ENTANGLED EDEN:
ECOLOGICAL CHANGE AND
THE LAKE HURON COMMERCIAL FISHERIES,
1835-1978

by

KENT LACOMBE

A.A., History, Alpena Community College, 1995
B.A., History, Western Michigan University, 1998
M.A., History, Kansas State University, 2001
M.L.S., Emporia State University, 2006

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of History
College of Arts and Sciences

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2010

Abstract

This project examines ecological change in Lake Huron during the nineteenth and twentieth century and investigates the causative role of the commercial fisheries in that change. The repeated failures of various regional and international efforts designed to improve management of the lake's fisheries are also examined. The fundamental argument is that economic considerations were the primary motivations for policy development related to the Great Lakes fisheries. Historically management programs and legislation were shaped by local and regional economic interests.

The central focus of this project is Lake Huron. Anthropogenic changes in that lake's environment dramatically affected the lives and relationships of its non-human inhabitants. The same changes also transformed relationships among human beings who relied on the lake's resources. Commercial fishermen who operated in the waters of both the United States and Canada relied on the lake for their livelihood, but as the twentieth century commenced the supply of marketable fishes decreased. Competition accelerated and fishermen introduced new technologies and increased their quantity of fishing gear in an effort to maximize their catches in response to fluctuating returns. Economic considerations were of primary concern to both fishermen and government bureaucrats. Lake Huron's status as an international borderland further complicated the situation. Analysts in both the United States and Canada recognized the dramatically changing conditions of the lakes as reflected through the woes of the commercial fishery. Nonetheless, the germane state, provincial and national governments repeatedly failed in their attempts to develop a cooperative management plan. By the second half of the twentieth

century Lake Huron's embattled biome stood in stark contrast to the once seemingly endless numbers of fishes and flora that sustained the lake's web of life for hundreds of years.

ENTANGLED EDEN:
ECOLOGICAL CHANGE AND
THE LAKE HURON COMMERCIAL FISHERIES,
1835-1978

by

KENT LACOMBE

A.A., History, Alpena Community College, 1995
B.A., History, Western Michigan University, 1998
M.A., History, Kansas State University, 2001
M.L.S., Emporia State University, 2006

A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of History
College of Arts and Sciences

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2010

Approved by:
Major Professor
James E. Sherow

Copyright

Abstract

This project examines ecological change in Lake Huron during the nineteenth and twentieth century and investigates the causative role of the commercial fisheries in that change. The repeated failures of various regional and international efforts designed to improve the management of the lake's fisheries are also examined. The fundamental argument is that economic considerations were the primary motivations for policy development related to the Great Lakes fisheries. Historically management programs and legislation were shaped by local and regional economic interests.

The central focus of this project is Lake Huron. Anthropogenic changes in that lake's environment dramatically affected the lives and relationships of its non-human inhabitants. The same changes also transformed relationships among human beings who relied on the lake's resources. Commercial fishermen who operated in the waters of both the United States and Canada relied on the lake for their livelihood, but as the twentieth century commenced the supply of marketable fishes decreased. Competition accelerated and fishermen introduced new technologies and increased their quantity of fishing gear in an effort to maximize their catches in response to fluctuating returns. Economic considerations were of primary concern to both fishermen and government bureaucrats. Lake Huron's status as an international borderland further complicated the situation. Analysts in both the United States and Canada recognized the dramatically changing conditions of the lakes as reflected through the woes of the commercial fishery. Nonetheless, the germane state, provincial and national governments repeatedly failed in their attempts to develop a cooperative management plan. By the second half of the twentieth

century Lake Huron's embattled biome stood in stark contrast to the once seemingly endless numbers of fishes and flora that sustained the lake's web of life for hundreds of years.

Table of Contents

List of Figures

Acknowledgements

The research and writing of this project, like my own academic training, navigated through many years and milestones of personal history to reach this fruition. Much like my own education, the ecological story of the Great Lakes is ongoing. Reaching this latest milestone would not have been possible without the guidance and support of a myriad of scholars, information specialists and friends. I have little doubt what follows is both an incomplete and inadequate list of the generous support I received. First and foremost professional credit is due to the faculty of the Kansas State University History Department. Numerous professionals within that department nurtured my evolving understanding of our shared historical past. Drs. David Graff, the late George Kren, Mark Parillo and Lou Falkner Williams were especially patient listening to my incomplete and flawed historical theories when I arrived in Manhattan, Kansas over a decade ago. They all contributed to the scholarly flowering of the hopefully more polished professional I have become.

Each member of my Ph.D. committee subsequently played a significant role not only in my completion of this project, but in fostering my growth as a more mature and diligent academic professional. Dr. Louise Breen was a source of reliable counsel throughout my program. Her graduate course on colonial history was one of the most memorable of my coursework at Kansas State University. Dr. Sue Zschoche has an almost uncanny ability to set students at ease even when various combinations of life's little surprises and academic hurdles seem too imposing. Her advice and constructive criticism was more valuable than she will ever know. Dr. Bonnie Lynn-Sherow combines an enthusiasm for her field with a genuine social compassion that is sorely lacking in far too many academic circles. It has been a privilege to work with her. Dr. Ted Cable of the Department of Horticulture, Forestry and Recreation Resources provided a valuable scientific perspective that made me more fully appreciate the interdisciplinary nature of my work. His comments both in and out of the classroom enriched my understanding of environmental management. Finally, my advisor Dr. James E. Sherow is the reason I am an environmental historian. His graduate course on environmental history led to a complete revolution in my thinking about history, the environment and the place of human

beings in the ecology of our shared planet. His instruction, counsel and subsequent guidance through my M.A. and Ph.D. programs were invaluable and will never be forgotten.

In addition to the faculty of Kansas State University, the friendship and support of numerous other friends and colleagues in Manhattan, Kansas kept me grounded and dedicated to the study of history. Dr. Brice Hobrock, Dean Emeritus of Kansas State University Libraries, was a steadfast, respected source of encouragement and advice. Dr. Margaret Bickers, Jon and Susan Berhow, Dr. Michael Davis, Christina Fishback, Tim Hoheisel, Van Hutchison and many others were both friends and colleagues during this long journey. If I had not chosen Kansas State University for graduate work I would not have met my life partner Dr. Michelle J. Krehbiel. Our partnership is the most rewarding consequence of my time spent in Manhattan, Kansas. Michelle provided support and inspiration during some of the most difficult hours of the long Ph.D. process.

