislature

Quick Summary

VT has 800+ Lakes and Ponds, 447 greater than 10 acres

Vermont's lakes & ponds in decent shape, but many at risk of water quality impairment & habitat loss, variety of threats

Most comply fully with VT's Water Quality Standards

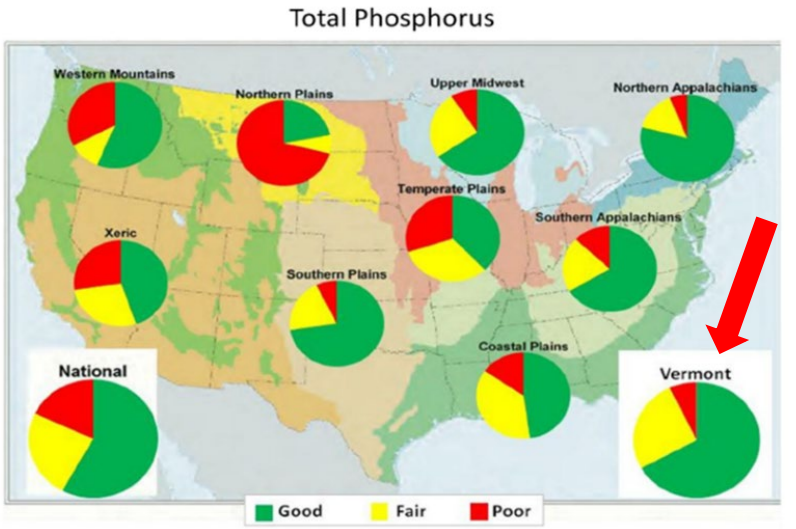
Formally Impaired (23 lakes and ponds)

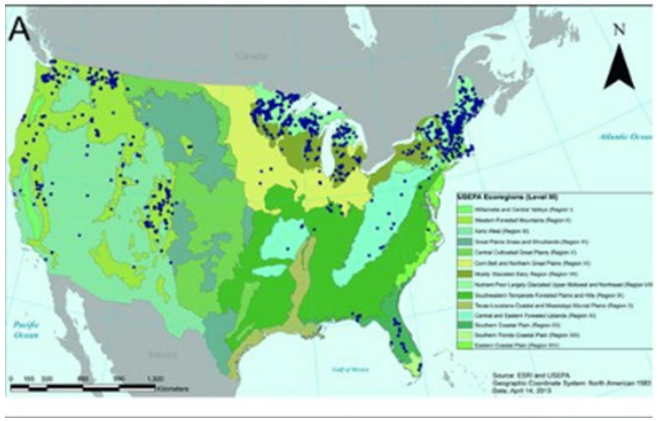
- Champlain: Phosphorus, Mercury & PCBs in fish
- Carmi & Memphremagog: Elevated Phosphorus, TMDLs
- Acid Lakes: 12 acid sensitive lakes
- High Mercury in Walleye: Arrowhead, Salem, Chittenden
- Five High Phosphorus Ponds (Shelburne has a TMDL)
- *50+ lakes and ponds **altered** by invasive species*

Data doesn't support "all lakes are in crisis" idea but threats are growing, concerted action needed to maintain WQ

Status of Vermont's Waters

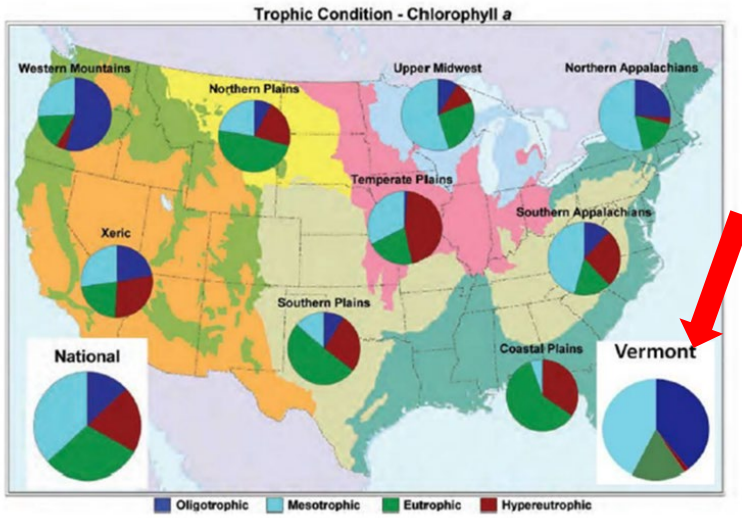
Vermont is stewarding lakes with a high proportion in "Good Condition" for phosphorus



