

Road Salting: Pros and Cons, Impacts and Challenges

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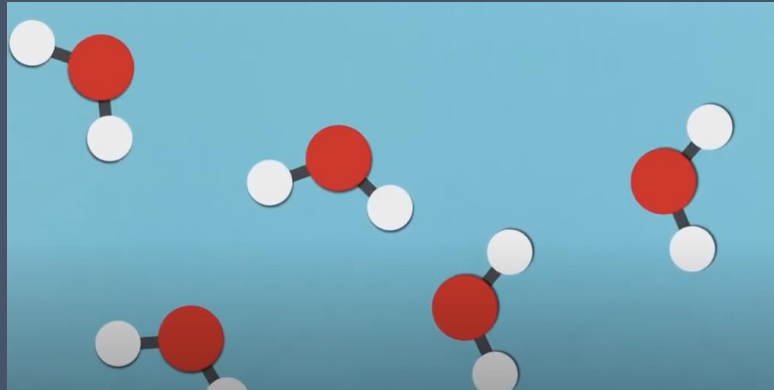
Extension Assistant Professor

Rubenstein School of Environment and Natural Resources

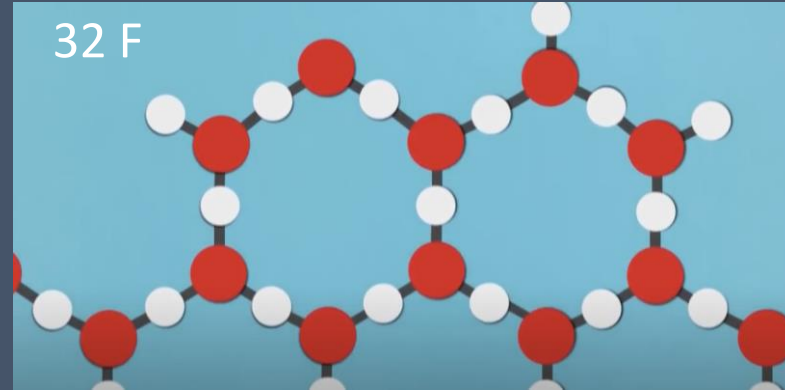
University of Vermont



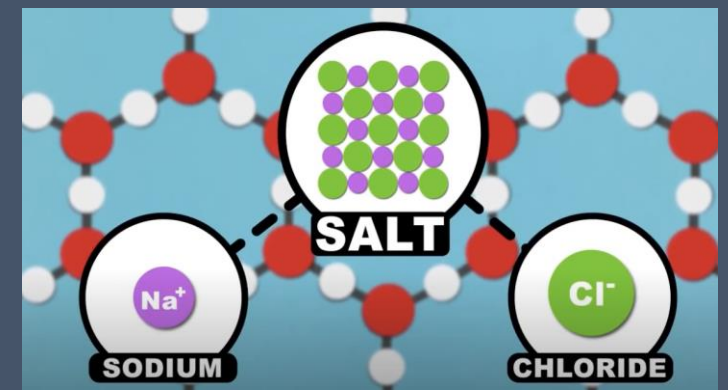
Salt decreases the freezing point of water



