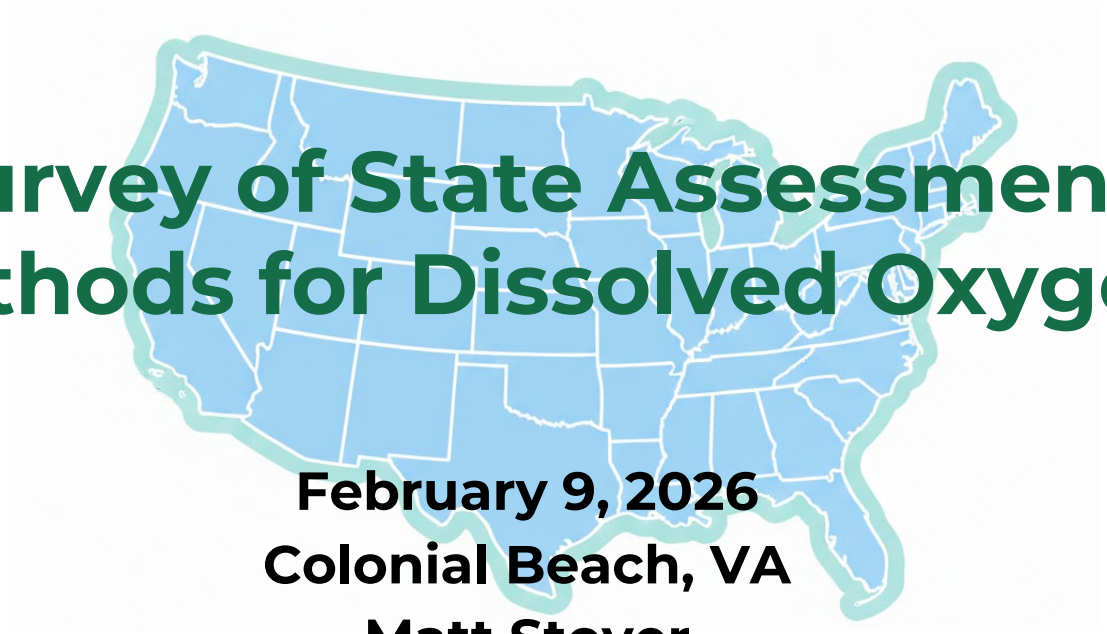
Maryland
Department of the Environment



Survey of State Assessment Methods for Dissolved Oxygen

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Survey completed with assistance from the Association of Clean Water Administrators (ACWA)

Image of contiguous US states created with Gemini

Background & Objectives

- Goals:
  - 1) Understand how other States assess their DO criteria with different frequencies of sampling, i.e., discrete vs. continuous
  - 2) Understand how they assess acute or “minimum” criteria (e.g., not less than…)
  - 3) Potentially use this information to inform assessment methodology for Chesapeake Bay DO

Questions posed through the Association of Clean Water Administrators (ACWA) membership.

- 14 States responded (DE, FL, GA, LA, MA, MN, MO, MT, NE, NV, OR, UT, WA, WY)
  - 7 of them have tidal waters within their jurisdiction.

Question 1: In terms of duration and frequency, what are the different ways that your State specifies DO water quality criteria?

Summary of State Responses:

- Coastal States DO Criteria*
  - 3 states use instantaneous min
  - 3 use just a magnitude with no freq or duration
  - 1 uses a daily avg, 1 uses a 30-day mean, one uses a 7-day mean min, one uses a 7-day min mean
- Non-tidal DO Criteria
  - 5 states use a 30-day mean
  - 5 use a 7-d mean, 4 use a 7-d min
  - 3 use 1-d average, 3 use 1-d min
  - 7 use an instantaneous min
  - 5 use don't specify any freq or duration and just have magnitude with 10% rule

*Since some States had more than 1 DO criterion, there are more than 7 DO criterion mentioned here.