Many other institutions and professionals contributed to this project. The staff at the Archives of Ontario in Toronto, Canada was especially helpful in finding the Ontario records I required. I also wish to thank Rich Quintal of the Great Lakes Science Center in Ann Arbor, Michigan, Judith Schlaak of the Marialyce Canonie Great Lakes Research Library in South Haven, Michigan and Joseph D. Schwarz of the National Archives and Records Association in College Park, Maryland for their personal assistance in tracking down specific and relevant information. A special thank-you also goes out to Lacey Mason, Project Coordinator for the Great Lakes Geographic Information Systems Project. She authored the included map of the Lake Huron Basin.

These acknowledgements would not be complete without thanking my parents, Jerry and Kay LaCombe. They made everything that follows possible. Without their emotional and financial support I would never have reached this significant academic milestone. I am forever in their debt.

Three other people must be mentioned. Prior to coming to Kansas State my post-secondary education spanned two excellent learning institutions. At Western Michigan University a cadre of historians shaped my thinking in their own right. At Western Dr. Michael J. Chiarappa first introduced me to the history of the Great Lakes. His course planted an intellectual seed that slowly germinated over the ensuing years. That seed finally finds its fruition in this research project.

Prior to attending Western I completed an A.A. in history at Alpena Community College, an educational gem near the shores of Lake Huron. I was a different person then, immature and unsure of my ability to succeed in the post-secondary realm. Two instructors at Alpena Community College changed my life forever. Wes Law and Richard Matteson saw a budding historian where I saw little of anything. After repeatedly hearing what I could not do during my tenure in high school, a time when I worked hard resisting the conformist standards of a small Midwest community, Wes and Richard told me what I could do. They raised me higher than I ever imagined possible. I do this, all of this, because they taught me to believe I could.

Dedication

Dedicated in loving memory to

John Wesley Law

1936-2002

teacher, mentor, friend

Preface

Nothing is more important to life on Earth than water. Fresh water is critical to human life. The Great Lakes contain more readily available freshwater than anywhere else on the Earth's surface.[1] Collectively the lakes hold approximately eighty-four percent of North America's surface freshwater. The Great Lakes are a critical integrated ecosystem populated by a vast variety of living organisms and marked by diverse landscapes. As an ecosystem the lakes have a long natural history of interrelations among the thousands of plants and animals that inhabited the lakes' long shorelines and swam in their vast bodies. What follows is a slice of that region's ecological story.

This project examines ecological change in Lake Huron during the nineteenth and twentieth century and investigates the causative role of the commercial fisheries in that change. The failures of various efforts, both regional and international, to maintain the lake's environmental stability are examined. The central argument here is that economic considerations were the primary motivators for policy development on the lakes. Regional interests dominated lake management in the nineteenth and twentieth century. Religiously inspired ideas of human dominion over the earth and anthropocentric conceptions of human progress and recreation historically justified policies aimed at maximizing human use and consumption of environmental resources.[2] Over the second half of the twentieth century environmental theories evolved that suggested very different models of ecological stewardship. Newer theoretical models grounded in environmental thought and sciences range from human centered ideas regarding wise use to holistic models that seek to balance the needs of all living creatures.[3] Many new theories of

environmental management contrasted sharply with Great Lakes fisheries management of the nineteenth and most of the twentieth century.

This is one piece of an ongoing interconnected Great Lakes research puzzle worked on by a variety of scientists and scholars, past and present, intended to assist in forming a foundation for better understanding and managing our complex freshwater ecosystems. The central focus of this project is Lake Huron. Anthropogenic changes in that lake's environment dramatically affected the lives and relationships of its non-human inhabitants. The same changes also transformed relationships among human beings who relied on the lake's resources.

This project examines the changing historical conditions in and around the lake through the spectrum of the numerous commercial fishing operations that existed on Lake Huron in the nineteenth and twentieth centuries. Commercial fishermen who worked the waters of both the United States and Canada relied on the lake for their livelihood. As the twentieth century dawned the supply of marketable fishes declined. Canadian authorities responded with legislative controls that were poorly enforced and regularly violated. In the United States fisheries experts initially believed hatcheries could restore and maintain the commercialized species. Within the industry competition accelerated and fishermen introduced new technologies to maximize their catch in the face of fluctuating returns. They concurrently increased the amount of gear they were fishing in the lake. Analysts in both the United States and Canada recognized the dramatically changing conditions of the lakes as reflected through the woes of the commercial fishery. They realized regulations were a necessity and that the various conflicting codes of the various states and the Province of Ontario were counterproductive. Nonetheless, the U.S. and Canadian governments repeatedly failed in their attempts to develop a cooperative

management plan. While economic considerations were of primary concern to both fishermen and fisheries conservationists their priorities clashed and prevented real progress.

Environmental historian Donald Worster theorized that economic motivations inform decision making and cooperation in the modern industrial system. In his book *Nature's Economy* (1977) Worster stated industrial systems are fully interdependent, but that in the modern world interdependency "almost always gets reduced to economic terms."[4] Worster further argued that the environmental manager of the modern economic age often believes nature can be improved through intervention "for the sake of ever higher economic achievements."[5] Late nineteenth and twentieth century fisheries biologists often communicated similar economic goals. Efforts to restrain the fisheries were not designed to save fish for any reasons intrinsic to the fish themselves. Conservationists sought to preserve and enhance fisheries profits through restoration and protection of marketable fish stocks. However, the economic goals of conservationists were focused on future longevity while individual fishermen were almost always motivated by immediate profits. Thus their objectives clashed, and efforts to protect dwindling resources ran afoul of politically active commercial fishermen. When Lake Trout populations crashed in the middle of the twentieth century the governments undertook their largest cooperative fact finding mission to date, but translating the information they compiled into concerted legislative action became a slow and ultimately ineffectual affair. The depleted Great Lakes ecosystems of the late twentieth century stood in stark contrast to the seemingly endless numbers of fishes and flora that had lived in and sustained the web of life in the region for hundreds of years.

