Biofouling Experiments in Yaquina Bay

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Unsustainable Chemicals to UV Solutions

Biofouling is the main limitation in biogeochemical sensors. There are few effective and safe ways to prevent biofouling and it is nearly irreversible. However, UV LEDs have been shown to reduce biofouling and not pollute the environment any further. The downfall is that along with the sensors collecting data the UV LEDs need power. Finding the optimal duration of UV exposure to prevent biofouling and save energy is critical for the future of biogeochemical instrumentation, data collection, and discovery.

The current method of anti-fouling that Sea-Bird sensors use small amounts of unsustainable chemicals (bis(tributyltin) oxide) coated at the ends of where samples are collected. However, if **the efficacy can be replicated using an UV-based approach** then a complelty new avenues of biogeochemical sensing will become available since the same techniques could be applied to ROVs, AUVs, mooring systems, boats, etc.

PBOS

"Potato Boat of Science"

Deployment station for all experiments

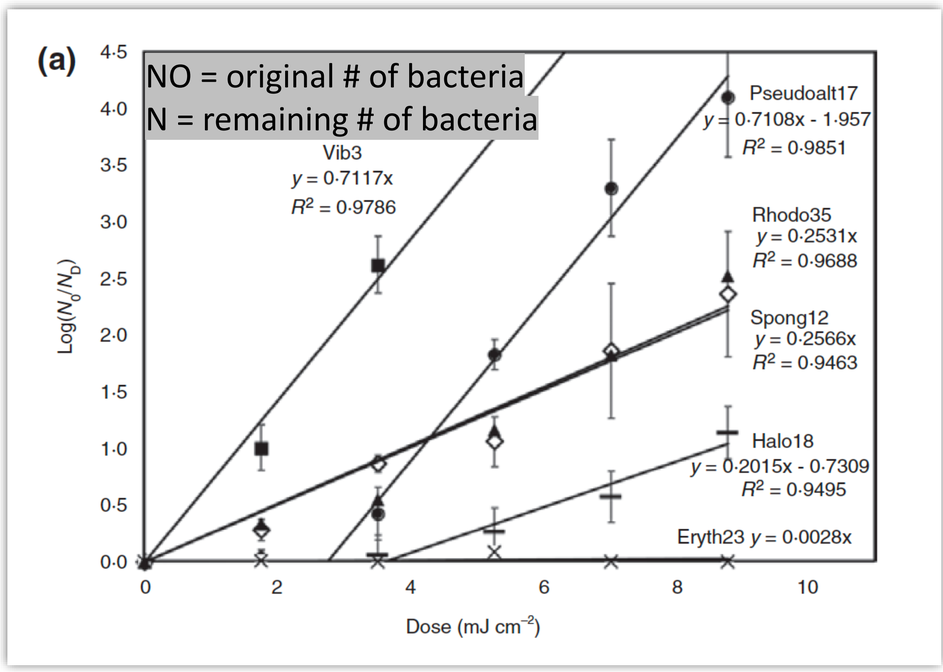
What is Biofouling??

The growth/accumulation of microbes, bacteria, or small organism on equipment/ materials that are exposed to any marine environment. However, there are other forms of biofouling in other industries outside of oceanographic and marine sciences. For instance, in the food and drug industry it is a major issue in the manufacturing process.

Biofilm accumulation after 3 Days of Deployment

Why UV??

1. Dose-response is log-linear: **Longer exposure to UV light kills more bacteria**: log(N0/N) is proportional to exposure (mJ/cm2)
2. Dose-response differs between bacterial species: **some bacteria are easier to kill with UV than others**



IT Infrastructure

All UVAF (Ultraviolet Anti-Fouling) instruments deployed off PBOS, are directly linked to an IT infrastructure that is accessible anywhere there is WIFI

Data is being logged on four platforms

1. Linux Systems hard drive
2. Log DNA (accessible "live" via internet)
3. Python/MATLAB program
4. Realtime output of each sensor can be monitored via Internet anywhere

UV Calibration & Sensor Setup

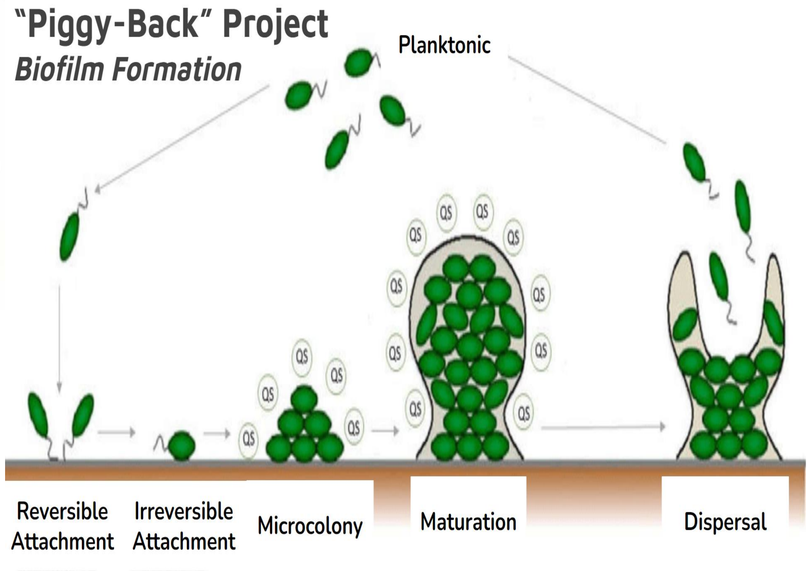
All the UV LEDs were calibrated to output the same intensity within error bounds of 10%.

Sensor Cage Assembled for Deployment

Along with the continuation of the UVAF (Ultraviolet Anti-Fouling) Experiment, future work will be conducted on PBOS as highlighted below

Piggy-Back Experiment

- **Goal:** Show how Biofilm formation occurs in Yaquina Bay using the *"ioLight 1mm Portable Digital Microscope"*
- Self designed Microscope holder, with removeable cover that allows for secure deployment & easy microscope removal

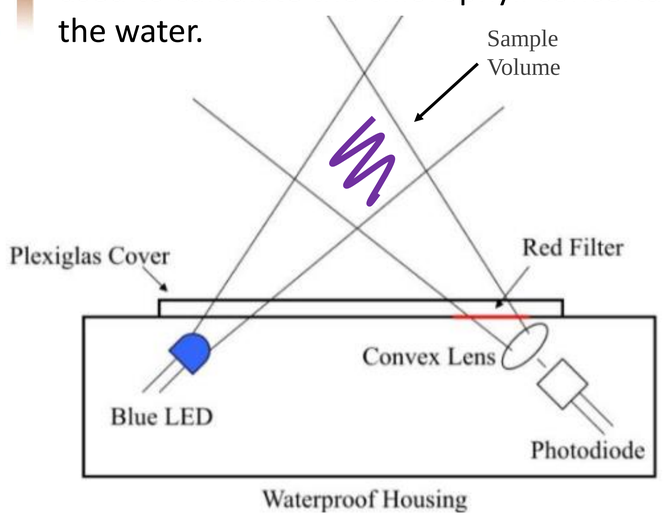


Biofilm formation model to be captured by ***ioLight Microscope.***

Fluorometer

Goal: Design/Build a Fluorimeter, and then test the accuracy & precision based off a factory calibrated SeaBird Fluorometer

Blue light from an LED will be emitted out of the waterproof housing, which will intersect with photodiodes beam that is being projected through a red filter. This creates a sample volume where the fluorescence is measured and used to calculate the chlorophyll concertation in the water.



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