

## NRAC ANNUAL PROGRESS REPORT

<b>Project Title</b>	<i>Optimizing the performance of the bottle upweller system for enhanced shellfish nursery production.</i>
<b>Reporting Period</b>	01/01/2021- 6/30/2021
<b>Author (Chair)</b>	Maija Benitz/Dale Leavitt
<b>Key Word</b>	shellfish hatchery, post-set nursery, bottle upweller
<b>Funding Level</b>	< \$500 expended to date on materials and supplies ~\$5,000 expended to date on student/technician salaries
<b>Participants: Names, Institutions and Contact Info</b>	<p>Maija Benitz - Assistant Professor of Mechanical Engineering Roger Williams University 101 School of Engineering One Old Ferry Road Bristol, RI 02809 401-254-5427 - mbenitz@rwu.edu</p> <p>Dale Leavitt – Emeritus Professor of Marine Biology Roger Williams University 10 Twin Oaks Drive East Falmouth, MA 02536 401-450-2581 - dale.f.leavitt@gmail.com</p>
<b>Project Objectives</b>	<p>The goal of this project is to optimize the performance of the bottle upweller in supporting juvenile shellfish growth. To meet that goal, we propose the following four objectives:</p> <ol style="list-style-type: none"> <li>1. Characterize the flow dynamics of the variety of bottle upweller vessels commonly used through computational fluid dynamic modeling and dye tracer studies.</li> <li>2. Test the role that vessel shape and water velocity through the system may play in enhancing the overall production of post-set juvenile shellfish in the system.</li> <li>3. Evaluate an optimized system design resulting from the combined efforts in Objectives 1 and 2.</li> <li>4. Outreach the results of this study to commercial shellfish hatcheries and other interested parties.</li> </ol>
<b>Anticipated Benefits</b>	By providing shellfish hatcheries with an optimized bottle upweller system, the production time for saleable seed coming from the hatchery will be reduced, increasing the profitability of the hatchery by producing more seed and holding it for shorter time intervals in the hatchery.

<p><b>Project Progress</b></p>	<p>Objective 1. Characterize the flow dynamics of the variety of bottle upweller vessels commonly used through computational fluid dynamic modeling and dye tracer studies.</p> <p>a. The computational fluid dynamics model of a bottle upweller vessel has been compiled successfully and is running stably. (See Appendix Figure 1.)</p> <p>b. The meshes (geometries) for the inverted cone and the cylinder vessel have been configured. (See Appendix Figure 2.)</p> <p>c. Three bottle shapes have been specified, drawings of the shapes have been generated and the fabrication of the bottles are underway for subsequent testing.</p> <p>d. Protocols for measuring the oyster seed characteristics required for input into the model have been developed.</p> <p>e. Post-set oyster seed have been ordered to complete the model parameter determinations and will be available 8 July.</p> <p>f. Design and construction of the test platform to observe flow dynamics in a bottle upweller is underway and should be available with the acquisition of the oyster seed.</p> <p>Objective 2. Test the role that vessel shape and water velocity through the system may play in enhancing the overall production of post-set juvenile shellfish in the system.</p> <p>a. To be completed at a later date</p> <p>Objective 3. Evaluate an optimized system design resulting from the combined efforts in Objectives 1 and 2.</p> <p>a. To be completed at a later date</p> <p>Objective 4. Outreach the results of this study to commercial shellfish hatcheries and other interested parties.</p> <p>a. To be completed at a later date</p>
<p><b>Accomplishments:</b></p>	
<p><b>Outreach Overview</b></p>	<p>Given that we are in the early phase of the study, no outreach effort has been generated at this point.</p>
<p><b>Targeted Audiences</b></p>	<p>The target audience for this study is the commercial shellfish hatcheries and nurseries in the business of producing oyster and clam seed for the industry.</p>
<p><b>Outputs:</b></p>	<p>Given that the project started in May 2021, no outputs have been generated to date.</p>

<b>Outcomes/Impacts:</b>	Given that the project started in May 2021, no outcomes/impacts have been produced at this time.			
<b>Impacts Summary</b>	Given that the project started in May 2021, no impacts have been produced at this time.			
<b>Publications</b>	Given that the project started in May 2021, no publications have been produced at this time.			
<b>Students/Participants:</b>	<p>Provide the following information for <b>every</b> student that worked with you during the reporting period:</p> <ul style="list-style-type: none"> <li>• Name: Celeste Hartley</li> <li>• Whether degree was completed during the reporting period (name, yes/no): B.S. in Engineering Yes</li> <li>• New or Continuing Student: New</li> <li>• Capstone/Thesis Title (actual or anticipated): Not anticipated</li> <li>• Date of Graduation: May 2021</li>   <li>• Name: David Dickey</li> <li>• Whether degree was completed during the reporting period (name, yes/no): B.S. in Marine Biology - Yes</li> <li>• New or Continuing Student: New</li> <li>• Capstone/Thesis Title (actual or anticipated): Not anticipated</li> <li>• Date of Graduation: May 2021</li>   <li>• Name: Ben Spellman</li> <li>• Whether degree was completed during the reporting period (name, yes/no): B.S. in Marine Biology – Not yet</li> <li>• New or Continuing Student: New</li> <li>• Capstone/Thesis Title (actual or anticipated): TBD</li> <li>• Date of Graduation: May 2022</li> </ul>			
<b>Partnerships</b>	List any partners that you worked with on your project. Provide the following information for each Partner:			
	<b>Partner</b>	<b>Specific Type</b>	<b>Level</b>	<b>Nature of Partnership</b>
	Robbie Hudson	RWU Hatchery Manager	Active participant	Providing guidance to students and space for experiments.

Appendix:

