

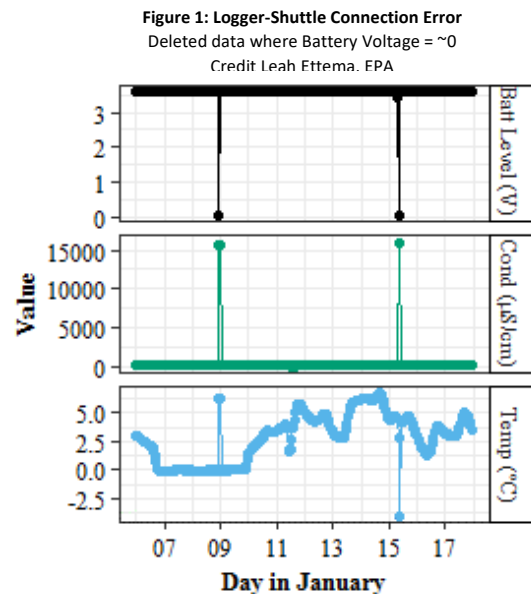
Recommendations to Prevent Biofouling on Water Quality Instruments within the Brackish Waters of New York, New Jersey, and Connecticut

A subcommittee to the Interstate Environmental Commission (IEC) Shared Waterways Monitoring Workgroup and the New York-New Jersey Harbor & Estuary Program (HEP) Water Quality Work Group was formed in 2019 to advance discussions on the shared challenges of continuous monitoring in the estuarine waters of New York, New Jersey, and Connecticut. The following recommendations have been compiled by the [Continuous Monitoring Practitioners](#) Subcommittee to help scientists, researchers, and their volunteers reduce the amount of fouling that can occur and increase the amount of reliable data in these shared waters. After spending countless of collective hours trialing and failing, these recommendations are the subcommittees' lessons learned to reduce flagging data as unusable as a result of fouling, critter interference or loss of the central wiper.

Field Considerations

As you prepare a [Quality Assurance Project Plan](#) or establish a procedure for your continuous water quality monitors, there are several field considerations that should be included in your project plan, regardless of the instruments being used.

- Record the battery level of your instrument. For battery powered sondes, data failures or drift can be associated to a dead battery but to flag the data the battery level record will be critical as to the amount of good data you will have.
 - For stations connected to solar panels, when installing your station consider shadows from buildings, trees, or other structures that will limit the amount of daylight and power to the solar panel.
- Consider putting together an inspection/repair bag to take with you during each visit. Materials to be included in this bag include: scrubs, toothbrushes, Q-tips, grease or silicone gel, extra o rings, extra sensor or probe supplies (i.e. dissolved oxygen, turbidity tips, and pH sensor), batteries, cooper tape, extra copies of field forms and/or calibration guidelines.
- Plan to visit each monitoring station every four to seven days during the summer months (June-October) and gently scrub regularly during visits (per manufacturer's instructions). Be sure to inspect the equipment (including all connection points), calibrate and relaunch the equipment, and consider bringing a laptop or other equipment to shuttle data. Ensure that all proper electrical connections are made in preparation for shuttling data. By shuttling your data in the field, this will help to inform you immediately of any corroded sensors that need replacing in real time.
 - During winter months (November – May) consider visiting stations once every four to five weeks.



- Collect your data before and after cleaning measurements to document any effects of fouling. You will want to ensure that all proper electrical connections are made and tightly secured when downloading data.

Structure and Equipment (Prior to Deployment)

Depending on the equipment and the data you are trying to collect, there are some general modifications you may want to consider prior to deployment.

- Consider replacing all plastic and metal (non-copper) housing or guards with either a copper or brass guard or housing. These will likely be an additional cost to replace, but will help to further prevent biofouling. Include a guard for Dissolved Oxygen sensors including copper mesh screens. The screens help to prevent critters, like crabs and fish, from entering the structure, laying eggs, and hanging around the probes.
- Spray paint the structure and equipment (while protecting sensors) with an antifouling paint. ePaint is an antifouling paint that does not use copper and presents less of a workplace hazard when using.
 - Other antifouling paints to consider is Petit Paint and Interlux.
- If possible, use copper mesh and copper tape around the pumps, including the head, and each individual probe. See surface treatment for further suggestions of protecting your equipment.
- Adding copper-alloy screens for conductivity temperature probes and non-wiped pH probes also help to minimize biofouling.
- Consider including a zinc sacrificial anode that can help to decrease degradation to other sensors.

Figure 2 (left): Copper mesh “cage” installed around pump inlet. Credit: Nicole Petersen, Barnegat Bay Partnership



Figure 3 (right): Replacing EnduraFlux membrane and copper tape to pump head. Credit: Nicole Petersen, Barnegat Bay Partnership



Surface Treatment

There are several methods that can be used to treat your equipment prior to deployment as well as during each inspection visit. These include taping, pastes, and paints.

- Wrap each sensor and sonde individually with packing tape first, followed by duct tape or a gorilla tape and end with copper tape. This will allow you to later remove and replace wrapping for an easy clean up later in the season. Generally, it is recommended that you replace taping twice throughout the year.
 - Alternatively, there has been some success with wrapping sensors with electrical tape, followed by a plastic wrap, and then electrical tape again. After taping is completed,

- antifouling paint is sprayed on. This makes it much easier to clean up by taking a razor to removal all the wrapping thanks to the use of the electrical tape.
- Tape and saran wrap have also been used with success when coupled with antifouling paint such as ePaint.
 - In addition, you may consider making a paste with Vaseline and cayenne pepper that can be added to areas where you are visibly seeing biofouling during visits. The paste helps to ward off critters, though it should not be considered a long term preventative treatment.



Figure 4: Taping of individual probes (seen here in Copper). Credit: Siddhartha Hayes and Helen Polanco, Hudson River Park River Project.

Wipers

External wipers, particularly for nitrate analyzer, are helpful in reducing biofouling. It is important that the wiper is large enough to clean the entire top surface of the sensor. However, as tightly secured as they may be, there is always the chance of losing wipers or having them get tangled in algae. Taping wipers with copper directly may impact the data you are attempting to collect. It is therefore recommended using packing tape first, followed by duck tape and end with copper tape. Along with adding a copper alloy mesh screen, be sure to wipe down conductivity sensors to prevent critters from hanging out in your equipment.

For more detailed guidance, the Continuous Monitoring Practitioners Subcommittee recommends the following guides:

U.S. Environmental Protection Agency (EPA). (2014) Best Practices for Continuous Monitoring of Temperature and Flow in Wadeable Streams. Global Change Research Program, National Center for Environmental Assessment, Washington, DC; EPA/600/R-13/170F. Available from the National Technical Information Service, Springfield, VA, and online at <http://www.epa.gov/ncea>.

Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3, 51 p. + 8 attachments; accessed April 10, 2006, at <http://pubs.water.usgs.gov/tm1d3>.