Project Report
Applying cutting-edge technology for reproductive control in emerging bivalve species
5/1/20 – 10/31/20

A. Project summary

To increase the productivity and sustainability of the shellfish aquaculture sector, while at the same time enabling hatchery responsiveness to both environmental challenges and market demands through breeding and maturation control, a time-efficient, practical, and cost-effective means to produce sterile shellfish is critically needed. The overarching goal of the proposed project is to develop a novel tool for conferring sterility on farmed shellfish that mitigates some of the shortcomings of ploidy manipulation. An attractive alternative to ploidy manipulation is the induction of sterility by inactivation of genes essential for germ cell formation.

One of the major roadblocks to the development of this technology is the lack of knowledge of these genes in bivalves. Single-cell RNA-Seq (scRNA-Seq) has emerged as a technology that will enable the identification of genes involved in germ cell differentiation via transcriptional profiling of single embryonic cells.

The primary milestone associated with our project will be a temporal atlas of gene expression in developing embryos at the single cell level. This outcome will not only have tremendous impact on the understanding of bivalve developmental biology, but importantly for our purposes, will provide gene targets for generating shellfish stocks that offer ecological security and optimal food production efficiency.

B. Summary of progress and results

· Bioinformatic analysis of 47Gb of scRNA-Seq data to identify genes associated with primordial germ cell specification in bivalves.

· Participated in one of Washington Sea Grant's internal "Lunch and Learn" monthly meeting, by presenting results from single-cell RNA-Seq analysis in Pacific oyster embryos to WSG staff (July 2020)

· Presented results from single-cell RNA-Seq analysis in embryos to Taylor Shellfish hatchery staff. This "inreach" effort was designed to offer staff at Taylor Shellfish (who provided the oyster gametes for this research) a direct opportunity to hear about the science they are supporting. (Sept 2020)

· Presentation: Gavery M, Vadopalas B, Roberts S, Luckenbach A, Saunders L, Trapnell C. Harnessing the power of single-cell RNA sequencing to control reproductive development in bivalves. 74th Annual Pacific Coast Shellfish Growers Association Conference, Virtual (Oct 2020) Slidedeck: https://d.pr/IC8n80

C. Challenges

The COVID-19 pandemic has resulted in non-essential laboratory closures at the University of Washington, denial of access to the Jamestown Point Whitney Shellfish Laboratory, and cessation of non-essential sampling by the Washington Department of Fish and Wildlife shellfish dive team. We expect to access biological material during the next reporting period.