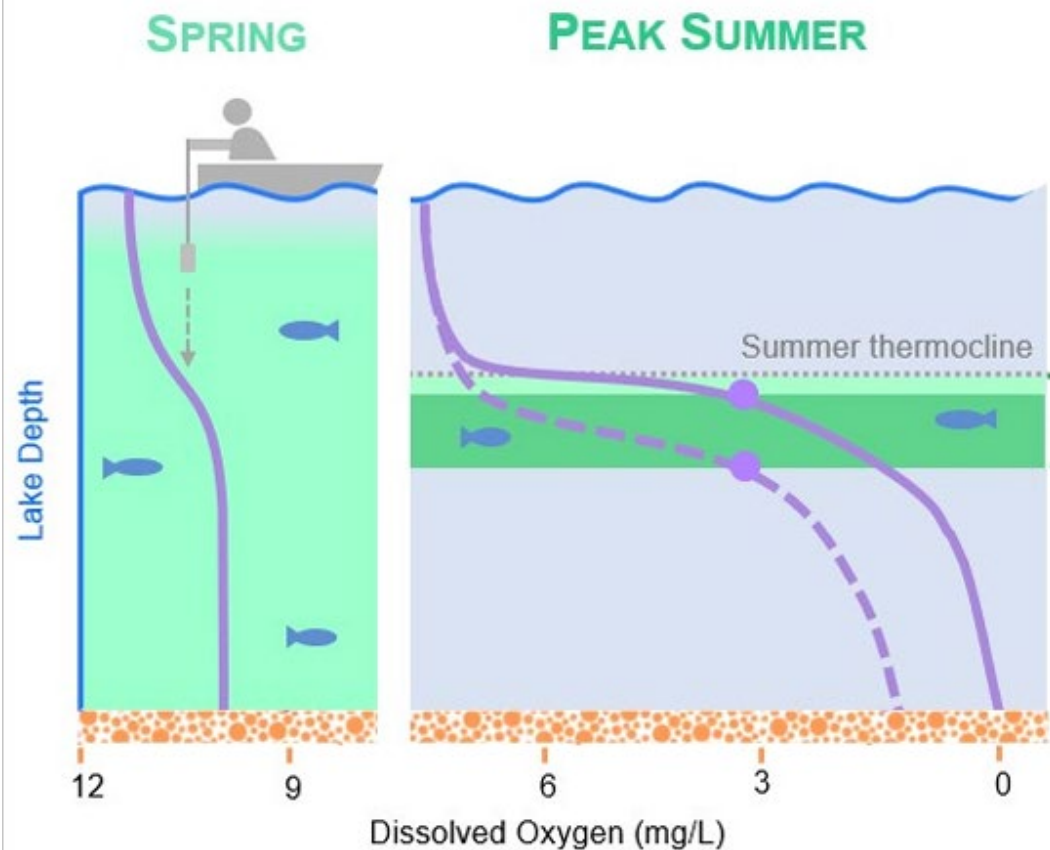


Grindstone Lake Oxythermal Habitat Study



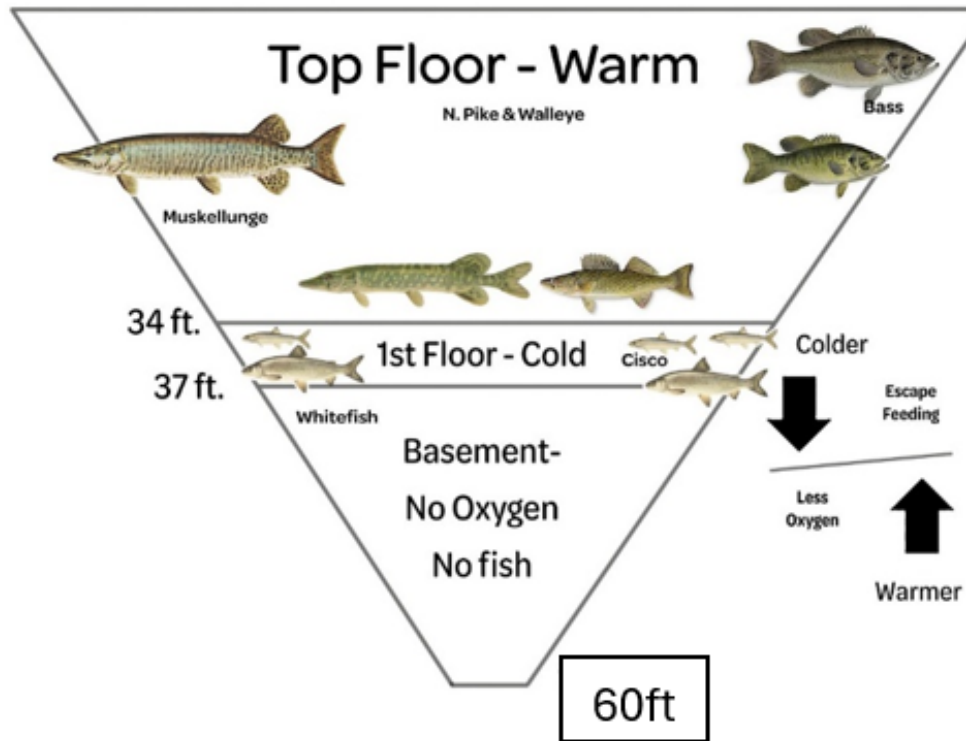
What is oxythermal habitat?

- Oxythermal habitat measurements allow us to determine whether a lake provides the **temperature and dissolved oxygen** levels to support coldwater fish communities during critical periods.
 - If lake water temperatures are too high and/or if dissolved oxygen levels are too low, then fish species such as cisco and whitefish cannot survive



When lakes stratify in the summer, different layers or stories are created that support different oxythermal habitat conditions

