Projected Climate Change Effects on Cisco, a Keystone Whitefish Species in Deep Wisconsin Lakes

John Lyons

WDNR Fish and Aquatic Research, Madison

WISCONSIN DEPT. OF NATURAL RESOURCES

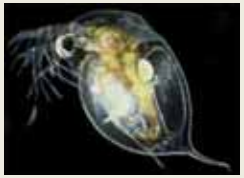
SPORT FISH RESTORATION

Why Do Cisco Matter?

Adult Gamefish
(e.g., musky, walleye)

Climate Change Indicator

Fishery
(spawning, winter)



Zooplankton

Juvenile Gamefish
(e.g., musky, walleye)

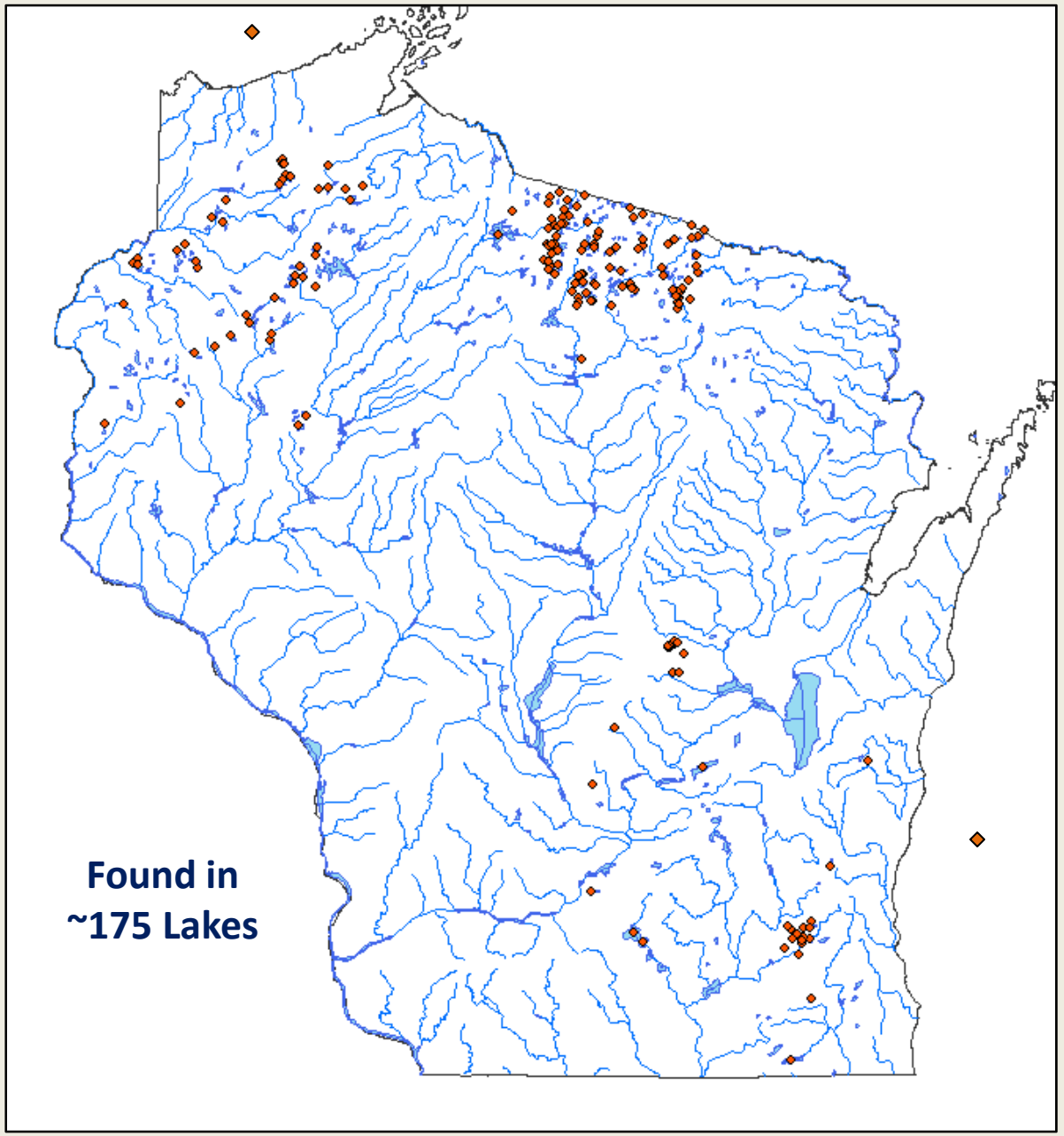
Water Clarity
(algae conditions)

Where Do Cisco Live in Wisconsin?

Deep (> 50 ft) Lakes!

