USGS NSF GRIP, GSP Opportunity

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USGS Center:	Illinois-Iowa Water Science Center
Project Title:	Assessment of historical recruitment of grass carp in the Sandusky River
Summary:	This is an interdisciplinary project linking stream ecology and hydraulic engineering. The intern will join a team to conduct scientific research on a “hot-topic problem” that has gained national attention. The intern will benefit by gaining exposure to a real-world problem that perhaps cannot be found in textbooks. The intern would have personal growth experiences and exposure to a carrier path different than academia.
Project Hypothesis or Objectives:	Grass carp, a fish species of invasive Asian carp, have successfully reproduced in the Sandusky River (Ohio), a tributary of Lake Erie, with 1-year-old and 2-year old fish captured in 2012 and 2015, respectively. In this project the flow, thermal, and biological conditions that led recruitment success of grass carp in Lake Erie will be studied with the goal of evaluating optimal temperature and hydrologic conditions for recruitment success. A better understanding of the transport, development, and fate of grass carp eggs has the potential to create prevention, management, and control strategies before the eggs hatch and develop the ability to swim. Although this effort is focused on the Sandusky River, our analysis framework is applicable to any river system where researchers need to assess risk of spawning and recruitment of riverine spawning species. The Fluvial Egg Drift Simulator (FluEgg) is a Lagrangian numerical model developed to track drifting eggs and larvae in riverine habitats. The FluEgg model was developed by University of Illinois in collaboration with U.S. Geological Survey. The model simulates interactions between egg development, water temperature, and river hydraulics, with the underlying assumption that Asian carp eggs survive if they transport in suspension. FluEgg tracks fish eggs from spawning locations until hatching, and larvae until reaching the gas bladder stage. Fish biologists have used information from field sampled eggs to back-calculate spawning

	locations and further evaluate transport range of fish eggs in the riverine environment. Such information has been used for guiding their sampling efforts. Research in this interdisciplinary area is needed to enhance the capabilities and applications of the FluEgg model. In the present study, the transport of eggs and larvae at different flow events and water temperatures will be simulated to cross-correlate the capture of young fish (recruitment success) with the historical hydraulic and water quality conditions of the Sandusky River. Potential spawning events, will be analyzed using the FluEgg model together with an unsteady hydraulic model. Historical events from 2011 to 2015 will be evaluated for recruitment success or failure. The goal of this project is to evaluate the conditions that can lead to Grass Carp recruitment success or failure in the Sandusky River using historical information of captured Grass carp and FluEgg simulations coupled with an unsteady hydraulic model.
Duration:	Up to 12 months
Internship Location:	Urbana, Illinois
Field(s) of Study:	Engineering, Life Science
Applicable NSF Division:	EAR Earth Sciences, DEB Environmental Biology, CBET Chemical, Bioengineering, Environmental, and Transport Systems
Intern Type Preference:	Either Type of Intern
Keywords:	Ecology, Hydraulics, Hydrology, River, Fish, Invasive Grass Carp, modeling, HEC-RAS, MATLAB, GIS, web-mapping, Engineering
Expected Outcome:	The principal outcome of this research project is to publish a peer reviewed manuscript in a respected and reputable scientific journal. This is a unique opportunity to work on a research project that has gained national attention. The intern will work directly with the developer of the FluEgg model.
Special skills/training Required:	The intern would need to have skills or expertise in at least one (but not all) of the following areas to be successful as part of the project team: • Fish biology. • Stream ecology. • Open channel hydraulics. • GIS skills. • Hydraulic modeling (e.g. HEC-RAS). • Knowledge in MATLAB programming.
Duties/Responsibilities:	The intern would gain new experiences and will develop different skills by working on this project and by collaborating with USGS scientists in a relatively new scientific topic. Listed below are the duties and responsibilities assigned to the intern. This is an

interdisciplinary project. As such, the intern may select one or two research tasks depending on his or her area of interest.

- Investigate water temperature and hydraulic characteristics of the Sandusky River at two locations - upstream of the USGS gage station near Fremont OH (04198000) and at the confluence of the Sandusky River with Muddy Creek Bay. Information gathered here will be employed in modeling of the system.
- Assess eco-hydraulic statistics for Asian carp egg recruitment.
- Use models to simulate the transport of eggs and larvae in the lower Sandusky River under different flow and temperature conditions.
- Validate and/or calibrate the hydraulic model with sampled data collected by USGS in 2012.
- Evaluate Grass Carp recruitment success or failure in the Lower Sandusky River by cross-correlating information obtained from FluEgg simulation results, the hydraulic and water temperature characteristics of simulated events, and the capture of young Grass Carp in the Lower Sandusky River.
- The intern could collaborate with other project scientists to integrate results from this assessment with other components of this project managed by both, different USGS offices and different collaborators and stakeholders.
- The intern could use different GIS tools and web-mapping tools to display results in a sophisticated way. For example, the intern could create story maps describing optimum conditions for Grass Carp reproduction in the Sandusky River.
- Participate in the preparation of a peer-reviewed journal manuscript compiling findings of the project with opportunity to be listed as author (first or second depending on intern's involvement).