NBEP Water Clarity Working Group – 2021 Recap

Overview

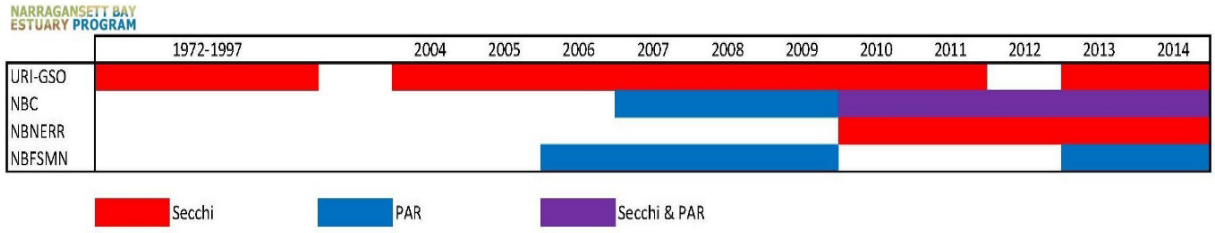
During 2021, the NBEP Water Clarity Working Group met virtually in April, July, and October to ensure the NBEP reports water clarity status and trends in a defensible, consistent, and repeatable manner. This includes identifying data gaps, facilitating filling those gaps, and serving as a community of practice for water data collectors/practitioners. This working group also assists NBEP in addressing public questions and concerns about water clarity.

Water clarity is an environmental condition indicator showcased in NBEP's 2017 *State of Narragansett Bay and Its Watershed*. The presentation of the data in that report and growing public concerns about the health (and clarity) of Narragansett Bay triggered the formation of this group. NBEP asked scientists, federal/state level managers, and non-profit organizations to systematically go through the meaning of water clarity to their audiences. We strived for consensus on how best to present the indicator in the future, and how best to address public concerns moving forward.

Water clarity measurements in Narragansett Bay

Water clarity data is collected either as Photosynthetically Active Radiation (PAR) or via Secchi depth. PAR is usually converted to *k* which is the light extinction coefficient (in 1/meter) and Secchi depth is reported in meters (m).

Many organizations collect data around the bay. We initially focused on those groups whose data was used in the 2017 *State of Narragansett Bay and Its Watershed* and is shown in the figure below.



We also discussed other datasets, including the Rhode Island Department of Environmental Management (RIDEM) Harmful Algal Bloom (HAB) monitoring program, the Bay Ecosystem Time Series (BETS) and the National Coastal Conditions Assessment both (maintained by the EPA). These datasets use Secchi depth in their programs. The University of Rhode Island's (URI) Watershed Watch also shared that they maintain a Secchi depth database at sites around Narragansett Bay as well.

The Working Group spent time discussing the pros and cons of each type of data. PAR is very useful for understanding fine scale changes in water clarity throughout the water column. Secchi depth is very easy to collect, but is a more coarse measure of water clarity. For example, PAR may be able to tell you the clarity difference between 2 and 2.25 m depth while Secchi can describe the water clarity difference between 2 and 2.5 m. The group also pointed out that Secchi is quite variable and prone to high error. URI's Watershed Watch group countered that Secchi can be a pretty good measurement with proper training and the use of a "viewing tube" to reduce sun glare. The training module is online and has been used by the group extensively to train their volunteer scientists. While the group agreed that PAR data is by far more accurate and less prone to error, they did understand that unless converted to a length

measurement, *k* is very difficult for the public to understand. Additionally, continuing to convert Secchi depth to *k* (as done in the *State of Narragansett Bay and Its Watershed*), adds additional error that may be unnecessary.

The group agreed that the **purpose** of the indicator is to provide understanding of how clear the bay is and how clarity changes daily, seasonally, and yearly to a broad audience. Since Secchi depth measurements are recorded in more places than PAR, and for longer time periods, the group decided to focus the water clarity indicator on those data.

Next, the group discussed how to visualize the data with a focus on (1) averaging the data across year(s), (2) representing seasonality, and (3) including a threshold to indicate "clear" or "not clear". (1) With nearly 60 years of data and many management upgrades during that time, the group feared losing the audience in the details. Averaging the data before and after the most recent major management upgrade in 2012 – reducing nitrogen effluent from wastewater treatment facilities by 50 – reduced the interannual "noise" while also highlighting the importance of the management upgrades. (2) The data could be averaged separately for summer (July-September) or for growing season (May through October). Members of the group pointed out that a summer average brings the most sensitivity and may better indicate the response to management strategies because the water is less clear, while a growing season average allows you to focus on physical properties of the water and seagrass habitat. The group chose to focus on the response of management strategies, and highlight only the summer averages. Finally, (3), the working group explored multiple thresholds (see notes for more detail), settling on the 80th percentile of the pre-2012 (pre-upgrade) average as a benchmark. The benchmark wouldn't necessary be a goal, but a way to communicate how water clarity has changed. The 80th percentile would be represented as a water clarity depth on the figures with a notation explaining the benchmark.

What's next

This working group decided on two pillars: (1) continue updating the indicator based on the suggestions above and (2) work towards a water clarity management goal.

As more data becomes available in more places, we will reconvene to make sure the data are being represented accurately and fairly. Additionally, we will explore how best to convert Secchi and PAR to *k* to reduce error and provide an avenue for more data applications. We will also focus on methods to encourage the collection of water clarity data in the embayments, which is a data gap identified in the *State of Narragansett Bay and Its Watershed*.

Since water clarity measurements are easy to make, using them as a proxy for "realtime" information to make decisions is an interesting challenge. Could we use it to close beaches or the bay for fishing? Could we use it as a proxy for nutrient enrichment and identify places where we should focus management efforts? The working group suggested correlating water clarity with other information we already have, such as the chlorophyll or hypoxia indices. These types of analyses can explore how best to use water clarity data, and develop goals towards maintaining a thriving Narragansett Bay.