This project is divided into five chapters. Chapter one includes a brief discussion of the formation of the Great Lakes, a description of species that became important to commercial fishermen, a consideration of pre-contact use of lake resources by Great Lakes Indian peoples and a brief synopsis of the first commercial fishing enterprises in the region. The purpose of this chapter is to both provide an overview of Lake Huron's geologic history and ecology as well as illustrate the ethical frameworks certain Indian nations developed to guide resource use in order to compare and contrast their pre-contact models to the for profit market systems that developed later.

In chapter one I introduce the Great Lakes region with a brief discussion of its geologic evolution followed by an overview of several of the species of fishes that were among the most prized by the commercial fisheries. The life cycles of the various species are presented alongside the ecological niche they played within the lake's ecosystem. The use of lake resources by pre-contact Great Lakes Indian peoples is then discussed. I specifically consider the fishing practices and related cultural ceremonies of Wendats and Anishinabeks. I further consider the ethical dimensions of indigenous behavior alongside the modern stereotype of North American Indians as natural environmentalists. I reflect on *The Ecological Indian* (1999) by Shepard Krech III and his effort to challenge that stereotype. While I agree that the "ecological Indian" stereotype criticized by Krech III and his supporters is inaccurate and dehumanizing, I argue the individual ethical proscriptions of specific Indian nations are often lost in the rush to recast Indian peoples as ultimately just like everyone else. The use of lake resources by Wendats, Anishinabeks and other unique Great Lakes nations bore little resemblance to introduced Western conceptions of resource use. Because of this, I argue they deserve consideration.

While the focal point of this project is not the indigenous fisheries, the pre-contact worldviews and practices of Great Lakes Indian peoples are offered in contrast to the market systems that came later. In the late nineteenth and throughout the twentieth century the various Indian nations faced their own individual struggles to fish on ceded lands and retain their treaty guaranteed rights to resource access. Their stories are not well documented in the records of the commercial fisheries and the resultant management schemes examined for this project. Until very recently Great Lakes Indian peoples were routinely left out of the policy making and legislative processes. A large component of this paper is focused on the history of fisheries management and the recurrent population failures that occurred in the fisheries as a result. Thus it is appropriate to consider the pre-contact fishing practices and ceremonies that were ignored by nineteenth and twentieth century policy makers – practices that utilized Great Lakes fishes in a sustainable fashion for centuries.

Chapter one concludes with a consideration of the early commercial fishery on Lake Ontario and the problems that fishery foreshadowed for Lake Huron. The destruction of Lake Ontario's fishery resources is described through transcripts of interviews with fishermen during the era, many of whom relocated to Lake Huron following the collapse of Lake Ontario's fishery. The settlement and growth of early lakeside communities around Lake Huron are also considered.

In chapter two I consider the evolution of technologies utilized by the commercial fisheries, consider Lake Huron in its context as an international borderland and finally provide an examination of the data compiled by the International Joint Commission of 1892. The purpose of the chapter is threefold. I provide an overview of the technological workings of the commercial fishery in order to better understand the industry's day to day functionality. The

chapter additionally offers a framework for envisioning the lake as a borderland. Finally I provide documentation of how quickly the intensive use of new technologies fostered declines of marketable species on both sides of the international border, changes that generated cooperative investigations of the fishery. The decline led to the creation of the Joint Commission of 1892. Various types of fishing vessels and gear are discussed. The mechanization of vessels and modernization of netting materials are considered in conjunction with the growing concerns early conservation officials expressed regarding some of the new technologies.

I discuss the International Joint Commission of 1892. The commissioners created a rich repository of information related to the Great Lakes fisheries when they completed an ambitious tour of the region and interviewed a large number of commercial fishermen. Selections from a variety of interviews from both the American and Canadian sides of Lake Huron are included. The interviews provide a better understanding of issues of widespread concern and of the regional problems that afflicted the industry in the 1890s. The interviewees often expressed a frustration with lake conditions coupled with an unwillingness to embrace changes that might impede their own profitability. The political influence of more powerful fishing operations is also apparent from the interviews.

Other problematic divisions within the fishery are presented. Commercial fishermen using one specific type of technology often blamed fishermen relying on a different technology for the fishery's growing problems. Few were willing to fault their own activities. Regional and personal interests influenced individual perspectives. Mutual suspicion soured relations between the Canadian and American fisheries. The records of the 1892 Joint Commission are a window into a commercial fishery that was rife with internal divisions, struggling to maintain its

profitability and resistant to the idea of increased regulations. As a result the commission's recommendations for increased cooperative management were not followed.

Chapter three includes an examination of the 1908 International Fisheries Commission followed by a brief consideration of the day to day operations of the commercial fisheries and the difficulty inherent in enforcing early regulations. The chapter concludes with an overview of several failed efforts to create a cooperative management scheme for the Great Lakes in the years leading up to World War II. The purpose of the chapter is to illustrate the efforts of various administrators to address declines in commercialized fish species and the continued resistance of fishermen to anything that might jeopardize their profits, including new laws or existing enforcement. The 1908 International Fisheries Commission represented the second major push to develop a broad set of legislative controls for conserving the embattled Great Lakes fisheries. The story of its formation, research and recommendations followed by the failure of the United States Government to adopt its legislative plan exemplified the continued power and influence of the commercial fishing industry and its ability to protect its economic interests. The account of the plan's failure also underscores the lack of knowledge shared by respected fisheries biologists and their willingness to accept dubious information from commercial fishermen at face value. The successful political revolt of Saginaw Bay fishermen against the commission demonstrated that fact and is considered.

Canada had both the earliest and strongest restrictions applied to the commercial fishing industry. However, the lakes were vast and enforcement was insufficient. The day to day problems enforcement officers faced in Ontario are illuminated through the records of Neil MacNaughtan. MacNaughtan worked as the game and fishery overseer for Ontario's Parry Sound District from 1920 until 1946. The records of his employment provide a fascinating

historical account of a fishery that was rife with abuses. Chapter three concludes with a consideration of various efforts to create consistent regulations for the Great Lakes prior to World War II.