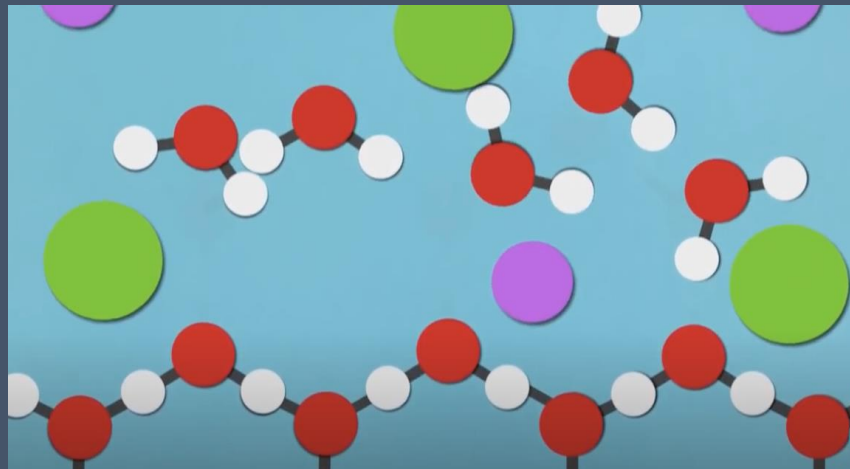
Water



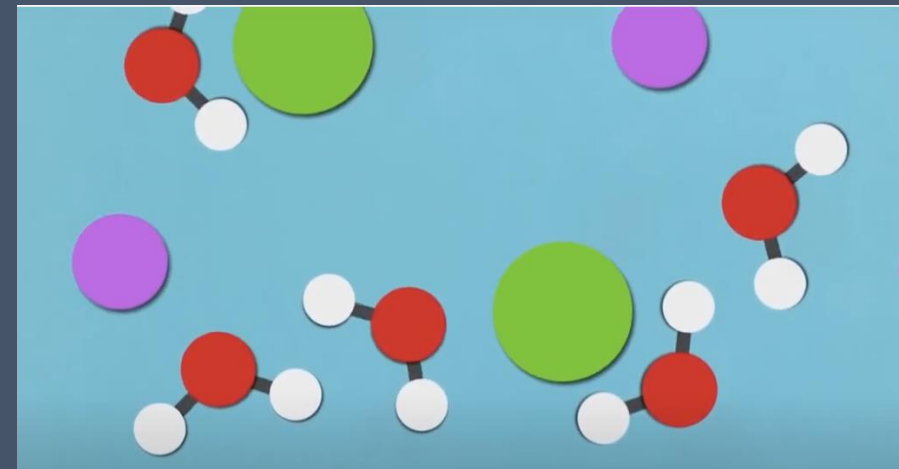
Ice



Salt breaks apart into Na and Cl when it mixes with water



Na and Cl move in between water molecules and disrupt them from forming ice



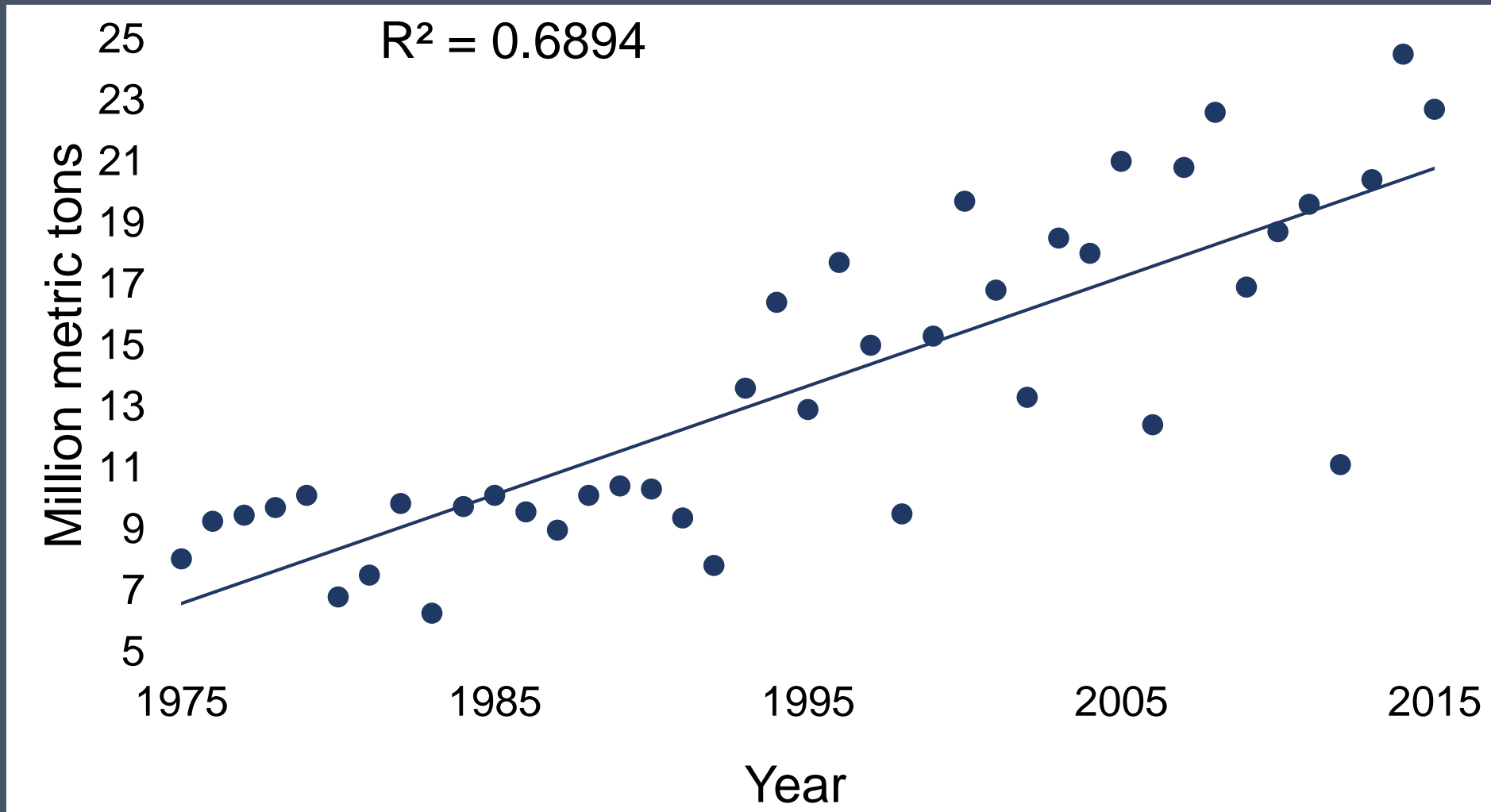


The Good Old Days



- **1941-First direct application of salt in US was on NH roads**

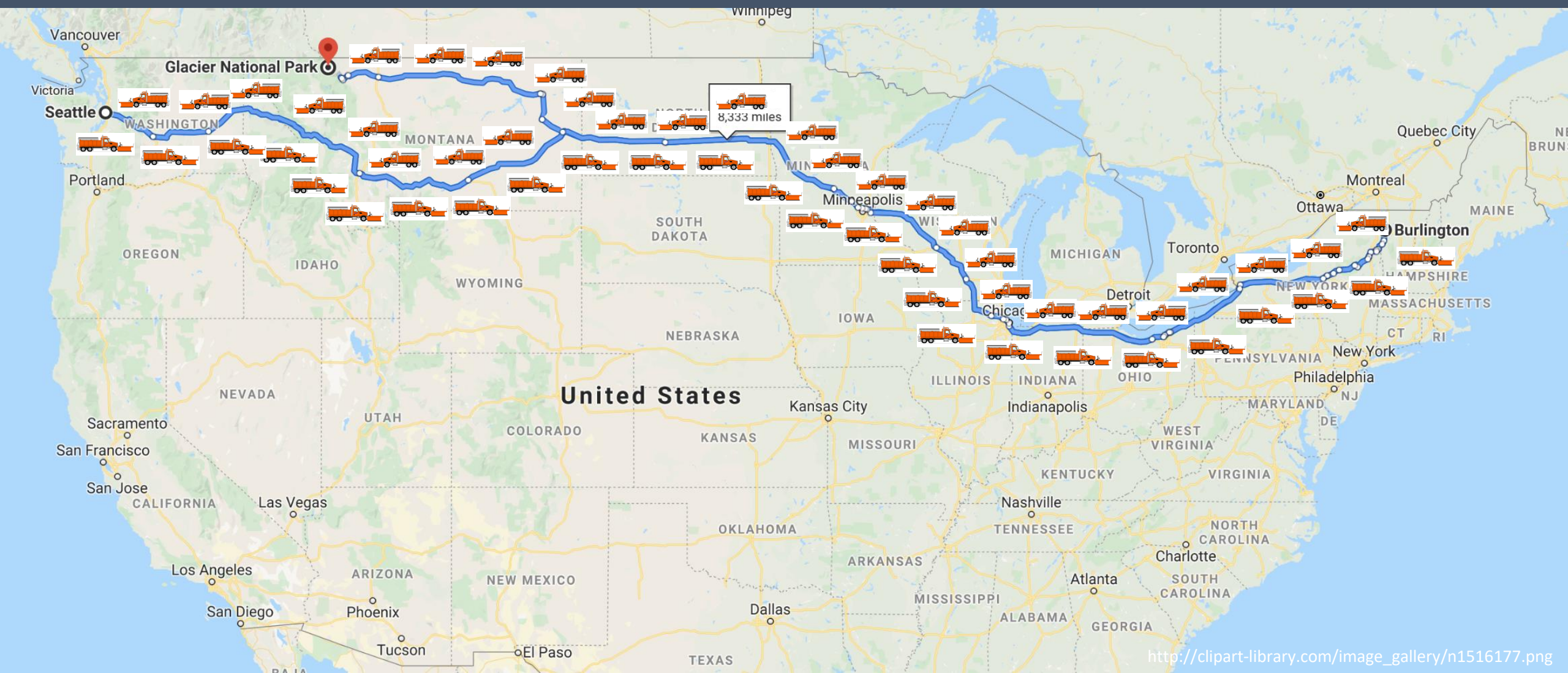
Road salt use in the United States has continued to increase over time