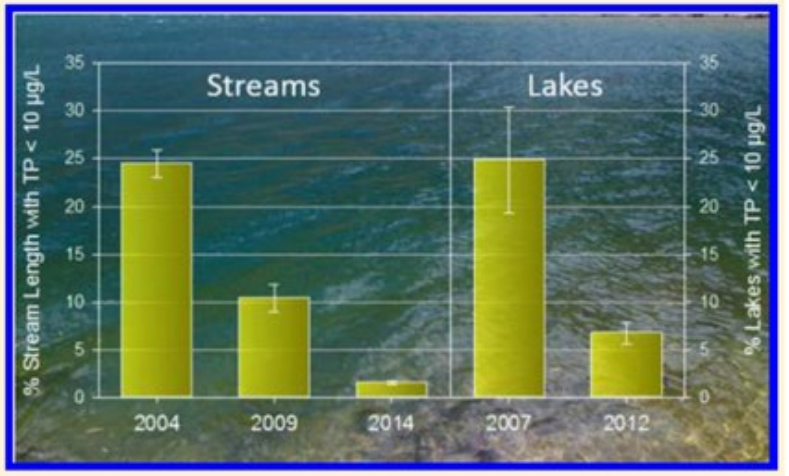


Vermont is stewarding some of nation's clearest lakes; Stephens et al., 2015

2017 data: Vermont stewarding a higher proportion of low nutrient lakes than rest of USA except Western Mts



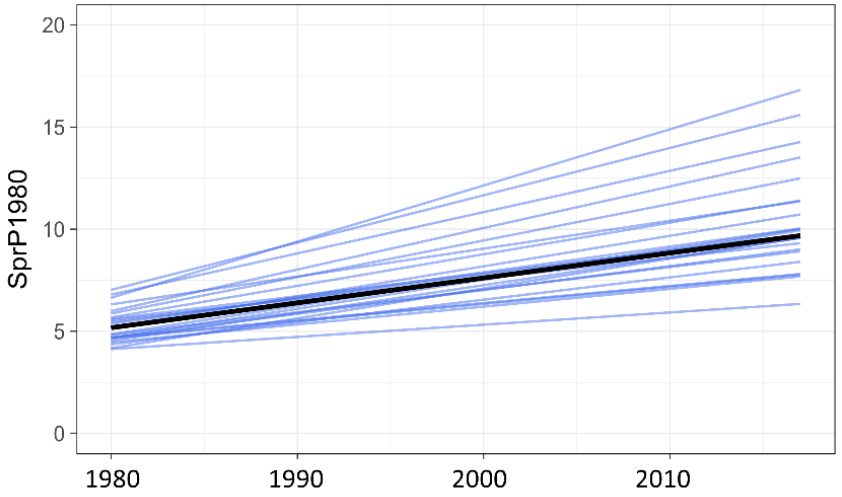
Changing Trophic Status in Lakes



Lakes are classified into trophic levels based on amount of available nutrients in water that support productivity

2017 National Lakes Assessment Data:

- USA Eutrophic: **2007** around half; **2017** around 2/3; VT around 1/6
- Today, only 10% of the Nation's Lakes are Oligotrophic; VT around 30%

