

## **RESEARCH**

We have organized the ongoing research projects at CBFS under the following subheadings: Fisheries Management, Food Web Interactions and Limnology of Oneida Lake, and Great Lakes Ecology.

### ***Fisheries Management***

Management efforts in warmwater fisheries often involve large-scale changes in the structure and function of entire fish communities. This complexity presents a serious challenge to effective management because the outcome of a given strategy will depend on responses at the community-level, which often involve numerous direct and indirect effects. Improving fisheries management will require active research into complimentary areas. First, we must improve our understanding of the underlying processes, such as size-structured or trophic-level interactions, that operate in warmwater fish communities. Second, we need to examine the ways that management activities modify the processes that influence community structure. Together, this combination of basic and applied research will improve our ability to successfully manage warmwater fisheries in the face of the multiple problems that affect lakes, streams and rivers.

#### **Angler catch rates in Oneida Lake: effects of walleye abundance and forage fish availability (CWFU).**

*Investigators:* Tony VanDeValk, Randy Jackson and Lars Rudstam

*Objectives:* To assess annual changes in catch rates of walleye, yellow perch and other species in Oneida Lake and compare these catch rates with stock abundance and forage fish abundance data obtained through other projects.

#### **Walleye dermal sarcoma**

*Investigators:* Paul Bowser, Rod Getchell, Greg Wooster, Tony VanDeValk, Lars Rudstam

*Objectives:* This cooperative project between the Veterinary School and CBFS involves studies of walleye dermal sarcoma using Oneida Lake fish. Faculty in Microbiology and Biochemistry are also involved.

#### **Evaluation of acoustic methods and comparison with other assessment techniques (various sources).**

*Investigators:* Lars Rudstam, Pat Sullivan, Doran Mason, Ted Schaner, Dave Warner, John Horne, Mike Jech, Tom Brooking, Sandra Parker Stetter, Don Einhouse, and Larry Witzel

*Objectives:* (1) To evaluate different acoustic methods for determining distribution, abundance and biomass of pelagic fish populations and (2) to compare acoustic fish abundance with catches in traditional sampling gear (gillnets, trawls).

#### **Analysis of population trends in Oneida and Canadarago Lakes (CWFU).**

*Investigators:* Lars Rudstam, Randy Jackson, David Green, John Forney, Tony VanDeValk, and Tom Brooking

*Objectives:* To assess annual changes in species abundance and provide projections of stock abundance; monitor age structure, growth and recruitment of predominant species; identify species interactions and incorporate information into management plans.

#### **Walleye and alewife interactions: can alewife be controlled through predation? (CWFU).**

*Investigators:* Randy Jackson, Lars Rudstam, Tom Brooking, and Tony VanDeValk

*Objectives:* To investigate the feasibility of controlling alewife populations using stocking of walleye fingerlings in Cayuta Lake. We are also working with Bill Harman and colleagues at SUNY-Oneonta to evaluate the effect of walleye stocking on the alewife populations in Otsego Lake.



#### **Assessment of lake sturgeon restoration in Oneida Lake (Hatch).**

*Investigators:* Randy Jackson, Tony VanDeValk and Tom Brooking

*Objectives:* To monitor habitat use and population dynamics of lake sturgeon in Oneida Lake.



**Comparative modeling of the ecosystem impacts of exotic invertebrates and productivity changes on fisheries in the Bay of Quinte and Oneida Lake (GLFC).**

*Investigators:* Ed Mills, Lars Rudstam, Scott Millard, Doran Mason, Randy Jackson plus 11 co-investigators

*Objectives:* (1) Utilize a combination of ecosystem and population modeling approaches to address the declining walleye stocks in both Oneida Lake and eastern Lake Ontario-Bay of Quinte and, (2) investigate the role exotic invertebrate invaders played in this decline.

***Food Web Interactions and Limnology of Oneida Lake***

A large number of projects involve studies of species interactions and the coupling between abiotic and biotic processes within the Oneida Lake ecosystem. Baseline monitoring data are collected by the Warmwater Fisheries Unit (fish populations, see above) and by a project on the long-term changes in other trophic levels in Oneida Lake (nutrients, temperature, oxygen, phytoplankton, zooplankton). The other projects build on this database to address specific questions.

**Limnological monitoring of Oneida Lake (SPE).**

*Investigator:* Edward Mills

*Objectives:* To monitor seasonal limnological changes in Oneida Lake (April through October with limited collections during winter ice cover).

**Long term dynamics of colonial fish eating birds in Oneida Lake (USGS).**

*Investigator:* Jeremy Coleman and Milo Richmond

*Objectives:* To study the long-term dynamics of interacting tern and gull colonies on islands in Oneida Lake.

**Ecology of the cormorant and effects on fish populations in Oneida Lake (USGS, Berryman Institute).**

*Investigator:* Jeremy Coleman, Randy Jackson, Milo Richmond, Lars Rudstam and Tony VanDeValk

*Objectives:* To study cormorant foraging and habitat utilization; to determine prey selection and total fish consumption by the cormorants on Oneida Lake; include mortality rates from birds in models of species interactions between walleye and perch.