1975-2003

- US road surface increased 6%
- Salt use increased 43%

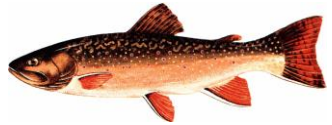
At least 20 million metric tons of salt are spread annually in the U.S.



So what's the problem?

- Environmental
- Economic
- Social

Salt impacts the environment in many ways



Chloride is toxic to fish and other aquatic life

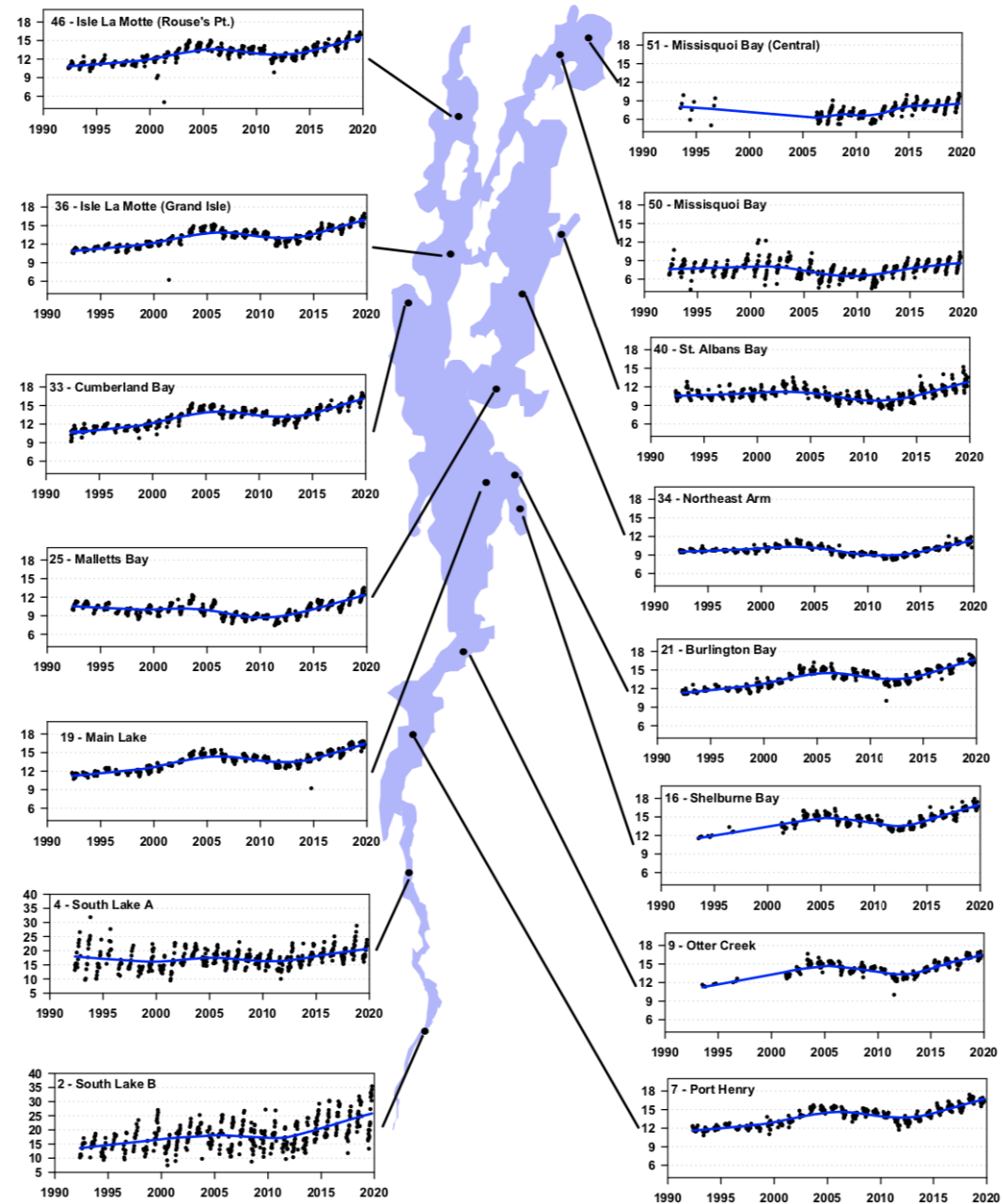
- Acute (860 mg/L)
 - Not more than 1x/ in 3 yrs
- Chronic (230 mg/L)
 - 4-day average can't exceed



Annual chloride concentrations are increasing in most Lake Champlain tributaries

Source: Lake Champlain Basin Program

Annual chloride concentrations (mg/L) in Lake Champlain, 1992 - 2019
Blue lines indicate trends over time as determined by Lowess smoothing analysis



