

Addressing Biofouling in Florida's Hard Clam Aquaculture Industry: Performance of Two Net Coatings



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Justification



In Florida, northern hard clams *Mercenaria mercenaria* are grown in polyester mesh bags on open-water leases in coastal waters. During this phase of production (~1.5 years), bags are subjected to natural conditions, including biofouling. Biofouling can compete with clams for resources, impede harvesting efforts, and intensify equipment upkeep. Some clam growers treat bags with an alkyd-based coating that stiffens the bag, thus reducing predation. However, no coating is currently being utilized to address biofouling.

Objective

To evaluate the performance of two fouling release net coatings deployed on near shore shellfish lease areas over three and six month time periods and compare them with the standard alkyd-based net coating used by industry as well as uncoated netting.

Methods

Four treatments were evaluated in this field study:

- Treatment A – Foul release, photo-active coating, White (Wht)
- Treatment B – Foul release, silicone-based coating
 - Colors – Red (B-Red), Black (B-Blk), White (B-Wht)
- Treatment C – Standard alkyd-based coating
 - Colors – Black (C-Blk), Green (C-Grn)
- Treatment D – Uncoated (Control), White (Wht)



Thirty-six treated net pieces (30cm x 30cm, n=6) and six untreated pieces were attached to PVC racks (n=3, Figure 1) and deployed for three or six months on two shellfish aquaculture lease areas near Cedar Key, Florida.



Figure 1. PVC rack with treated net pieces.

Upon recovery, each net piece was photographed and weighed. Individual pieces were agitated in seawater; released fouling was weighed. Net pieces and their released fouling were preserved in 10% buffered formalin for species identification. To determine total wet weight (TWW) of biofouling, the weight of net pieces prior to deployment was compared to the final wet weights. Fouling released was expressed as a percent [PFR = (wet weight of fouling released / TWW) * 100].

Photographs of net samples after three months deployment were analyzed for biofouling coverage using Coral Point Count software; 200 random points were assigned to each net piece. A point count code was developed for analysis of photos based on two groups:

- Not Fouled (NF) and
- Fouled (F), Subgroups within F:
 - Tunicates (TC),
 - Detritus/Mud (D/M), and
 - Other (O), such as barnacles, sponges, and cnidarians.

The dominant groups were verified by inspection of preserved nets.

ANOVAs and Tukey HSD tests were performed to determine significant differences between treatments ($p < 0.05$). Percentage data were arcsin square root transformed prior to analysis.

Results



Figure 2. Net coating treatments (A, B, C, D) after three months deployment on a shellfish aquaculture lease.

Biofouling Wet Weight (g)

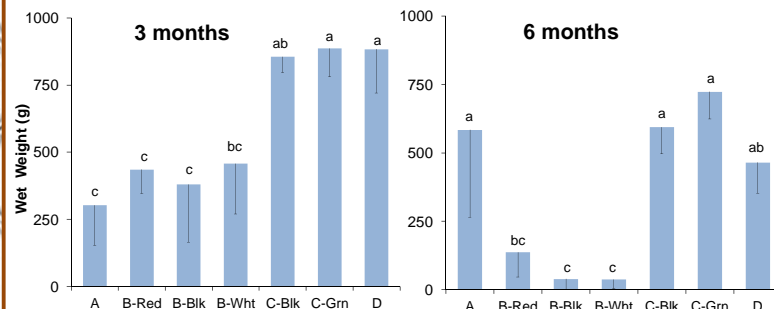


Figure 3. The average total wet weight (TWW, g) of biofouling organisms for all treatments deployed for three and six months on shellfish aquaculture leases near Cedar Key, Florida. Letters denote statistical differences between treatments and error bars represent standard deviation.

At three months, Treatments A and B (all colors) had significantly less total wet weight (TWW) of biofouling than C (both colors) and D (Figure 3). Treatment B-Wht had less TWW than C-Grn and D. No treatments differed in percent fouling released (PFR) after agitation. At six months, treatments B-Blk and B-Wht had less TWW than A, C, and D. Treatment B-Red had less TWW than A and C (both colors). Treatment B-Blk had greater PFR than D.

Biofouling Coverage

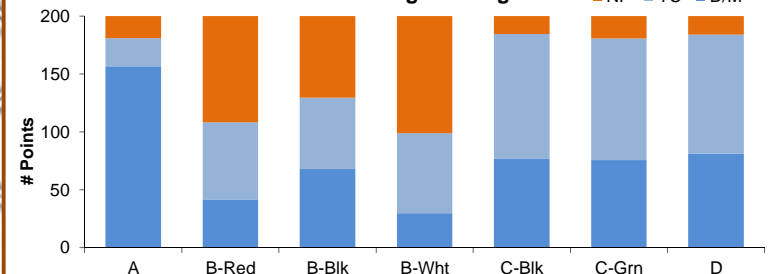


Figure 4. The average biofouling coverage of net coating treatments deployed for three months on a shellfish aquaculture lease near Cedar Key, Florida. Coverage is defined as Not Fouled (NF), Tunicates (TC), and Detritus/Mud (D/M). The category Other (O) is not represented graphically due to low occurrence.

Treatment B (all colors) had significantly more "not fouled" points than other treatments (Figure 4). Treatment A had less points fouled with TC than C and D, and more points fouled with D/M than others. Treatment D had more points fouled with D/M than B-Wht.

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Discussion

Biofouling is a major impediment in all areas of extensive aquaculture, including shellfish farming. By reducing biofouling, we can improve equipment maintenance, reduce harvest labor, and may enhance stock performance. In this study, the advantages of two non-toxic, fouling release coatings were demonstrated. When compared to the industry standard coating (C) and untreated netting (D), Treatment A had variable performance with less total wet weight of biofouling at the three month duration, but similar total wet weight of biofouling at the six month duration. Treatment A also had similar biofouling coverage at the three month duration. Upon further examination, we saw that Treatment A had significantly less tunicates (TC) but significantly more detritus/mud (D/M), likely accounting for the lower wet weight but similar biofouling coverage. Conversely, Treatment B performed well in terms of both total wet weight of biofouling organisms and biofouling coverage at both durations when compared to C and D. Although net color was examined, no significant trends were detected. No differences in percent fouling released through agitation may be attributed to methodology; an increase in replication coupled with a standardized technique may help identify fouling release advantages of the experimental net coatings. The performance of both fouling release coatings was encouraging and warrant future research of their application in shellfish aquaculture.