## ABSTRACT

BACTERIAL COMMUNITY ASSEMBLY AND STABILITY ON THE SURFACE OF THE LAKE STURGEON (*ACIPENSER FULVESCENS)* EGGS

By

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High egg and larvae mortality represents a significant problem in aquaculture. Scientific evidence for a variety of fish, shrimp and shellfish species support the hypothesis that fish–microbe interactions are the major factors determining high levels of egg mortality. As such, in order to address this problem systematically, it is crucial to extend the knowledge of egg-associated microbial communities and develop a detailed understanding of their potential probiotic effects on the wellbeing of fish eggs. In this dissertation we present the results of several studies related to development of bacterial communities on the surface of Lake Sturgeon eggs. Throughout this work our perspective on bacterial species associated with Sturgeon eggs is to treat them as an integral part of the egg-bacteria symbiotic relationship with the focus on manipulating bacterial communities in order to decrease egg mortality.

First, we discuss the results of *in vitro* biofilm formation assays for six bacterial species previously isolated from the surface of healthy Lake Sturgeon (*Acipebser fulvesens*) eggs. The goal of this study was to understand how these bacterial species interact with each other when present in the same environment. We used a crystal violet assay, resazurin assay and Terminal Restriction Fragment Length Polymorphisms (T-RFLP) to analyze biofilm biomass formation, biofilm metabolic activity, and changes in

the abundance of each isolate in double-species biofilms, respectively. Our results indicated that one of these isolates, *Brevundimonas F16*, produces a robust biofilm *in vitro*. Furthermore, biofilm formation increases significantly in mixed cultures of *Brevundimonas-Hydrogenophaga* and *Brevundimonas-Acidovorax*. However, biofilm formation decreased in mixed cultures that included *Pseudomonas C22*.

Next, we describe the results of the study on how established biofilms of egg isolates interact with the river water microbiome. Our goal in this experiment was to measure the susceptibility to secondary colonization of a preexisting biofilm due to exposure to the river water. We measured the compositional stability of biofilms and identified specific river genera that invade or are recruited by preexisting biofilms. In this study, we were able to detect both highly resilient and weak biofilms, specific exclusions and recruitments of river populations by established biofilms of egg isolates, and apparent enhancements of biofilm development.

Finally, we present the results of *in vivo* studies in the hatchery. Here we investigated the effect of early use of monosaccharides and potential probiotics on assembly and stability of Lake Sturgeon egg-associated bacterial communities. Our results indicate that both monosaccharides and bacterial treatments during early developmental stages of the egg could change the early egg-associated bacterial communities. Moreover, some members of *Pseudomonas* and *Rheinheimera* genera could be egg mutualists, protecting the eggs against pathogenic fungi and bacteria such as certain species from the genera *Aeromonas* and *Flavobacterium.*