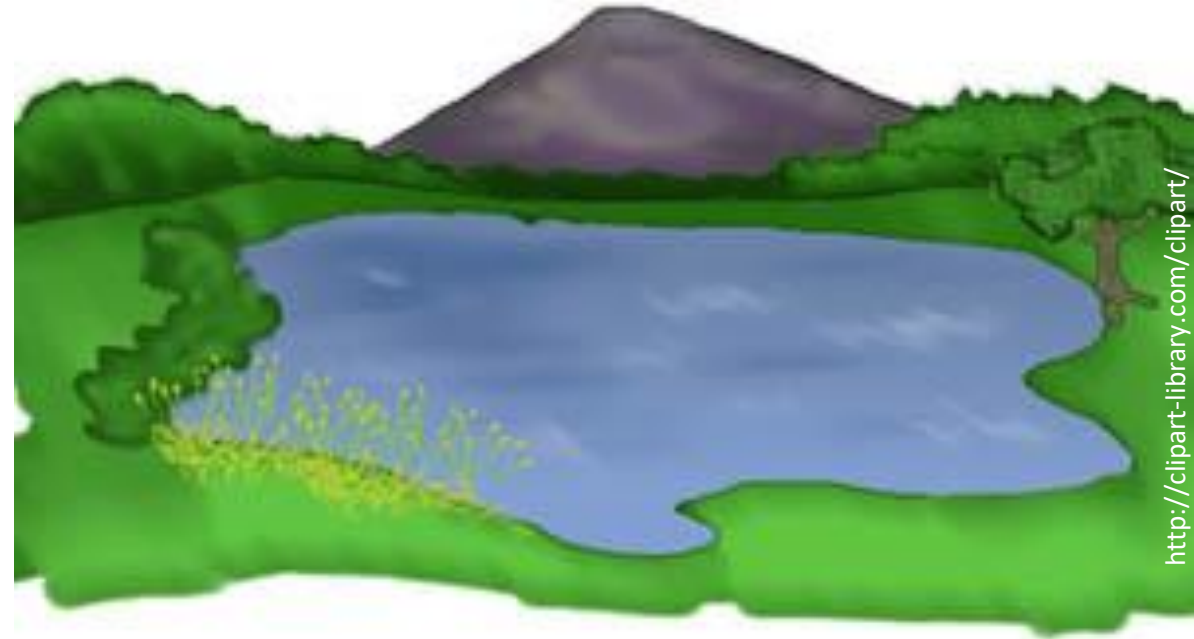
Currently, Vermont has four stream segments listed as impaired for chloride

- Muddy Brook tributary #4 - Williston
- Tributary to tributary #4 - Williston
- Sunnyside Brook (Trib #8 to Sunderland Brook) - Colchester
- Blanchard Brook - Montpelier

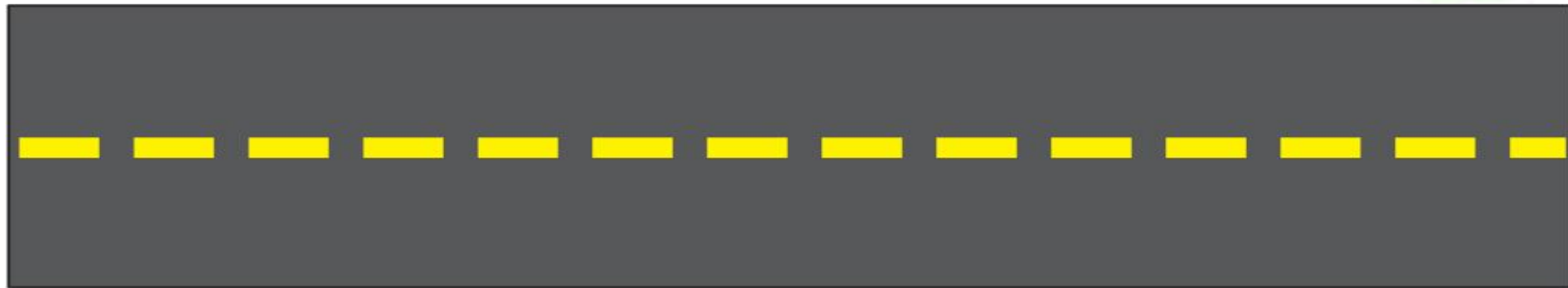
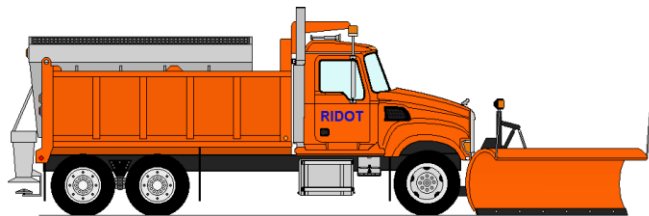
A pollution diet, called a *total maximum daily load* will need to be determined for each stream to clean it

Environmental Challenge: Chloride can affect natural lake processes

- Prolonged periods without oxygen on lake bottom (anoxic)
- Inhibit natural seasonal mixing