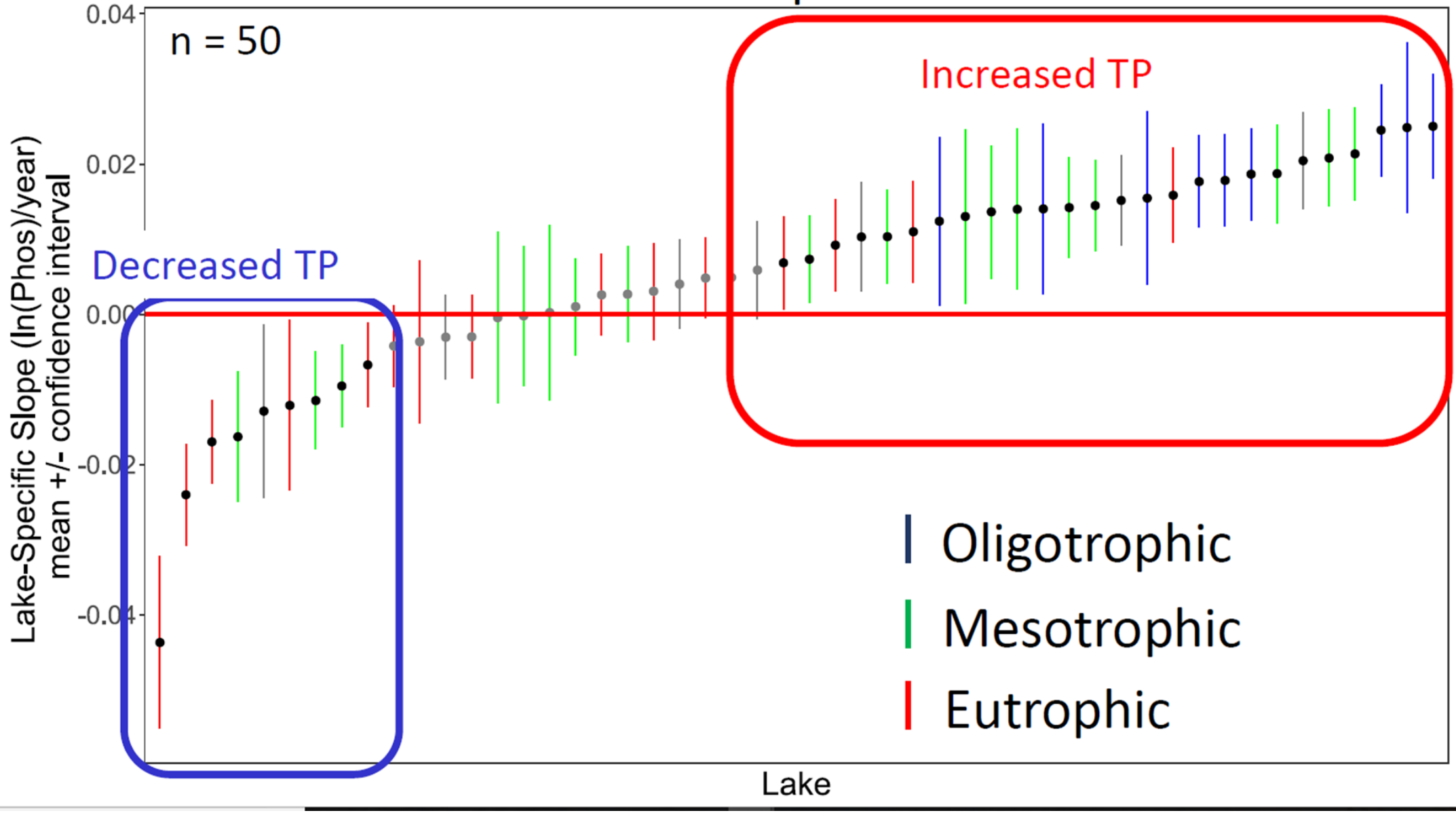


Vermont's **oligotrophic lakes** have seen significant increases in TP over the period from 1980-2017

Table 1. Percentages of Lakes for Which Spring or Summer TP is Predicted to have Increased, Decreased, or Remained Stable (No Change) Based on the Linear Mixed Effects Model.

	Increased (%)		Decreased (%)		No Change (%)	
Trophic Status	Spring TP	Summer TP	Spring TP	Summer TP	Spring TP	Summer TP
Eutrophic	0	0	8	6	92	94
Mesotrophic	38	90	0	0	62	10
Oligotrophic	100	100	0	0	0	0

Summer Total Phosphorus Trends



Changing Trophic Status in Lakes

- Increased nutrients (P) bolster aquatic invasive plant infestations
- AIS present in 100+ lakes, new infestations increasing annually

Changing Trophic Status in Lakes

What is driving these changes?

- Land Use / non-point source pollution -> cultural eutrophication, cyanobacteria
- Climate Change -> increased runoff & heat, more productive waters
- Development (shorelines) -> cultural eutrophication and habitat loss
- Increased use of lakes & ponds -> spreading AIS, habitat damage, shore erosion

How do we know this?