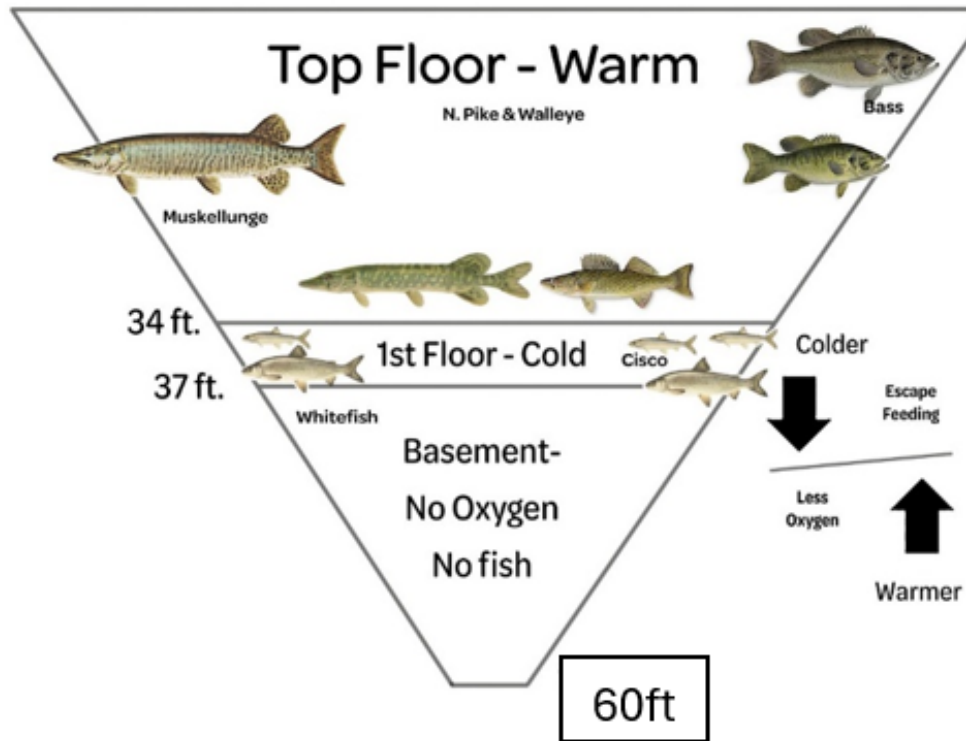
Two-Story Fishery in Grindstone Lake



Grindstone Lake supports a unique Two Story Fishery:

- When the lake stratifies in the summer:
 - The top floor or story supports oxythermal habitat that is warmer with somewhat lower dissolved oxygen levels than in spring.
 - This warmer top story or floor supports warm water fish species such as muskie, bass, bluegills, etc.

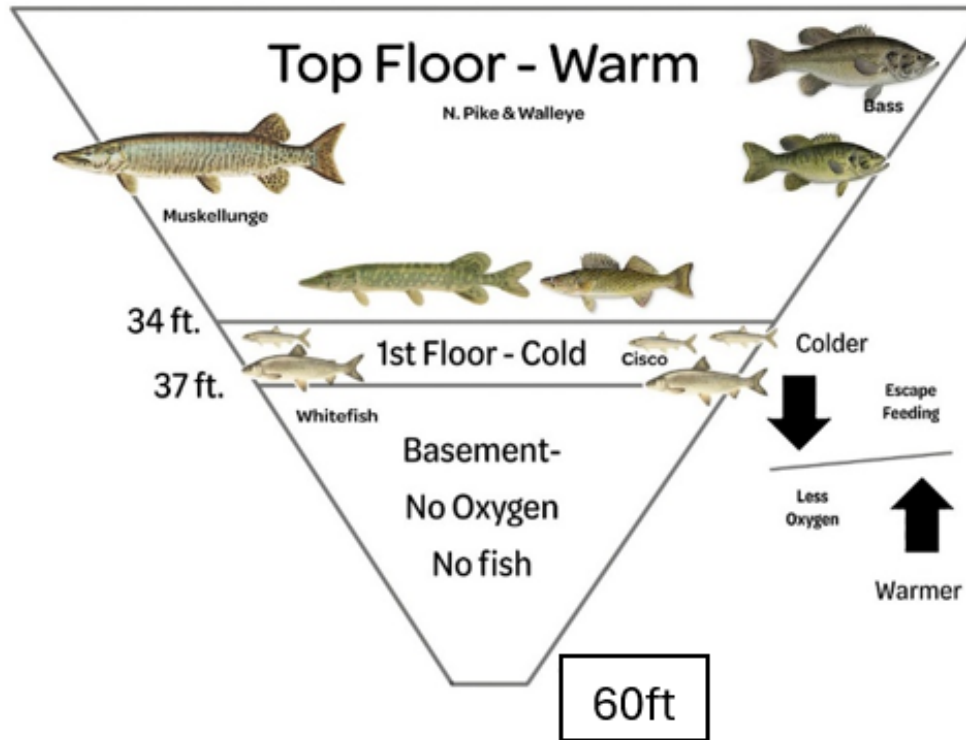
Two-Story Fishery in Grindstone Lake



Grindstone Lake supports a unique Two Story Fishery:

- When the lake stratifies in the summer:
 - A colder first floor or story is also established that supports oxythermal habitat that is colder with higher oxygen levels than the top floor.
 - The colder first floor or story supports cold water fish species such as whitefish and cisco

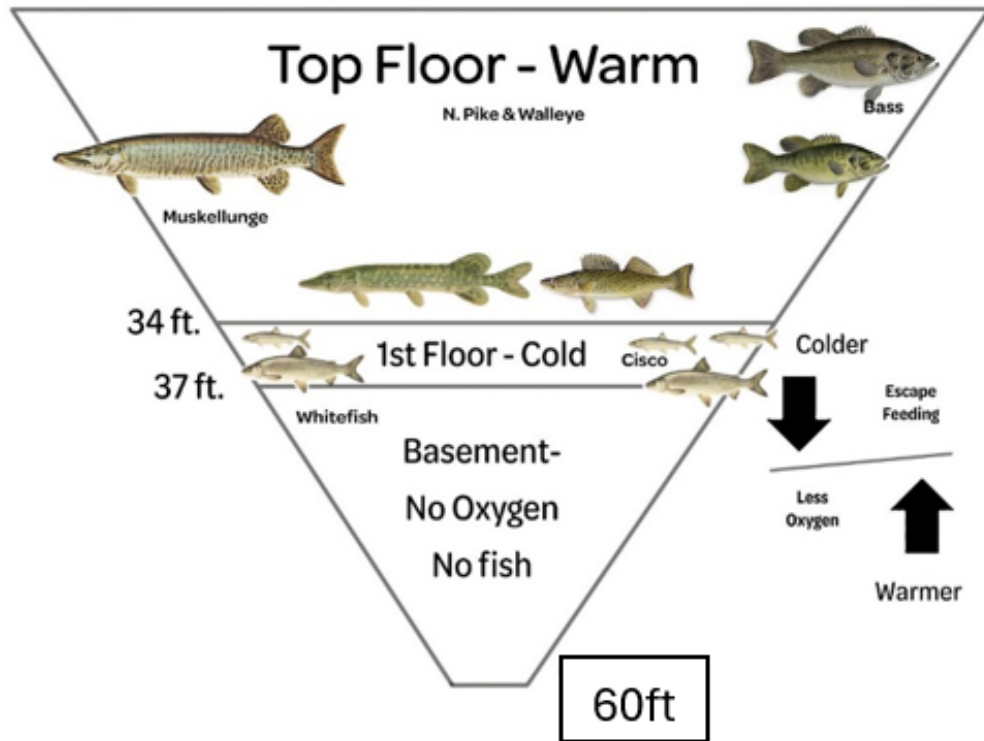
Two-Story Fishery in Grindstone Lake



Grindstone Lake supports a unique Two Story Fishery:

