Great Lakes Science Center

Genetics and Fishery Research

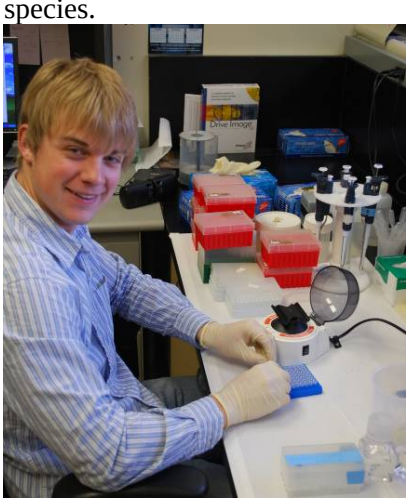
Human settlement, industrialization, and interaction with non-indigenous species caused the decline of several Great Lakes species, some even to extinction.

Why Genetics?

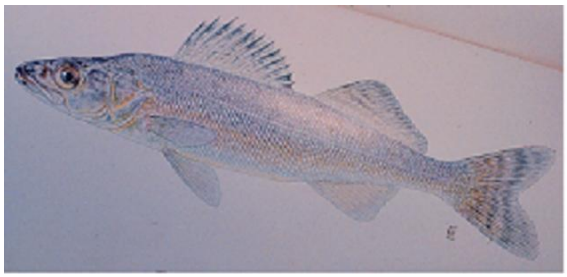
1) Levels of genetic diversity are useful measures of long-term population health for conservation and restoration management programs.
2) Genetic information about captive and wild populations is essential for effective design and implementation of hatchery programs.
3) Genetic characters can be compared among individuals, different tissue sources, life history stages, and across generations.

What Genetics Reveals

Genetic data provides information about taxonomic relationships, stock structure, interactions among different populations, and the relationship of morphological or life history differences to genetic diversity. Recent advances in genetic technology also enable us to explore historical genetic diversity, estimate effective population sizes, and investigate levels of interbreeding among populations of the same or different species.



Technician preparing samples.



The blue pike, once the primary commercial species in Lake Erie, was declared extinct in 1983. GLSC researchers have been able to extract DNA from historical scale samples for genetic analysis (plate circa 1931).

Endangered Species

We are evaluating the population genetic characteristics of endangered and extinct populations, including Great Lakes coregonids, Lake Superior "coaster" brook trout, and Lake Erie blue pike. The purpose of these studies is not only to catalogue declining species, but also to investigate the genetic impact of population declines that may lead to extinction. Such information could be useful in identifying populations at risk.

Fish Stock Identification

Hatchery supplementation is a key strategy in fishery recovery programs. Unfortunately, hatchery propagation often results in a reduction in genetic diversity due to reduced sizes of wild populations and small broodstock sizes. Goals for the restoration and management of Great Lakes fish species now incorporate genetic information about stock differences to maintain the integrity of wild populations and to insure that hatchery broodstock adequately represent the genetic variability available in the wild.

Lake Superior: Two of the three lake trout types (lean, siscowet, and humper) are unique to the Lake Superior basin, and may have evolved there in post-glacial times. Investigations into their genetic structure suggest that geographic location and depth differences among populations may be factors that limit interbreeding. Recent advances in genetic

technology have enabled GLSC researchers and collaborators to develop population-specific genetic markers that will be useful for evaluating genetic, morphological and geographic variation among Lake Superior lake trout populations.

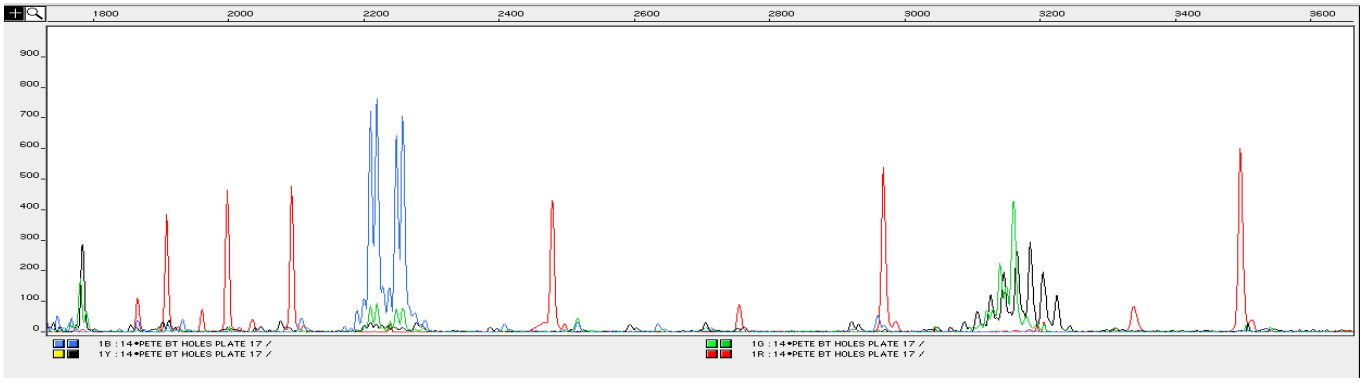
Lake Huron: Hatchery supplementation has been used extensively for restoration of lake trout, and recent success with natural reproduction has led to questions about parental origin of wild-produced fish. Mixed stock analysis using multiple genetic characters is being tested for use in parental strain identification of the wild juvenile fish.

Applications to the Fishery

Information for managers: GLSC researchers and their cooperators are using genetic technology to develop economical, efficient, reliable procedures to evaluate species and stock identity. This information is useful for managing wild populations as well as hatchery supplementation programs, devising informative indicators for exploited fisheries, and determining stock identity of fish involved in harvest disputes. Measures of genetic diversity can be used along with traditional measures of mortality and survival to evaluate the long term health of a population.

Non-lethal sampling: GLSC researchers use non-lethal tissue sampling techniques to limit destruction of endangered and sensitive fish populations. These techniques facilitate field sampling efforts and also enable the researchers to access historical collections.

Genetic profiles of historical fish: We are developing techniques to analyze genetic characteristics of historical fish populations. Some of these populations have been extinct in the Great Lakes for two decades or more, but archived scale samples from historical surveys are housed at the Center and provide a source of DNA for these analyses. Researchers hope to obtain information pertaining to historical levels of genetic diversity and changes in diversity that may occur with changes in abundance. In some populations, historical data can be compared to similar data for an extant population to look for changes in diversity or to evaluate impacts of management program.



Electropherogram with genotypes at microsatellite DNA loci (green, blue, and black lines) generated using an automated DNA sequencer.