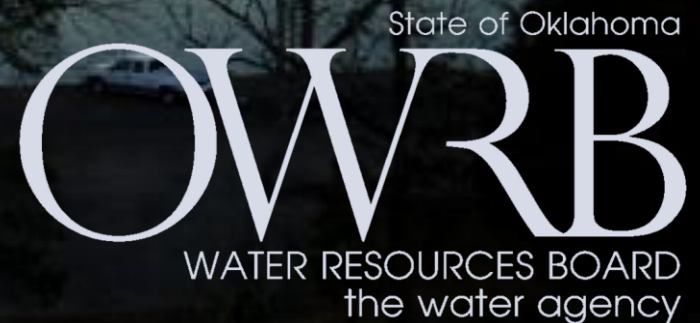


Modification of the Use Support Assessment Protocol for Dissolved Oxygen in Oklahoma Lakes

Jason Childress

Oklahoma Water Resources Board



Dissolved Oxygen Assessment

The F&W Propagation B.U. (for a lake/reservoir) shall be deemed to be not supported ... if more than 50% of water column at any given sample site has D.O. concentrations less than the screening level ... due to other than naturally occurring conditions.

Screening levels for D.O. in lakes:

water column = 2mg/L

surface = 4 mg/L (Jun 16 – Oct 15)

5 mg/L (rest of the year)

Lake/Reservoir Dissolved Oxygen

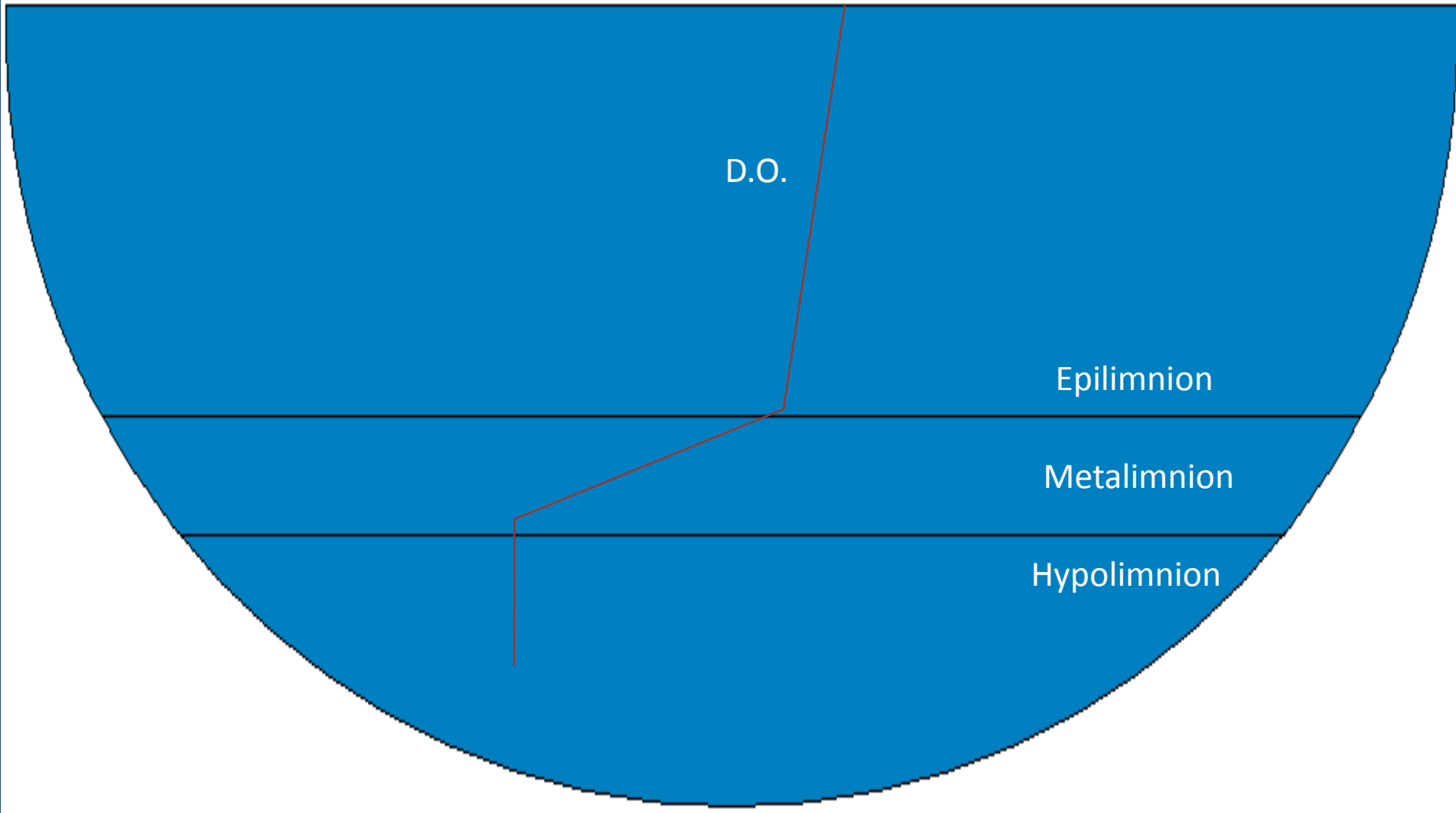
785:46-15-5

- Assessment Issues / 2010 303(d) list
 - 2 mg/L screening level
 - Profile Data – Sub-surface D.O. measurements?

