SLAP

Sea Lamprey Aquaculture & Procurement

sealampreycontrol.org

What is aquaculture?

Aquaculture is the process of breeding and raising fish and other aquatic organisms in a contained area. A benefit to this process is the ability to control aspects of the environment, such as water quality and food source. Aquaculture not only provides food for humans but also makes it possible to stock sport fish, rehabilitate endangered species, and provide specimens for research to inform species management.

In the context of research, the ability to rear fish from eggs to adults - making all life stages of a species available for study - is critical to fully understanding a species and opens a wealth of experimental opportunities.

The Sea Lamprey Aquaculture & Procurement (SLAP) initiative is a cooperative project funded by the Great Lakes Fishery Commission (Commission). Implementation partners include Michigan State University Department of Fisheries and Wildlife, the U.S. Geological Survey, University of Manitoba, Yakama Nation, SUNY Brockport, and Wilfrid Laurier University.

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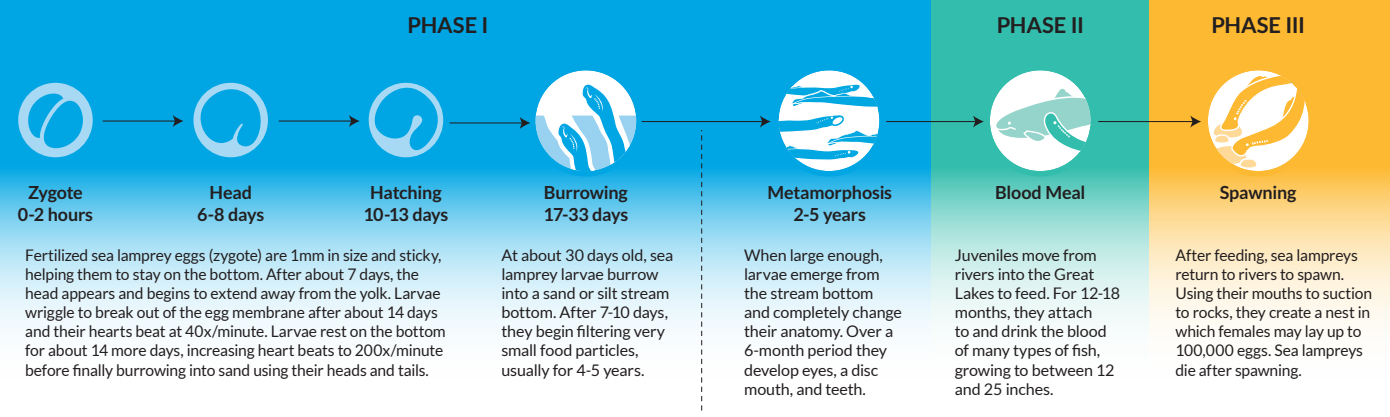

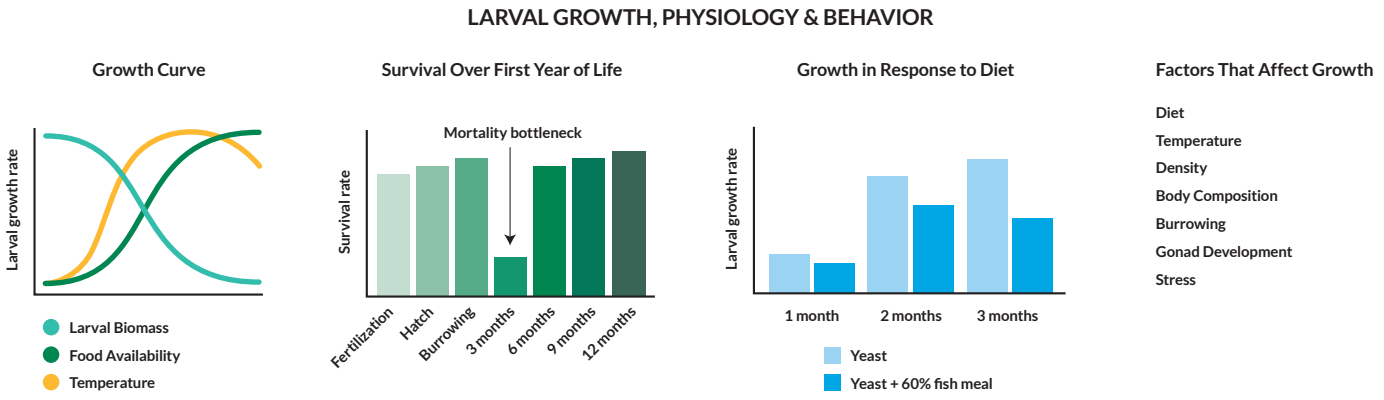

*Graphs are examples and do not depict actual data

Why raise sea lampreys?

Sea lampreys (*Petromyzon marinus*) are parasitic fish native to the Atlantic Ocean that are invasive in the Great Lakes, where they contributed significantly to the collapse of fish species and valuable fisheries. The Great Lakes Fishery Commission (Commission) and partners have developed a highly successful program to control sea lamprey populations. Currently, the main control method targets larval sea lampreys using the pesticides 3-trifluoromethyl-4-nitrophenol (TFM) and niclosamide (Bayluscide®), commonly referred to as "lampricides". In many locations, lampricide control is aided by barriers that block the spawning migration of adult sea lampreys. The barrier's role is to reduce the access of adult sea lamprey to spawning habitat, meaning there's less stream to treat with pesticide (i.e., makes the pesticide more efficient/less costly). Lampricide use has been increasing, resulting in higher costs of sea lamprey control and a greater risk that sea lampreys evolve resistance. Additionally, many barriers are aging and in need of refurbishment or removal. To improve the efficacy of the sea lamprey control program, it is important to develop new or supplemental control methods.

