



Evaluation of Various Antifouling Techniques for Water Quality Sensors in Coastal Waters

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Tampa, FL

10th National Monitoring Conference

Tampa, Florida, May 2 - 6, 2016

Background



- 70 Water Quality Sensors deployed
- Approximately 50 % in high saline coastal conditions
- Temperature, Specific Conductance, Dissolved Oxygen, and Nitrate

Common types of fouling



- Mud
- Silt
- Algae
- Organisms including: crabs, worms, slugs, and small fish
- BARNACLES!!!

Fun Facts

- Barnacles are actually crustaceans and related to crabs
- Free floating until they permanently attach themselves to substrates
- Have a calcite outer shell
- Most live in shallow tidal waters
- Are thought to be one of the oldest surviving creatures on the planet.

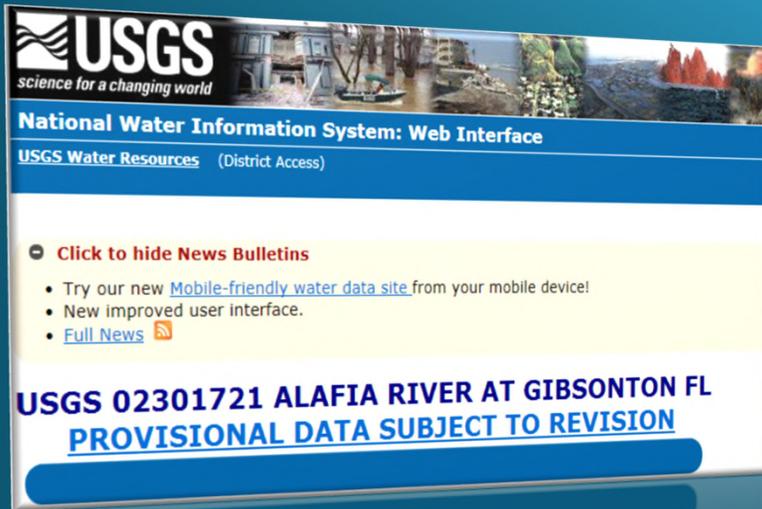


Precipitation and temperature can affect Barnacle growth



Alafia River at Gibsonton, FL (02301721)

- Located near the mouth of Alafia River flowing into Tampa Bay



Study site logistics

- Site was chosen due to proximity to Tampa Bay and known barnacle problem
- Two existing water quality sensors, plus a pressure transducer to determine stage
- Study sensors were not transmitted. Data was logged and downloaded during routine visits
- Location of study site posed accessibility issues. Station is located on a bridge support in middle of channel and a boat is required to service station
- All sensors involved with study were deployed at same depth
- Specific Conductance ranges from 800-40,500 $\mu\text{S}/\text{cm}$ at 25° C, but typically averages 30,000 $\mu\text{S}/\text{cm}$ at 25° C

Study included four water quality sensors

- YSI 600R[®]- Plain
- YSI 600R[®]- inserted into a HydroTech Long-term Deployment Module[®] (LDM)
- YSI 600R[®]- Covered with copper mesh
- Sea-Bird Coastal Micro CAT[®]- uses EPA approved antifouling device with pump



HydroTech LDM[®]

- A valve opens and hydrostatic pressure allows water to flow into sample housing
- Valve then closes and water is held until reading is taken
- The pump turns on and sample water is expelled



Micro CAT[®]

- Has integral pump that pumps water into cell
- As water flow in, it passes through a US EPA approved anti-foulant
- Sample flows through cell, obtains reading
- Sample water is then pumped out



Determining Fouling Corrections



Data corrections for fouling are percentages based on readings prior to cleaning vs. post cleaning readings

Maximum allowable limits for Specific conductance is +/- 30%. Data must be censored when correction exceeds this threshold