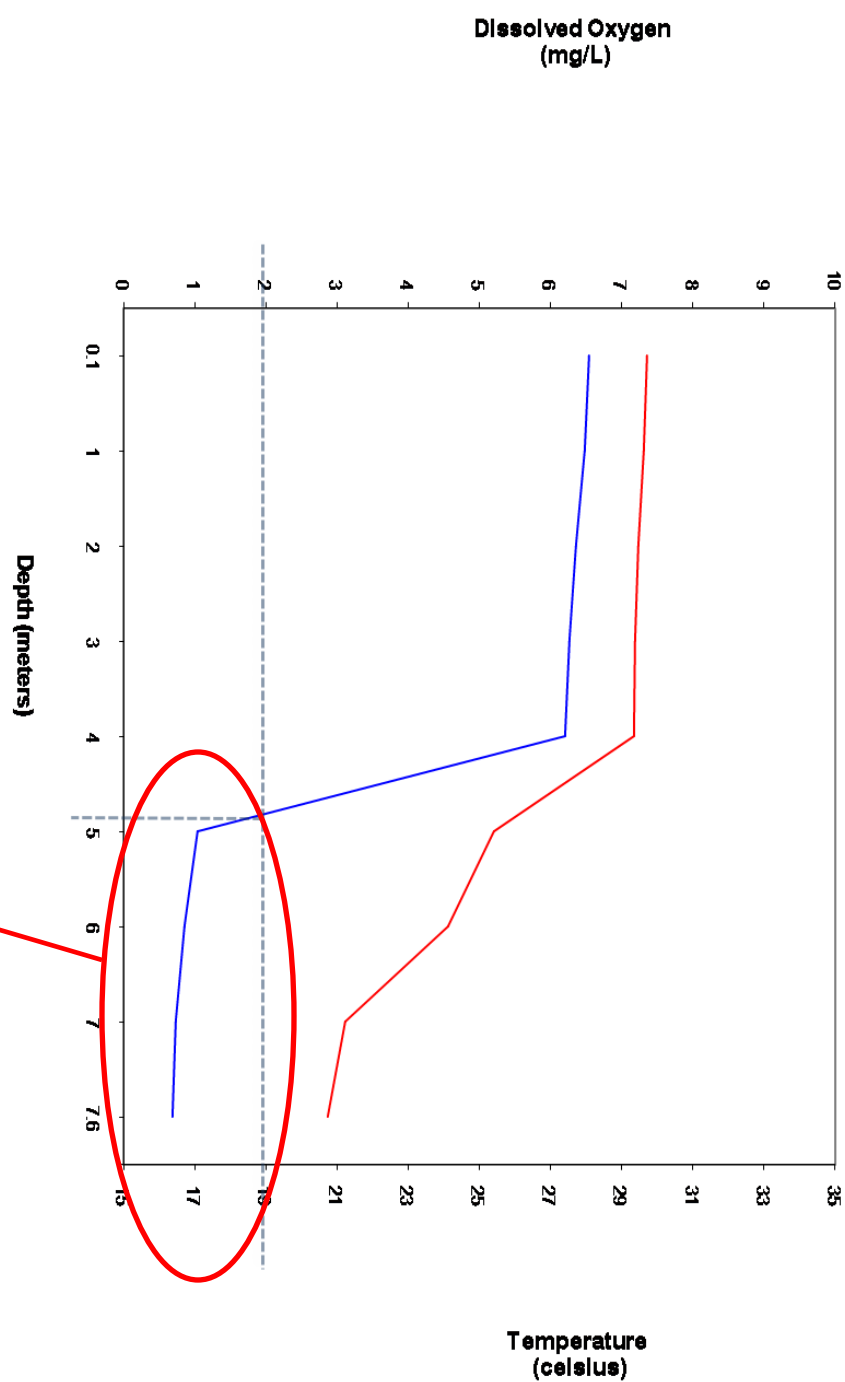
The Revision Process

- Public Input – Working Group of Lake Professionals
- USAP Workgroup
- Informal Meeting
- Formal Public Meeting
- Draft Language to the OWRB
- Board Approval – Legislative Review –
Gubernatorial Approval – Attorney General
Certification – Then...
- EPA Review