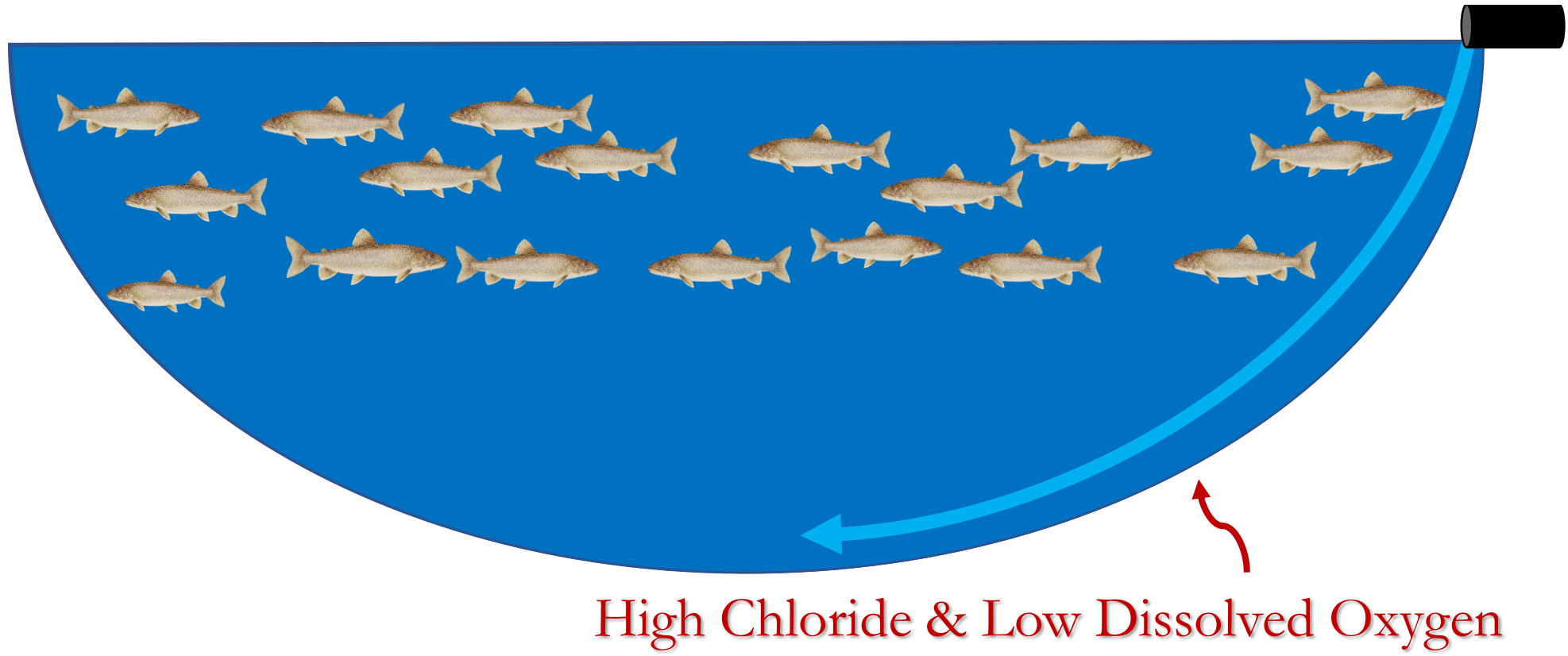


<http://clipart-library.com/clipart/>



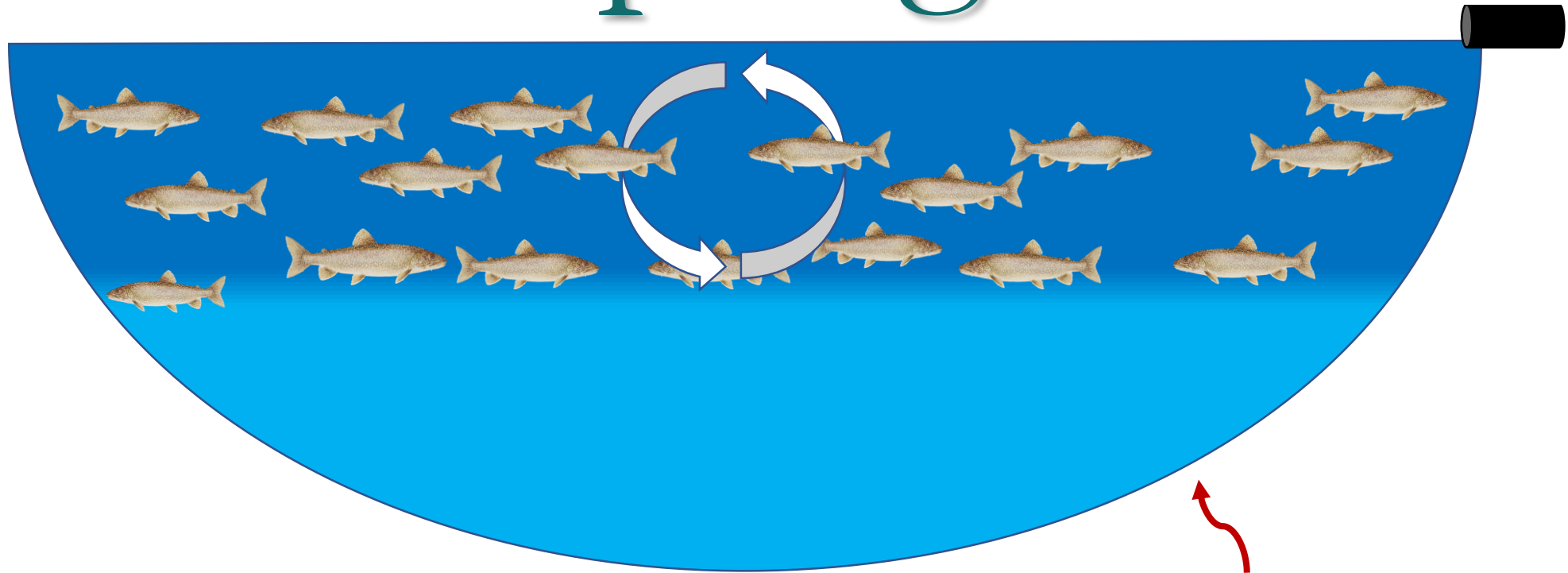
Mirror Lake in Lake Placid, NY

Winter



Mirror Lake in Lake Placid, NY

Spring

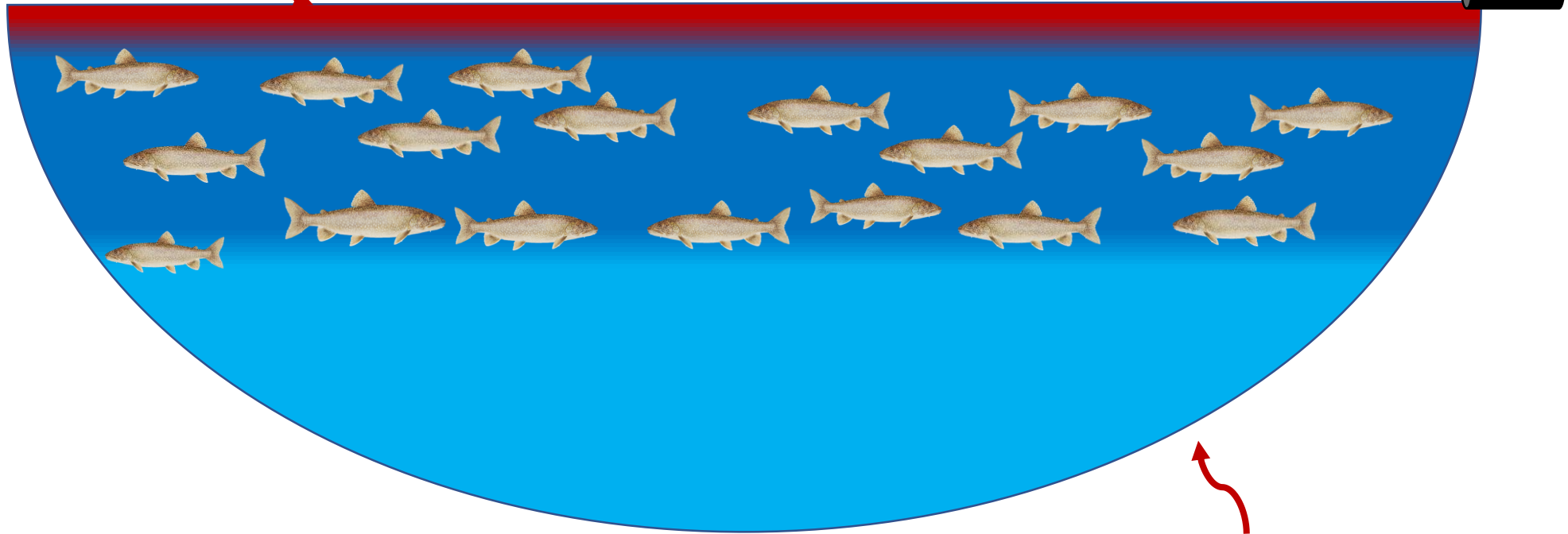


High Chloride & Low Dissolved Oxygen

Mirror Lake in Lake Placid, NY

Early Summer

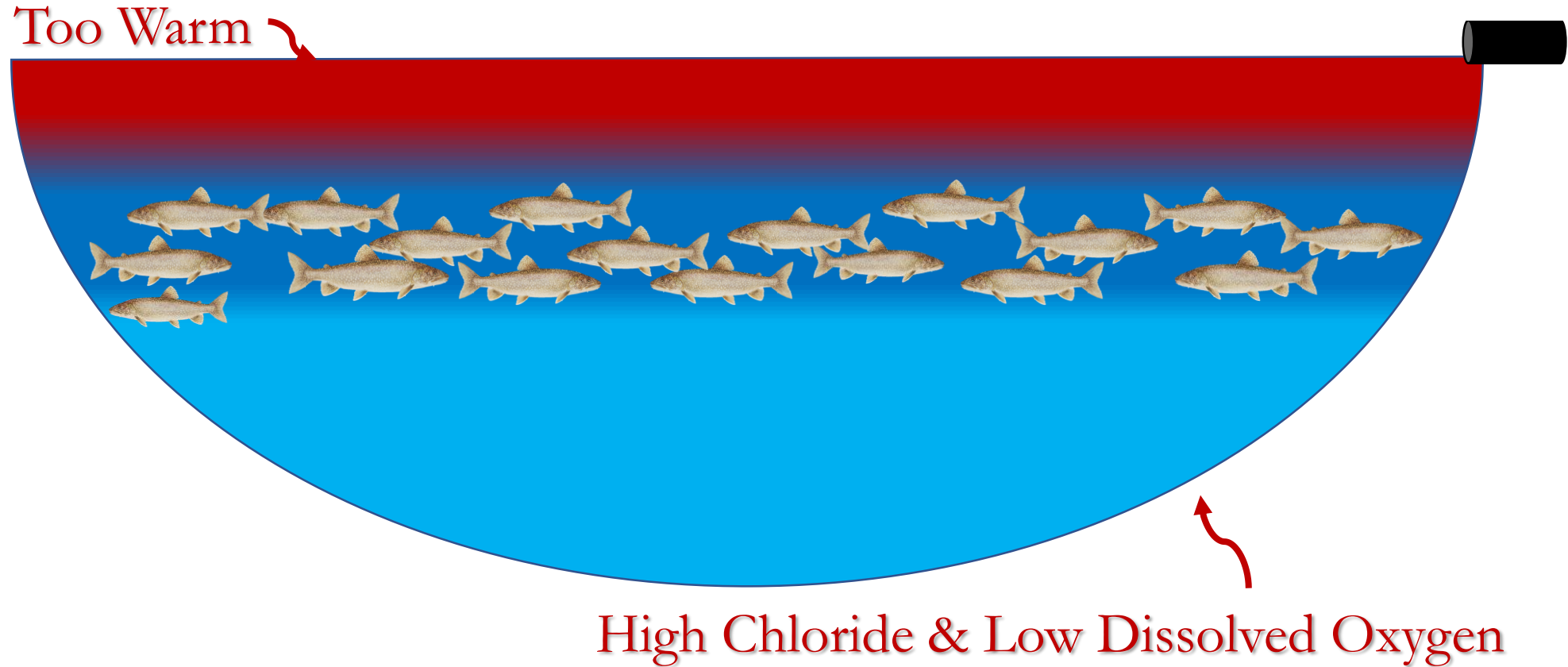
Too Warm ↘



High Chloride & Low Dissolved Oxygen ↗

Mirror Lake in Lake Placid, NY

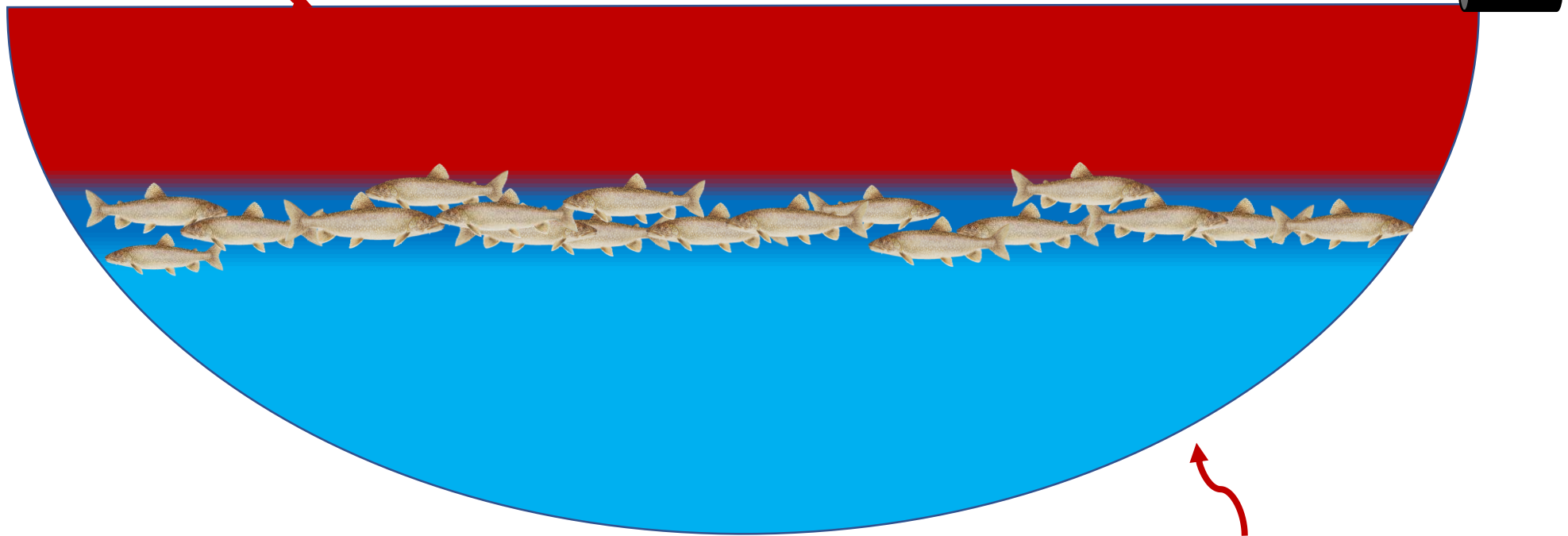
Mid Summer



Mirror Lake in Lake Placid, NY

Late Summer

Too Warm ↘



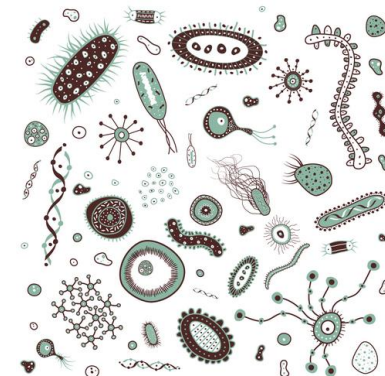
High Chloride & Low Dissolved Oxygen

Environmental Challenge: Roadside vegetation and soils can be impacted

