C3™ Submersible Fluorometer

Technical Note:
Effects of Antifouling Copper Tape on Bio-Fouling of C3 Submersible Fluorometer Sensors

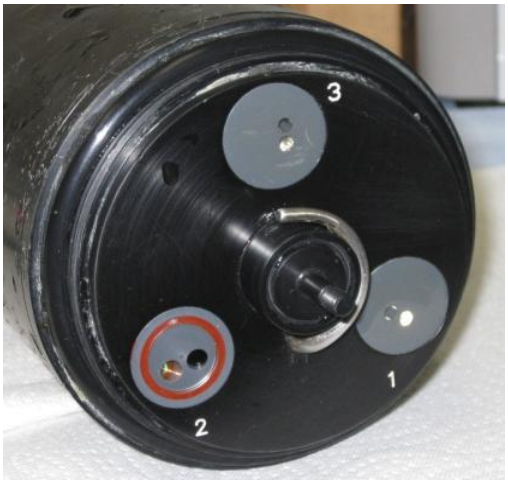
Introduction

Copper is a highly effective material used for minimizing bio-fouling of substrates. Copper can be purchased as sprays, tape, plates, or mesh. Accessories can also be made from copper material, however, these accessories, such as shade caps or sensor guards, may degrade over time requiring the customer to discard their degraded accessory and purchase a new one. This may not be a cost efficient situation for many oceanographers. Furthermore, many sprays in general don't have a visual cue after being applied that tells the user: 1) when the spray needs to be reapplied and 2) how well it was applied initially. The sprays that do have a visual cue may optically interfere with sensor readings. Copper tape, plates, or mesh are typically low in cost, easy to replace, and have visual cues to tell the user when to replace or clean. Turner Designs recommends using our Antifouling Copper Tape Kit (PN 2300-506) with the C3 Submersible Fluorometer to significantly reduce bio-fouling of sensors during long-term deployments. It is preferred customers use our Antifouling Copper Tape in conjunction with our mechanical wiper for most efficient reduction of bio-fouling, but this report shows that antifouling copper tape without mechanical wiper works better than a C3 Submersible Fluorometer that has neither.

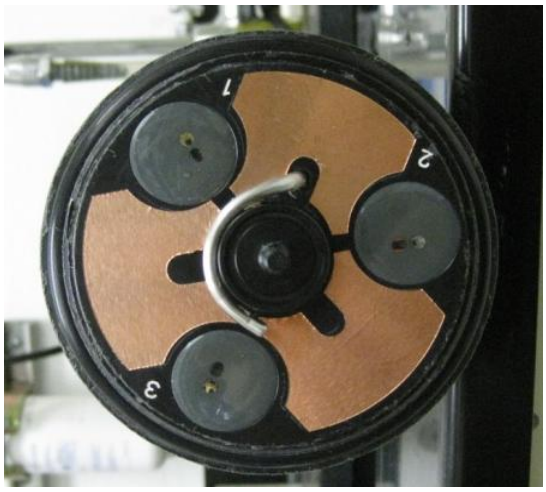
Deployment

Two C3 Submersible Fluorometers were deployed in the San Francisco Bay for a period of 1 month, from March 15, 2012 to April 18, 2012. Both units were equipped with a Chlorophyll sensor (Sensor 1) used to detect the fluorescence of chlorophyll from algal cells. To one of the units, antifouling copper tape was applied to the optical head (designated as Copper Unit), and the other unit was used as a control (designated No Copper Unit). Instruments were deployed with C3 Submersible Fluorometer's standard shade caps and no wipers were used for this deployment.