Stratification and Hypolimnetic Oxygen



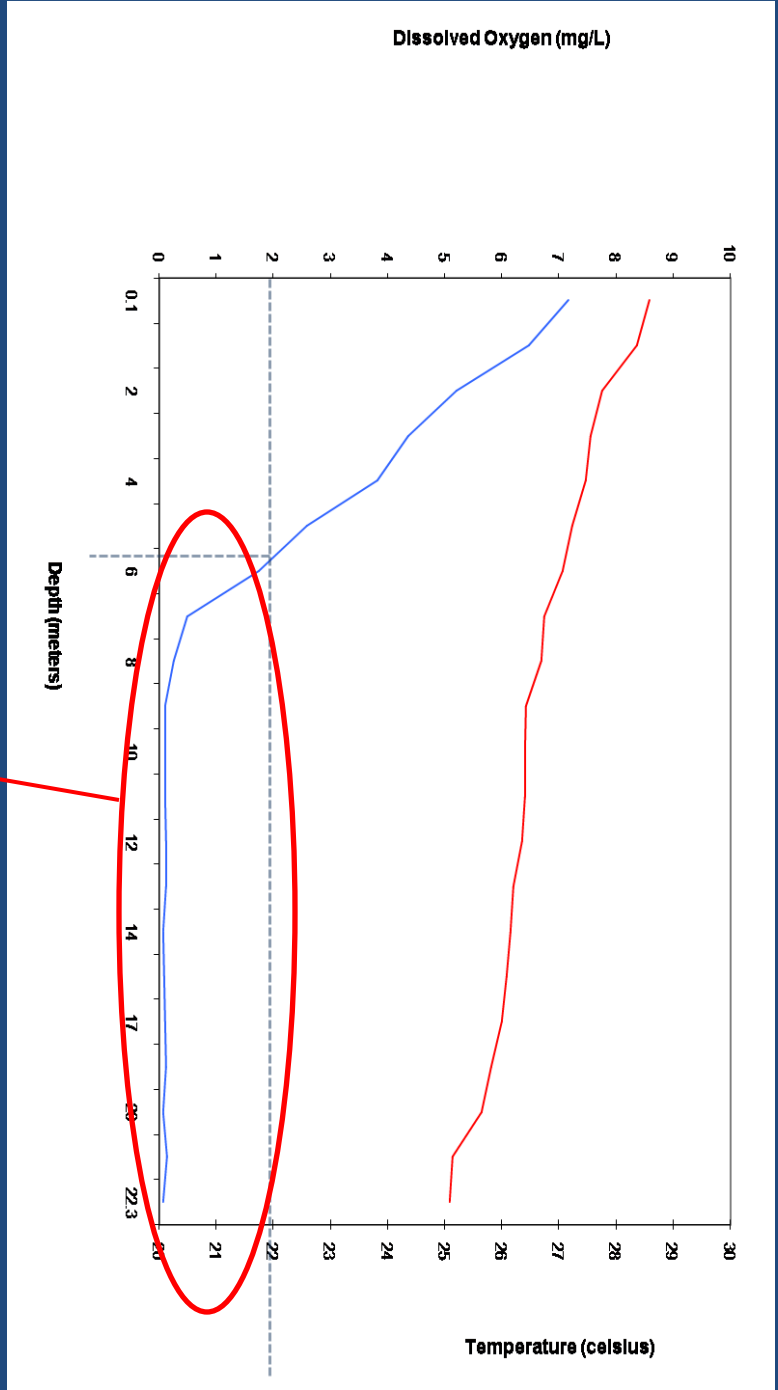
Wewoka Lake Temperature and DO Profile July 23, 2002



36.8 % of water column exceeds the criteria of 2 mg/L

Ft. Gibson Reservoir Temperature and DO Profile July 23, 2007

77.3 % of water column exceeds the criteria of 2 mg/L



Literature Review, Etc.

- Fish Kills



Literature Review, Etc.

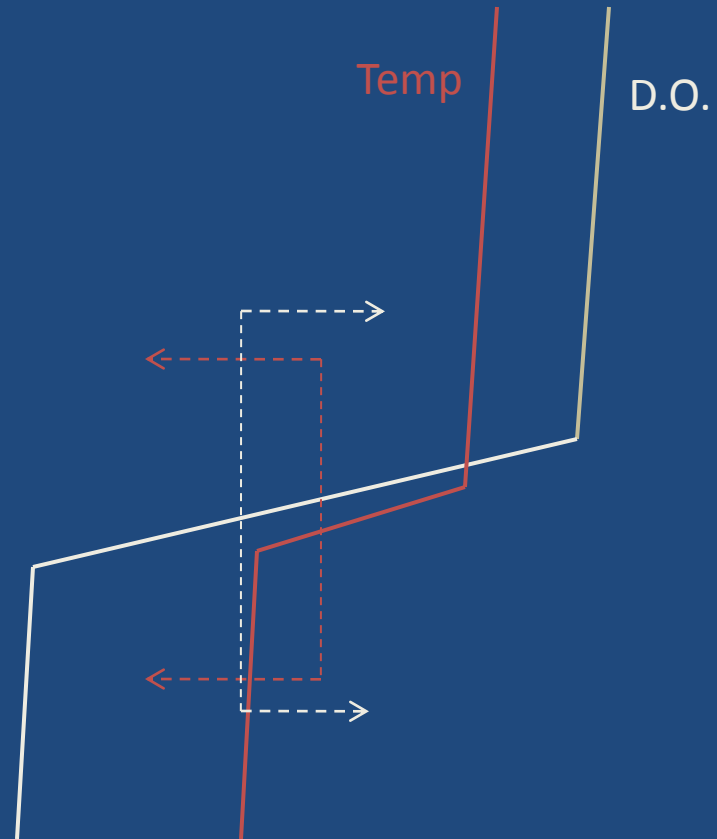
- Fish and Wildlife Propagation effects
 - Recruitment
 - Growth & Survival
 - Reproduction

Literature Review, Etc.

- Eutrophication and hypolimnetic hypoxia

The Fish “Squeeze”

- Temp vs. D.O. Profile
- Striped Bass



State Reviews

- What do other states do in regards to subsurface Do?