- When the lake stratifies in the summer:
 - The basement or bottom level is the oxygen depletion zone that does not support fish

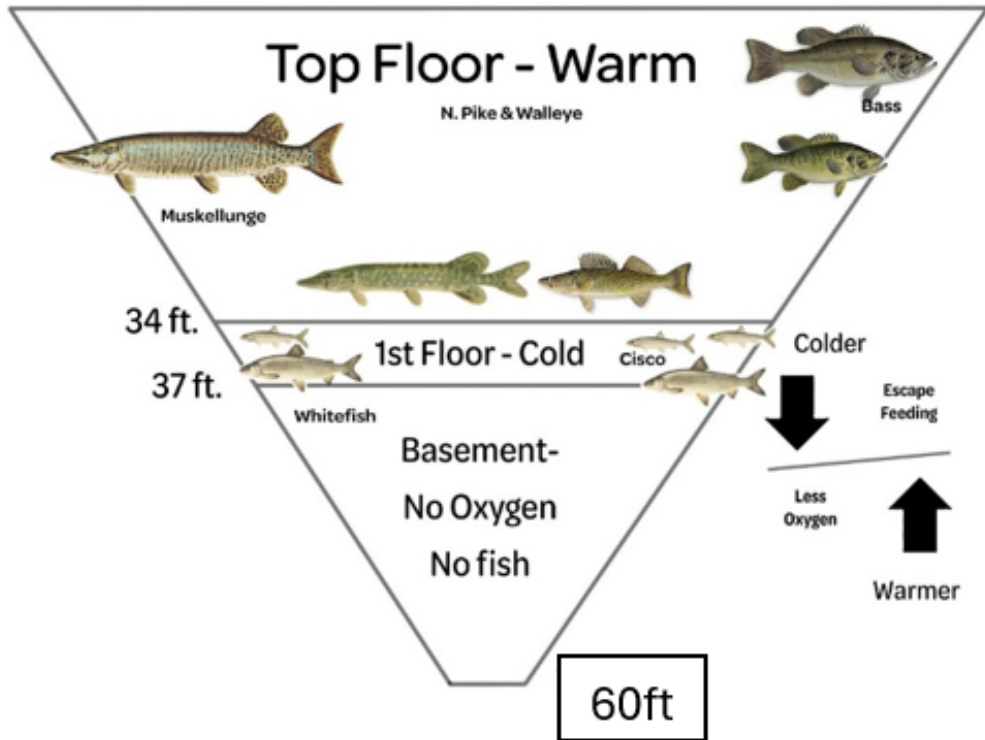
Two-Story Fishery in Grindstone Lake



Two Story Fisheries are rare and unique:

- Grindstone Lake is one of:
 - 190 Two-Story Lakes in WI
 - 5 Two-Story Lakes in Sawyer Co.
- Ashegon Lake
- Grindstone Lake
- Lac Courte Oreilles
- Round Lake (Big Round)
- Whitefish Lake

Two-Story Fishery in Grindstone Lake

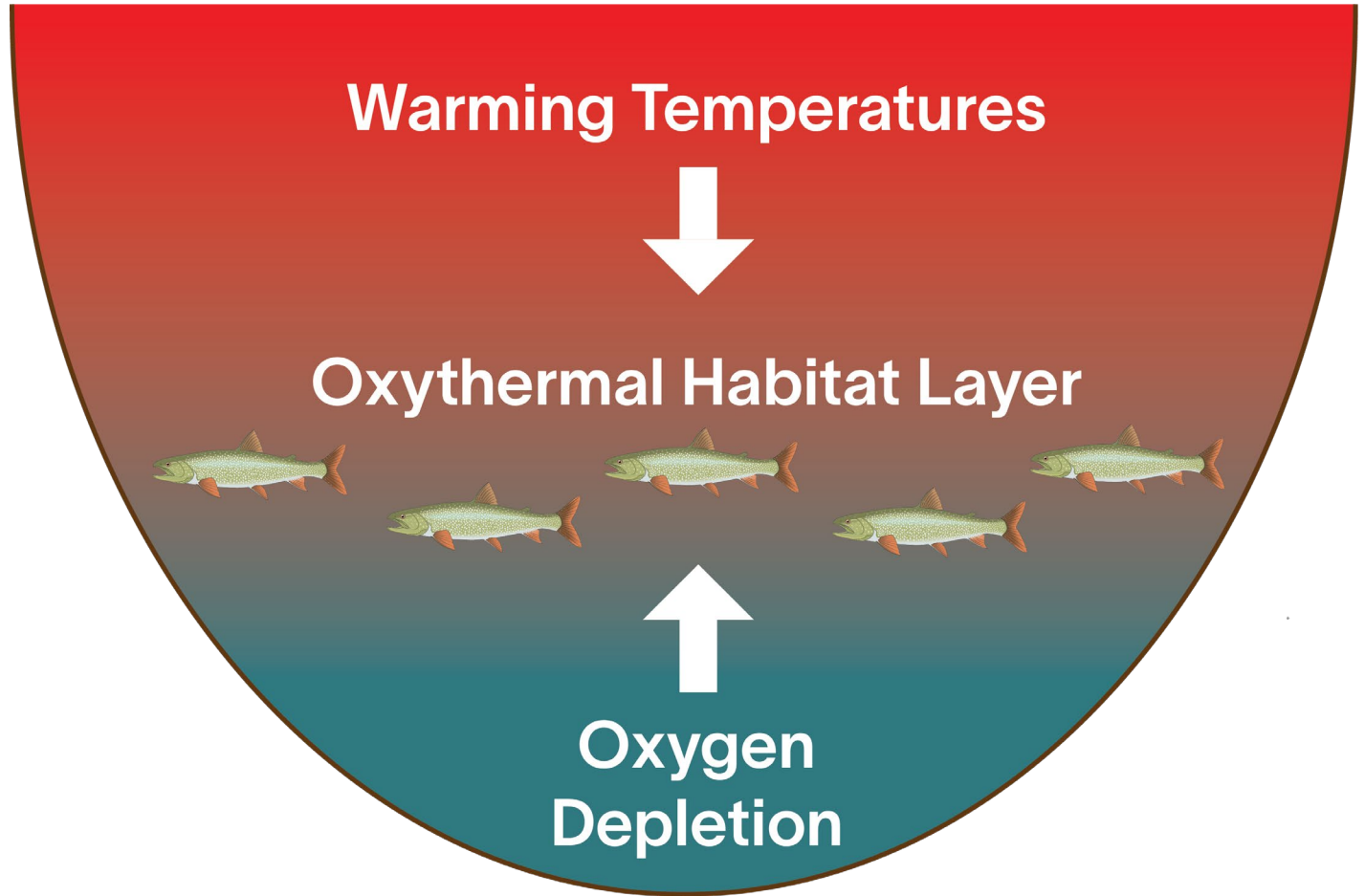


Two Story Fisheries are rare and unique:

AND...many lakes can no longer support Two Story fisheries causing whitefish and cisco populations to disappear...

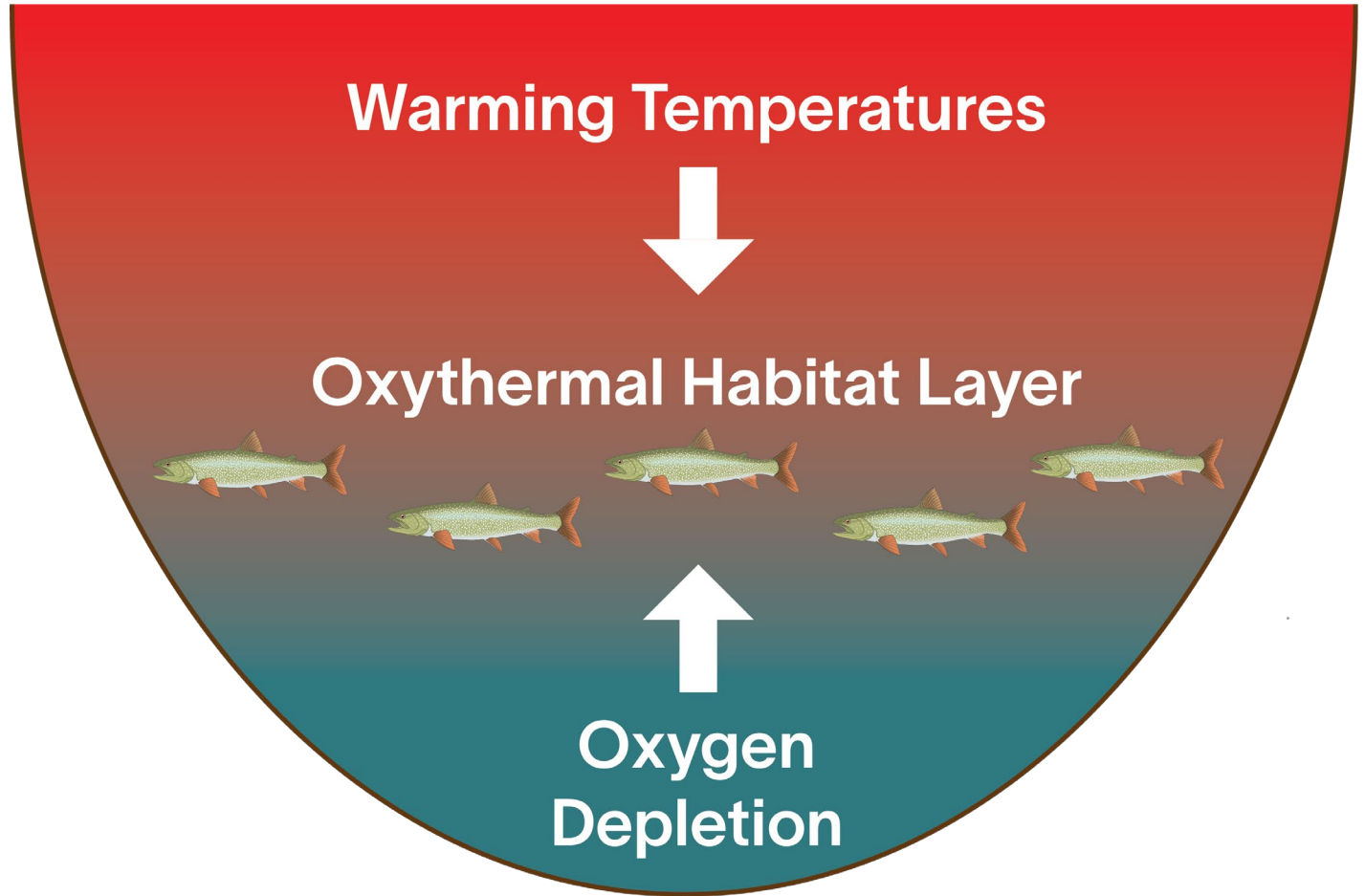
Why are Two Story lakes disappearing?

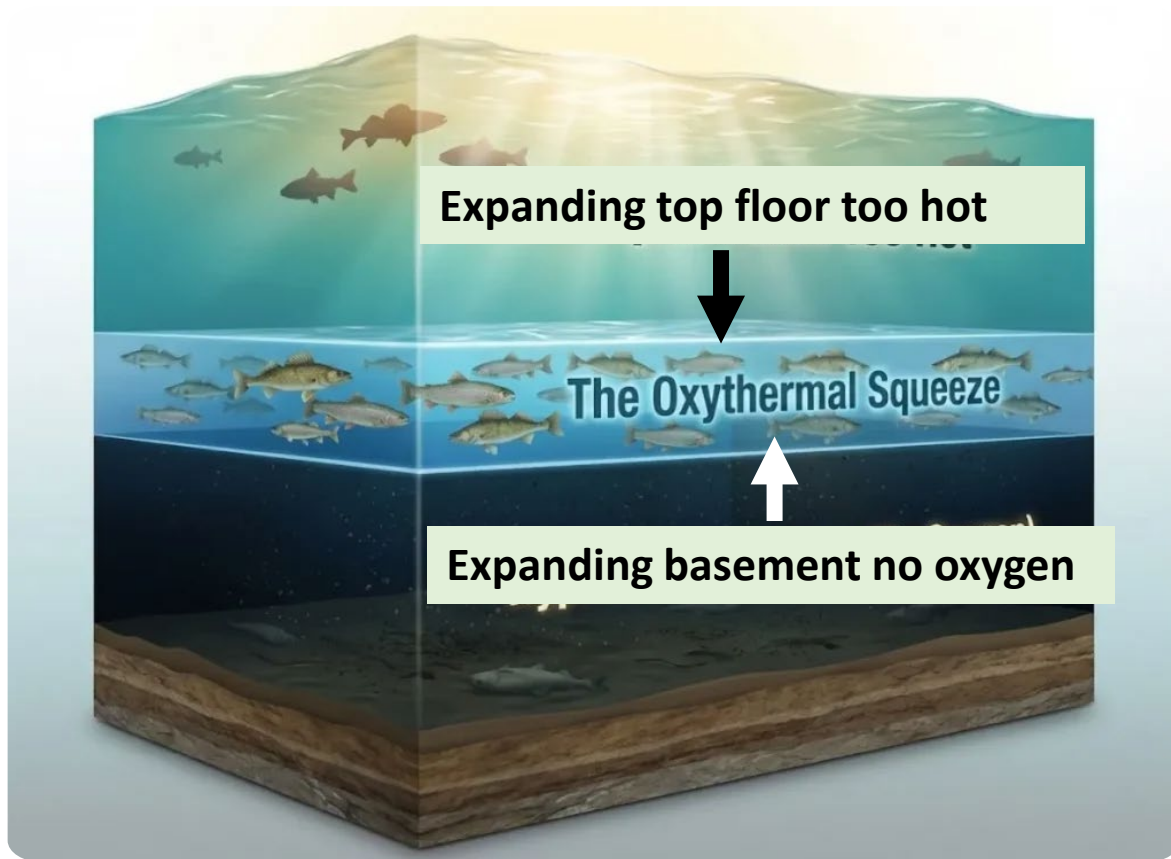
Due to a warming climate, the warm temperatures of the top floor are expanding downward and reducing the size of the cold water first floor...



Why are Two Story lakes disappearing?

...AND...due to increased nutrients in the lake, such as nitrogen or phosphorus, the oxygen depletion zone is expanding upward and increasing the oxygen depletion zone so fish can't survive





- Both the **warmer** and **oxygen depletion** layers are **expanding** and are literally squeezing and **shrinking the available habitat** for cold water species

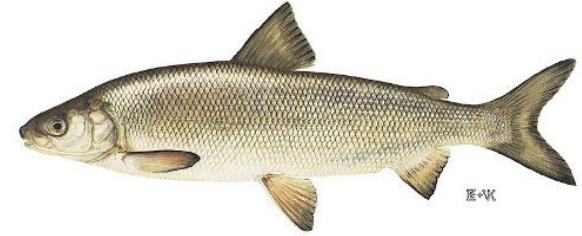
To support whitefish and cisco, Grindstone's First Story cold layer needs to support these temperature and oxygen levels :

cisco



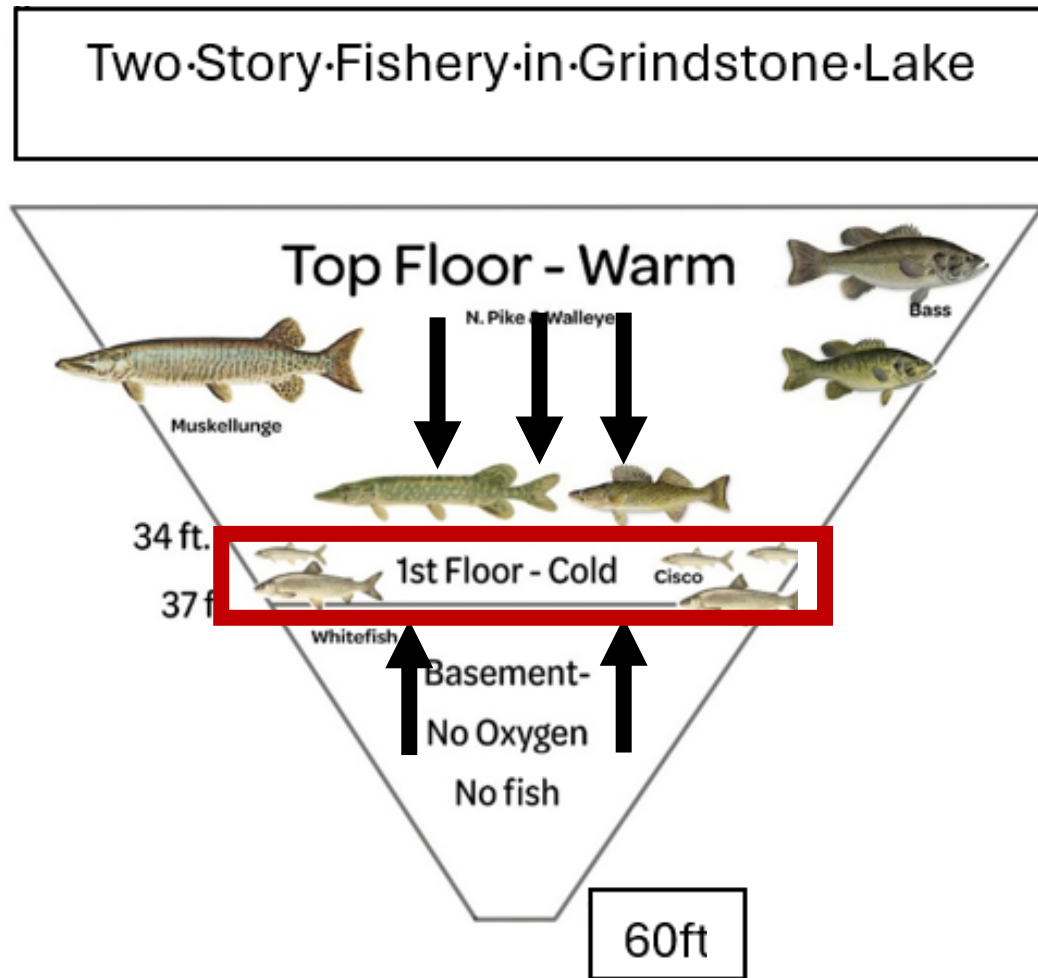
- A layer of lake water at least 1 meter thick that supports:
 - Dissolved oxygen levels of at least 6mg/l
 - Maximum temperature of 73F
 - All summer and fall

whitefish



- A layer of lake water at least 1 meter thick that supports:
 - Dissolved oxygen levels of at least 6mg/l
 - Maximum temperature of 66F
 - All summer and fall

Grindstone Lake Oxythermal Habitat Study



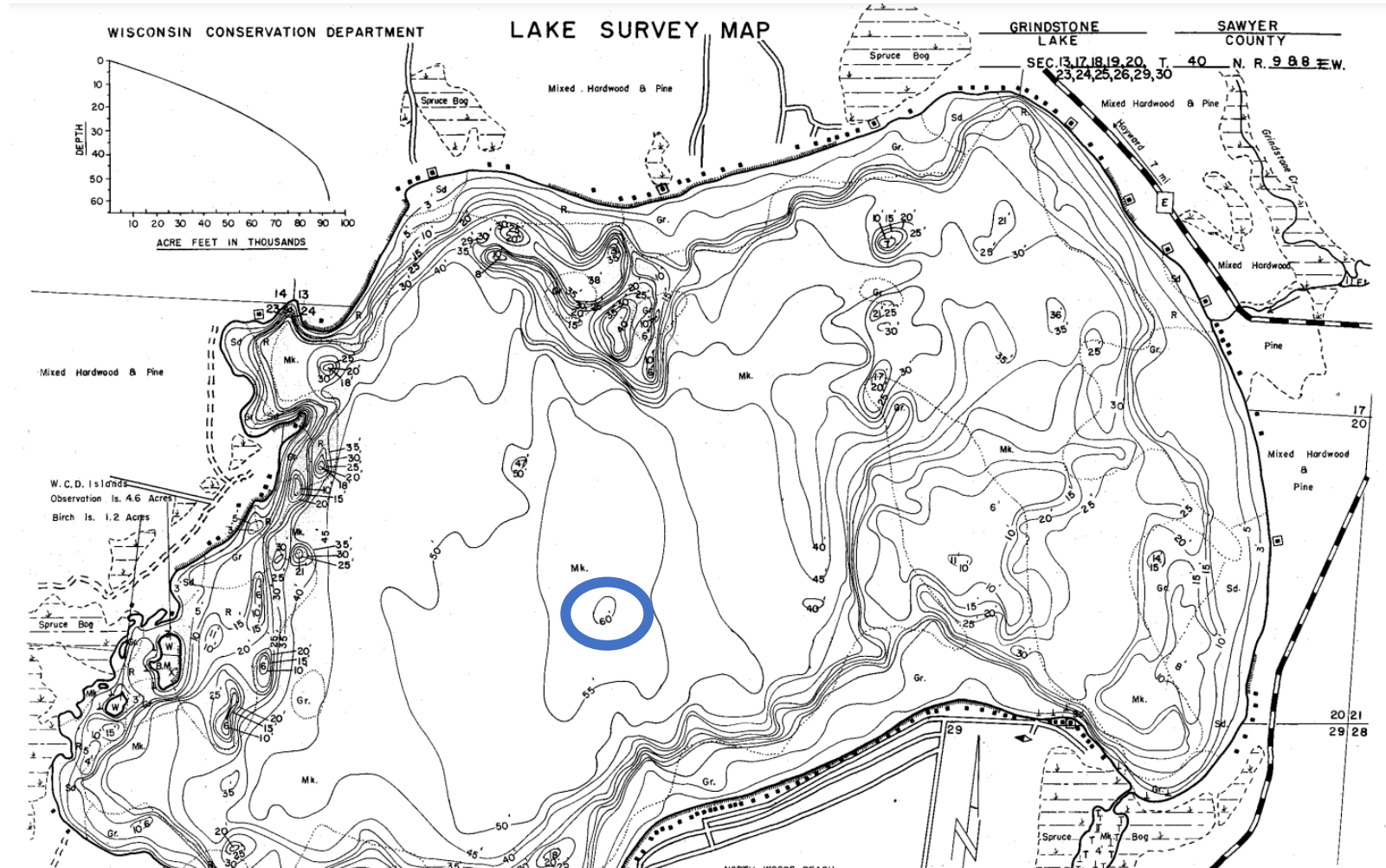
What if Grindstone Lake's 1st Floor cold-water fishery habitat is disappearing during the summer?

To determine whether Grindstone supports the oxygen and temperatures levels needed to support Whitefish and Cisco:

- GLA received a grant from WDNR to study the lake's oxythermal habitat.
- The grant allowed us to:
 - Purchase a temperature (T) and dissolved oxygen (DO) meter
 - Train volunteers to use the meter
 - Collect T and DO data 2x/month during spring through fall of 2024 and 2025



- We collected DO and T data at **one location**:
 - Grindstone's 60 ft deep hole



Data Collection

- Volunteers collected DO, T, and specific conductivity (SC) measures **every meter down to the lake bottom at 60ft.**
- This provides a **T, DO, and SC profile** from surface to bottom of the sampling area

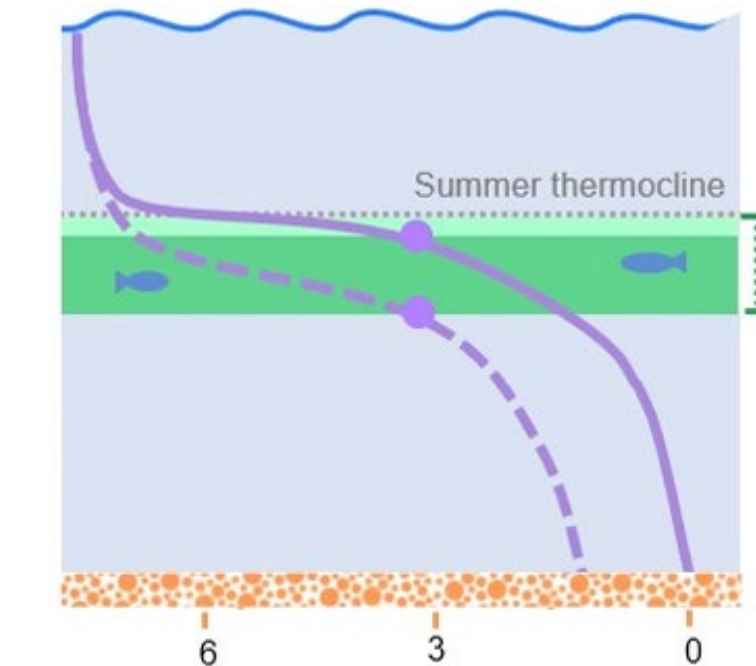


Grindstone Lake Oxythermal Habitat Study

- This temperature and dissolved oxygen profile will help us determine whether a **layer of colder oxygen-rich oxythermal habitat is sustained all summer** and into the fall to support whitefish and cisco

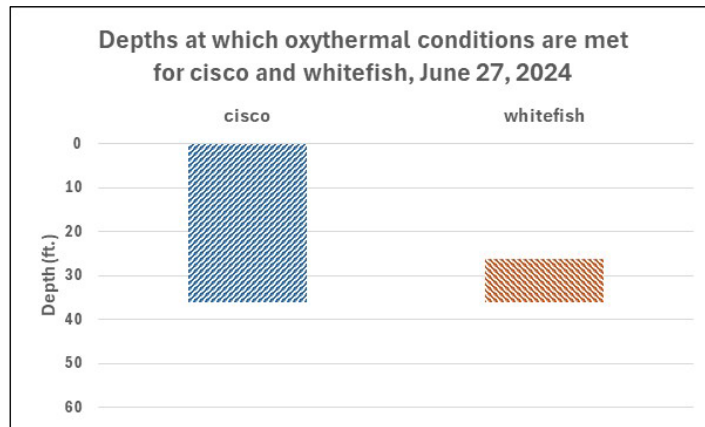
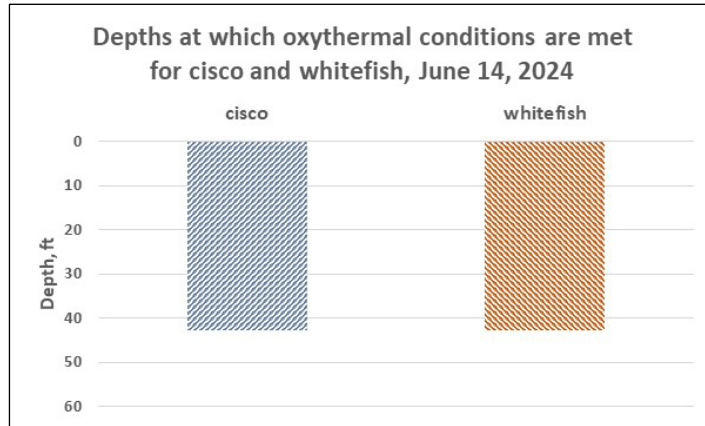


PEAK SUMMER



Is coldwater layer sustained?