**Effects of spatial patterns on fish population dynamics and fisheries (Hatch).**

*Investigators:* Lars Rudstam, Ed Mills, Cliff Kraft, Pat Sullivan, Randy Jackson and Dan Josephson

*Objectives:* To investigate spatial patterns, including nearshore – offshore dynamics in Little Moose Lake, Oneida Lake and Great Lakes. Understand how these patterns affect predator-prey interactions.

**Zooplankton as ecological indicators of functional integrity of Great Lakes ecosystems (New York Sea Grant).**

*Investigators:* Ed Mills, Ora Johannsson, Michael Paterson, Ken Nichols, Allison Gamble, Russ Lloyd, David Findlay, Sarah Malkin Jennifer Chun, John Aiken and Oliver Li

*Objective:* Develop a zooplankton index of functional integrity using the long-term Oneida Lake dataset.

**Dynamics of interacting, age-structured fish populations (SPE).**

*Investigators:* Ed Rutherford, Edward Mills, Lars Rudstam, John Forney, Ken Rose, Brian Irwin and John Post

*Objectives:* To develop an age-structured model of the interaction between walleye and yellow perch that includes reciprocal cannibalism and allows for testing of management options. Compare these models with individual based approaches developed previously.

***Great Lakes Ecology***

Research on the ecology of the Laurentian Great Lakes is the second largest area of specialization at the station. Most work is associated with species interactions and the current concerns about the balance between predatory demand and prey supply.

**Status of the Lake Ontario Ecosystem: A biomonitoring approach (NYS DEC and EPA).**

*Investigators:* Edward Mills and Lars Rudstam

*Objectives:* To develop a biomonitoring program to evaluate the lower food web components of Lake Ontario.

**Biological Invasions in the Laurentian Great Lakes: an analysis of ship vectors (GLFC).**

*Investigators:* Ed Mills, Kristen Holeck, Hugh MacIsaac, and Igor Grigorovich

*Objectives:* Prepare a comprehensive inventory of traffic patterns of ships entering the Great Lakes – St. Lawrence River system pre- and post-ballast water guidelines.

**Dynamics of rainbow smelt population in Lake Champlain (Vermont and New York Sea Grants).**

*Investigators:* Donna Parrish, Lars Rudstam, Patrick Sullivan, Sandra Parker, Jennifer Strizle

*Objectives:* To investigate population dynamics of three sub population of rainbow smelt in Lake Champlain, including investigating the role of cannibalism in maintaining differences in growth and abundance. To investigate the interactions between planktivores (smelt and mysids) and the seasonal dynamics of zooplankton. To develop a cost efficient acoustic sampling protocol for Lake Champlain.

**Interactions between the alien zebra mussel and the native hexagenid mayflies on water turbidity, growth and survival (NYDEC and USFWS).**

*Investigators:* Ed Mills, Eva Bergman, Larry Greenberg, and Brad Baldwin

*Objectives:* Assess the mutual effects of *Hexagenia*, and zebra and quagga mussels on each other.

**Mysis in crisis: analysis of recent declines in Lake Ontario (New York Sea Grant).**

*Investigators:* Lars Rudstam, Ora Johannsson, Ed Mills, Ellis Loew, Gideon Gal, Michael Arts, Brent Boscarino

*Objectives:* To investigate various hypothesis for an observed decline of mysids in Lake Ontario. To develop acoustics techniques for assessing distributions of mysids across Lake Ontario. To investigate the use of RNA and fatty lipids for assessing mysid growth rates. To validate vertical migration models through experiments and observations.

**Effects of changing light levels on alewife-mysid interactions in Lake Ontario**

*Investigators:* Lars Rudstam, Ellis Loew, Ed Mills, Brent Boscarino.

*Objectives:* To investigate the effect of increasing water clarity in Lake Ontario on the interactions between alewife and mysid shrimps.

**The coupling between physical and biogeochemical processes in southern Cayuga Lake (Cornell Biocomplexity Initiative)**

*Investigators:* E. A. Cowen, Lars Rudstam, Nelson Hairston, Steve Effler and Quian Liao.

*Objectives:* To develop a hydrodynamic 3-D water circulation model for the Cayuga Lake southern shelf as an example of internal waves interactions with shelf topography. Couple hydrodynamics with biological interactions.

**Estimating Natural Recruitment of Chinook Salmon in the Salmon River, New York (2 projects, New York Sea Grant).**

*Investigators:* Neil Ringler, Lars Rudstam, Michael Connerton, Dan Bishop, Jim Johnson, Nathan Smith, Pat Sullivan

*Objectives:* The objective of the first project (with Sullivan and Smith) is to develop markers of natural reproduction in salmon otoliths that can be used to determine wild versus hatchery source for returning adult salmon and investigate the effect of changing flow regimes in the Salmon River for natural reproduction. The objective of the second project (with Ringler, Connerton, Bishop and Johnson) is to measure adult return and natural smolt production of Chinook salmon in the Salmon River by sampling, redd counts, harvest estimates, and hydroacoustics.

