

The Effectiveness of Physical Filtration at Removing Tunicates from Aquaculture Systems

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Introduction

Tunicates as Invasive Species

The Canadian government refers to invasive species as species that are established outside their natural range that may cause harm to the environment, the economy, or society⁴.

There are several species of invasive tunicates that can be found in Atlantic Canada including the vase tunicate, club tunicate, and golden star tunicate⁵.

Tunicates in Shellfish Aquaculture

Shellfish aquaculture plays a large role in the Canadian economy; in 2023 the sector generated over \$126 million CAD⁶.

Tunicates pose a significant threat to shellfish aquaculture. Tunicates compete with shellfish for plankton in the water column which can decrease overall yield and have also been shown to carry pathogens².

Water Filtration

For land-based aquaculture, water filtration is vital as it allows for greater control over what enters the systems. A common method of physical filtration is the use of cartridge filters, which exist in various pore sizes.

Ordering cartridge filters from largest to smallest pore sizes in a line can improve their lifespan^{1,5}. However, the more a filter is used the smaller the pore sizes becomes due to particle accumulation on the filters' surface¹; this can subsequently increase the water pressure in the line^{1,3,7}.

Question/Hypotheses

How may tunicates become introduced to aquaculture systems through filtration systems and how may their entry change over a filter's lifespan?

Increased filtration should be most effective when filters are newly implemented, and effectiveness would decrease over time. This would result in less tunicates and less and smaller particles in the filtered water compared to raw water.



AQUATRON



Figure 1. Image of the experimental design of the study, taken in the Dalhousie University Aquatron. The image shows the tanks, labelled using red tape according to treatment, as well as the filters and hoses.



Figure 2. Image of the PAMAS machine used to collect particle size data. A beaker is shown to the left contains water sampled from a treatment tank.

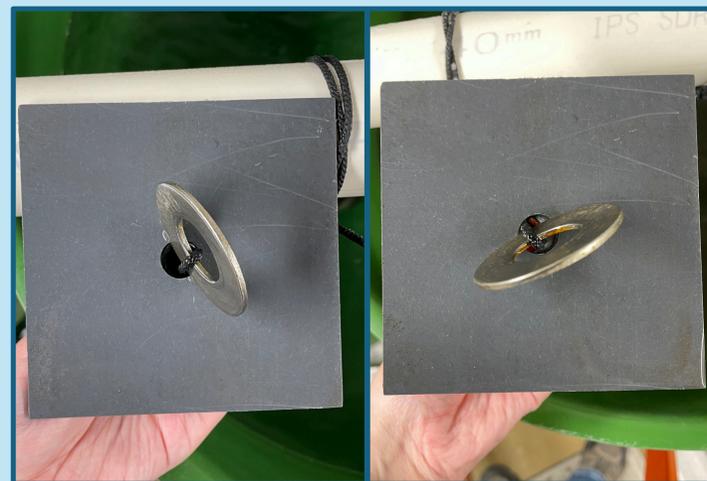


Figure 3. Images of a PVC plate used at the beginning (left) and after 4 weeks (right) of the experiment.

Methods

Location

The experiments are being run out of the Dalhousie Aquatron in Halifax, NS using water from the Northwest Arm. The experiment started on October 17th.

Experimental Design

In a lab, 9 tanks were set up to receive water at various filtration levels: 3 tanks had unfiltered, raw water from the Northwest Arm, 3 tanks had water filtered to 1 μm , and the remaining 3 tanks had water filtered to 0.35 μm (Figure 1). The position of the treatments was determined randomly in excel.

Filters were changed routinely about once a week. Water temperature and salinity were measured on the incoming seawater.

Tunicate Plates

One PVC plate was set in each treatment tank to provide a surface for tunicates to grow on. The bottom of each plate was grated using 220 grit sandpaper. This experiment was run for 4 weeks.

Particle Size Counts

After filter changes, flow rates for each tank were adjusted to either a 'Fast' (0.017-0.018 L/s) or 'Slow' (0.011-0.012 L/s) flow rate then particle counts were taken using a PAMAS (Figure 2). Particle counts and flow rates were taken 6, 12, 24, and 48 hours after the filter change. This experiment has been done twice (once per flow rate) and will be repeated twice more.

Results and Discussion

No tunicates have been found on the tunicate plates (Figure 3). Additionally, the particle size counts experiment is still ongoing so there are no results yet. Once completed, these results will help guide policies regarding proper filtration of aquaculture systems.

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