Results: 2024 Oxythermal Data

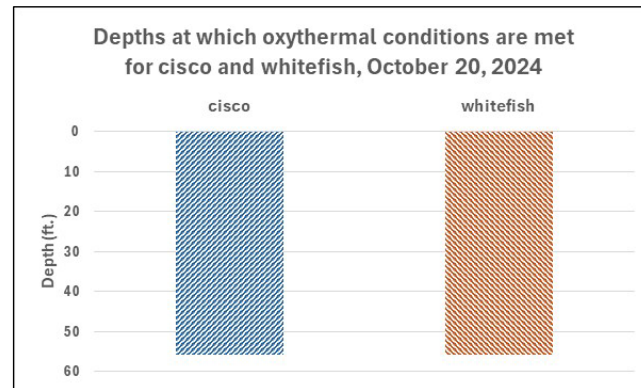
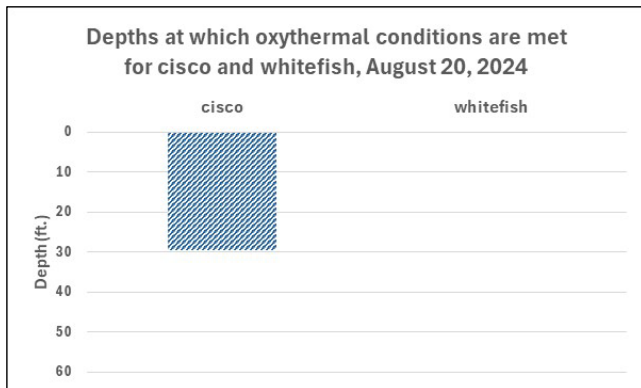
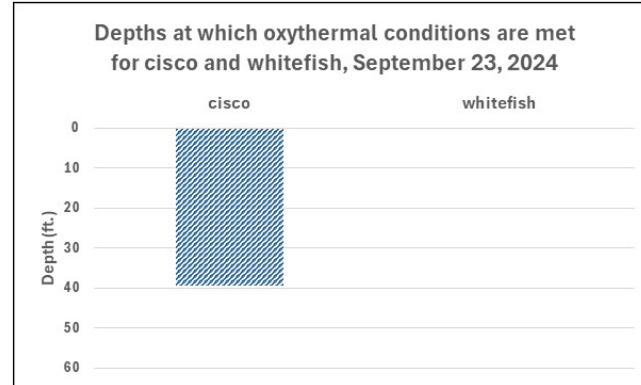
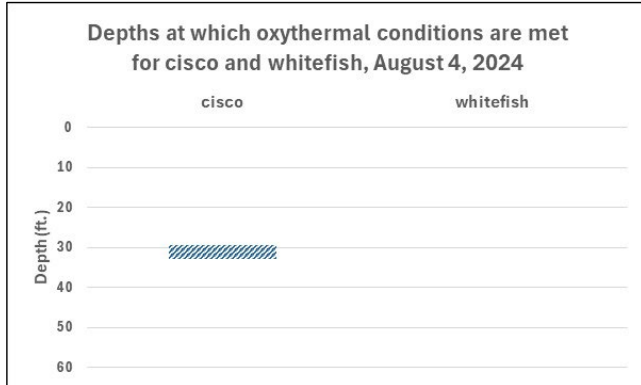
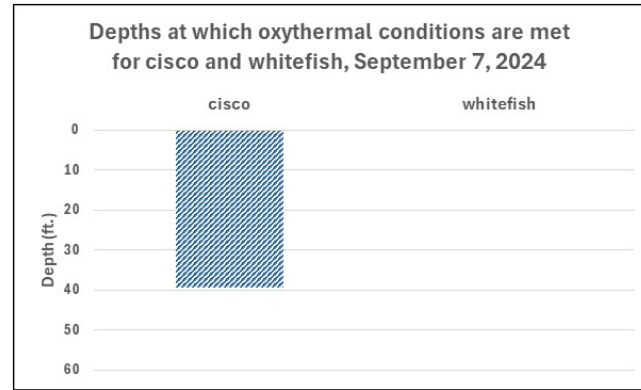
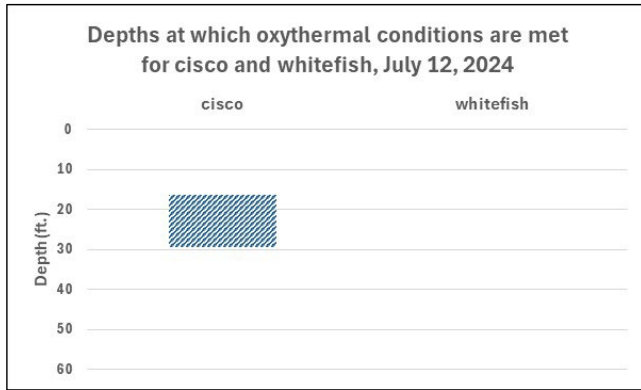


These figures show the depth in Grindstone at which we measured DO and T levels needed to sustain cisco and whitefish

On June 14th (top slide) temperature and dissolved oxygen levels meet the requirements to support both cisco and whitefish from the top of the lake down to about 42 feet

However, two weeks later (June 27th) DO and T levels meet the requirements for cisco from the lake surface down to about 36ft; while the DO and T layer to sustain whitefish shrinks to a layer between 30 to 40 feet.