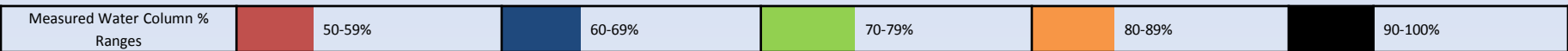
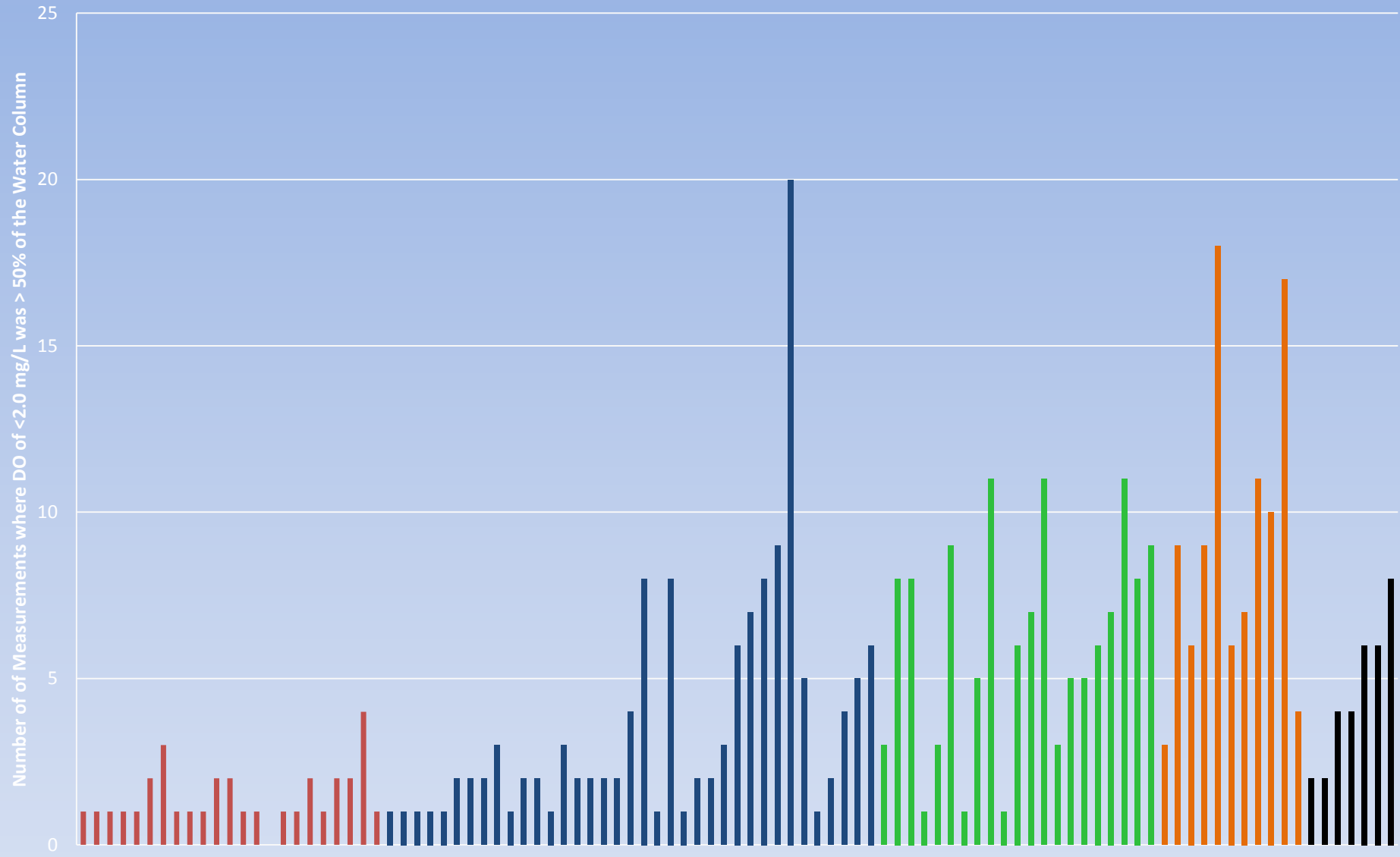
Assessment Data Review

- BUMP lakes program
- What other parameters are not meeting WQS?
- Biological Data?

2008 303(d) List

<u>Water Column Percent Categories</u>	<u>Number of Lakes</u>
50%-59%	23
60%-69%	37
70%-79%	21
80%-89%	10
90%-99%	2
100%	6

Number of lakes on 2008 303(d) impaired waters list per water column percent categories.

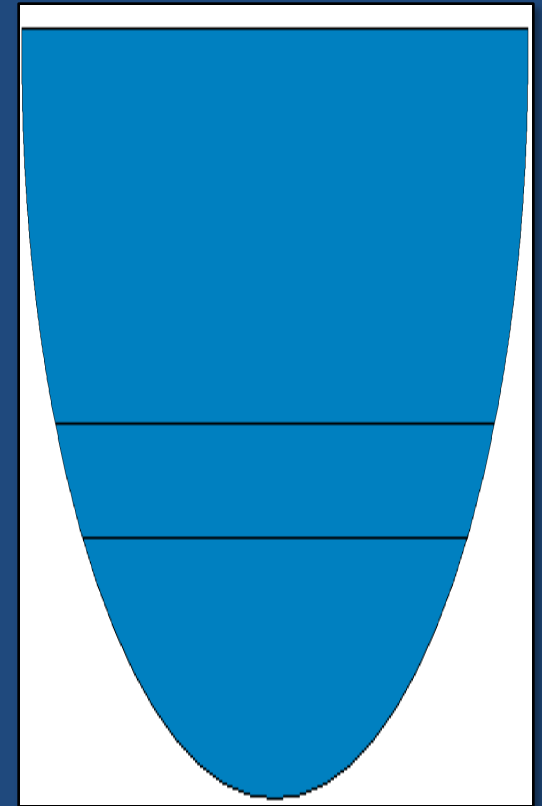
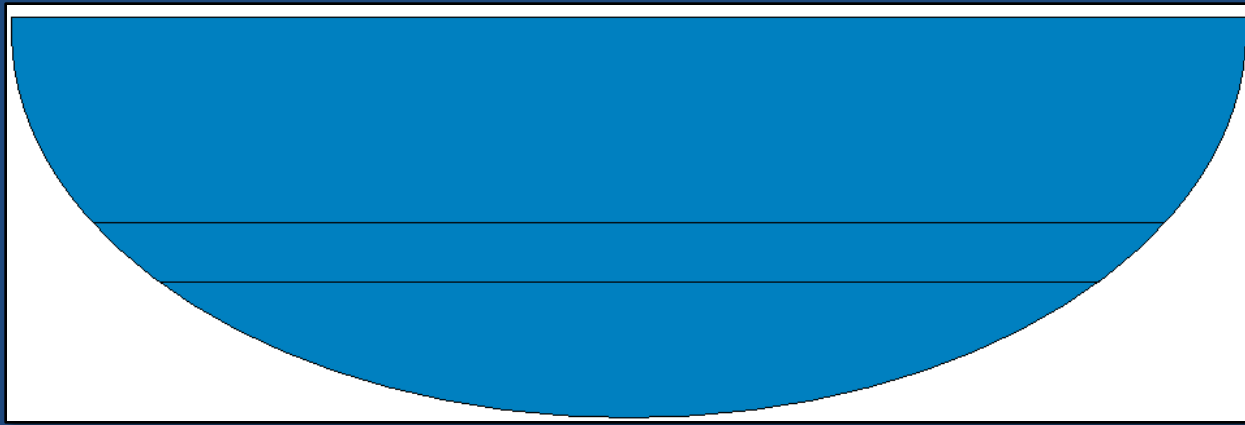