No Copper Unit

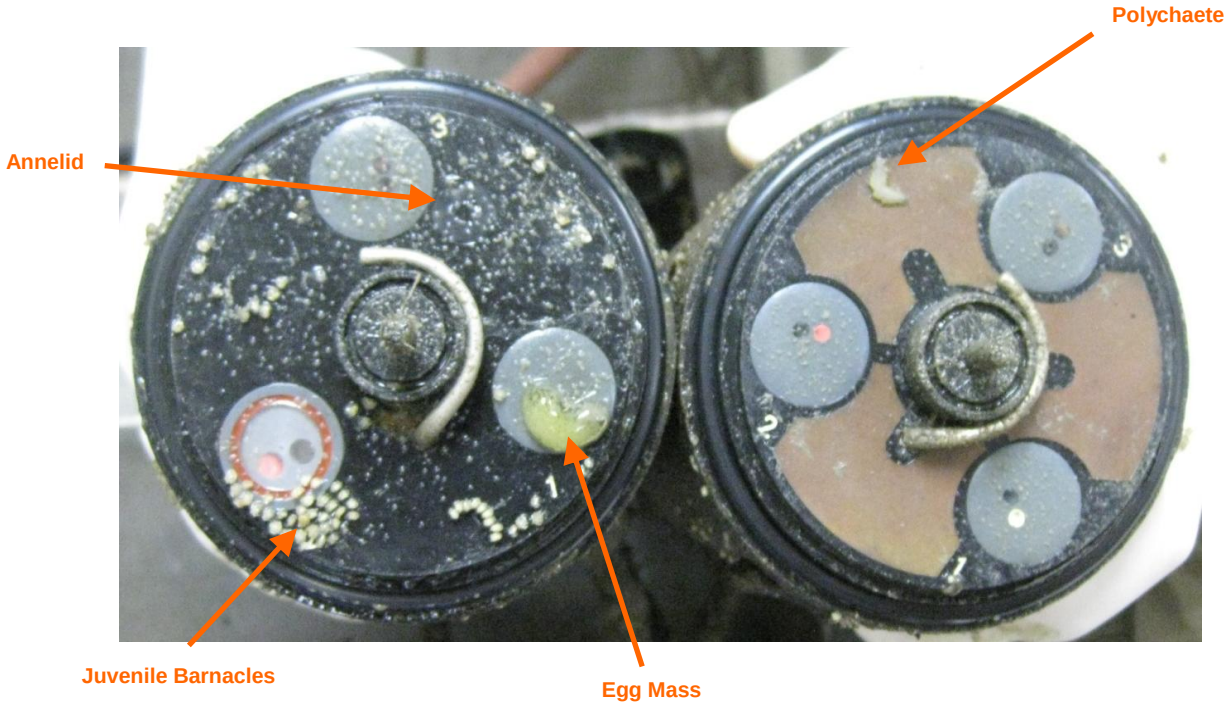


Copper Unit

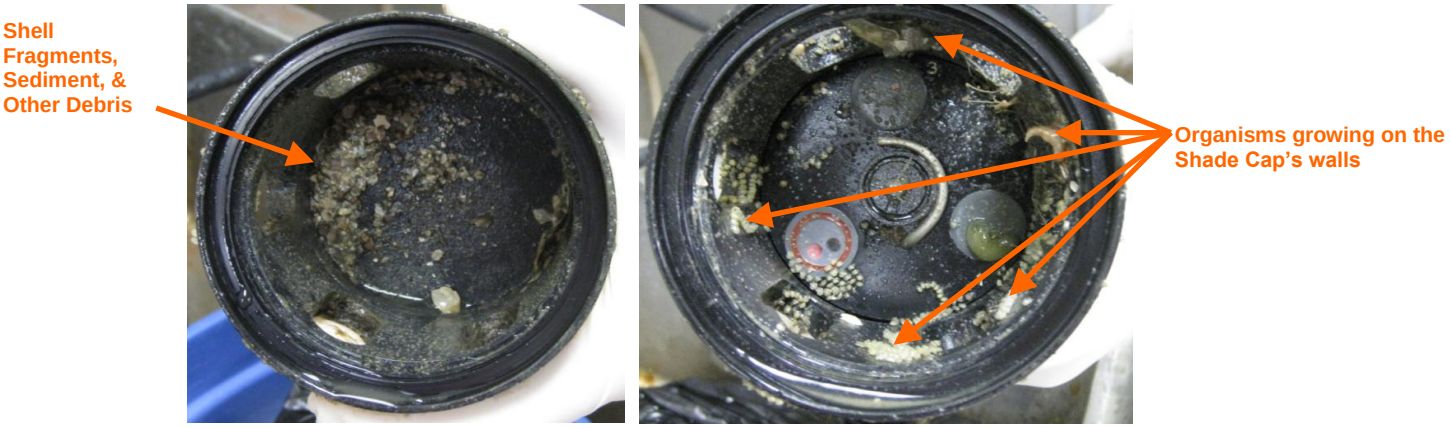


Results

After recovery, visual observations indicated that there was more growth on the No Copper Unit's optical head than the Copper Unit. Sessile organisms took hold and were growing on the No Copper Units optical head. Covering roughly 55% of the total area of the Copper Unit's optical head with antifouling copper tape was enough to deter growth from sessile organisms that would affect sensor readings. Only a few mobile animals were found living in and around the optical head, but there is no indication of when or how long they were there.



Shade caps also showed a visual difference with respect to bio-fouling organisms. The Copper Unit's shade cap (below, left) showed less growth than the No Copper Unit's shade cap (below, right). One explanation for this observation is that the concentration of copper ions around the C3's optical head may have minimized growth on the shade cap as well.



Chlorophyll Data

Data recovered from the units are plotted below as relative fluorescence units over time. The two C3 fluorometers tracked chlorophyll responses over 24 days indicating that the antifouling copper tape doesn't affect sensor measurements or the organisms being detected, phytoplankton in this case, even at low algal concentrations (< 5 μg/L). Around 24 days there seems to be a spike in data from the No Copper Unit and an increase in spike frequencies in that data set from that point on until the units were recovered. In comparison, the Copper Unit showed a stable reading with only one data spike (representing one data point) most likely from a mobile organism passing by the sensor at the time a reading was being made. The stability in the Copper Unit's data set is further indication that copper tape was effective at minimizing organism activity around the optical head and within the Shade Cap for up to one month, the length of the deployment, in a productive system.