Examples:

Lake Michigan
Lake Geneva
Okauchee Lake
Lake Mendota
Big Green Lake
Chain of Lakes
Long Lake (Chippewa Co.)
Long Lake (Washburn Co.)
Lake Owen
Turtle-Flambeau Flowage
Lake Tomahawk
Trout Lake
Lake Superior



Where Do Cisco Live in Lakes?

Cold Water

Prefer: 40-65 º F

Stressful: 65-75 º F

Lethal: > 75 º F

Open Water

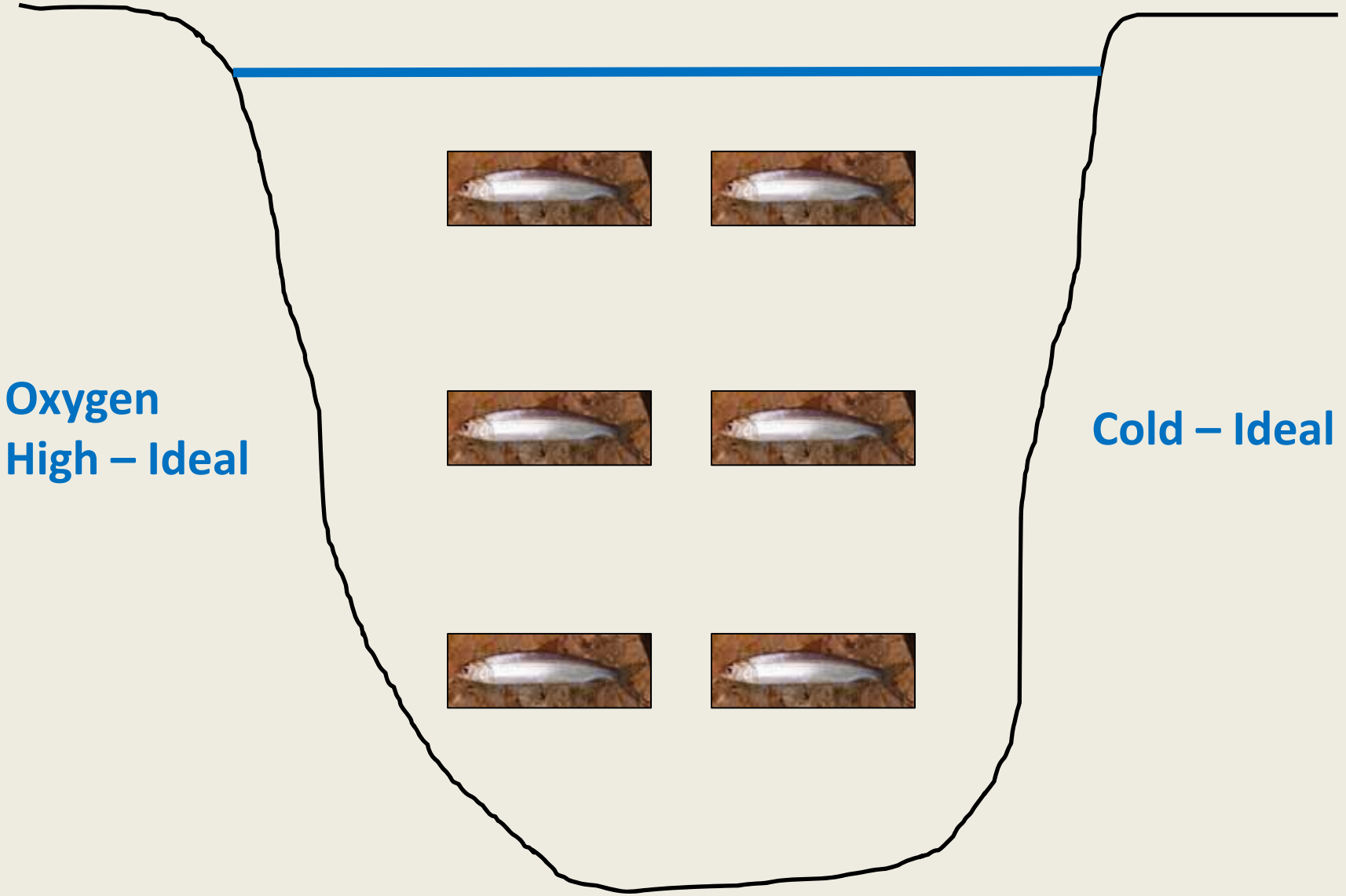
Prefer: Mid-Water

Rarely: Near Bottom

Avoid: Shallow Shores

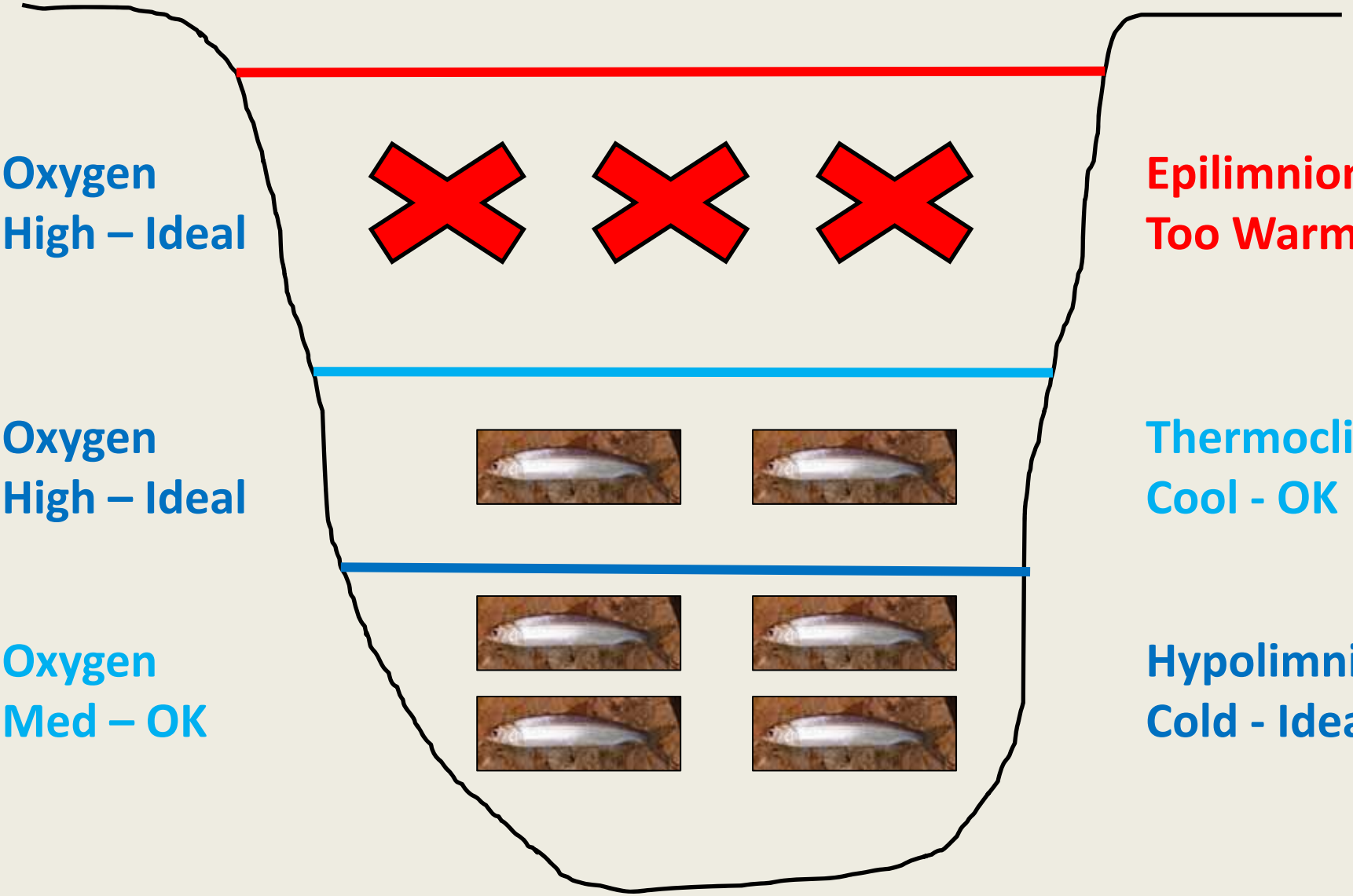
Where Do Cisco Live in Lakes?