2. What assessment rules or methodology does your State use for assessing each of these DO criteria?

- 9 out of 14 states assess discrete and ConMon data differently, while 3 assess them the same way (2 have assessment methodologies in development)
- Discrete samples are typically compared against the minimum criterion.
- Continuous data (if available) is generally assessed against daily averages, minima, and any longer (e.g., 30-day) term criteria that are statistically-based.
- 10% exceedance rate is the most common threshold for listing (i.e., 8/10 states).
- Another common practice is using a binomial test for assessment at specified confidence levels (e.g., OR).
- Side Notes:
  - 2 states use measurements of DO percent saturation
  - 2 states seek to collect pre-dawn or pre-9am measurements
  - FL uses percent saturation to assess DO and has developed a DO saturation calculator to assess values taken at different times in the day

3. Does your State use an instantaneous minimum-like criteria for DO assessment?”

- Half of states (GA, OR, WY, MT, DE, MO, MA) have a criteria that is essentially 'Instantaneous Minimum’.
- Some use the term “instantaneous minimum”, others express as “shall not be less than…” or “absolute minimum”.

Side Notes:

- When ConMon data is available, Oregon does not assess their instantaneous minimum criteria (i.e., absolute minimum).
- MO assessed instantaneous minimums for not only DO but temperature and pH also.

4. For your instantaneous minimum DO criteria, do you use the 10% rule, a ‘never-to-exceed’ rule, or something else?

- The '10% rule’ for assessment is used by 6 of the states with their instantaneous minimum-like criterion.
- One state, Delaware, specifies that 2 or more samples exceeding the criteria in a 5-year period results in impairment listing.
- Wyoming had been using a weight-of-evidence approach for assessment but EPA objected on “independent applicability” concerns.

5. How does your State assess high frequency DO criteria (e.g., instantaneous minimum, 1-day averages) using discrete data (i.e., data collected no more frequently than one measurement per day)?

- Discrete data is often (6 states) used for assessing instantaneous minimum criteria and 6* use it for assessing daily mins and daily avgs.
- Utah will use discrete data for longer term (i.e., 30-day avg, 7-day avg) DO criteria.
- Florida requires more than one sample per day for assessment
- Two states don't have high frequency DO criteria
- Notably several states will not use discrete data for longer term (30-day and 7-day) criteria and instead require the use of ConMon data.

* Since many states have more than 1 DO criterion, in some cases, I'm double-counting each state.

6. How does your State assess longer term DO criteria (e.g., 30-day mean) using discrete data (i.e., data collected no more frequently than one daily measurement)?

- Most states will not use discrete data for assessing longer term DO criteria.
- In only 2 cases (UT, FL) were discrete data used for longer term criteria. FL requires 10 discrete samples in a 30-day period.
- Most states default to the instantaneous minimum or daily average when data frequency is low.
- Some states (GA) do not use 30-day means for assessment at all.

7. Do you have any procedures or methodology for assessing DO criteria that were derived based on discrete monitoring data but for which you are now using ConMon data to assess?

- Most states (8) either modified or created new assessment procedures specifically to address the availability of ConMon data.
- Several states (3) simply assess ConMon data the same way as discrete using the 10% rule.
- Two states are in development of assessment methodologies to handle ConMon data.
- Side Note:
  - Oregon uses a '10%-10% rule' for continuous pH – could be just as easily used for DO

General Themes

- Many states have high frequency or acute DO criteria (e.g., instantaneous minimums)
- Longer term DO criteria (e.g., 30-day mean) were less common.
- Discrete or grab sampling data was typically used for assessing high frequency DO criteria (e.g., instantaneous minimum)
- ConMon data was used for assessing DO criteria for longer durations (30-day) as well as shorter durations.
- Many states assess their discrete and ConMon data differently
- EPA's 10% rule is widely used, with some states applying it by using binomial probability.
- Useful for exploring simple methods of DO assessment for the Bay as a complement to the 4D Interpolator