Chapter four opens with a discussion of the expanding Great Lakes market system. The chapter includes a discussion of industrial development, species introductions, canal construction and the efforts of conservation officials to create a more efficient and effective managerial framework for the lakes from the 1930s through 1950. The purpose of this chapter is to illustrate the accelerated industrialization of the Great Lakes Basin, the overall ramifications of that development for the aquatic ecosystems of the lakes and the effects of development on the conservation efforts of lake biologists. From my initial consideration of industrial impacts in the basin, I move to a related discussion of nonindigenous species in the lakes. Certain nonindigenous species, such as the common carp, were introduced as a means of creating a ready and profitable food source. However, the planting of carp backfired and the fish became a nuisance. Other species, such as smelt, were introduced accidentally. I then consider the building and modernization of the Welland Canal and the convenient entry point it created for a variety of marine species. Perhaps most significant among those species were sea lampreys. Their subsequent effects on the fisheries are considered. I further discuss the increasing complexity of lake management and the efforts of biologists to address those changes, using the example of John Van Oosten, Head of Great Lakes Fisheries Investigations from the late 1920s until 1949. Van Oosten believed the commercial fisheries were responsible for the population declines of several species and supported the concept of an international regulatory body. His fisheries work contributed to the eventual formation of the Great Lakes Fishery Commission in 1955, a policy advisory and sea lamprey control organization.

In chapter five I examine postwar management of Lake Huron through the year 1978. The purpose of this chapter is both to bring the continuing chronological story of managing the lake's troubled ecology into the 1970s while providing a contrasting example of environmental management through the history of the retention of the Big Chute Marine Railway at the western end of Ontario's Trent-Severn Waterway. Lamprey control dominated the work of lake conservationists during this period. The decision to focus on chemical controls and the regional results of that decision, both pro and con, are discussed. The chapter then considers the creation of the United States Bureau of Commercial Fisheries (BCF) and its emphasis on maximum production. The BCF's focus on increased production came at a time when both marine and freshwater commercial fisheries in the United States were struggling with resource depletion.

I then discuss the Michigan Department of Conservation's embrace of recreational fishing interests at the expense of its longstanding commitment to commercial fisheries. The State of Michigan and the Province of Ontario followed divergent paths to lake rehabilitation. Ontario attempted to balance its focus between the commercial and sport fisheries while Michigan concentrated on building a thriving recreational fishery. I include a consideration of the State of Michigan's planting of several exotic species while Ontario officials adopted a hybrid splake program.

The chapter concludes with a discussion of the Province of Ontario's plan to demolish the Big Chute Marine Railway at the western end of the Trent-Severn Waterway and replace it with a more profitable and efficient lock system. In contrast to the earlier drive to modernize the Welland Canal, Big Chute planners carefully considered the possible ecological ramifications of tearing down the marine railway. While economic considerations played a role, the story of the marine railway's retention demonstrates the possibilities of moving beyond simple economic

considerations and managing for ecosystem health. Finally, in the Afterword I conclude this project with a consideration of the continuing ecological issues that plague Lake Huron and the ongoing efforts of a variety of scientists and other aquatic specialists to manage its changing ecosystem.

Preface endnotes

---

[1] Wayne Grady, *The Great Lakes: The Natural History of a Changing Region*, (Vancouver: Douglas and McIntyre, 2007), 21 (hereafter cited as *Great Lakes Natural History*).

[2] For a synopsis of the philosophical underpinnings of colonial European and early U.S. resource use see Philip Shabecoff, *A Fierce Green Fire* (Washington: Island Press, 2003), 1-18. For information on Christian conceptions of dominion see Benjamin Kline, *First Along the River: A Brief History of the U.S. Environmental Movement* (Lanham: Acada Books, 2000), 3-12.

[3] For information on the history of environmental thought see Robert Gottlieb, *Forcing the Spring: The Transformation of the American Environmental Movement* (Washington: Island Press, 2005), Kline, *First Along the River*, David Macauley, *Minding Nature: The Philosophers of Ecology* (New York: The Guilford Press, 1996), Shabecoff, *A Fierce Green Fire*.

[4] Donald Worster, *Nature's Economy: A History of Ecological Ideas*. 2nd ed. (San Francisco: Sierra Club Books, 1977, New York: Cambridge University Press, 1994), 293. Citations refer to the Cambridge University Press edition.

[5] Ibid., 294.

