FINAL PROGRESS REPORT

Project Title	Measuring flow within shellfish growout systems: developing and evaluating a logging mini-flow meter.
Reporting Period	*Final Report*
Author (Project Coordinator)	*Dale F. Leavitt*
Key Word	Flow meter
Funding Level	Total funds allocated for this project to date. *$8,634*
Participants	Dale F. Leavitt & Vitalii Sheremet
Project Objectives	The objective of this mini-grant is to develop a small scale logging flow meter that will be of a size and a capacity capable of independent deployment in traditional shellfish aquaculture gear for an extended period of time.
Anticipated Benefits	Food flux, the combination of suspended food particle density and delivery rate or flow, is a key factor in supporting the growth of active filter feeders, such as bivalve mollusks held in concentrated growing. While there are numerous technologies for measuring water flow, few have been developed that are scalable to allow for flow characteristics to be measured within a single shellfish growout unit, such as the traditional plastic mesh grow-out bag. Furthermore, none are available at the appropriate scale with the additional feature allowing for long-term independent logging of flow characteristics within the shellfish growout system. The lack of such an instrument has restricted researchers' capacity to monitor and study flow characteristics and food flux within shellfish culture gear under specific environmental conditions, with the objective of optimizing the shellfish growing environment within the system. The development of this flowmeter will significantly contribute to our understanding of water and food flow dynamics in shellfish aquaculture structures.
Project Progress	As a result of this funding, two prototype flowmeters have been engineered that can be deployed inside of conventional shellfish aquaculture devices that will allow one to quantify the water flow dynamics through the equipment. The design and calibration of the flowmeters were completed and an initial deployment within and external to a conventional oyster bag was undertaken to evaluate the application of the instrument. The flow measuring devices worked as designed and are ready for a follow-up study of water flow characteristics, to be completed in the near future.
Accomplishments:	
Outreach Overview	The immediate plan is to initiate a series of studies addressing the role of fouling on water flow characteristics within plastic mesh oyster bags. These studies will provide valuable information to shellfish growers as to what level of effort is required to sustain adequate food flux through their aquaculture gear, relative to the degree of external biofouling and necessity of cleaning of the gear. In addition, the flowmeters will be placed at a local RI shellfish farm that is suspected of having inadequate water flow within the oyster bags. By coupling the water flow characteristics with a recording fluorimeter, we hope to inform the farmer as to appropriate stocking densities given the adequacy of the food supply.

Targeted Audiences	The flowmeter developed as a result of this funding will be deployed at active shellfish farms to evaluate water flow characteristics of the farm. The overall target audience of this project is to work with existing shellfish farmers in characterizing their farm environment and adapting their husbandry practices to their prevailing site characteristics.			
Outputs:	The primary output of this project is the development of a working flowmeter that can be deployed within shellfish aquaculture gear. At this point, we have developed the engineering for a working model and are refining the design.			
Outcomes/Impacts:	The general outcome of this project is to develop the technology that allows shellfish farmers to evaluate the growing conditions within their holding gear, thereby allowing them to adjust husbandry practices, such as stocking density or gear placement, to optimize production within their farm.			
Impacts Summary	1. **Relevance:** Issue – what was the problem? Shellfish farmers need to know what the growing conditions are within their aquaculture devices to allow them to optimize their husbandry practices. Food flux, a combination of food density and water flow, is a critical component to the rearing environment for a shellfish farm. 2. **Response:** What was done? A flowmeter was developed that could be deployed within conventional shellfish aquaculture gear that measured the water flow dynamics within the gear over an extended period of time. 3. **Results:** How did your work make a to the target audiences? While the project focused on the engineering of the flowmeter, its application will provide shellfish farmers with a means to refine their husbandry practices to optimize production on their farm. 4. **Recap:** A flowmeter was designed and constructed that allows one to measure the water flow characteristics within conventional shellfish aquaculture devices.			
Publications	As the engineering is completed, the flowmeter will contribute to a series of outreach documents, including peer-reviewed publications, presentations and non-technical bulletins. However, at this point, no new publications have been generated as a result of this work.			
Students/Participants:	Provide the following information for **every** student that worked with you during the reporting period: • There will be an undergraduate student (TBD) working on this project, applying the flowmeter on an oyster farm, during the fall of 2016.			
Partnerships	List any partners that you worked with on your project			
	Partner Vitalii Sheremet	**Specific Type** Engineer	**Level**	**Nature of Partnership** Consultant to the project