Fall, Winter, and Spring



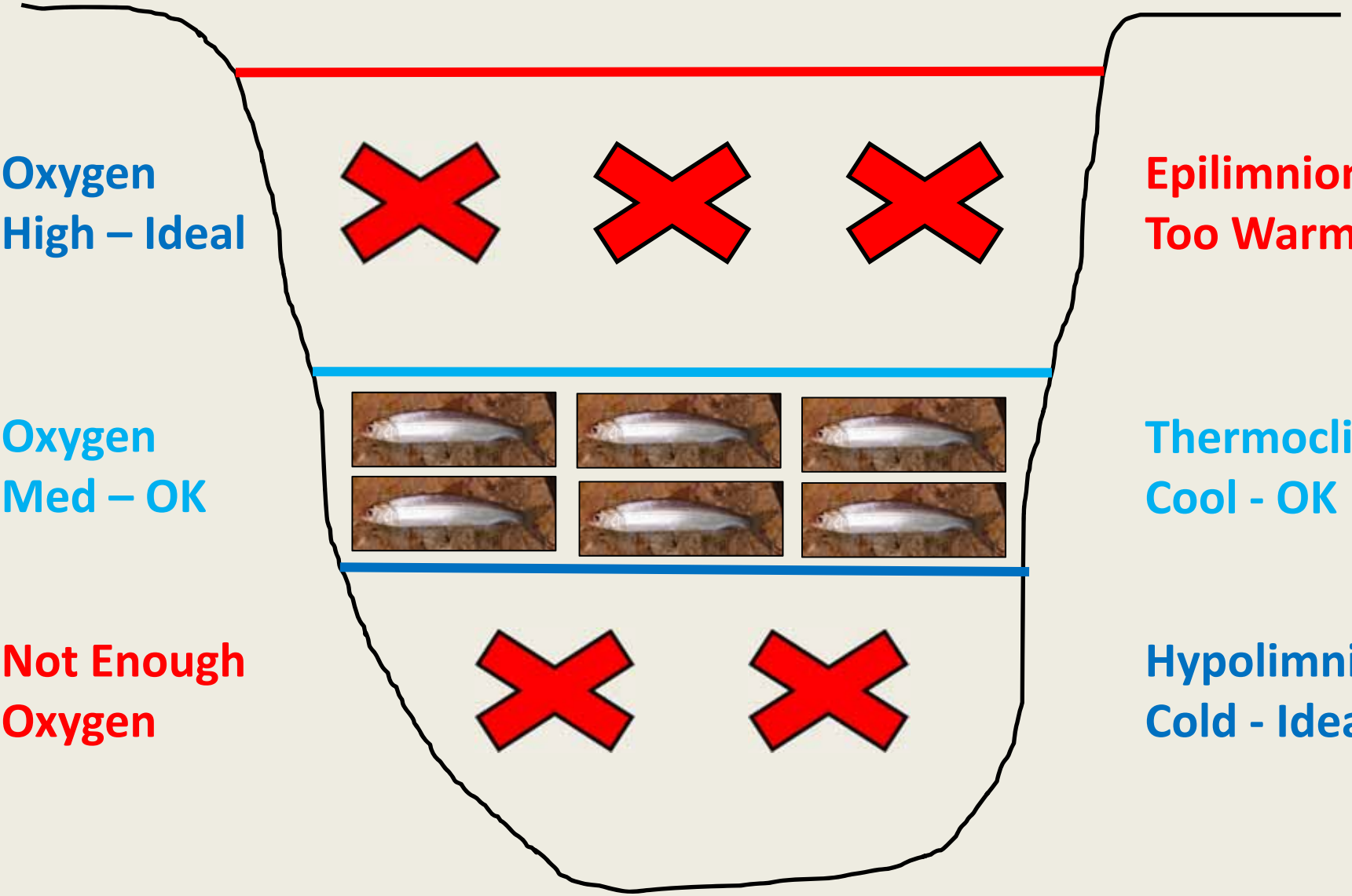
Where Do Cisco Live in Lakes?

Early Summer



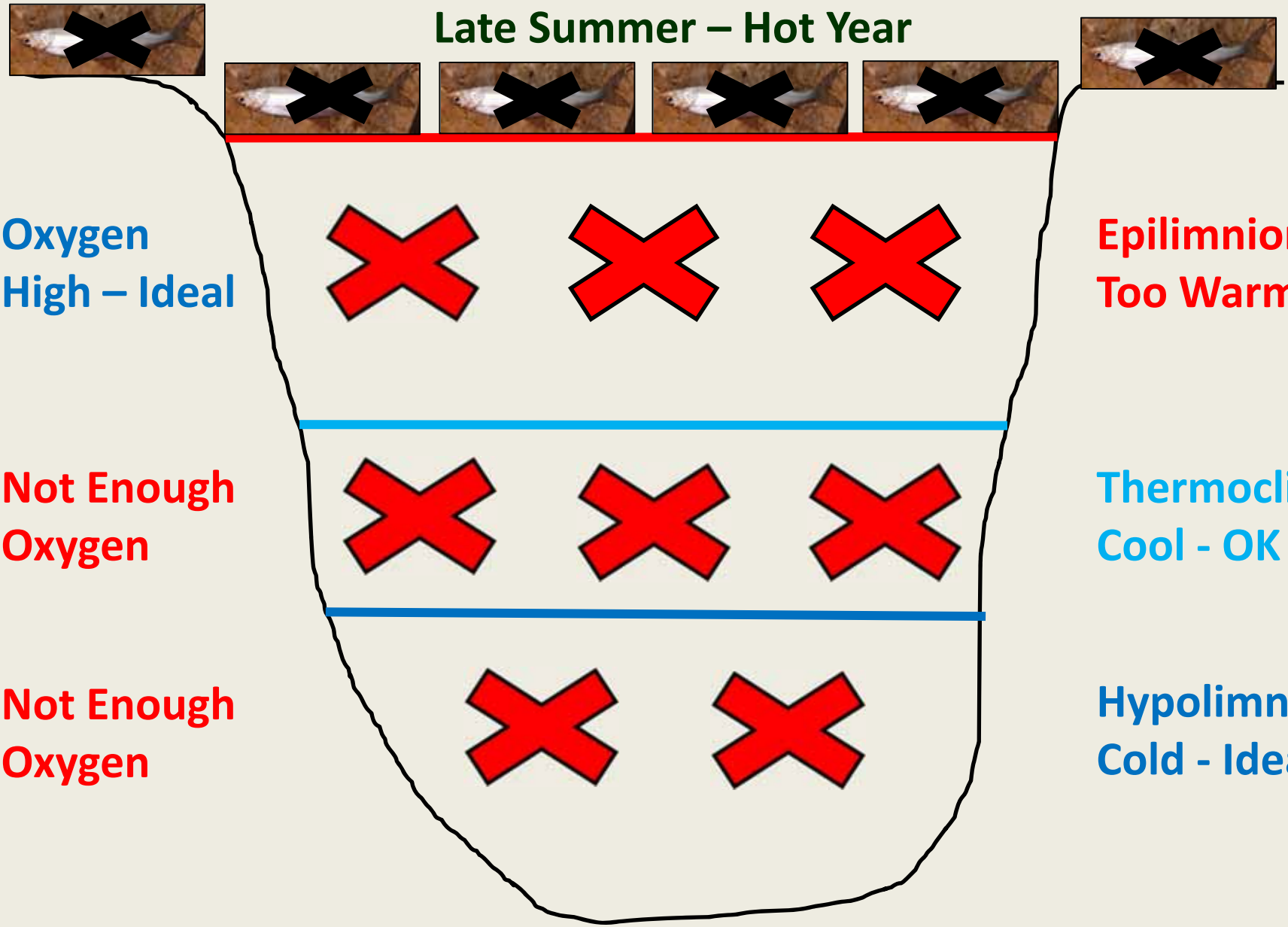
Where Do Cisco Live in Lakes?

