Recently ended New York Sea Grant projects (*2013 – 2016*)
(in end date order)

R/CMB-40. Dr. Christopher Gobler, Stony Brook University. **Assessing Bloom Dynamics of The Toxic Dinoflagellate, Cochlodinium Polykrikoides and Impacts on Fisheries: Are There Mitigation Options?** *Ended on 1/31/2016*.

The red tide forming dinoflagellate Cochlodinium polykrikoides is responsible for fish and shellfish kills in NY coastal waters. Within the last couple of decades, the U.S east coast has experienced an increase in significant blooms. Since 2004, Cochlodinium has annually formed dense blooms in the Peconic Estuary, Great South Bay, and Shinnecock Bay of NY during late summer and early fall months causing mass mortalities in wild and cultured finfish and shellfish. Management and mitigation of red tide blooms has been hampered by a lack of knowledge of red tide bloom dynamics.

New York Sea Grant funded a study led by Dr. Christopher Gobler at Stony Brook University to address this knowledge gap. The research team conducted field surveys of Cochlodinium blooms by measuring horizontal and vertical distribution and migration during bloom development. During the field surveys water quality properties were also measured within blooms and adjacent to blooms. The project team also conducted experiments to assess the growth and survival of shellfish under bloom conditions in both the field and laboratory. In addition the project also aimed to quantify the formation and distribution and formation of Cochlodinium resting cysts in the sediments.

This project made significant progress in understanding the ecology and dynamics of Cochlodinium blooms, as well as the effects of these blooms on shellfish and what might be done to mitigate these effects. Project results revealed that C. polykrikoides bloomsfundamentally change microbial communities and accelerate the cycling of carbon, some nutrients, and vitaminB12.The project provided clear results with real-world applications to shellfish growers. Experiments showed that cell densities during Cochlodinium blooms are greater at surface layers and, while there is some vertical movement within the water column during the day, densities are likely to be greatest at the surface throughout a 24-hour period. Accordingly, it was found that bay scallops experienced significantly greater mortality during Cochlodinium blooms than clams and that surface-deployed scallops experienced significantly more mortality than individuals deployed at depth. First- and second-year scallops were similarly vulnerable to Cochlodinium blooms. Therefore, the risks associated with scallop aquaculture during Cochlodinium events may be greater than those posed towards clam and oyster aquaculture. The greatest risk to all shellfish species was for individuals maintained at surface positions where cell densities are the greatest. This is information that can be used to modify hatchery operations to improve shellfish survivorship during red tide bloom events and thus reduce financial losses. In addition the project demonstrated that the simple use of a 10-µm mesh ‘sock’ on flow-through water effectively mitigated the harmful effects of

Cochlodinium blooms on bivalve survival thus representing a tool for hatcheries to protect seed bivalves against these HABs.

The project also resulted in the development and testing of a new genetics based tool that is a fluorescent in situ hybridization (FISH) assay using oligonucleotide probes specific for the large subunit (LSU) rDNA of C. polykrikoides. The final LSU rDNA-targeted FISH assay was found to quantitatively recover cysts made by North American isolates of C. polykrikoides, but not cysts formed by other common cyst-forming dinoflagellates. The method was then applied to identify and map C. polykrikoides cysts across bloom-prone estuaries.

R/FBF-22. Dr. Neil Ringler, SUNY College of Environmental Science and Forestry. **Atlantic Salmon Restoration in Great Lakes Tributaries: An Ecological and Bioenergetics Approach**. *Ended on 1/31/2016*.

Reestablishing self-sustaining populations of Atlantic salmon (Salmo salar) in the Lake Ontario watershed has historically produced limited regional results. Atlantic salmon are a prized fish among local anglers and their successful restoration would economically benefit coastal communities by providing increased opportunities for anglers. To help improve the odds at successful restoration in Lake Ontario tributaries it would be useful to match genetic traits to conditions in local streams to increase survivorship and the chance of establishing a self-sustaining population.

A research team led by Dr. Neil Ringler at the State University of New York, College of Environmental Science and Forestry Successful conducted a study that measured the growth, survival, and movement of Atlantic salmon fry of two genetic strains stocked in Lake Ontario tributaries in the Fish Creek watershed. In addition, habitat parameters including temperature, flow, substrate, and characteristics of man-made structures were evaluated to determine the suitability of current rearing conditions and adult salmon migration potential of several tributaries. Laboratory experiments were conducted comparing growth, respiration, and consumption between two strains at a range of temperatures. Also, analysis of food availability and salmon stomach contents was conducted to investigate diet patterns and identify potential limitations to growth. An individual based bioenergetics growth model was used to predict how salmon growth in five rearing streams across two geographic regions may respond to climate change.