Proposed Refinement

785:46-15-5

- Adjust the water column percentages
- Allow for an undetermined assessment
 - Fully Support = $\leq 50\%$ of water column below 2 mg/L D.O.
 - Not Supporting = $\geq 70\%$ of water column below 2 mg/L D.O.
 - Undetermined = when water column percentage below 2 mg/L is between 50%-70%

Lake/Reservoir Volume

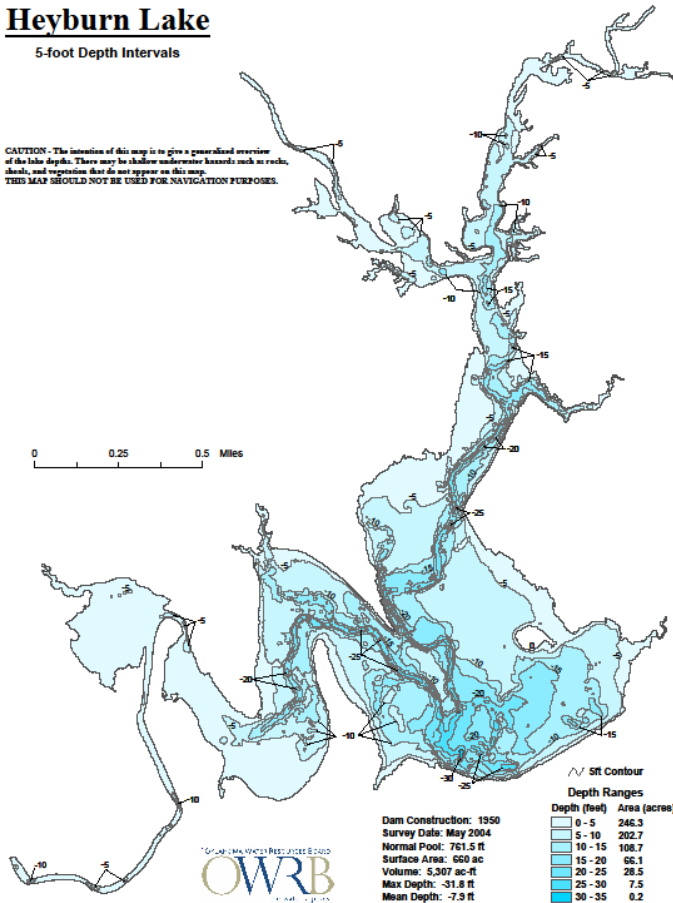


Heyburn Lake

5-foot Depth Intervals

C AUTION: The intention of this map is to give a generalized overview of the lake depths. There may be shallower underwater hazards such as rocks, shoals, and vegetation that do not appear on this map. THIS MAP SHOULD NOT BE USED FOR NAVIGATION PURPOSES.