Late Summer



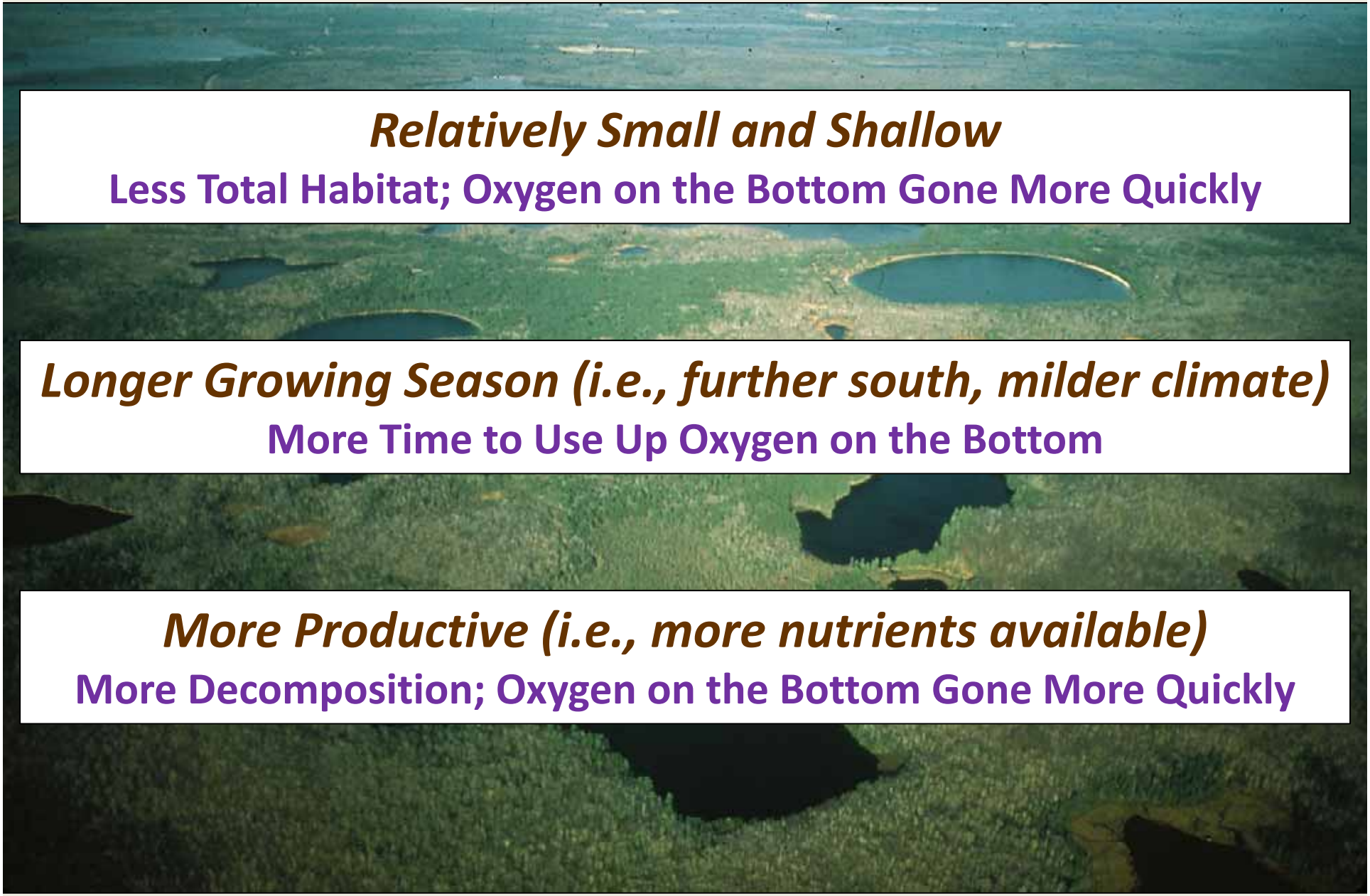
Where Do Cisco Live in Lakes?