Results from the project provide insight for future Atlantic salmon restoration in the Lake Ontario watershed, primarily as it relates to the further development of local sport fishing opportunities. Despite warm stream temperatures, streams of the Drumlins Region should be considered for future restoration efforts given the tributary access they provide for returning adult fish. Whereas streams in the Tug Hill Plateau Region offer very suitable juvenile salmon habitat and resilience to the impacts of climate change, numerous barriers to migration will probably make restoration difficult. A major influence of this project will likely be realized in future the efforts of the Fish Creek Atlantic Salmon Club. Project findings and communication with Club members helped them to alter Atlantic salmon stocking regimes for their purposes. It is hoped that after making changes to their plans, the Club will start to see more adult salmon in Oneida Lake and Fish Creek in the years to come.

R/CE-34-CTNY. Dr. Jamie Vaudrey, University of Connecticut. **Comparative Analysis and Model Development for Determining the Susceptibility to Eutrophication of Long Island Sound Embayments**. *Ended on 8/28/2015*.

Results from this study have identified the eutrophic status of embayments in Long Island Sound, estimated the nitrogen load and sources of nitrogen to all embayments of Long Island Sound, and established a list of embayments most likely to be experiencing the impacts of eutrophication. These results have been presented in a variety of forums beyond academia, including the Long Island Sound Study Estuary Program, New York and Connecticut government agencies, local citizen action groups, and advocacy organizations.

R/CTP-48. Dr. Chester Zarnoch, Baruch College, City University of New York. **Ecosystem Response to Enhanced Nutrient Loadings Following Hurricane Sandy in the Long Island South Shore Estuary: Increased Nitrogen Removal or Availability?** *Ended on 8/15/2014*.

Hurricane Sandy caused significant storm surge damage to the Bay Park Sewage Treatment Plant on the south shore of Long Island, New York, releasing estimated 68 million gallons of raw and partially treated sewage into Western Long Island South Shore estuary. In the aftermath, there were questions about what the impact of the sewage release would be to the estuary.

A Sea Grant rapid response and assessment study was initiated that was led by researcher Chester Zarnoch from Baruch College. The objective of the study was to determine if Western Long Island South Shore estuary responded to elevated nutrient loads by serving as a nutrient sink, or becoming a nutrient source that would lead to degraded water quality conditions.

The research team measured nitrogen transformations seasonally for 1 year following Hurricane Sandy at a site with high nutrient concentrations due to the sewage treatment inputs, and a lower nutrient site not impacted by inputs. At each site marsh, mudflats, and channel sediments were sampled. Measurements of water quality indicators (dissolved oxygen, chlorophyll a, reactive nitrogen) showed only short-term impacts (i.e. days) from the sewage release.

The project results suggest that the major controls on N removal and fluxes of reactive nitrogen appear to be sediment oxygen demand, nitrification, and the quality of sediment organic matter Efforts to improve water quality by reducing nitrogen loading to the system would benefit through both treatment plant upgrades and reduction in non-point sources of nitrogen.

R/CTP-49. Dr. Michael Twiss, Clarkson University. **Investigate the Paradox of Nitrogen Limitation in Nitrate-Rich Lake Ontario**. *Ended on 12/31/2013*.

Over the past several decades Lake Ontario has undergone a steady increase in nitrate concentrations. Nitrate accumulation in the Great Lakes has important implications for the coastal environment. Since Lake Ontario is the headwaters of Saint Lawrence River, the largest fluvial source of freshwater to the North Atlantic Ocean, export of nitrate from the Great Lakes contributes to coastal eutrophication and can be linked to expansion of coastal hypoxia in the Gulf of St. Lawrence. Much of the details concerning the processing nitrate in the Great Lakes remain unknown.

One such area is the role of trace metals. The trace metals Molybdenum (Mo) and iron (Fe) are involved in the biochemistry of nitrate assimilation to protein in phytoplankton. Nitrate assimilation in Lake Ontario may be limited in phytoplankton by low trace metal bioavailability.

Sea Grant funded research led by Michael Twiss of Clarkson University along with colleagues from Central Michigan University and Michigan State University that focused on the role that low level nutrients (trace metals) have on reduction of nitrate concentrations by phytoplankton. Results have shown that elements like molybdenum and iron, often present at low concentrations in Lake Ontario serve an important function in allowing phytoplankton to utilize the nutrient nitrate.

This research has clarified the important role that phytoplankton play in controlling excessive nutrients in the lake. An implication of this work is the necessity to improve efforts at reducing nitrogen inputs into the lake. Currently more nitrogen is input than the system can process.