



USGS Fish Health Research in the Great Lakes Thiamine Deficiency Complex and Fish Mortality

Recreational and commercial fishing currently generates over \$4 billion annually to the economy of the Great Lakes region and supports more than 75,000 jobs, but the health of the Great Lakes fishery is threatened by invasive species, habitat degradation, and other factors that affect the functioning of the entire ecosystem. Fish health is of particular concern to fishery managers in the Great Lakes as it affects the sustainability of fish populations as well as the success of native fish restoration projects. Lake trout and other salmon species such as coho and chinook are being affected by a nutritional disease known as Thiamine Deficiency Complex (TDC) that may result in early death. The primary question fishery managers and other partners are asking is:

How severely does Thiamine Deficiency Complex impact Great Lakes fish stocks and what can be done to minimize the effects?

What is Thiamine Deficiency Complex?

The failure of newly hatched lake trout and other salmon species to survive and grow has been linked in part to a lack of thiamine (Vitamin B1) in their system. What is causing this thiamine deficiency? Scientists have found that one of the primary prey of these fish is the alewife, an invasive fish species that entered the Great Lakes over 50 years ago. Alewives contain an enzyme called thiaminase that destroys thiamine. When lake trout or salmon eat alewife, they take in this enzyme. This is causing a reduction of thiamine in adult lake trout and salmon and their eggs. Symptoms of TDC in newly hatched fish include loss of equilibrium, swimming in a spiral pattern, lethargy, and early death.



Thiamine implants are a tool that can be used to improve survival of young fish.

USGS Scientists Working Together to Find Answers

A multi-disciplinary team of USGS scientists are working on various aspects of this fish health issue. This integrated approach results in a broader array of scientific information and more economical and effective research.

USGS

- ◆ Columbia Environmental Research Center
- ◆ Great Lakes Science Center, Ann Arbor and Tunison Laboratory of Aquatic Science
- ◆ Leetown Science Center, Northern Appalachian Research Laboratory and Fish Health Laboratory

Key Partners include:

- Great Lakes Fishery Commission
- Environment Canada
- Department of Fisheries and Oceans Canada
- Illinois, Indiana, Michigan, Ohio, Wisconsin DNRs
- New York State Dept. of Environmental Conservation
- Native American Tribes

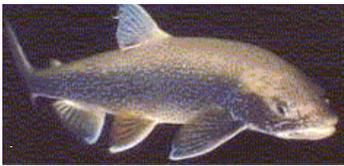
USGS/Partner Research Outcomes

- Newly hatched lake trout and other salmon species often do not survive because of a deficiency of thiamine.
- Alewives, food for lake trout and salmon, contain the enzyme thiaminase that destroys thiamine.
- Lake trout and salmon that feed on alewife often produce thiamine deficient young that don't survive.
- Very few lake trout have been found that live to one year of age from natural spawned eggs.
- Fish hatched from eggs with low thiamine have poor immune systems. Specific components of their immune systems are not working properly.
- Thiamine deficient lake trout die from a certain bacterial infection while those with thiamine survive.



HOW ARE USGS SCIENTISTS WORKING TO MEET THE SCIENCE NEEDS OF OUR PARTNERS?

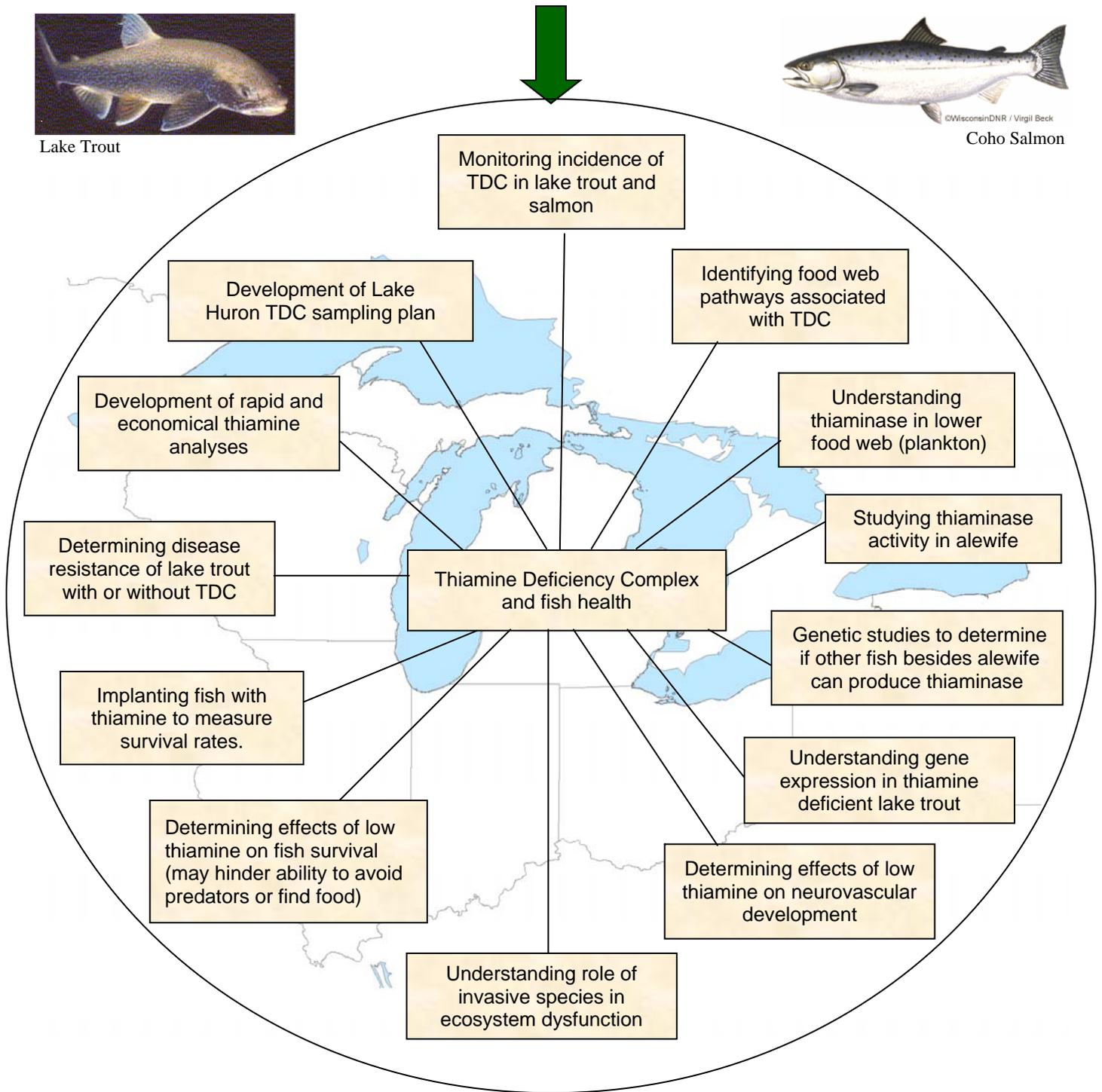
To determine the severity of the effects of TDC on fish stocks and how to minimize those effects, research is currently focusing on:



Lake Trout



Coho Salmon



USGS scientists are working proactively with partners and using an ecosystem approach to provide relevant science that addresses fish health concerns and contributes to a stronger and more resilient Great Lakes ecosystem.

A HEALTHY AQUATIC ECOSYSTEM = A STRONGER GREAT LAKES FISHERY.