Late Summer – Hot Year



SUMMER FISH KILL!

In What Types of Lakes Are Cisco Most Vulnerable?



Relatively Small and Shallow

Less Total Habitat; Oxygen on the Bottom Gone More Quickly

Longer Growing Season (i.e., further south, milder climate)

More Time to Use Up Oxygen on the Bottom

More Productive (i.e., more nutrients available)

More Decomposition; Oxygen on the Bottom Gone More Quickly

Future Climate Change – Some Relevant Predictions:

Winters will be warmer and shorter,
Spring will come earlier and Fall later,
Summer will be longer and hotter….

Longer Growing Season

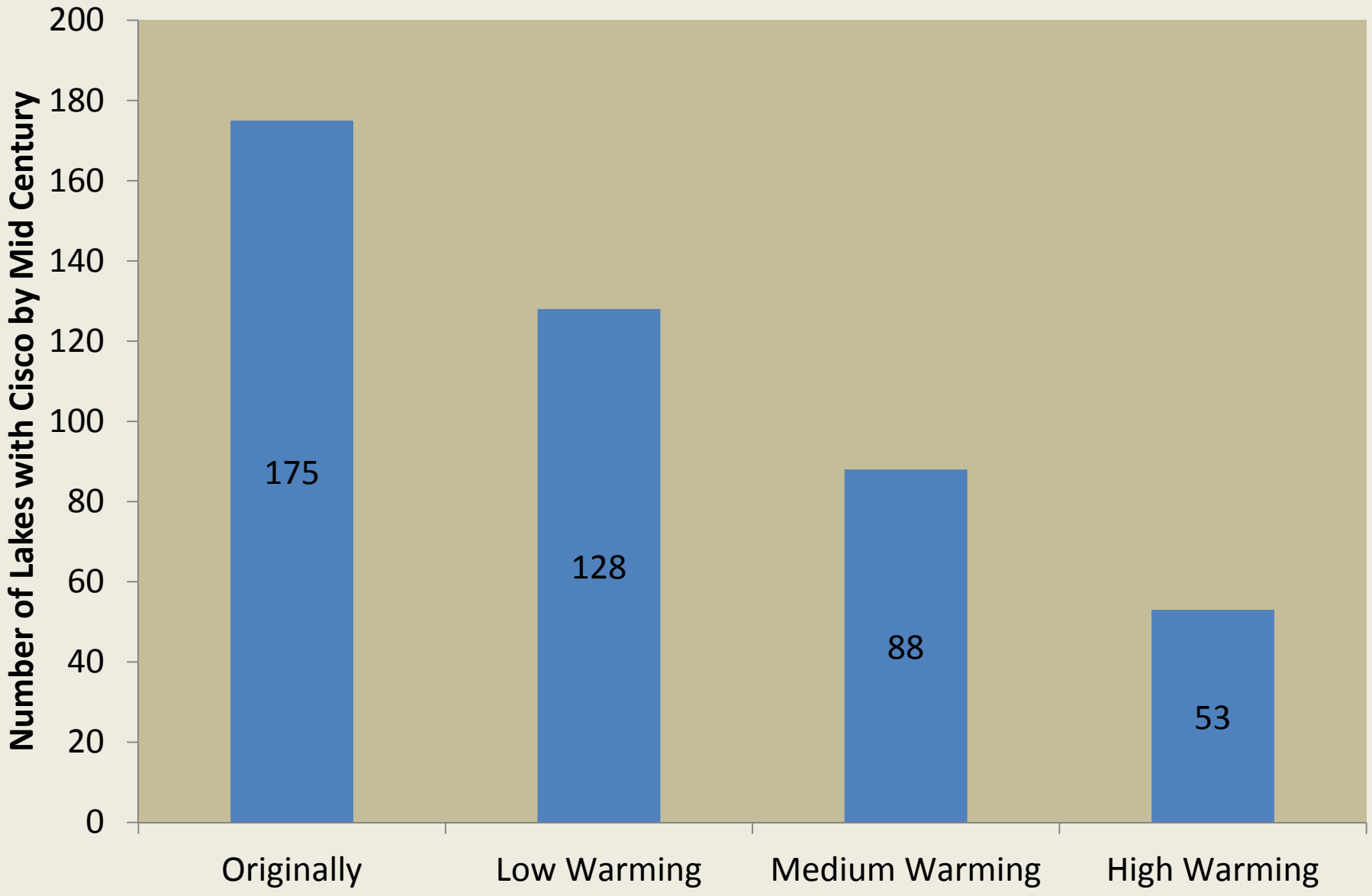
More Time to Use Up Oxygen on the Bottom

