Sea Lamprey Settlement Behavior in Response to Variations in Migratory Pheromone Compounds: A Proof of Concept Study.

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Project Abstract

A migrating sea lamprey makes two crucial reproductive decisions that are mediated by pheromones: where to spawn (larval migratory pheromone), and with whom to spawn (male mating pheromone). Understanding exactly how these pheromones mediate these behaviors has become a central research focus for the Great Lakes Fishery Commission in their quest to find new alternative control measures for this devastating invasive species. Two functional hypotheses have been put forth for the role of the larval migratory pheromone in the reproductive migration of sea lamprey. The first, that larval odor induces settlement of migrants in river mouths, has not been tested. The second, that larval odors steer lamprey through river systems to the tributaries with habitat sufficient to support future offspring has received considerable attention. We have recently demonstrated that the three compounds thought to compose the migratory pheromone do not induce tributary selection behavior in migrating lampreys after they have entered a river system. Given the availability of recently synthesized copies of the pheromone compounds, we now return our attention to testing the first hypothesis.

Because these behaviors are expressed at large spatial (0.5-5 km) and temporal (1-3 d) scales a full test of the response to migratory pheromone must be completed in the natural environment. Consequently, we require the ability to track the location of individuals over large distances. Our preferred solution is the use of acoustic telemetry. Acoustic telemetry involves the use of transmitters to emit signals (tags), hydrophones to convert them to electronic information, and receivers to detect and record the data. Acoustic tags can be recorded over considerable distance (several kilometers) and fitted to provide depth and temperature readings in addition to vector and distance information from the hydrophones. Unfortunately, this equipment is expensive to purchase, and justifications for its use typically require previous experience on the part of the investigators.

Here, we propose to tag and track migratory-phase sea lamprey to achieve two purposes. First, in support of an application for funding in 2009 to the Great Lakes Fishery Commission, we will collect preliminary data mapping sea lamprey response to the migratory pheromone during the settlement phase. These data should establish the feasibility of full-scale testing of various mixtures and intensities of migratory pheromone as a plausible control strategy for the Great Lakes. With this new support I will develop the technical proficiency necessary to increase the physical scale of my experiments and push our research into large lacustrine environs. In particular, I will use this skill to support the request to rent a large hydroacoustic array as part of the GLFC proposal.

Second, if successful, we plan to submit a large-equipment grant proposal to the National Science Foundation for the purchase of a large hydroacoustic array for use in future studies of fish migration in the Great Lakes. We anticipate submitting a multi-investigator and multi-institution proposal in the development of a new collaboration with Dr. Robert McLaughlin of the University of Guelph.