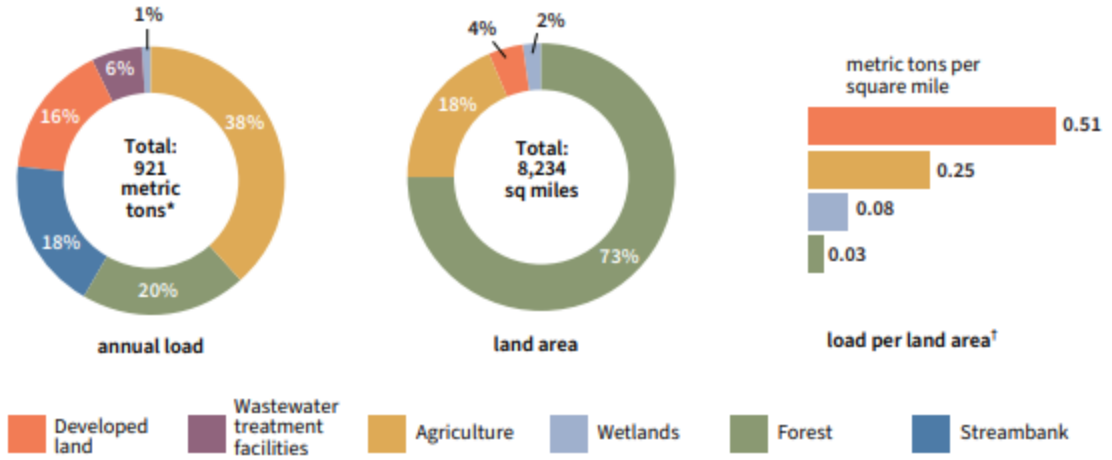
- Importance of monitoring and assessment

Lake Champlain Monitoring	Inland Lake Monitoring	Cyanobacteria Monitoring & Tracking	Aquatic Invasives Monitoring	Sentinel Lake (Climate Change) Monitoring
TMDL Monitoring			Supplemental Monitoring	

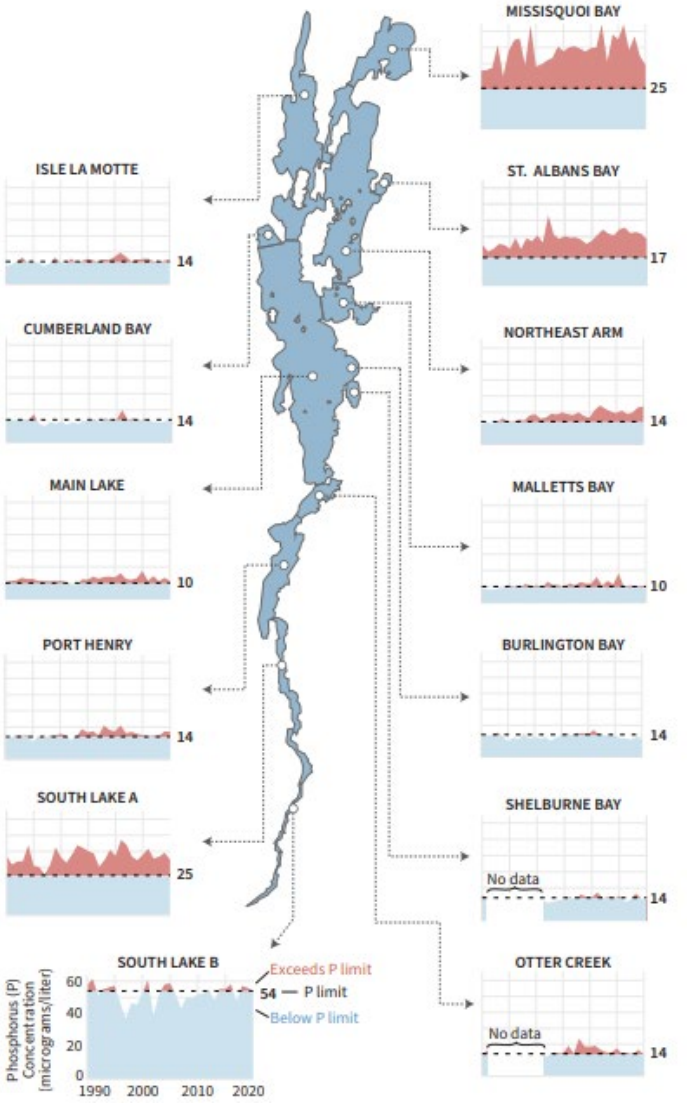
Principal Water Quality & Lake Management Challenges