- Kill roadside plants
- Change soil microbe communities
- Decrease soil permeability
- Reduced soil ability to hold water
- Release toxic metals



<https://www.lzgardener.com/blog/2015/10/7/salt-bad-for-you-bad-for-your-yard>



<http://clipart-library.com/clipart/>

Environmental Challenge: Road salt has contaminated groundwater

- Drinking water sodium levels too high (salt = sodium chloride)
- Leaching from groundwater into pond



MDOT Low Salt Designation, I-93 Andover

Economic Challenge: Road salt degrades infrastructure

- \$8 billion/year in infrastructure damage
- Shortened lifespans
 - Bridges
 - Pipes
 - Buildings
 - Vehicles



Economic Challenges

Liability

- Average cost per person for winter slips and falls: \$33,000 - \$48,000
- \$34-\$40 billion/yr cost in lawsuits (all types of falls)



Social Challenges

- Safety
 - Need to maintain safety (by using salt)
 - Need to maintain safety (by keeping bridges functioning)
- People's expectations for road conditions
 - Changing behaviors is hard
- Concerns about vehicle corrosion due to chosen practices



Pbase.com

Best practices
can help reduce
use of salt



Anti-icing – treating surfaces ahead of a storm

- can reduce salt use 25-40%
- is less corrosive
- Up to 137% return on investment



Changing expectations can help limit use of salt.

Slow down!

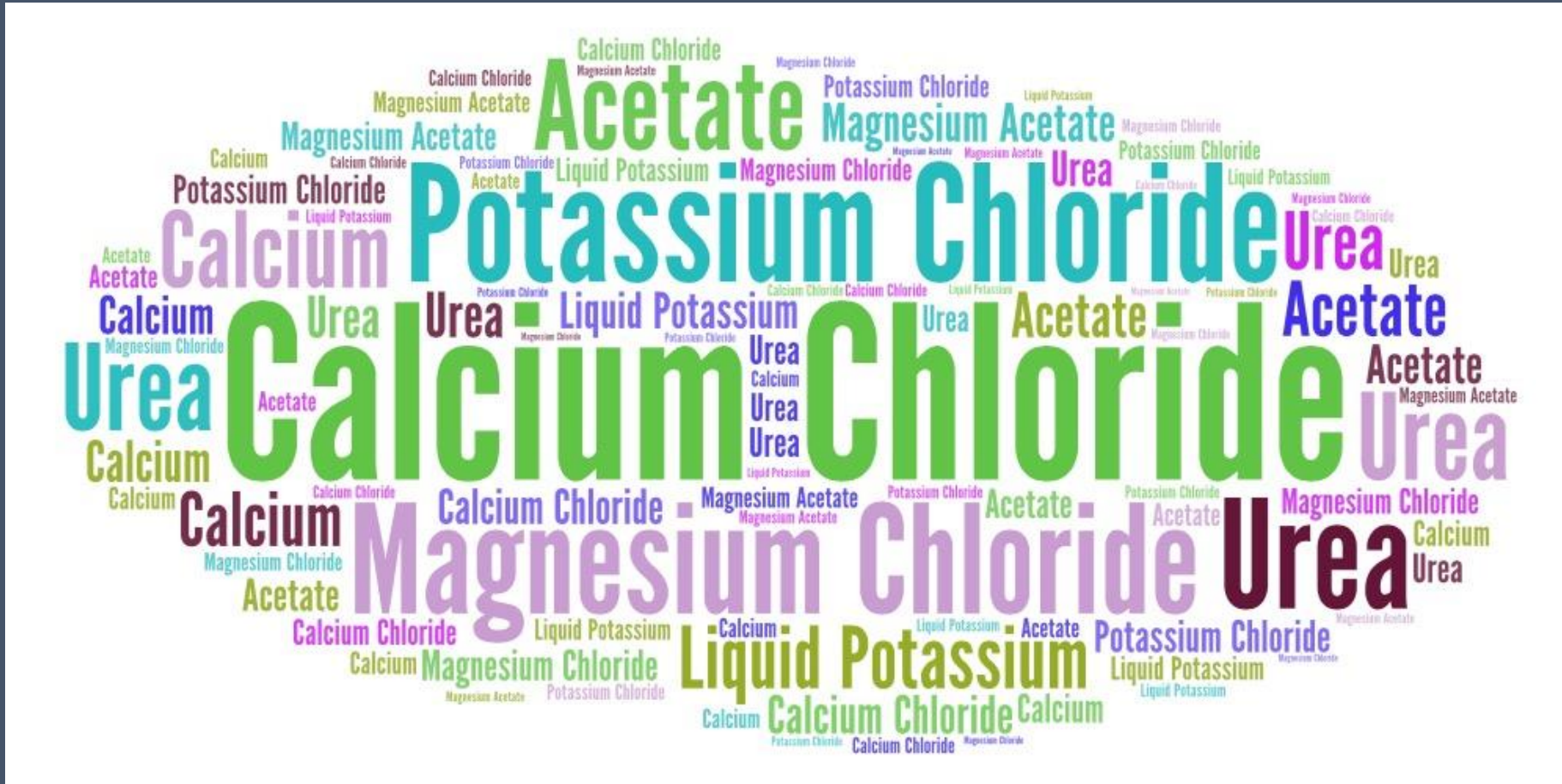
Vermont: “Safe-roads-at-safe-speeds”