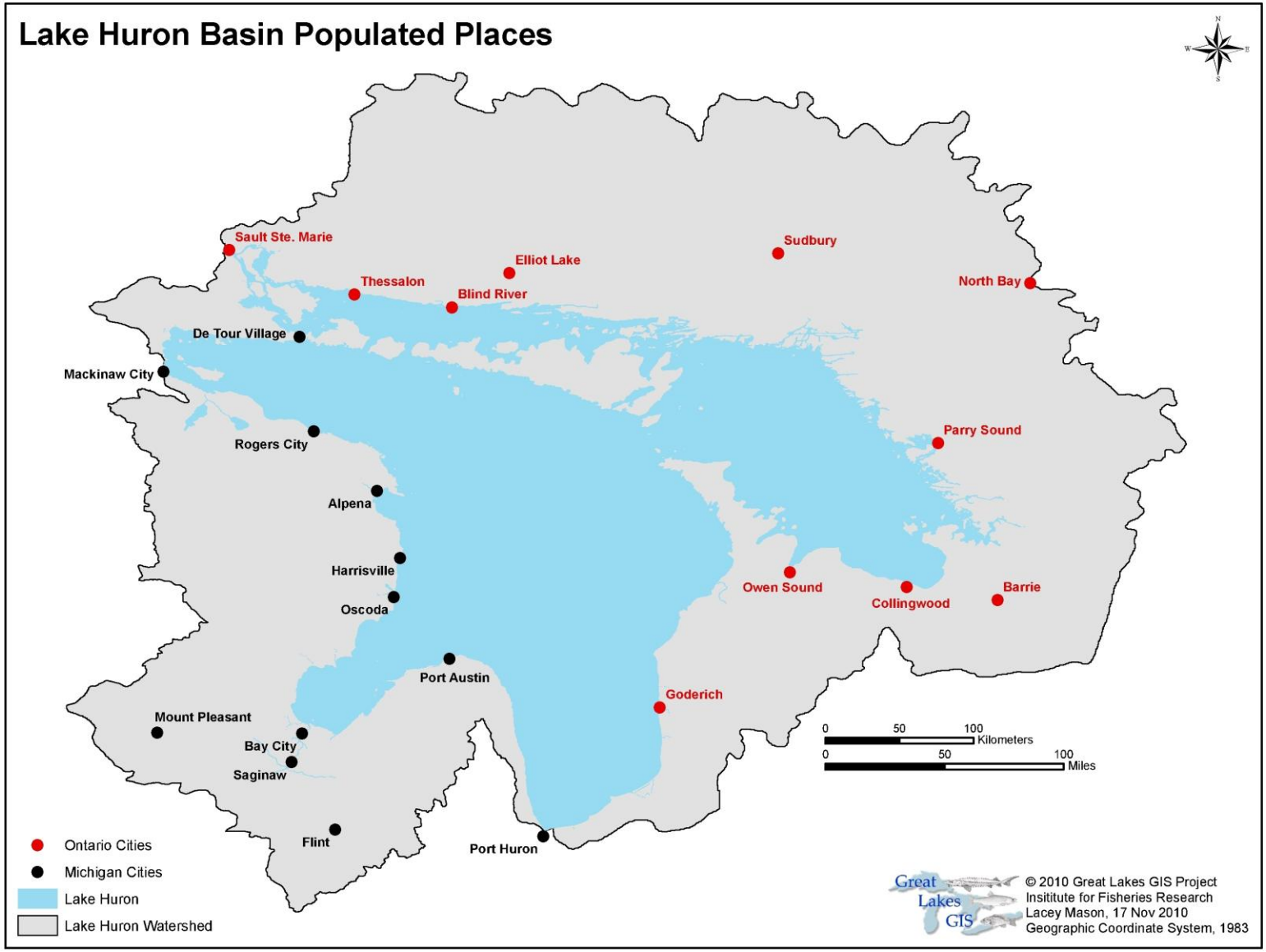

Fig. 1 The Lake Huron Basin. Map courtesy of Lacey Mason, Great lakes GIS Project.

Chapter 1 - Reaping La Mer Douce: Lake Huron's ecosystem and human utilization through the centuries

Lake Huron and its fishes

The region that became host to the world's largest commercial freshwater fishery came into existence thousands of years before the first fish dealer set up shop in the area. The Great Lakes Basin was formed during the last major ice age. The final glaciers of the ice age receded from the area approximately six thousand years ago. The glaciers had further depressed existing valleys in the basin and as they receded filled the ravines with their melt water. The lakes reached their present day levels roughly 2,500 years ago. The fishes and faunas of the region remained relatively stable for over two thousand years.[1]

Lake Huron occupies the middle of the Great Lakes Basin, and is often referred to as the lake in the middle. It is the third largest of the Great Lakes by volume, after Lakes Superior and Michigan, respectively. Huron's average depth is one hundred and ninety-five feet. At its deepest point it reaches seven hundred fifty feet. Huron's drainage area is more than twice the size of its actual surface waters. Its drainage encompasses a variety of wetland areas and more recently supported intensive agriculture in certain regions.[2] In the nineteenth century researchers mistakenly labeled Huron as the deepest of the Great Lakes because of its sprawling size. Its waters were known for their clarity and perceived purity.[3] There are over thirty thousand islands in Lake Huron. Manitoulin is the largest. It is the largest island located within a fresh water body in the world. Lake Huron shares a hydrological connection to Lake Michigan via the Straits of Mackinaw. The largest urban area on Lake Huron is Sarnia, Canada on its extreme

southern end.[4] Because of the growth in human populations and industry around the lake, anthropogenic influences led to dramatic changes in the chemical and biological content of the lake over the last century and a half, especially within Saginaw Bay.[5]

The fishing industry that thrived on Lake Huron in the nineteenth and twentieth century would never have existed without the various species of fishes that came to be highly prized by the commercial netters. Of the more than one hundred fifty species of fish inhabiting the waters of Lake Huron, several species were highly influential in the growth of the intensive commercial and recreational fisheries. Perhaps no Great Lakes fish garnered more human interest nor played a more central role in the history of the lake fisheries than the freshwater whitefish. Whitefish inhabited the Great Lakes for centuries. Present day researchers often regard whitefish as barometers of the overall health of the lakes.[6] While their numbers fluctuated wildly due to increased exploitation and predation over the previous two centuries, they long played an important part in the ecology of the lakes. Members of the salmon family, whitefish are most common in the pelagic and benthipelagic zones away from shore in cohesive groups.[7] Within Lake Huron's diverse web of life whitefishes are a larger predatory fish that is reliant on a number of other species for sustenance. Whitefish will feed on insects, zooplankton, amphipods, mollusks and smaller fishes. They will also eat eggs of fishes, including their own.[8] Whitefish are typically classified as benthivores meaning they feed primarily in the benthipelagic zone – the area of the lake near the bottom. They move energy reserves from the benthipelagic region of the lake to other pelagic areas through their feeding and digestive processes.[9]

Many of the food sources that are important to whitefish changed dramatically as a result of human development. For example, the invertebrate amphipod *Diporeia* provided a historically important source of nutrition for whitefishes. Populations of Diporeia accounted for over seventy percent of the benthic biomass at lake depths beyond thirty meters.[10] After the introduction of zebra mussels to the interior Great Lakes in the 1980s populations of Diporeia declined. Diporeia rely on suspended organic materials in the water for their sustenance, but zebra mussels filter the water and remove the compounds Diporeia rely on. That population change in turn affected whitefish that depend on Diporeia as part of their diet. Researchers predicted a loss of overall energy consumption in the fishes' diets, which can affect growth, spawning, population densities and the health of individual fishes. [11] Other species of fishes are also affected and "cascading impacts" across various depths are predicted.[12]

Whitefish typically have a greenish brown or olive gray coloration fading into silver along their sides leading into pale white on their underbelly.[13] In the Great Lakes the fins of the whitefish are clear or lightly pigmented. The average length of an adult whitefish taken by the commercial fishery averaged from fifteen to twenty-two inches, but they can reach lengths of forty inches and likely grew even larger prior to the development of an intensive fishery and the increased environmental stresses of the twentieth century. [14] One of the largest recorded was a forty-two pound specimen caught near Isle Royale in Lake Superior.[15] Whitefish spawn late in the year, usually in November and December. During spawning they travel from the deeper waters of Lake Huron to shallower areas where they deposit their eggs on the bottom of the lake or connected rivers. The farther north in the lakes the fish reside, the earlier they tend to spawn. Twentieth century calculations placed the number of eggs produced per pound of adult female whitefish in Lake Huron at 8,200. It is improbable we will ever know the productivity of

whitefishes prior to the industrialization of the basin. The eggs hatch the following April or May. Young whitefish fry are susceptible to predation by adult whitefish, lake trout, northern pike and other fishes. As the whitefish grow they also have to contend with freshwater eels, birds, otters and bears. They are highly susceptible to parasite infestations.[16]