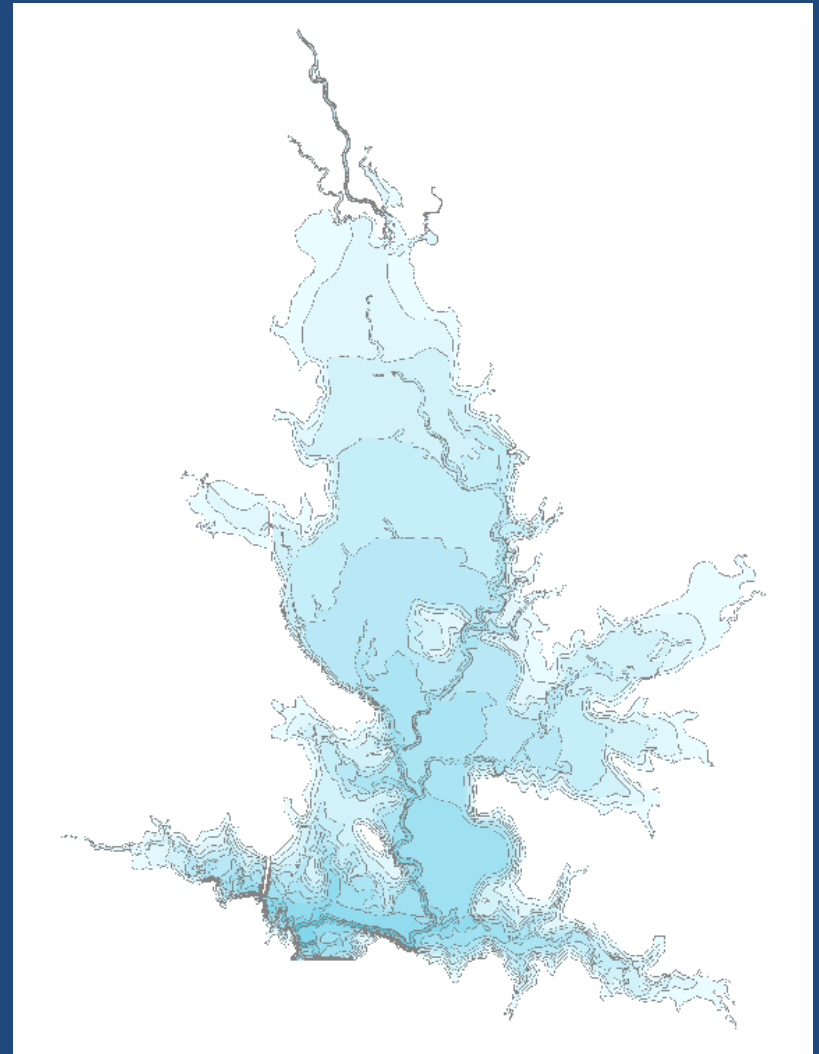
0 0.25 0.5 Miles



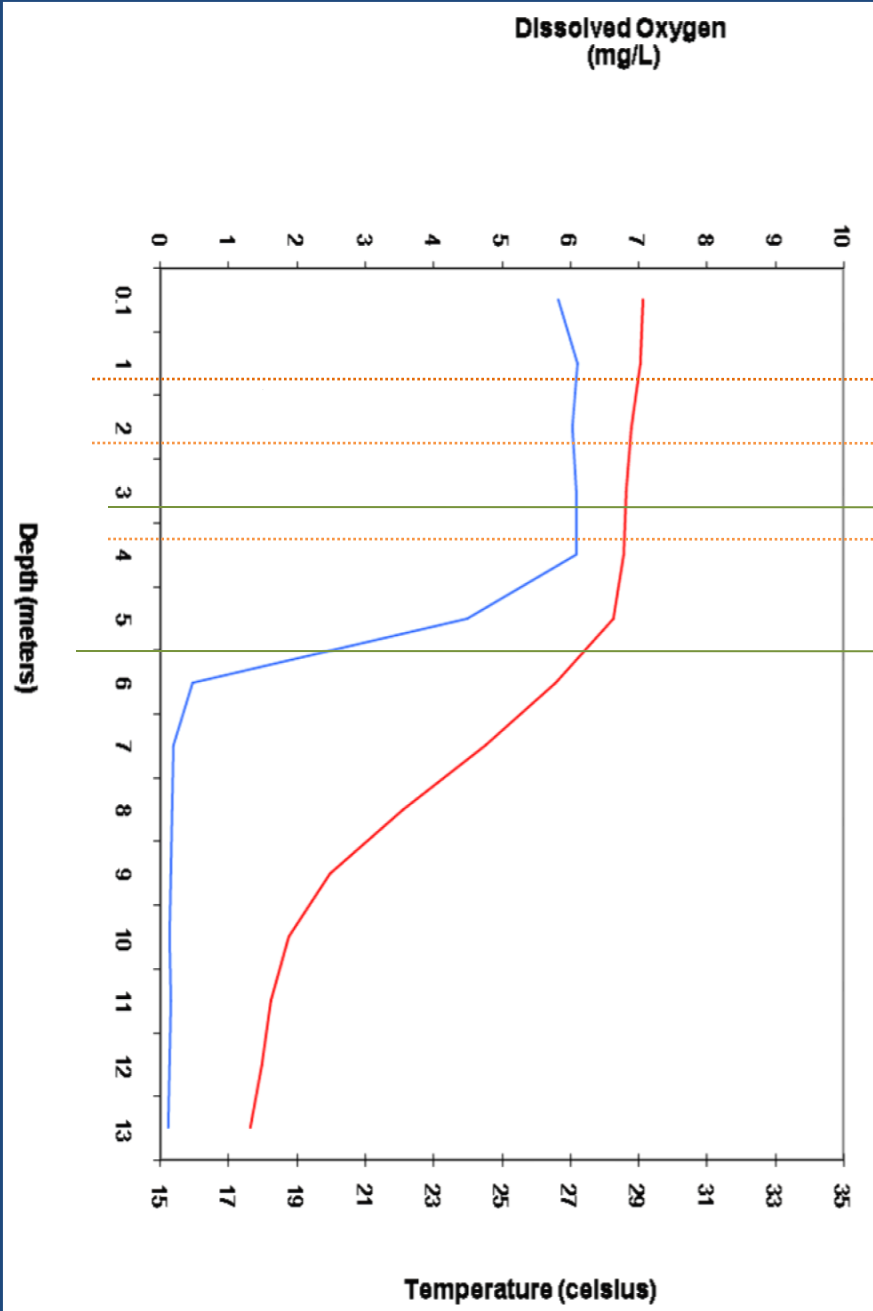
Dam Construction: 1950
Survey Date: May 2004
Normal Pool: 761.5 ft
Surface Area: 660 ac
Volume: 5,307 ac-ft
Max Depth: -31.8 ft
Mean Depth: -7.9 ft

~ Sft Contour

Depth (feet)	Area (acres)
0 - 5	246.3
5 - 10	202.7
10 - 15	106.7
15 - 20	66.1
20 - 25	29.5
25 - 30	7.5
30 - 35	0.2



