



Oneida Lake: Long-Term Dynamics of a Managed Ecosystem and Its Fishery

Lars G. Rudstam, Edward L. Mills, James R. Jackson, and Donald J. Stewart (editors). American Fisheries Society, Bethesda, MD. 2016. 541 pages. US\$79.00 (softcover or pdf download).

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This edited book tells the story of a large lake ecosystem and research conducted on it over several decades. Its 24 chapters

and 61 contributing authors present a comprehensive treatment, documenting successive changes since the 1960s. In the early years, research conducted at the Cornell University Biological Field Station (CBFS), was focused on the dynamics of a fishery dependent on the coupled dynamics of Walleye predators and Yellow Perch prey. A goal of the science was to develop management recommendations to support the productive and valuable recreational fishery. This part of the Oneida Lake story evolves from the enduring insights, accomplishments, and contributions of John Forney, first director of the CBFS (1956–1992). The book, fittingly, is dedicated to him.

Ecosystems change and Oneida Lake is no exception. Reductions in phosphorus inputs (1970s) and invasions by White Perch *Morone americana* (1960s), zebra *Dreissena polymorpha* and quagga *D. rostriformis bugensis* mussels (1990s), and ongoing climate change have impacted the lake and broadened the scope of science on its problems that have included a wide range of limnological research since the 1980s under CBFS Directors Edward Mills and, most recently, Lars Rudstam. A “simple” fishery management scheme proposed by Forney, which relied on annually assigned, minimum size limits on Walleye *Sander vitreus*, referred to as “Forney’s algorithm” in the book, became less effective after the 1980s. Much of the book is a synthesis of the decades of data documenting changes and leading to predictions and forecasts of the ecosystem’s trajectory. The massive amounts of data supporting contributions in this book are archived and available to all (Chapter 1).

The first six chapters of the book (Parts I and II) largely serve as an introduction to the Oneida Lake ecosystem and its history of successive changes, especially those since the late 20th century. The interesting history of the CBFS (Chapter 2) is followed by readable and engaging chapters that describe the lake, the history of fish and fisheries on the lake back to the 18th century, the people who fished, and the science aimed at understanding and managing fisheries. Atlantic Salmon *Salmo salar* and American Eel *Anguilla rostrata* disappeared from Oneida Lake long ago. White Perch invaded and thrived in the 1950s–1960s. The history of species losses and ongoing introductions of invasive species and range extensions

(Chapter 6) demonstrate the lake’s ability to absorb changes while remaining resilient and productive. Stressors and factors emerging successively since the 1950s are documented—these include (1) eutrophication and disappearance of the mayfly *Hexagenia* as a dominant benthic invertebrate; (2) the range extension and establishment of White Perch in the lake; (3) the reductions in phosphorus inputs and a trend toward oligotrophication; (4) introduction of invasive, filter-feeding zebra and quagga mussels; and (5) accelerating climate change. Readers will be disappointed to not find a clear, detailed, map of the lake, its watershed, tributaries, canal systems, and surrounding towns.

Part III consists of 13 chapters, each written as a typical journal paper. Topics include nutrient and plankton dynamics, submerged aquatic vegetation, hydrodynamics, and trophic-level analysis. The chapters on zebra mussel invasion in the early 1990s and its impact (Chapters 9 and Chapter 18) describe the “benthification” of the lake and associated changes, including probable effects on fish community ecology. The reestablishment of submerged vegetation, associated with increased water clarity after zebra mussel establishment, is well documented (Chapter 10) and similar to outcomes in other ecosystems invaded by this mussel. Chapters on plankton indicate recent declines in phytoplankton biomass (Chapter 8) but no clear change in dynamics of key zooplankters (*Daphnia* spp.; Chapter 12) that are prey for young of Walleye and Yellow Perch *Perca flavescens*.

For fisheries scientists, key chapters in Part III are those on the Walleye and Yellow Perch population trends, recruitment variability, and predator–prey relationships (Chapters 15–17). The analyses and bioenergetics modeling that quantify Walleye predation on Yellow Perch (Chapter 15) should be instructive and useful for scientists addressing similar questions in other systems. Chapter 16, in my view, is the single most important chapter in the book. It critically addresses recruitment variability in Walleye and Yellow Perch and the trends over time, with analysis of change and causality. The paper’s benchmark is the important paper by Forney (1980) that synthesized the topic years ago and strongly influenced management strategies for Walleye and Yellow Perch fisheries in Oneida Lake and beyond. The new analysis indicates that the length-based management strategy proposed by Forney for the closely coupled predator–prey pair may no longer apply in the evolved Oneida Lake with its decoupled Walleye–Yellow Perch dynamics.

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Two chapters in Part IV present quantitative models of Walleye and Yellow Perch population dynamics, demonstrating that individual-based models (Chapter 20) and matrix models (Chapter 21) can simulate variability in abundances and have utility to understand long-term changes. A comparative analysis of recent fish community trends in Oneida Lake with trends in three embayments of the Great Lakes (Chapter 23) indicated similarities but also differences. The final chapter (Chapter 24) summarizes the book's content and forecasts and speculates on the future of Oneida Lake's fisheries, concluding that climate change will inevitably lead to shifts in community structure, with Largemouth Bass *Micropterus salmoides* and Smallmouth Bass *M. dolomieu* increasing in dominance while percids decline.

The book need not be read in its entirety to appreciate the Oneida Lake ecosystem. Fishery scientists, managers, and limnologists will benefit from reading selected chapters. Students will be interested in chapters on the history of an evolving lake ecosystem and will learn about the evolution and conduct of large, collaborative research programs.

I was pleased to have the opportunity to review this book. Fifty-three years ago, I began my graduate research on Oneida Lake at the CBFS. I was John Forney's first graduate student. Forney was a role model, teaching by example and instilling in me lessons that served me throughout my career. I add my accolades to those offered by Noble et al. in the book's dedication to John Forney. I can heartily recommend the book for its science, its history, and its recognition of Forney's contributions to understanding Oneida Lake and factors that regulate fish population abundance.

REFERENCE

Forney, J. L. 1980. Evolution of a management strategy for the Walleye in Oneida Lake, New York. *New York Fish and Game Journal* 27:105-141. 