Common PVC pipe with flow through holes

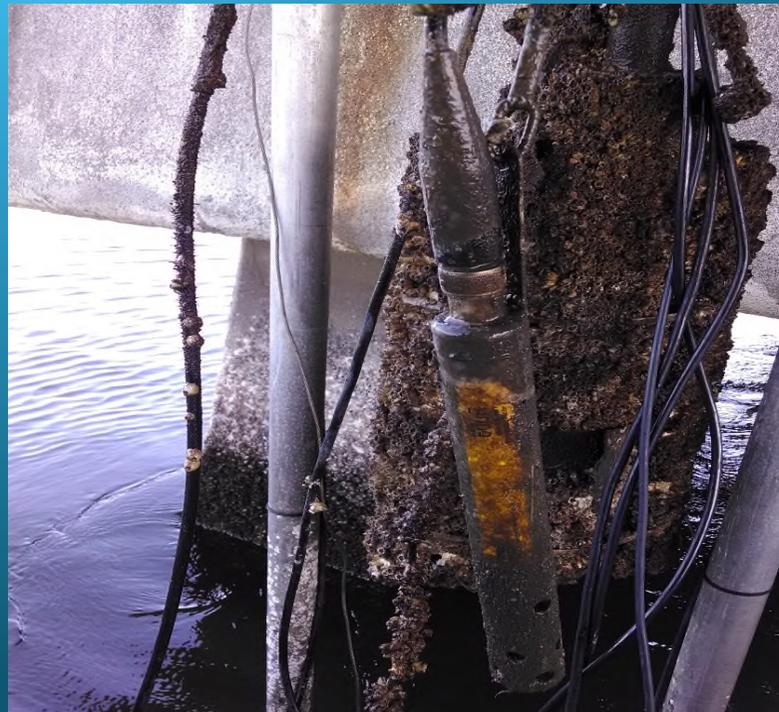


YSI 600R[®] Plain

Before Deployment



After 2 Months



YSI 600R[®] inserted into LDM

Before Deployment



After 2 Months



YSI 600R[®] w/ Copper

Before Deployment



After 2 Months



MicorCat[®] with built in Biocide

Before Deployment



After 2 Months



Antifouling Chemical

- Use of a biocide



Correction Table

- (Drift corrections were disregarded)

| Sensor Type | Fouling Correction |
|--------------------------|--------------------|
| YSI [®] -Plain | -3.30% |
| YSI [®] -Copper | 8.40% |
| YSI [®] in LDM | 4.65% |
| MicroCat [®] | 0% |

Technical Issues with Study Sensors

- Low battery due to added load from study sensors. Extra solar panel had to be installed to sustain voltage.
- Sensor with copper mesh accumulated gunk, which did not allow for good circulation.
- LDM that held a sensor, had mechanical problems and did not pump correctly for the complete study period. Possible that very small particulates clogged pump.
- The data from the sensors being evaluated was not transmitted and problems were not known until site visit.

MicroCat[®]



- For Quality Control, a calibration check still needs to be performed.
- No need for fouling or drift corrections to be applied

BUT...

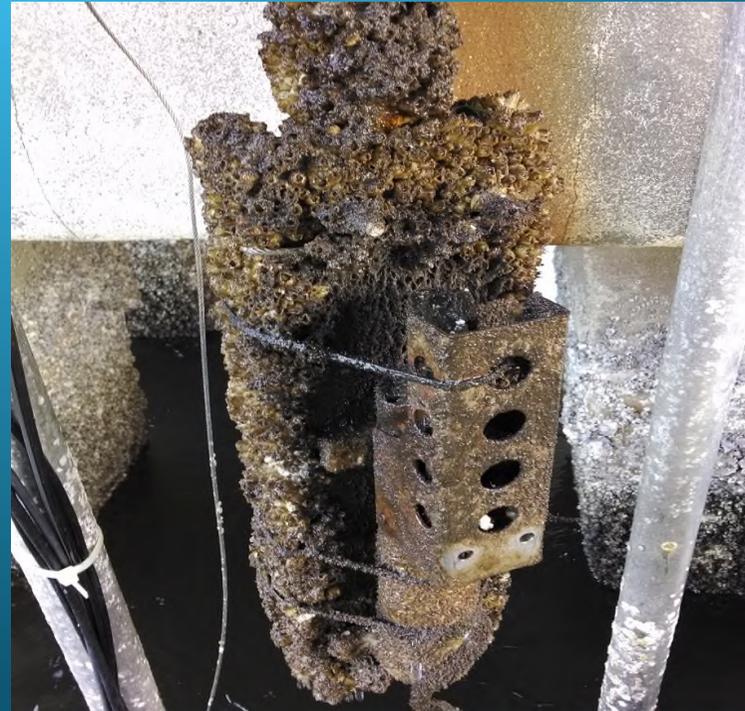
- After long term deployments, barnacle growth can cause time consuming cleaning processes
- Sensor must be clean in order to be able to check the calibration

MicorCat[®] with built in Biocide

Sensor without
Antifouling Paint



Sensor with
Antifouling Paint



Conclusion

- One size “Does Not” fit all!



- Type of antifouling application can vary with location depending on conditions.
- Understanding the location, tidal flows, temperature, and what types fouling you may expect, can help determine which application can be utilized to minimize the need for data corrections.



Thank You!

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