Phosphorus: principal source of impairment, limiting nutrient for productivity

- Impacts
  - Accelerated growth of aquatic plants, including invasives & nuisances
  - Reduced clarity, can lead to reductions in oxygen
  - Increased growth of blue-green algae, can lead to cyanobacteria blooms
  - Increasing P in oligotrophic lakes, altering their characteristics
  - Has been shown in two UVM studies to negatively impact property values
- Sources
  - Non-point source pollution
    - Agriculture
    - Runoff from developed land
    - Streambank erosion / forestry

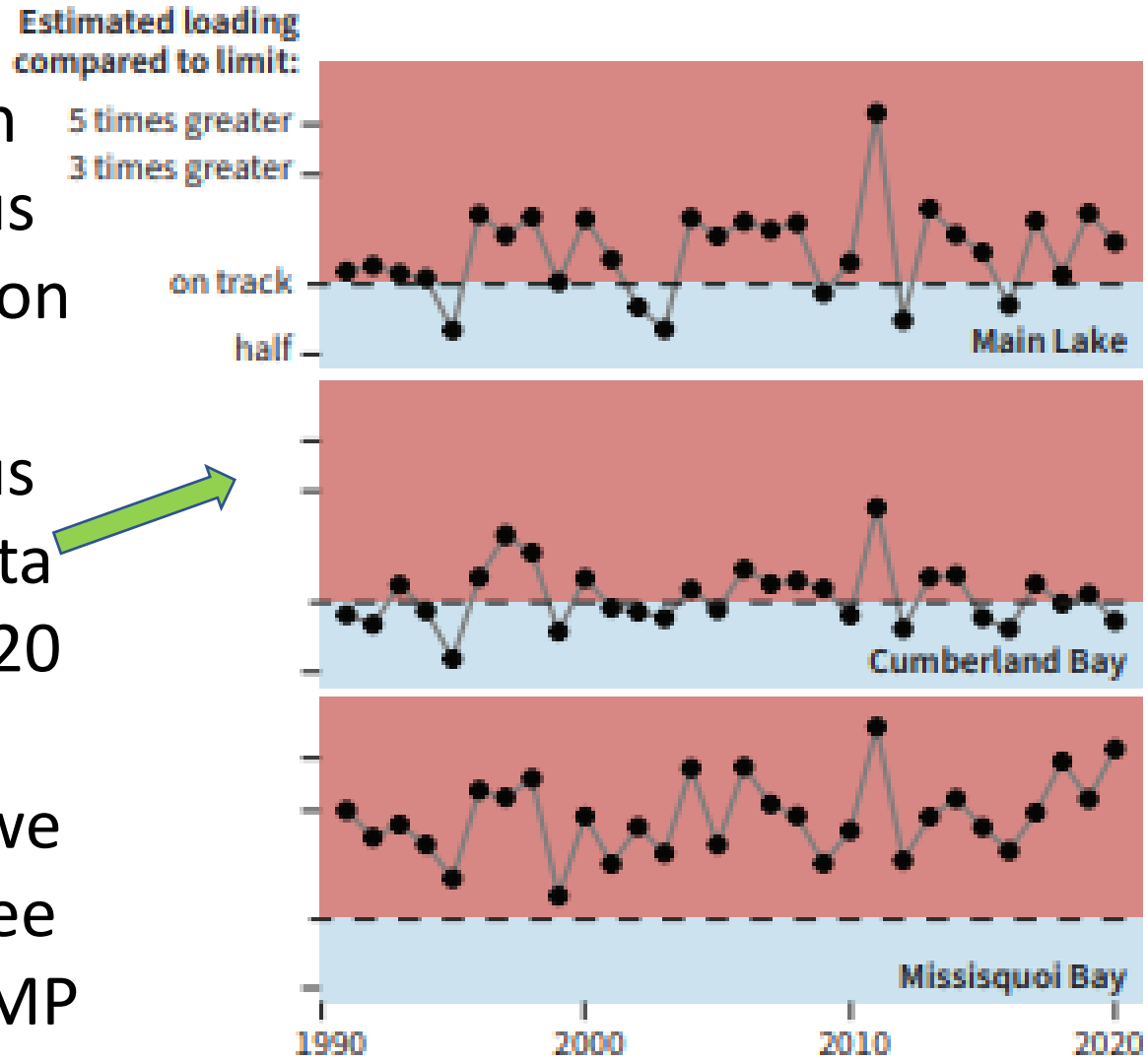


Principal Water Quality & Lake Management Challenges



Lake Champlain Phosphorus Concentration and Phosphorus Loading Data through 2020

When can we expect to see impact of BMP implementation?