Adult whitefish generally travel from deeper water to shallower areas in the spring. During the summer when the water temperatures are warming, whitefish return to the deeper waters of the lake. During their spawning period in the fall and winter they again travel to shallower waters. Whitefish often travel extensively throughout the lakes, but they appear to have a definite purpose to their movements. Various tagged stocks of whitefishes moved in very different patterns and distances depending on the environment they inhabit. However, despite displaying a variety of migratory routes, individual whitefishes seem to move with purpose and demonstrate a strong preference for spawning areas specific to their individual groups. They return to the spawning grounds that are familiar to them.[17] Whitefish provided a critical link in Lake Huron's interdependent web of life. They were arguably the most influential species in the growth of an intensive commercial fishery in the Great Lakes during the nineteenth century, followed closely by lake trout.

Lake trout similarly share a long history in Lake Huron. Adult lengths average fifteen to twenty inches, but they can grow to over three feet in length.[18] Their bodies are usually light hues of green or gray to darker hues of brown to almost black. Overlay on their body color are hundreds of small light spots which give the lake trout a speckled appearance. Some lake trout have a lighter background color making the speckles difficult to see. Lake trout spawn in the fall and early winter. Typically they move into waters of less than 120 feet in depth and seek out formations of rubble or large boulders. Sometimes lake trout travel repeatedly to the same

spawning areas, while at other times they do not. The fish rub the spawning area with their bodies or sometimes with just their fins or snout in order to clean and prepare it. They typically spawn at night. A single female can produce 400-1200 eggs per pound of body weight. The eggs hatch four to five months later.[19]

Like whitefish, lake trout can range hundreds of miles around the lake although tagging experiments varied in the breadth of movements they recorded.[20] Lake trout prefer deep, cold water. Historically lake trout were a key predator within the ecological networks of the lakes. Young trout feed on plankton, insects and their larvae and various small crustaceans and fishes. Adult trout feed primarily on other fishes. While they will eat whitefish, perch, smelt, sculpins, other trout and numerous other small fishes, ciscoes seem to be particularly favored when available. Sometimes lake trout will even eat mice and other small mammals that venture into the water.[21] Ontario fisherman David Belrose said he caught a seventy five pound trout with a muskrat inside.[22] Commercial fisherman also caught trout that had consumed rocks and one fisherman even claimed he found a discarded jackknife inside a trout's stomach.[23] Like whitefish, lake trout suffer from a variety of lake parasites.[24]

Besides whitefish and lake trout, a number of other species played important roles in the early fisheries. Lake sturgeons are the largest native species of fish in the lakes. Sturgeons are an ancient species. The fossil record indicates that sturgeons existed for some 100 to 200 million years. Sturgeons are bottom feeders, eating molluscs, crustaceans, insect larva and small fishes. Their mouths are set back beneath and behind their eyes. Their bodies are typically shades of brown or grey, with dark blotches and rows of bony plates running along their sides and back. The largest sturgeons reach nine feet in length. They are the largest fish in the Great Lakes. While today adult sturgeons usually average between 43 to 71 inches, the largest on record was

caught in Lake Michigan in 1943 and had a length of 95 inches. The fish weighed just over 309 pounds. Historically very large sturgeons were much more common. Enormous individuals were probably widespread before the advent of commercial fisheries. A sturgeon can take fifteen to twenty-five years to reach sexual maturity. Males live about fifty-five years while females can live from eighty to as much as one hundred and fifty years. [25] Sturgeons spawn at varying intervals depending on the sex of the fish and their location. Pauses between spawning cycles can run several years for both males and females in some regions. Spawning females produce from four to seven thousand eggs for every pound of their body weight. While Native American fishermen prized sturgeon as a source of food, oil and leather, early commercial fishermen regarded them as a nuisance because of their large size and ability to damage netting.[26]

Many fishermen erroneously labeled sturgeons as major destroyers of the spawn of other marketable fishes and in turn destroyed them when they found them. These magnificent fish were slaughtered in spawning schools by fishermen wielding axes, caught and thrown to pigs and even dried and burned for fuel in nineteenth century steamboat boilers.[27] Other factors that affected sturgeon populations included barriers to spawning areas, pollutants and waste from the timber industry.[28] Because of their large sizes, slow maturity, intermittent spawning and a high susceptibility to population depressions in the face of habitat change and loss, sturgeons were an early casualty in the growth of lakeshore industries and the intensive commercial fisheries of the nineteenth century.

Walleyes are another important lake species. They typically inhabit waters nearer the Lake Huron shoreline as well as adjoining lakes and streams. They range in color from light browns to yellow with darker bands across their back and sides. Great Lakes walleyes typically spawn in the spring. They usually spawn at night.[29] Walleyes grow quickly, reaching three to

eight inches in length their first year of life in Lake Erie. They grow somewhat slower in the northern Great Lakes. They often reach two feet in length.[30] While they frequently inhabit shallow waters, they are sensitive to bright light and will often feed in twilight or nighttime hours unless the water is cloudy. Their range is typically not as vast as some other Great Lakes fishes, though some tagged walleyes traveled over one hundred miles.[31] Adult walleyes feed primarily on other smaller fishes. Walleyes are in turn an important food source for Northern Pikes and Muskellunges.[32] Walleyes were often shipped whole (referred to as "in the round"), and became a popular food with Jewish people following a kosher diet. The practice became so common that some Great Lakes commercial fishermen took to referring to walleyes with the prejudicial name "Jew fish."[33] Blue walleye were a distinct sub-species. They were called blue walleyes due to their bodies ranging in color from slate to ice blue. Their pelvic fins were a distinctive white color. The pelvic fins of other walleyes are typically yellowish. Blue walleyes inhabited lakes Erie and Ontario. They were overexploited by the commercial fishery and went extinct in the 1980s.[34]

