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SEA LAMPREY TRAPPING IMPROVED SIGNIFICANTLY WITH ELECTRICITY

ANN ARBOR, MI—A recent study funded by the Great Lakes Fishery Commission has concluded sea lamprey trapping can be improved significantly when electricity is used. The study, led by scientists from the U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service, and Fisheries and Oceans Canada, demonstrated a 75% sea lamprey capture rate when electricity was used to "guide" lampreys to traps, compared to an average rate of 50% without electricity. Sea lamprey trapping is an integral component of the successful sea lamprey control program, and this study suggests the control technique, with relatively simple changes, can be enhanced significantly. Sea lamprey control is essential to the $7 billion Great Lakes fishery.

Sea lampreys – parasitic, jawless vertebrates that feed on the blood and body fluids of other fishes – invaded the Great Lakes in the 1800s and early 1900s and have caused enormous ecological and economic damage. To combat this menace, the Great Lakes Fishery Commission delivers an integrated sea lamprey control program that combines lampricides, barriers, and traps. The control program is remarkably successful: sea lamprey populations in most areas of the Great Lakes have been reduced by 90% of their historical highs, which saves an estimated 100 million pounds of Great Lakes fish per year.

Since the beginning of the sea lamprey control program in the 1950s, scientists have been researching the use of electricity to manipulate sea lamprey behavior. "Dr. Vernon Applegate, known as the 'Father of Sea Lamprey Control' deployed a number of systems using electrical guidance to block lampreys' upstream migration and limit access to spawning habitat – in fact, these were some of the very first efforts to respond to the sea lamprey invasion," said David Ullrich, chair of the Commission. "While the concept is not new, the technology has come a long way and our understanding of how to use it properly has improved tremendously, thanks to this research."

Previous research on electrical guidance systems has been limited to the laboratory or small-scale field sites. While such efforts indicated electrical guidance could be effective at increasing sea lamprey trapping rates, a number of uncertainties, such as performance during flooding events and impacts on non-target species limited the application of this technology. This new study addressed those knowledge gaps, as well as others. With additional research and development, control program experts hope this technique could be used to enhance sea lamprey control.

The experimental system developed by the research team involved a portable trap paired with a low-voltage, pulsed direct current generated by vertically-oriented electrodes in the water column. The electrodes created an electrical fish barrier across the stream channel that was run at an angle to guide migrating fish into a trap at the far end. The research team deployed the system in 2014 and 2015, during the time when adult sea lampreys are moving upstream to spawn.

"While many techniques exist to guide fish, most are ineffective, costly, or difficult to modify after construction," said Dr. Nicholas Johnson, project lead at the USGS Hammond Bay Biological Station. "Our research shows that an electrical system can function as a non-physical means to guide fishes. The system we tested did not alter stream flow. It was low cost, portable, and easy to install. It could be seasonally deployed and operated in remote sites. The system was also resilient to several flooding events over the course of the study."

During the first year of the project, the electrical guidance system was only activated every other night (sea lamprey are nocturnal species) to demonstrate that significantly more sea lampreys were captured in the trap when the system was on than when it was not. The next year, the system was deployed in a different stream and electricity was run every night. Using the electrical guidance system, the research team captured 60% of sea lampreys in the stream the first year and 75% of in the second year.

Non-target species were also assessed as part of this study to determine if the electrical guidance system caused any adverse effects. Effects on species other than sea lamprey were minimal. The electric field was maintained at a voltage gradient less than the threshold expected to cause injury to other species and was deactivated during the day. Researchers determined the majority of non-target species were able to move through the electrode array during the day. Non-target species that were guided into the trap were removed and passed upstream of the system whenever possible.

"Perhaps one of the most noteworthy points about this research is that its application is not limited to sea lamprey or the Great Lakes," added Johnson. "The research team is excited about the potential applications of this work. This technology could not only be used to substantially advance integrated control of sea lampreys, but could also be employed to guide valued fishes around barriers that fragment their habitat. The portability, ease of installation, and low cost also make the system an attractive option as a rapid response tool for emerging invasions or restoration needs across the globe."

For more information about this research, visit: http://www.nature.com/articles/srep28430.

The Great Lakes Fishery Commission is an international organization established by the United States and Canada through the 1954 Convention on Great Lakes Fisheries. The commission has the responsibility to support fisheries research, control the invasive sea lamprey in the Great Lakes, and facilitate implementation of A Joint Strategic Plan for Management of Great Lakes Fisheries, a provincial, state, and tribal fisheries management agreement.