Principal Water Quality & Lake Management Challenges

Blooms in 2021:

- 8 lakes w/ high alert blooms (vs. 9 in 2020)
- 12 lakes w/ low alert blooms (vs. 11 in 2020)
- NE Arm of Lake Champlain has a deteriorating trend
  - St Albans & Missisquoi Bay had persistent issues
- Lake Memphremagog had highest # of recorded blooms
- Lake Carmi had extended period of blooms (July-Oct)

Why are we concerned about blooms?

- Blooms can be toxic
- Blooms limit or prevent recreation
- Blooms negatively impact aquatic habitat
  - Reduce oxygen & light, can lead to fish kills

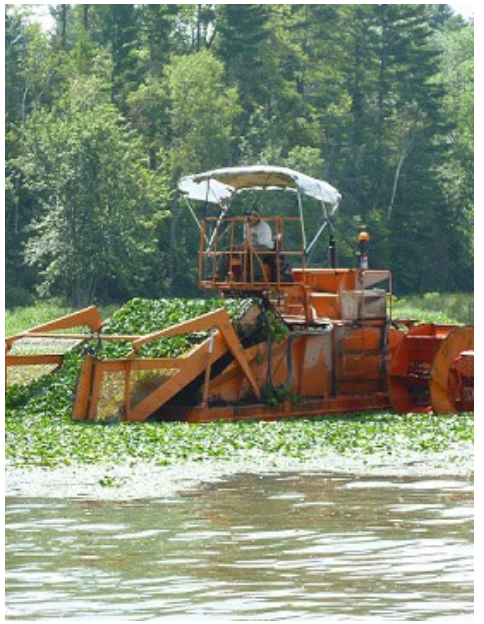
Principal Water Quality & Lake Management Challenges

- Aquatic Invasive Species (AIS) are non-native species that harm the environment, the economy, or human health
- Lake Champlain has 51 species of AIS, with more on the way (Round Goby)
- AIS are found in over 100 inland lakes, with milfoil the predominant concern

Principal Water Quality & Lake Management Challenges

Why are we concerned about AIS?

- EW Milfoil and water chestnut quickly reach nuisance levels, preventing recreation & navigation, crowding out native species, and removing oxygen
- Zebra mussels, Spiny waterfleas and Asian clams negatively impact aquatic food webs: filter out plankton needed by native species (mussels)
- AIS clogs and impacts in-water infrastructure & recreational watercraft, and drastically limits fishing opportunities
- AIS can lower property values, cause an economic hardship on overburdened municipalities, and reduce tourism



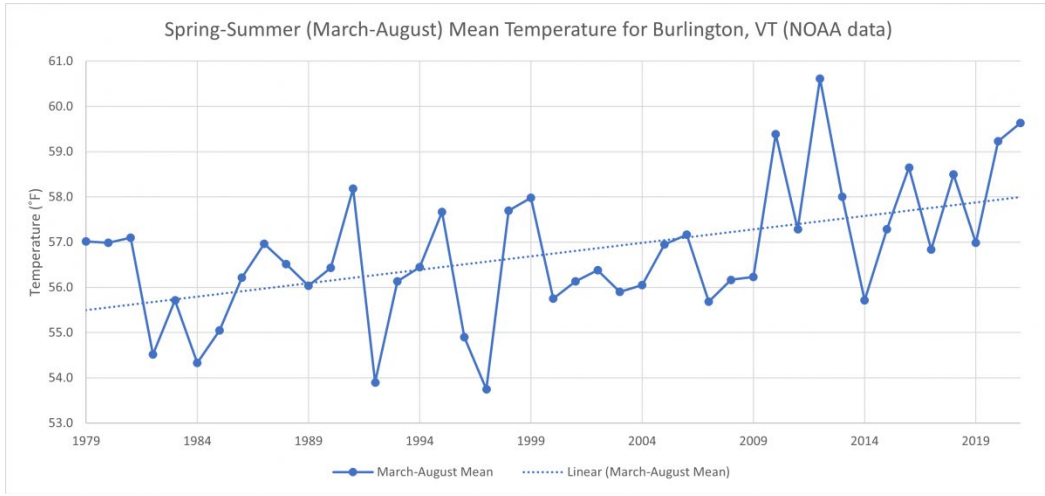
Principal Water Quality & Lake Management Challenges