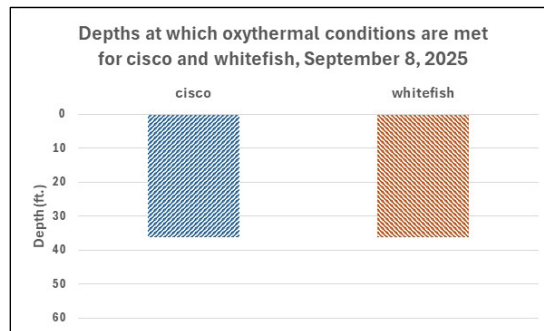
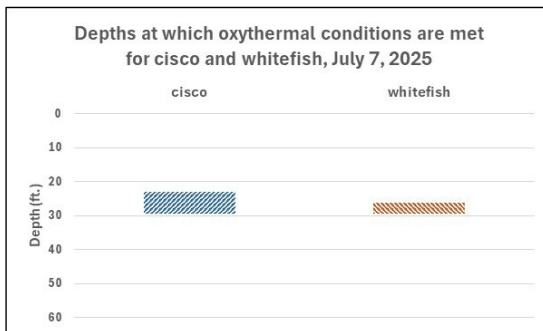
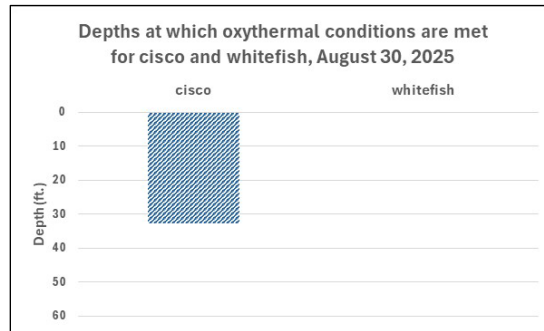
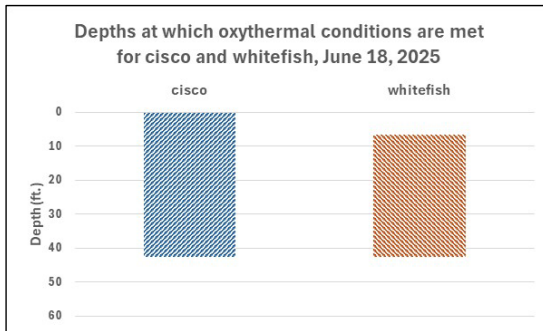
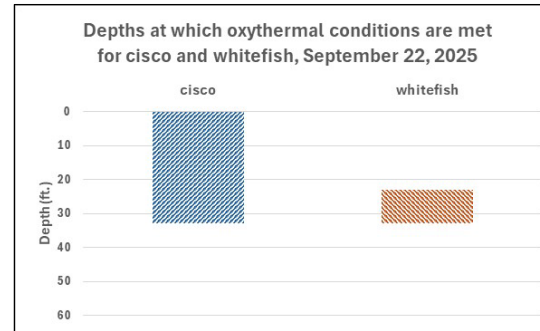
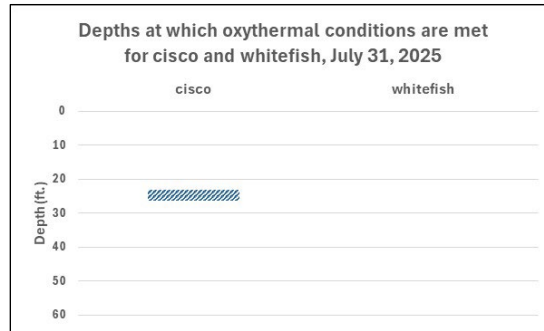
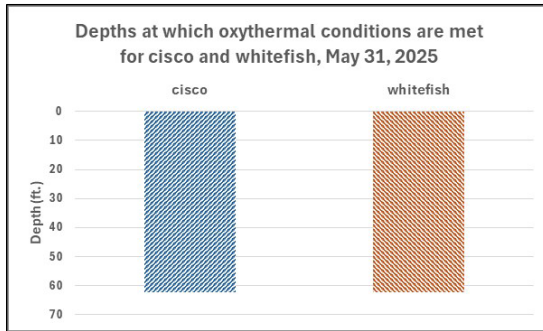
Results: 2024 Oxythermal Data



From July 12th through Sept. 23rd, Grindstone does not support the DO and T levels needed to sustain whitefish

Although DO and T levels support cisco all through the season, by August 4th the DO and T layer supporting cisco is reduced about 2-3 ft. wide at around 30ft. of depth

Results: 2025 Oxythermal Data



For 2025, Grindstone's DO and T levels **do not support whitefish by July 31st**.

Temperature and dissolved oxygen levels support cisco all through the season. However, by July 31st, the habitat layer supporting cisco is only about 2-3ft wide at around 25 ft. of depth.

Summary

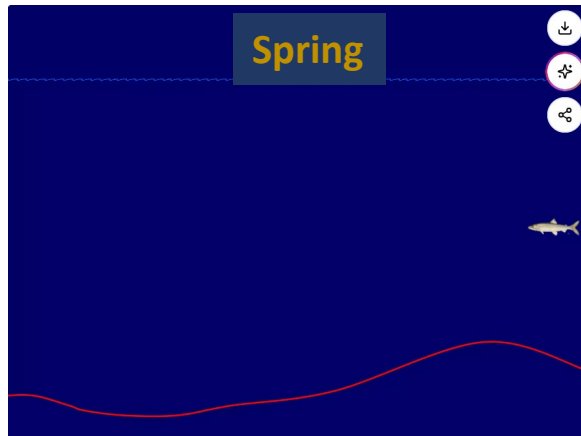


- Oxythermal habitat conditions in Grindstone needed to sustain whitefish disappeared during both the 2024 and 2025 sampling seasons



- Oxythermal habitat conditions for sustaining cisco, narrows to a deeper 3 ft layer and was sustained during both the 2024 and 2025 sampling seasons

What's happening in Grindstone Lake?



Spring: Temperature and oxygen levels support coldwater fish throughout the water column.



Early summer: Lake stratification creates the two story fish habitat. Light blue represents warmwater fish habitat, dark blue represents coldwater fish habitat, and red shows the oxygen depletion zone.



Mid-summer: The two story fish habitat is maintained and the coldwater layer is reduced compared to early summer.



Later-summer: The warmwater fish habitat and the oxygen depletion zone expand but the coldwater layer needed to support coldwater fish is gone.

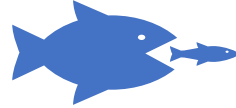
Implications

- These results suggest that the coldwater habitat conditions in Grindstone may still support cisco populations but not whitefish
- A WDNR 2014 gillnet study indicated that whitefish populations were not present in either Grindstone nor Lac Courte Oreilles but that cisco populations were categorized as high in Grindstone while non-existent in Lac Courte Oreilles (Lyons et al., 2015)
- A follow-up gillnet study of Grindstone's cisco population needs to be conducted to confirm the continued presence of cisco

Implications and Actions



Support the protection of Grindstone's two-story fisheries habitat



Support the monitoring and possible restoration of cold water species

Important for biodiversity and as prey for other fishes including muskie and walleye



What can you do?

Become an ally for the prevention and mitigation of the warming of the climate

Prevent the expansion of the oxygen depletion zone by:

- **Reducing or eliminating use of fertilizers** and other nutrients on your lake shore property
- Put in a **shoreline buffer** with native species to prevent movement of nutrients into the lake

We are grateful for:

- Our monitoring volunteers
 - Joe Beran
 - Cheryl Contant
 - Greg Klausen
 - John Morse
 - Karen Mumford
 - Mike Stalpes
- WI DNR for funding for this study
- The Grindstone Lake Association