Pikes are one of the larger species of Great Lakes fishes. Pikes have a more slender body shape than trout or whitefish. The fossil record indicates that while pikes experienced some microevolution, their skeletal characteristics remained essentially the same for sixty million years. They have been called "living fossils."[35] Northern Pikes average eighteen to thirty inches in length, although records exist of some approaching sixty inches. Northern Pikes have a lower jaw that extends slightly past the upper. Like lake trout, they have lighter colored spots on a darker undercoating. Unlike most other large freshwater fishes, their dorsal fin is set much farther back toward the caudal (tail) fin.[36]

Pikes typically spawn in the spring, from April to May, usually during daylight. A mature female averages 32,000 eggs when spawning. The largest females produce much higher numbers. The male and female fish swim freely in shallower waters, often rolling while releasing milt and eggs into the water. Pike eggs usually hatch after twelve to fourteen days and the fry grow quickly thereafter. A relative of northern pike, the muskellunge, has a body shape similar to a northern pike. However, instead of light spots on a dark background, the muskellunge has dark markings on a light background. The muskellunge's markings are not as defined as the pike's, varying in appearance between spots, splotches and stripes. Muskellunge average 28-48 inches, although they may grow as long as six feet. They spawn in the spring, in late April or early May. Muskellunge inspired early protective legislation in Canada. In 1904 Ontario's commercial fishermen were barred from catching them due to the growing popularity of Muskellunges as a sport fish. [37]

Ciscoes are smaller than most of the other fishes outlined here. Commercial fishermen usually referred to ciscoes as lake herring.[38] Pound net fishermen initially regarded them as a nuisance species because of the difficulty associated with cleaning them out of their nets. Once a market developed for ciscoes they became a prized species. [39] Ciscoes average eight to twelve inches in length. Ciscoes in the Great Lakes are silvery in appearance, with darker coloration along their back. They typically have traces of purple or pink iridescence. They spawn in November and December. They prefer shallow waters of three to ten feet in depth, often spawning above gravel or other rock formations. Females produce eggs based on size and environmental conditions. Ciscoes in Lake Erie averaged 29,000 eggs, while those in Lake Superior only produced 6,000. While their primary food source is plankton, ciscoes eat a variety of insects as well as smaller fishes and fish eggs, including their own. Ciscoes play an important

role in the diets of lake trout, pikes, walleyes and other fishes. Like many other Great Lakes fishes, ciscoes host a variety of parasitic organisms in their bodies.[40]

Numerous other species of fishes and aquatic and terrestrial life filled important niches in the environmental history of Lake Huron. Chubs, suckers, perch, catfish, American eels, bass, crappies, drums and others have deep roots in the history of the lake's ecosystem. They existed in a relatively young ecosystem that lacked a long gestation period that could foster greater stability and resilience.[41] Many of the species targeted by the fisheries were predators who filled important niches in controlling populations of smaller fishes. They carried critical nutrients and energy throughout various aquatic zones through eating, excretion and other life processes. Similarly, their eventual death and decomposition contributed to the overall biotic health of the aquatic ecosystem they inhabited.[42] They provided important sources of food for other animals and birds living around the lakes. Each of these species also played their own respective roles in the growth of an intensive fisheries market in, on and around the lake. The commercial fisheries and the human development that accompanied it took a staggering toll on the Lake Huron ecosystem. Yet prior to the growth of for profit fisheries human beings had successfully utilized lake resources in a sustainable fashion. Long before the rise of industrial capitalism and commercial fisheries many of these same species sustained human populations on a subsistence level for centuries.

Indigenous history and environmental resources

Pre-contact Indian peoples relied on the lakes for subsistence. Fish were a source of sustenance. They were incorporated into a variety of social and spiritual practices. They were traded for other necessities. The use and management of environments by Indian peoples is a source of intense debate among anthropologists, historians and other scholars of indigenous cultures and histories. Since first contact European immigrants and later white Americans cast North American Indian peoples into a variety of stereotypical roles. Often portrayed as handmaidens of the Christian devil by early English settlers, Indian peoples were subjected to an imposed cultural evolution in the history books of the United States. Described as everything from fallen souls to romanticized noble savages, they were routinely denied the ability to define themselves.

One of the more recent stereotypes directed at North American Indian peoples is the idea of indigenous peoples as the first environmentalists. Native peoples are often portrayed as especially attuned to the "natural" world. In this stereotype they function as an extension of wilderness while other human societies do not. This stereotype has been challenged, as in Shephard Krech's *The Ecological Indian* (1999).[43] Krech challenged what he termed the "Noble Indian/Ecological Indian stereotype."[44] He pointed to various instances of indigenous resource use, from pre-contact bison kills to contemporary oil and gas development and confronted the idea of American Indians as consistent environmental stewards. However, Krech's work and others like it too often evaluate Indian peoples according to western constructs and erode the vast cultural differences existent between Westerners and Native Americans, to say nothing of the significant differences between the practices of individual Indian nations. When considering post-contact environmental use, they fail to sufficiently account for the systemic genocide and

abuses that forced Indian peoples to make tough choices and cultural accommodations to survive in the dominant society's cultural and economic systems. Indians are placed into a new stereotype where they act the same as the majority culture, with the same propensity to act in an unethical manner.

The problem is compounded when the decisions of Indian peoples are evaluated by Western society and its ingrained dualist thinking. Western traditions of duality tend to view the world in an either or context. Simple concepts of good and evil, black and white, left and right replace the inherent multifaceted realities of the everyday world and ignore the kaleidoscope of different cultural models. Thus efforts to reform the stereotype of what has come to be called the "ecological Indian" can fuel another extreme. Indians become just as wasteful, inept and greedy as colonizing Europeans. They cease to be one thing and become another, as defined by western scholars. Instances of effective resource management in their ancestral past become wholly accidental while excess and waste are the norm. Modern day efforts at resource access and use – whether to spear fish, hunt whales or build a casino – can then be attributed to Western ideas and experiences with economics, greed and wastefulness. Despite the altogether different economic, cultural and social systems of Westerners, the hundreds of unique North American Indian nations are lumped into the shared human experience under the guise of making them more human through making them more like the majority. Neither model is correct. Both are stereotypes.

