Marine Biofouling, a Friend or Foe of Cage Aquaculture

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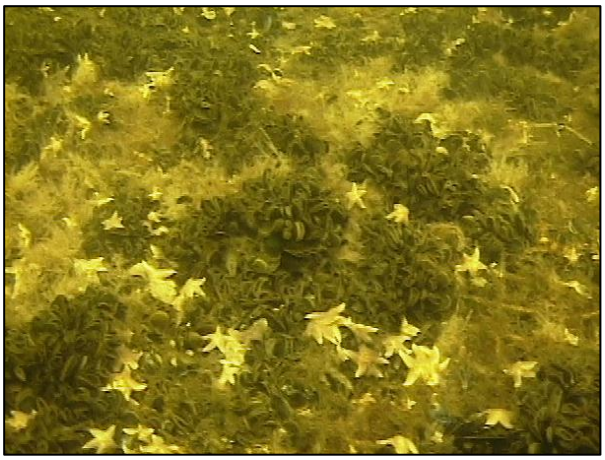
Biofouling is the settlement of undesirable marine organisms on culture systems in the ocean.

Biofouling on net pens has been a major concern for marine aquaculture. Marine life such as mussels, kelp and hydroids can quickly accumulate on wetted structures that create drag and weight on the system, reduces water flow that is important to fish health, and increases operational costs to clean. Antifouling paints (Flexgard and E-Paint) have been widely used in the aquaculture industry to minimize fouling communities. However, these paints have a short life span before natural recruitment returns. At this point, the net is usually removed, cleaned and recoated with an antifoul paint. Other cleaning methods utilize divers with high pressure sprayers that clean the net in situ.

Common fouling species found on aquaculture systems in the Gulf of Maine include mussels, hydroids, skeleton shrimp, starfish, kelp, rock weeds, sea squirts and numerous species of brown, green and red algae.

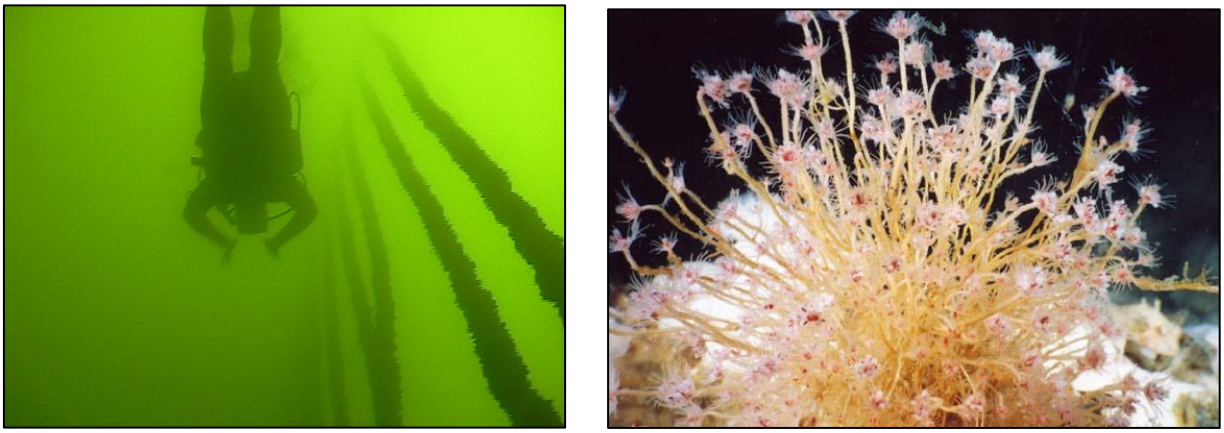


The settlement of hydroids, blue mussels and star fish on fish cage nets in the Gulf of Maine.

Bio Filter and Bio-extraction

There are benefits with the recruitment of fouling communities on aquaculture systems. The inert net evolves into a living structure that absorbs dissolved nutrients and particulate matter from the fish in culture. This artificial reef performs ecosystem services for the farmer and the environment, 24 hours a day, 7 days a week. Kelp for example recruits onto the cage system in early spring and starts absorbing ammonia, nitrogen and carbon from the water. In addition, kelp provides a unique three-dimensional recruitment habitat for young marine organisms. In some cases, the fouling species have monetary value such as mussels (http://www.nrac.umd.edu/files/Factsheets/NRAC1062010_NH.pdf), kelp (http://www.noamkelp.com/about.html) and red algae that can be harvested and sold. These organisms bio-extract nitrogen, phosphorous and suspended matter and build it into their tissues, so when harvested, these nutrients are removed from the ocean or river. This can generate additional revenue for a farmer while maintaining a healthy culture environment around their farm.

Natural recruitment of marine algae on the float platform of a fish cage in the Piscataqua River, NH.



A. B.

Submerged mussels lines near the Isle of Shoals, NH that were socked out with spat collected from a fish cage (A). The hydroid *tubularia* with filter feeding polyps (B).

Biofoul Management

Most important is that fouling organisms are maintained in accordance to the structure they accumulate on. Too much fouling adds weight and drag that can sink the structure creating operational difficulties. Improper water flow thru the net can reduce oxygen levels imperative to health of the organisms in culture. Periodic cleaning with a pressure sprayer can reduce the fouling communities to make them more manageable. Cage cleaning though is an additional cost to the farmer. Seasonal changes of fouling species should be observed. Especially during the summer and fall months when increased water temperatures, sunlight and natural settlement occur. One species, the hydroid *tubularia,* can attach in thick mats that reduce water flow. They also have polyps with stinging cells that can create stress on fish when they come in contact with one another.

Biofouling should be carefully managed to benefit the farmer and the environment. In some cases it can add value to the aquaculture farm and at times it can pose challenges with fish health and farming operations. Understanding the fouling organisms and there life cycles can better prepare an aquafarmer in the ocean environment.