Okemah Lake
Aug 24, 2005



70% of Water Volume

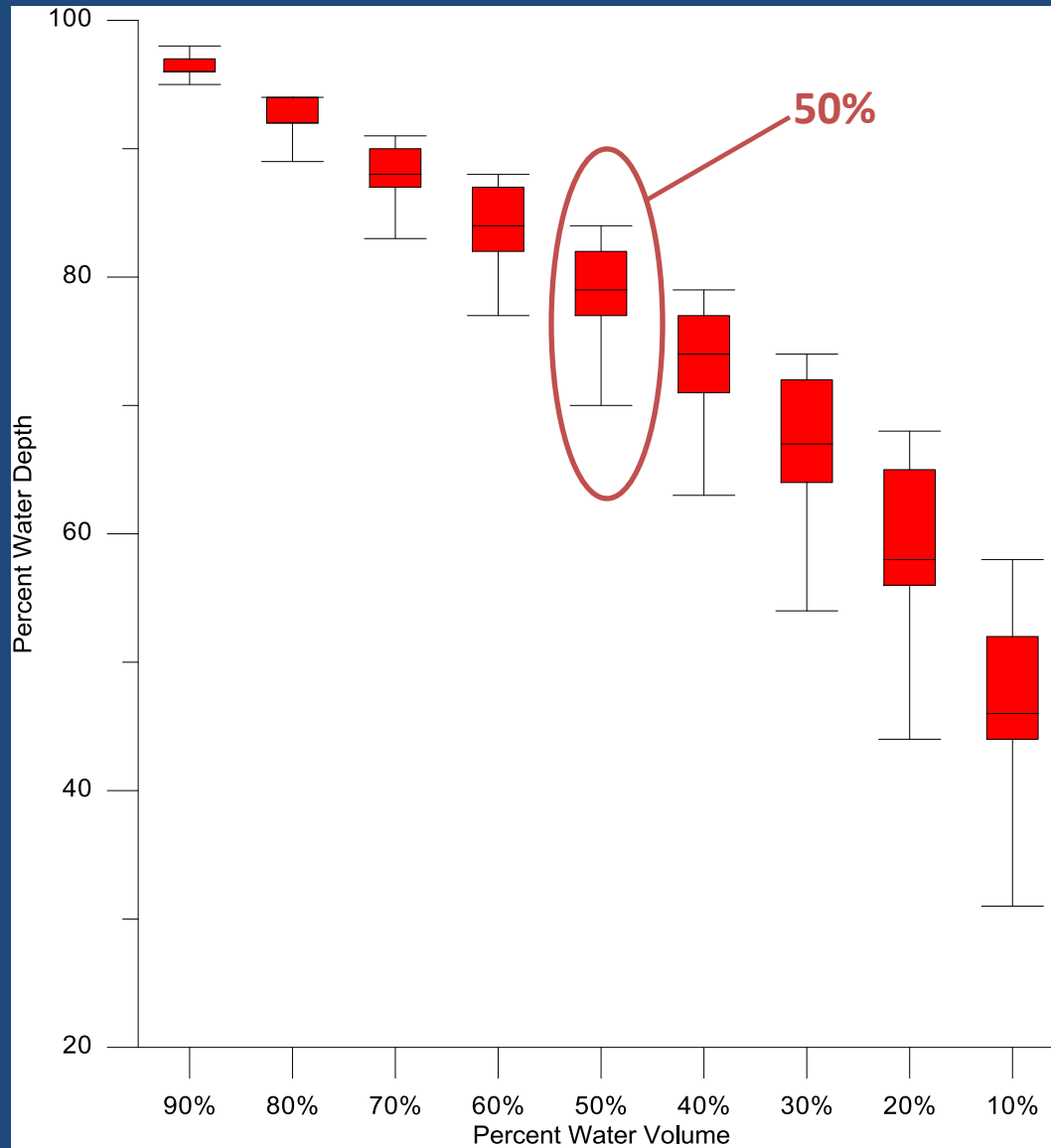
50% of Water Volume

70 % Water Depth

30% of Water Volume

Assessment = 57 %

Lake Volume to % Water Column



Proposed Refinement

785:46-15-5

- Use volumetric data when available
 - Fully Support = $\leq 50\%$ of water volume below 2 mg/L D.O.
 - Not Supporting = $> 50\%$ of water column below 2 mg/L D.O.
 - No Undetermined Range

Final Recommendations

- Reservoir DO refinement
 - Adjust the water column percentages
 - Use volumetric data when available
 - Add Subpart D – moving assessments into WQS