Development & Land Use

- Non-point source pollution from agricultural sources is largest P source
  - Manure, fertilizer, and tile drains remain large sources of dissolved P
  - After a storm, 35-acre tiled field has P load similar to daily WWTF load
  - Due to legacy P, it will take time for land BMPs to show impact in lakes
- Lakeshores remain most densely settled part of Vermont (houses / sq mile)
  - Runoff from impervious & cleared areas can be principal nutrient source
  - Leaky & overused septic an issue, especially for low-nutrient lakes
- Point Sources (WWTF) & Roads remain a P loading issue, w/ improvements
- Forestry operations and stream bank erosion can be site-specific issues
  - Account for 20% and 18% of P loading to Lake Champlain respectively

Principal Water Quality & Lake Management Challenges

- Climate Change:
  - Longer & warmer summers, less ice, more intense storms & drought
  - Can increase release of legacy phosphorus from lake sediments
  - Can increase algae and plant growth (warmth + nutrients + calm)
  - Will be challenging for certain species to adapt to (cold water fish)



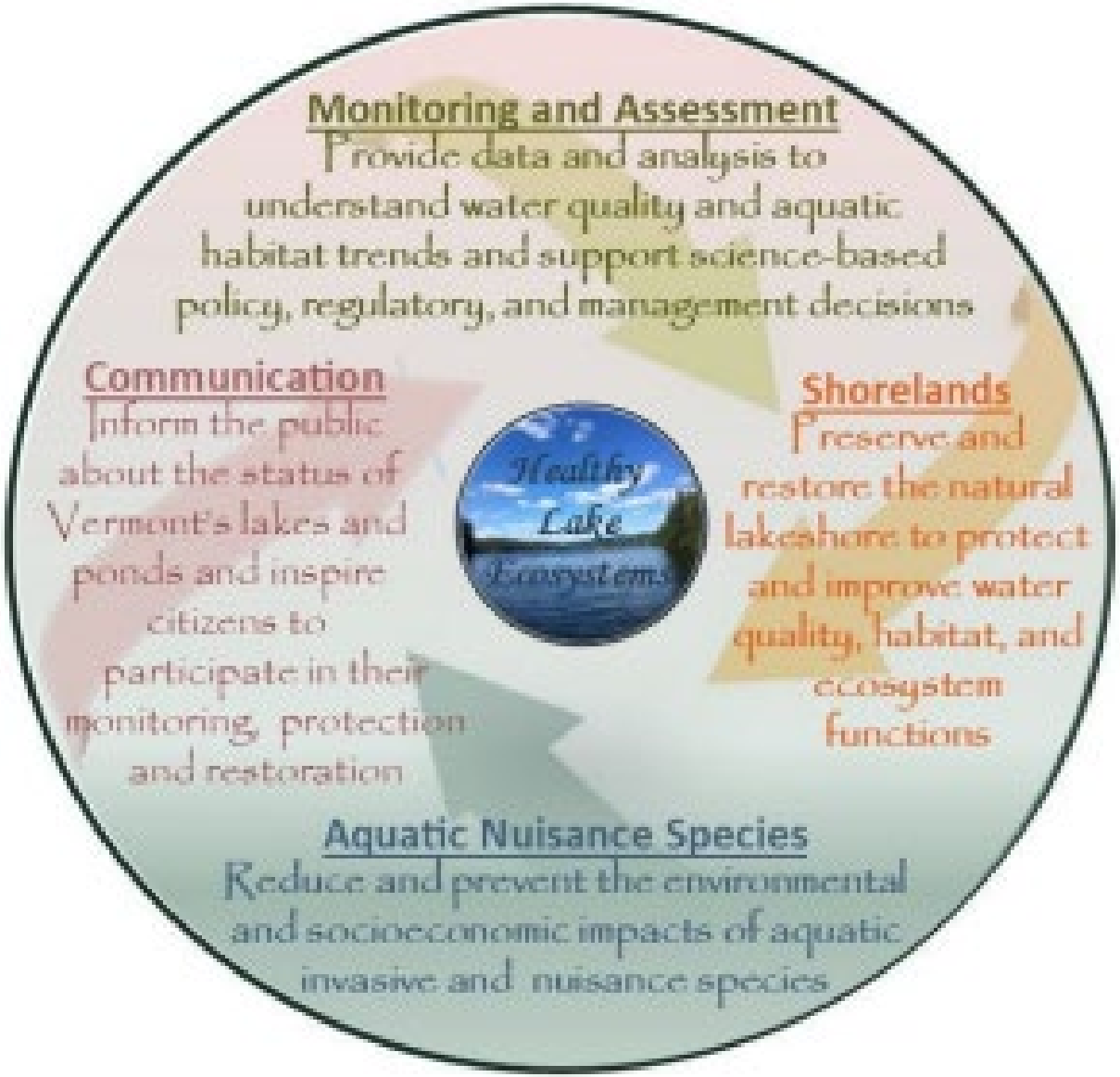
- Contaminants of Emerging Concern
  - PFAS in lakes & rivers found to be very limited and below VT advisory (2021)
  - Pesticide Monitoring in Champlain