Precipitation events will be more extreme,
Runoff will be greater,
More nutrients will reach lakes….

More Productive

Oxygen on the Bottom Gone More Quickly

Predicted Effects Climate Change on Cisco Occurrence



Can We Prevent Disappearances?

Maybe….

Cisco Lake Vulnerability:

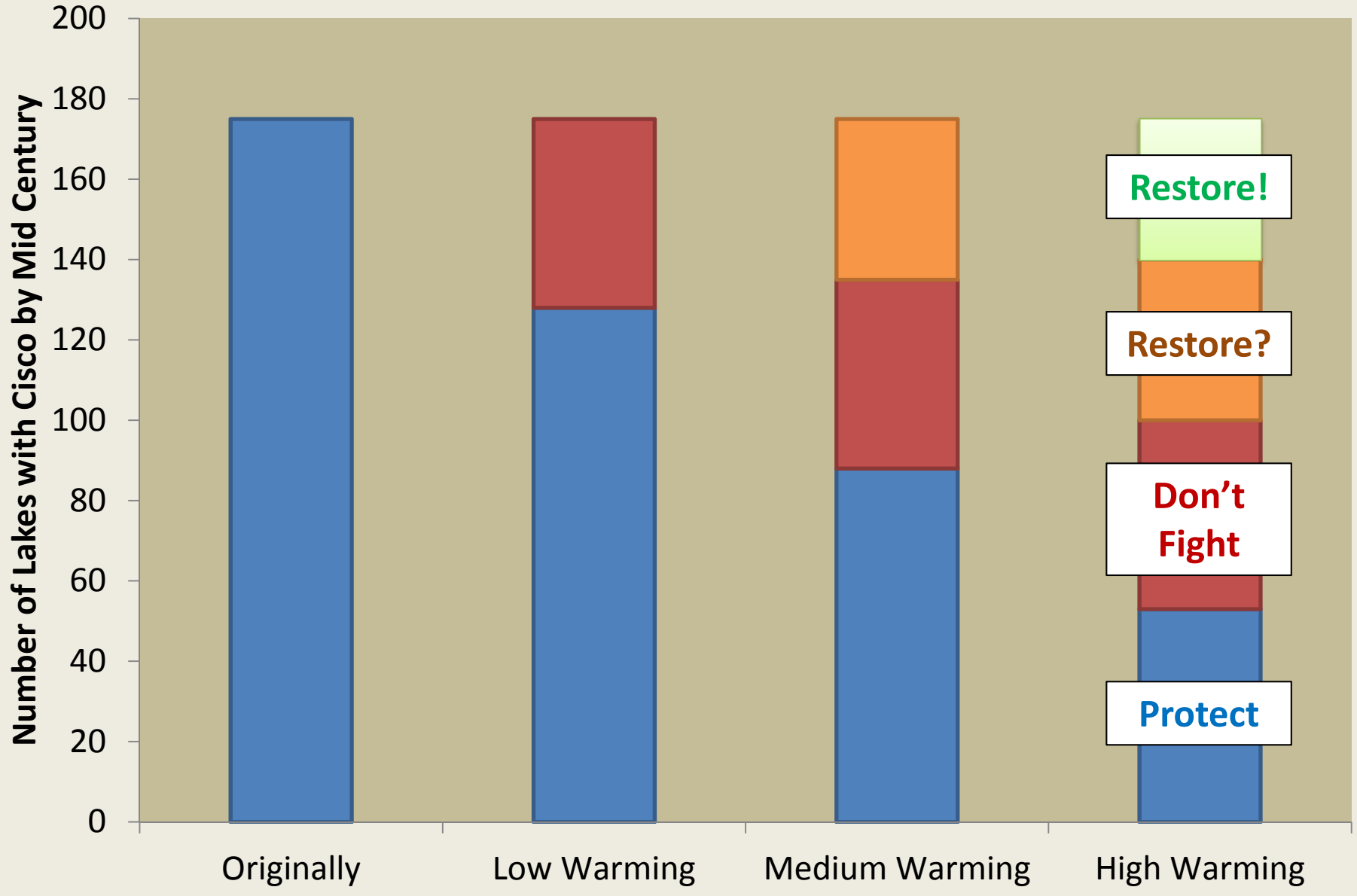
- ~~*Relatively Small and Shallow*~~
- ~~*Longer Growing Season*~~
- ? *More Productive* ?