Research and development of novel and innovative techniques to control sea lampreys requires consistent access to specimens for research. In 2018, the Commission approved a new vision for supplemental controls, expanding exploration into different control tactics such as chemical attractants and repellents to increase adult trapping efficacy, release of sterilized males, portable traps and portable electrical barriers for adults and juveniles, modifying lampricide treatment protocols to protect non-target species and respond to changing environmental conditions, and investigating the possible evolution of lampricide resistance. This new vision increases the demand on all sea lamprey life stages for research, but access to sea lampreys for research is limited by:

- A lack of efficient capture devices to collect life stages other than adults (which are provided by the current trapping program)
- Lampricide treatments which have successfully reduced the density and size of larvae, ultimately reducing the number available for collection for research
- Wide variation in timing of downstream migration of juvenile stage sea lampreys

Together, these limitations constrain the advancement of research into new sea lamprey control methods.

Rearing sea lampreys in an aquaculture setting would provide a consistent source of difficult-to-acquire life stages sufficient to meet current and anticipated research needs of the Commission's sea lamprey research program.

Artificial fertilization in lab at Hammond Bay Biological Station

How can the SLAP initiative help?

The Commission and partners have initiated a multi-year research effort with an ultimate goal of completing the sea lamprey life cycle within a laboratory. This effort, called the Sea Lamprey Aquaculture and Procurement (SLAP) initiative, will increase knowledge of the biology and physiology of sea lampreys to better develop and target control mechanisms. For example, variability in growth, age at metamorphosis, and sex ratios of sea lampreys – key considerations when selecting streams for lampricide treatment – could all be studied in a controlled setting. Additionally, readily available reared sea lampreys will allow for the development and testing of innovative genetic control strategies, which will require that sea lampreys be reared in captivity from embryo to adult. The development of a research program to complete the sea lamprey life cycle outside its habitat – i.e. in a laboratory – would yield impossible insights into the ecology, physiology, and genetics of Great Lakes sea lampreys, beneficial to future needs of the sea lamprey research program.

Experimental tanks for studying sea lamprey growth

Who is involved?

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In addition to the Great Lakes partners, the project will also establish a formal partnership with Pacific lamprey (*Entosphenus tridentatus*) biologists and managers. The Yakama Nation Department of Natural Resources has been leading efforts to rear Pacific lampreys for more than 12 years and has developed methods to rear lampreys, including the collection of gametes, fertilization, incubation, early rearing, and maintaining larvae during metamorphosis. This partnership will be indispensable for the development of the SLAP initiative, sharing information and strategies between all involved.

Size comparison between two lab-reared lampreys with same rearing conditions

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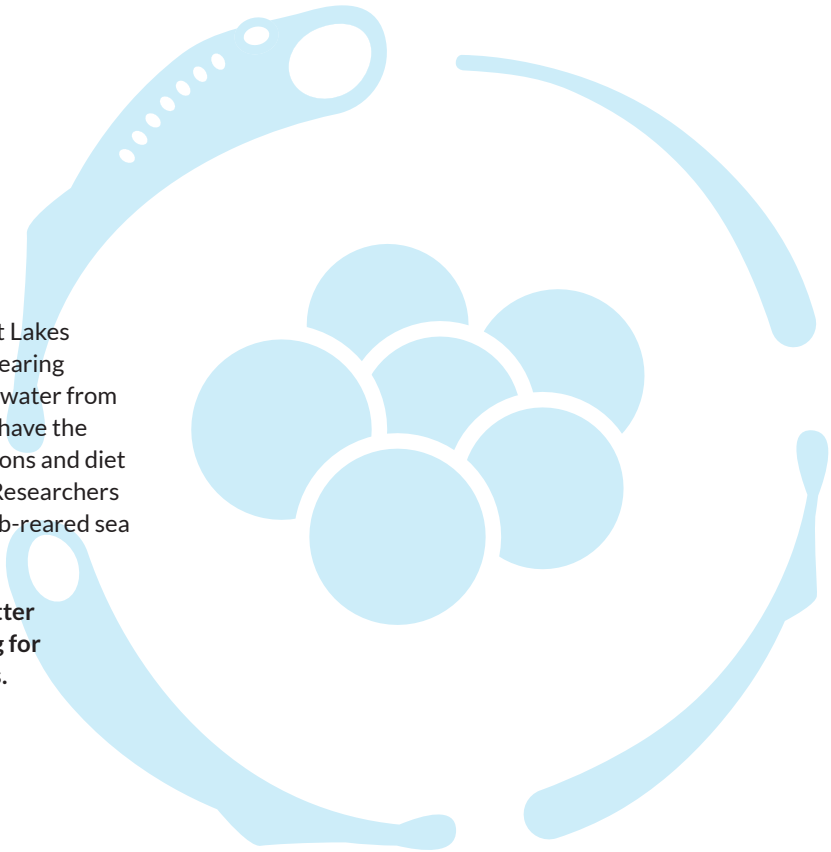

How will it work?

Research partners will collect sea lampreys from Great Lakes tributaries. Specimens will be transferred to multiple rearing facilities and placed in fish holding tanks supplied with water from local rivers or lakes. In these settings, researchers will have the ability to determine the optimal environmental conditions and diet for promoting sea lamprey development and growth. Researchers will also determine if the physiology and behavior of lab-reared sea lampreys differ from wild individuals.

This information will be helpful for researchers to better understand sea lampreys of the Great Lakes, allowing for additional scientific advancement in control methods.

Sea Lamprey Research Program
Funded by the Great Lakes Fishery Commission