Existing VT DEC Efforts to address challenges

Mission: To protect and restore ecosystem health of Vermont's lakes and ponds so that these water bodies maintain a range of uses for Vermonters

Priorities:

- Monitoring & Assessment
- Shoreland Protection
  - Lake Wise & BMPs
- Aquatic Invasive Species Prevention
- Regulatory Work
- Outreach: data & key messages

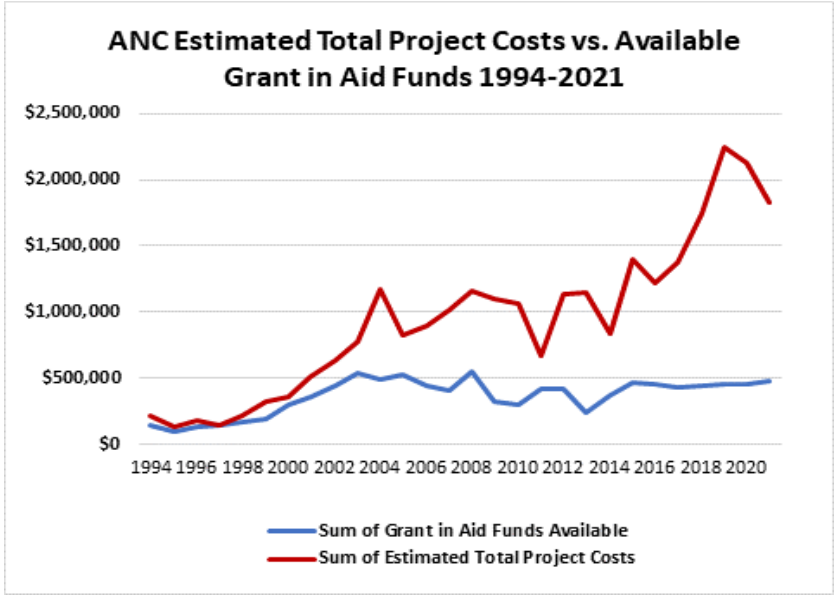


Existing VT DEC Efforts to address challenges

Initiatives

- Lake Watershed Action Plans (lake w/ increasing phosphorus)
- Increased Protection via Lake Reclassification to A(1)
- Possible Regulation of Wakeboats (H503)
- Improving info on Use of Public Waters Rules
- Septic Monitoring on low-nutrient lakes
- Herbicide Minimization (but not elimination)
- Future rulemaking: revisions to two rules on water levels
- Improving guidance / procedures for lake regulation
- Biocriteria for aquatic habitat use under VT Water Quality Standards

Recommendations for Legislature



- Support for Aquatic Invasive Species: Motorboat Registration Funding and Federal Grants have plateaued, little GF, inadequate to meet needs
- Cyanobacteria: Support ANR/VDH Response Plan
- Carmi: Continued support from Legislature
- Memphremagog: Increased funding for BMPs & Tributary Monitoring
  - Need could be met via Act 76
- Support additional water quality and aquatic habitat monitoring
  - Federal funds are maxed out, VT Clean Water funds have tight limits
  - Need to determine impact of BMPs, emerging threats (climate change, PFAS)
- Make voluntary Shoreland Erosion Control Certification Training **mandatory**

Thanks for your support!