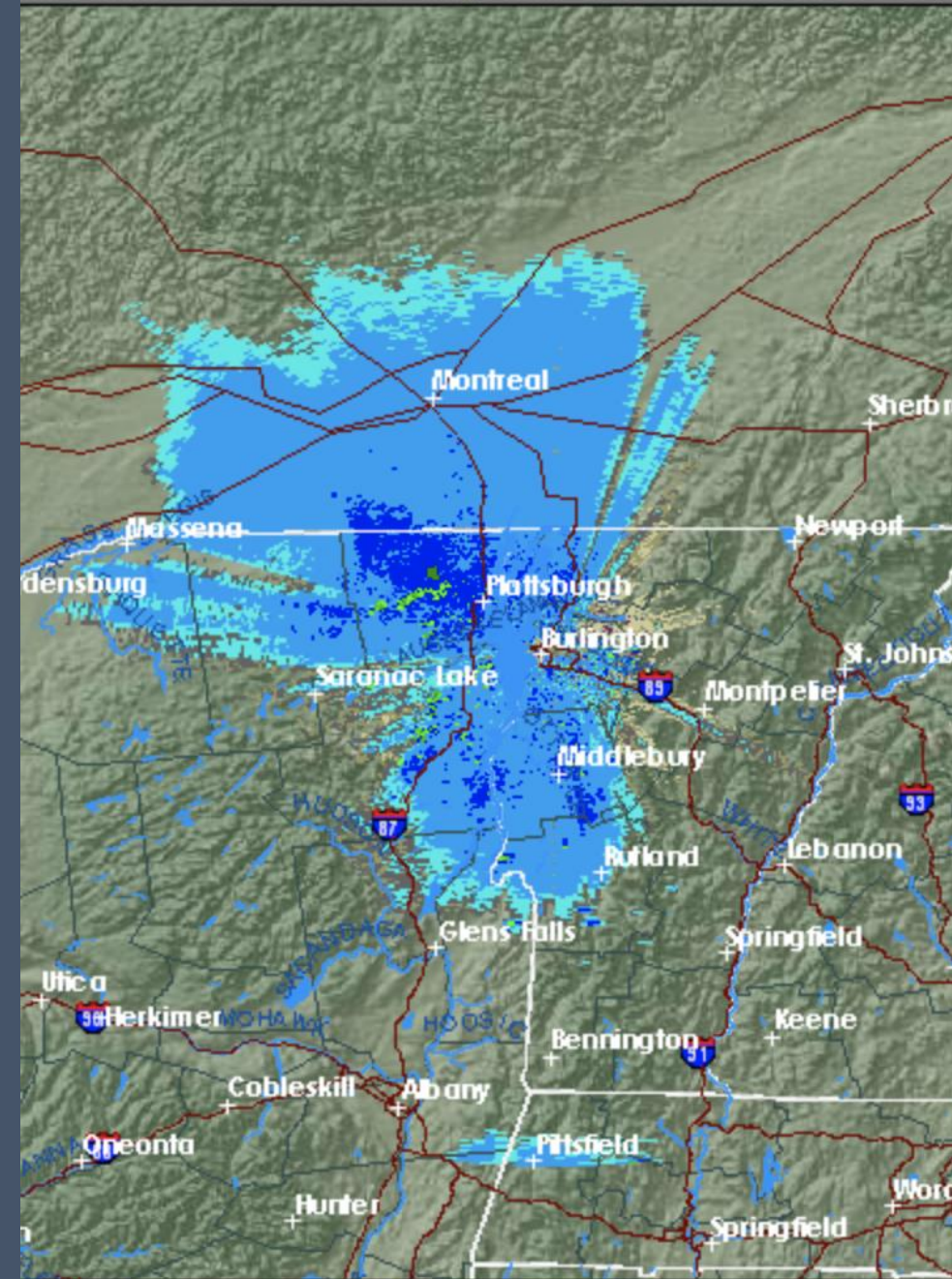
Calibrating
equipment and
tracking salt use to
know how much salt
is being released
helps minimize its
use



Use alternative deicers



Use weather forecasts
and an infrared
thermometer to plan



Even homeowners can
use best practices

Shovel early and often





Read the bag!

<https://www.cambridgema.gov/>

Sweep up extra salt and reuse in another storm



Use a handheld spreader and ensure no less than 3" between grains



Ask your contractor to limit
salt use



What questions do
you have?



Are there specific challenges that you (as local decision makers) face or are you aware that your road crews face related to salting?