Climate Change Adaptation: Reduce Nutrient Inputs

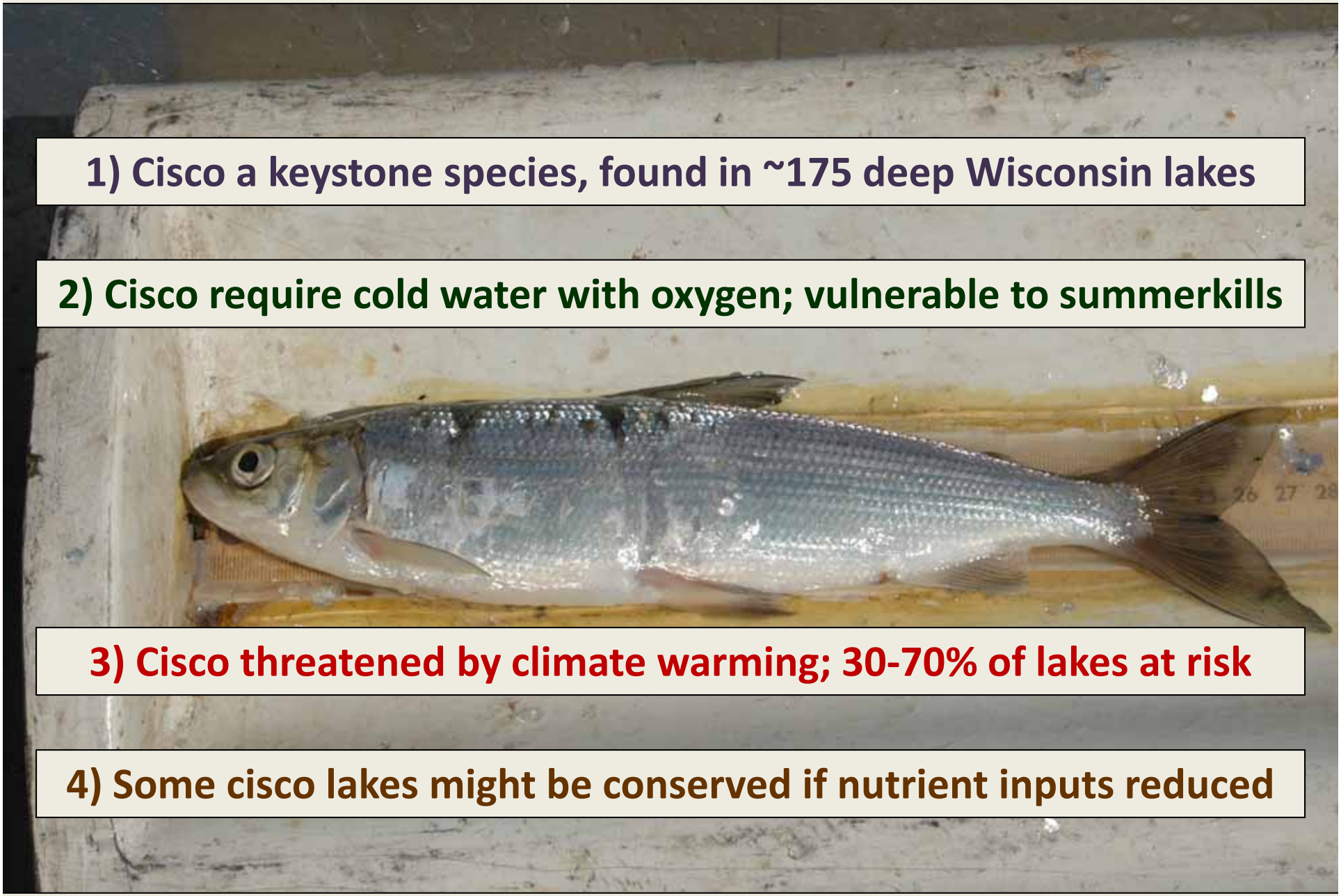
Improve Watershed Land Use

Protect Natural Shorelines

Climate Change Adaptation: Triage – Protect the Resilient, Don't Fight the Inevitable, Focus on the Restorable



Summary and Conclusions



1) Cisco a keystone species, found in ~175 deep Wisconsin lakes

2) Cisco require cold water with oxygen; vulnerable to summerkills

3) Cisco threatened by climate warming; 30-70% of lakes at risk

4) Some cisco lakes might be conserved if nutrient inputs reduced

Questions?