Reassessment of Wildlife Reproduction and Health Impairments in the Saginaw Bay and River Raisin Areas of Concern
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The industrial and chemical boom of the mid-1900s resulted in the release of unregulated chemicals into the environment. Chemicals including polychlorinated biphenyl (PCBs), dichlorodiphenyltrichloroethane (DDT), and chlorinated dioxins (TCDD) began to accumulate in the Great Lakes ecosystem. These persistent chemicals residing in the sediments of lakes and rivers in industrial areas became integrated into the aquatic food chain. Thus predators higher in the food web, including fish-eating water birds such as herring gulls and Caspian terns, accumulated magnified concentrations of these chemicals stored in the tissue of aquatic organisms. Studies of these birds beginning in the 1970s have found immunological impairments, deformities, chick edema, and reduced egg viability as a result of these industrial chemicals. Although the recognition of these problems lead to restrictions on the release of these chemicals beginning in the 1970s, relevant concentrations still remain in polluted areas around the Great Lakes. These areas have been identified as Areas of Concern (AOCs) by the US Fish and Wildlife Service, and are being monitored through programs set up through the Great Lakes Restoration Initiative (GLRI), a part of the Water Quality Agreement between the United States and Canada. This study, started in 2010, is a reassessment of AOCs in the Saginaw Bay and River Raisin, aimed at determining if the pollutants are still impairing the heath of the ecosystem. An additional site in Traverse Bay was also studied this year to see if the same effects are seen in an ecosystem low in PCBs, but containing dioxin-like chemicals and Chemicals of Emerging Concern (CECs).

The conducted research looks particularly at the reproductive health and immune function of herring gulls and Caspian terns. In the spring, eggs were collected from the various study sites and the contents were sent for chemical analysis. Additionally, the viability of eggs was assessed since historically AOCs have had higher levels of non-viability due to infertility or failed development of the embryonic chicks. Enclosures built around unhatched nests ensured the hatched chicks could be studied at three and four weeks of age. At three weeks, chicks were banded and injected with phytohemagglutinin (PHA) to produce a measurable swelling response as an indicator of T-cell mediated immune function. Birds were also vaccinated with sheep red blood cells (SRBCs), and blood samples were taken at three and four weeks to look at antibody response. Body measurements were also taken to assess the growth rate of the chicks, since growth may be variable at AOCs due to the effects of pollutants and various environmental stressors. Data from AOCs was compared with data from reference colonies in Michigan’s Upper Peninsula.

Data from this year will be combined with data from the past four years to create a comprehensive report about the health of the bird colonies. So far the study has shown immune responses in herring gull chicks to be 51-57% lower in the Saginaw Bay AOC and 52% lower in River Raisin AOC compared with the reference site. Terns in the Saginaw Bay AOC had a 45-50% lower immune response than the reference site. Embryonic nonviability rates in herring gulls at both the Saginaw Bay and River Raisin AOCs were higher than reference sites. Two chicks with crossed bills, a physical deformity associated with PCBs, were found at the River Raisin site in 2012 and 2013. Researchers will continue to analyze plasma and blood samples throughout the year.

The project has provided educational opportunities in field work and laboratory techniques. Students have become more familiar with the research process through studying background literature as well as analyzing and presenting data.