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Tasmanian salmon farms examine net biofouling to reduce impacts

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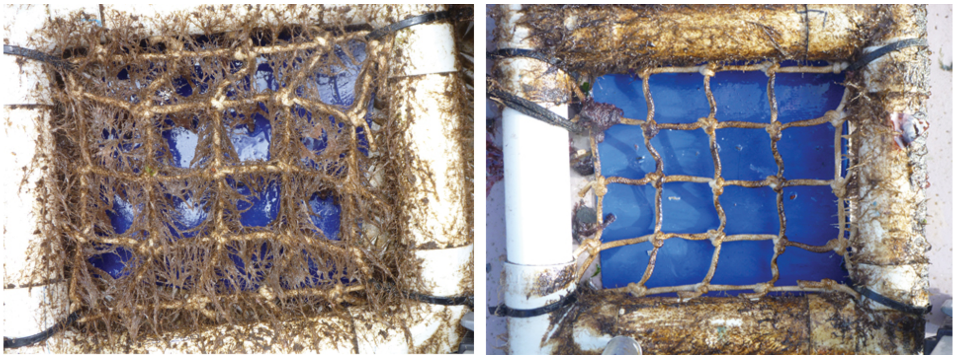
By Belinda Yaxley and Dr. Dominic O'Brien

Industry evaluates 'footprint' of in situ net-cleaning systems



The degree of net fouling varies considerably between summer (left) and winter (right) months.

Worldwide, the salmon aquaculture industry is addressing concerns regarding potential negative impacts on marine ecosystems by reducing its reliance on the use of copper-based anti-fouling coatings to control biofouling on nets. With the recent development of more efficient and economical in situ net-cleaning systems, the fish-farming industry in Tasmania, Australia, has committed to a strategy for the reduced use of copper-based anti-fouling coatings.

Two Tasmanian salmon aquaculture companies, Tassal Operations Pty. Ltd. and Huon Aquaculture Group Pty. Ltd., have embarked on an Australian government-funded project under the Caring for Our Country program to address potential water quality issues associated with in situ net cleaning. The results from this project will assist in developing best practice guidelines and promoting environmentally sustainable practices on farms that use in situ net cleaning within the greater salmon-farming industry in Tasmania.

Objectives

Upon adopting in situ net cleaning, it became apparent to Huon Aquaculture Group and Tassal Operations that little scientific information was available on the possible environmental effects of this cleaning method, both within lease areas and in the greater marine environments surrounding the farms.

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To investigate the potential impacts of in situ net cleaning on water quality, the project has three objectives:

- Define the types of fouling organisms that grow on nets and determine their seasonality.
- Characterize the net wash material expelled by in situ net cleaning.
- Use deposition models to demonstrate the footprint of the net wash.

Fouling organisms

Identifying the types of fouling organisms, their preferences for different net types, timing of settlement and seasonality allows for the alteration of operational procedures to maximize the effectiveness of cleaning machines. For example, some fouling organisms are harder to clean off than others, so if cleaning is done more regularly at certain times of the year, difficult types may be easier to remove or kept from settling on the net altogether.

The authors identified *Ectopleura crocea* as a major net-fouling organism.

To understand seasonality and net preference, a methodology developed by Dr. Simone Dürr of Liverpool John Moores University in the United Kingdom was employed. For a period of two years, experimental frames housing different net types were deployed at the Huon and Tassal farms in southeast Tasmania. Each month, the frames were retrieved and sampled, with the selected net pieces replaced before redeployment.

The first year's data identified the dominant fouling groups on all net types as amphipod housings and the hydroid species *Plumularia setacea, Sarsia eximia, Obelia australis* and *Ectopleura crocea*, which together occupied 90 percent of the biological sample points. When looking at fouling assemblages among net types, the results indicated significant differences among net types and seasons.

Water quality

To investigate potential impacts on water quality due to in situ net cleaning, the net wash was characterized by species composition and quantity. Analytes and size fractions were chosen based on the efficiency of previous sampling techniques and discussion with independent environmental chemists. The fates of copper, aluminum, phosphate, nitrate, nitrogen, carbon and ammonia were determined by quantifying analytes from a sample of net wash collected directly from the net cleaner.

Of particular interest to state and federal regulators was the amount of copper released from the nets during the cleaning process. To investigate the relationships between the amount of copper released to the environment and the number of net cleans, net wash was collected from cages treated with copper-based paint that had undergone differing numbers of cleanings.

While there was no statistically significant relationship between the numbers of cleanings and amounts of copper release, Tassal and Huon provided descriptive statistics that were reported to regulatory bodies. The data demonstrated the amount of copper released was thought to be within a comfortable range.

Determining the destination of net wash materials released to the environment was achieved using settlement testing. This established the particle size and velocity of the net wash. In addition, hydrodynamic data was collected at sites with different flows. Both the settlement tests and hydrodynamic information were critical in modeling the deposition of copper within the farm lease.

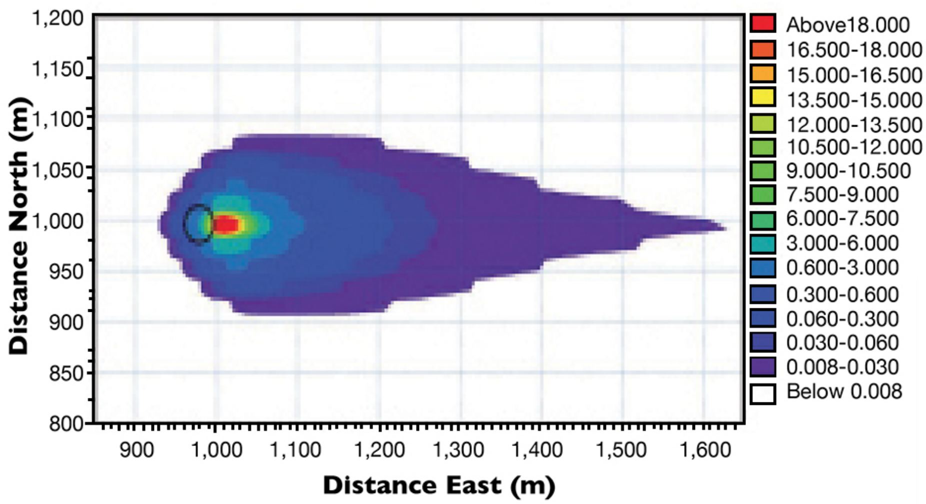

Fig. 1: Copper deposition (mg/m^2) at a high-deposition farm site. The hydrodynamic regime plays a significant role in defining sediment impacts. Typically, a narrow footprint is observed in low-flow conditions, whereas the footprint widens under medium to high flow.

To understand the copper footprint from in situ net cleaning, a deposition model was employed to demonstrate the movement of the analytes in the water column for high- and low-deposition sites. At the high-deposition site (Fig. 1), interpretation of the model revealed that copper deposition reached 10.0 mg/m^2 and above directly downstream of the source, but quickly reduced to concentrations of approximately 0.3 mg/m^2 150 m from the release point.

Editor’s Note: Since the time this article was written, Tassal Operations has stopped using copper-treated nets.

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