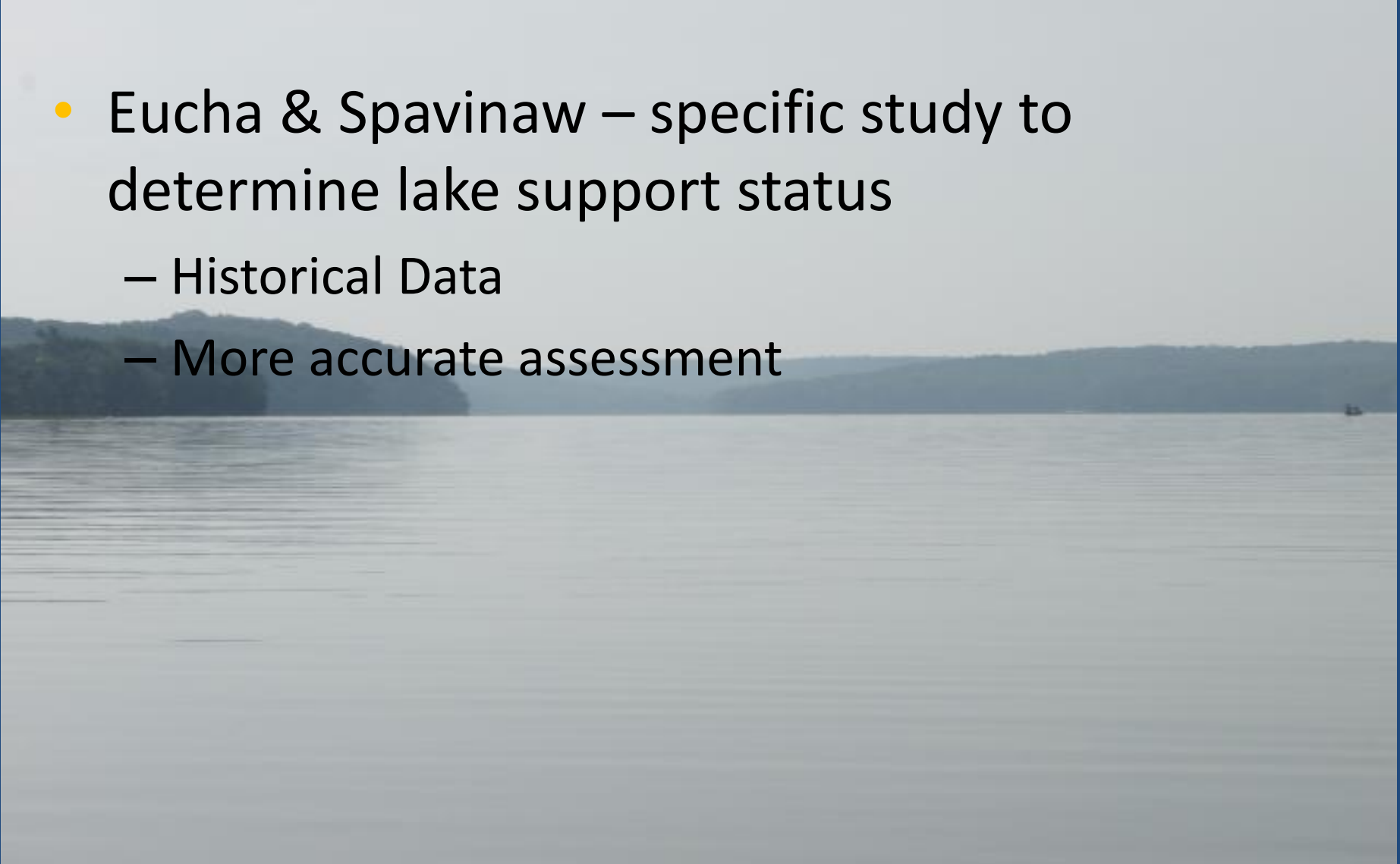
- Use volumetric data, when available, to determine support status of the water column for dissolved oxygen. The proposed threshold for support status is 50% of the water volume. The *fully supporting category is less than 50% of the water volume less than 2.0 mg/L dissolved oxygen. The non-support category is greater 50% of the water volume less than 2.0 mg/L.*
- When volumetric data is not available, the *fully supporting category is 50% or less of the percent (%) water column at less than 2.0 mg/L dissolved oxygen. The non-support category is 70% or more of the percent water column at less than 2.0 mg/L dissolved oxygen.*
- For assessments when volumetric data is not available, and *the percent (%) water column is between 50% and 70%*, the support status shall be deemed to be *undetermined*.

Comments and Response

- EPA strongly recommends that OWRB revise subpart D (vi) to ensure that the DO criteria described in subpart D (vi) apply throughout the water column during times when thermal stratification is not occurring in these reservoirs.
- EPA strongly recommends that the proposed provisions in subpart D (vi) apply throughout the epilimnion.
- EPA strongly recommends that OWRB revise subpart D (vii) to ensure that the provisions in subpart D (vii) only apply during times when thermal stratification is occurring in these reservoirs.

Lake Specific Studies

- Eucha & Spavinaw – specific study to determine lake support status
 - Historical Data
 - More accurate assessment



Final Rule Language

785:46-15-5. Assessment of Fish and Wildlife Propagation support

(b) Dissolved oxygen.

(6) Water Column criteria for WWAC ~~reservoirs~~ lakes .

(A) The WWAC subcategory of the Fish and Wildlife Propagation beneficial use designated for a ~~reservoir~~ lake shall be deemed to be fully supported **during periods of thermal stratification** with respect to the DO criterion if less than 50% of the volume (if volumetric data is available) or 50% or less of the water column (if no volumetric data is available) of all sample sites in the ~~reservoir~~ lake are less than 2.0 mg/L.

(B) The WWAC subcategory of the Fish and Wildlife Propagation beneficial use designated for a ~~reservoir~~ lake shall be deemed to be undetermined during periods of thermal stratification with respect to the DO criterion if 50% or more, but not greater than 70%, of the water column at any given sample site in the ~~reservoir~~ lake is less than 2.0 mg/L due to other than naturally occurring conditions.

(C) The WWAC subcategory of the Fish and Wildlife Propagation beneficial use designated for a ~~reservoir~~ lake shall be deemed to be not supported **during periods of thermal stratification** with respect to the DO criterion if 50% or more of the water volume (if volumetric data is available) or more than 70% of the water column (if no volumetric data is available) at any given sample site is less than 2.0 mg/L.

(D) **If a lake specific study including historical analysis produces a support status which is contrary to an assessment obtained from the application of (A), (B) or (C) of (b)(6) of this section, then that lake specific result will control .**

(7) **Additional application/exercise when support undetermined.** In instances where application of the tests in this subsection (b) initially produce a result that the pertinent subcategory is undetermined with respect to the DO criterion, such shall be subject to additional investigation that considers diurnal data ~~or biological assessments~~ for further application of such tests in order to resolve the determination of use support.

Work To Do:

- Address EPA comments further
- Upon approval – begin work on an S.O.P. to “standardize” how we do these assessments