Indian peoples created methods of interaction with their surroundings that mirrored their social and cultural understandings and needs. They learned from their mistakes. In many oral traditions temptations, poor choices and bad behaviors are represented by "Trickster." As Anishinabek /Métis scholar Melissa Nelson stated;

> For many indigenous cultures, this learning happens through teachings in the oral tradition that warn of humans' baser urges and tendencies for misjudgment and error. Greed, envy, arrogance, fear, self-centeredness, and other human traits are represented in the dark side of Trickster-the Tlingit Raven, the Kumeyaay Coyote, the Ojibwe Rabbit, the Iroquois Twins, and the Hopi Clown, to name a few. Indian peoples are explicitly aware of this dark side of human nature and incorporate it into the oral tradition, education, daily life, and religion. It is not a coincidence that most indigenous cultures' religious traditions and environmental knowledge and practices are intimately entwined. It's a matter of life and death. It's a matter of ethics, values, lessons. It is about kinship and relations.[45]

Indigenous life and Lake Huron

On the earliest maps drawn up by later Europeans Lake Huron is titled "Lac des Huron," or Lake of the Huron Indians. The Hurons, or Wendats as they refer to themselves, lived primarily along the Eastern shoreline of Lake Huron. Fish were a crucial component of Wendat subsistence, second only to agriculture. Wendats used spears and nets to take fishes. They also sometimes constructed weirs across rivers and streams as a method of capturing fishes. In the autumn Wendat fishermen traveled to the islands of Georgian Bay and constructed small round fishing cabins. From there they would travel as much as a mile from the shore and set their nets in an effort to catch spawning whitefish. Whitefishes were usually caught in the fall and sturgeons in the spring.[46]

For the Wendats everything possessed a manitou (spirit being), including all living and nonliving things. This fact troubled the Jesuit missionaries who sought to convert their allies to Christianity. "They hold that fish are possessed of reason" complained Jean de Brébeuf.[47] Wendats followed elaborate rituals to honor and thank the spirits of fishes that they caught for food or trade. A fishing priest was usually present in their seasonal fishing lodges. The priest gave a sermon to the fish, asking them to come and allow themselves to be caught. The priest reminded fish of the friendship between the Wendats and the fishes. Offerings of tobacco were made to the fishes and to the spirit of the water.[48] The remains of fishes and other animals were treated with great respect. French Jesuits recorded these practices with disdain.

> They believe that many kinds of animals have reasonable souls; they have an insane superstition against profaning certain bones of elk, beaver, and other beasts, or letting their dogs into a river. They pretend that the souls of these animals come to see how their bodies are treated, and go and tell the living beasts and those that are dead; so that if they are illtreated the beasts of the same kind will no longer allow themselves to be taken either in this world or the next.[49]

Wendats did not burn the bones of the fishes they caught. Nor did they feed them to village dogs. They believed showing a lack of respect toward the remains of their catch risked angering the fishes' spirits. Bones were returned to the waters in order to honor and care for the fishes' spirits. They extended their belief system to everyday life, even when not in the presence of their quarry. They thought their fishing nets were allied to fishes. Wendats believed their nets would warn the fish of destructive acts against the manitous of fishes or other animals.[50] Their various proscriptions worked against the wanton, wasteful destruction of fishes and unnecessary disturbance of their living and spawning areas.

In 1636 Wendats adapted a marriage ceremony from their Algonkian allies that demonstrated the integral importance of the lake and its fishes within Wendat culture. Some years prior Algonkian fishing fortunes had declined. Shortly thereafter the Algonkians were approached by the spirit of a seine net.[51] The spirit net expressed its dissatisfaction with being unable to find a virgin woman among the Algonkians to take as a wife. Jesuit missionaries observed the ceremonies that resulted from the story. The missionaries viewed it as an opportunity to inject their own teachings. "The ceremony of these espousals takes place at a fine feast, where the Seine is placed between the two virgins;" related Jean de Brébeuf,

> this is to render them fortunate in catching fish. Still, I am very glad that virginity receives among them this kind of honor; it will help us some day to make them understand the value of it.[52]

During the year long marriage the families of the girls would receive a special share of the fishing catch. According to the oral tradition, fishing fortunes improved for the Algonkians after they began this elaborate ceremony.[53] Thus Indian fisherfolk around Lake Huron incorporated the other species sharing their living spaces into indigenous sacred traditions and by doing so created a system that strove to maintain respectful relationships with the other inhabitants of their environments. Historian Bruce Trigger noted;

> These rituals illustrate very clearly the difference between the Huron's view of himself as a part of nature and the traditional European concept of man as having dominion over his environment.[54]

When the Wendats faced massive social and cultural upheaval during their wars with the Iroquois Confederacy in the Seventeenth Century, access to fish became critical. In competition for control of the burgeoning fur trade introduced by Europeans, the Iroquois made substantial inroads into Wendat territory. For the Wendats the situation was catastrophic by 1649. During the harsh winter of that year ice fishing on Georgian Bay was unproductive. A lack of sufficient foodstuffs led to widespread starvation and desperation. Wendats increasingly turned to the Jesuits for help. Unfortunately the Jesuits were one component of a European colonial network that had fomented the tragic fur trade wars in the first place.[55] Displacement from their homeland ecosystem and a concurrent slump in adequate lake resources led to increased dependence on their French allies.

The incursions of Europeans into North America brought sustained warfare over a new and growing market system with beaver furs at its center. Beaver furs were highly prized by white merchants due to their popularity in Europe. In an effort to survive in the changing environment Indian peoples adapted by trying to work within the frameworks of the European market system and concurrently manage alliances with the various European powers in addition to addressing their responsibilities to allied and competing tribes. While the breadth of these events are beyond the scope of this research, the important component is that traditional beliefs and ceremonies that worked to curb overuse and waste through reciprocity and respect were modified as Indian peoples struggled to survive in a rapidly changing environment. The fact that they chose to modify their varied lifeways as acts of survival does not negate the ethical foundations of their cultural practices prior to the rise of European markets in North America. In their book *American Indian Environmental Ethics: An Ojibwa Case Study*, J. Baird Callicott and Michael P. Nelson argued that Krech III and his supporters tend to focus on the individual

actions of Indian peoples, while ignoring the cultural ethics that underpin many of their cultural practices. [56] The ethical models developed by various Indian nations remain valid regardless of individual or tribal acculturation. One does not negate the other.

Anishinabeks (Ojibwes, Odawas) also fished the waters of Lake Huron. Young Odawa girls learned to make small fishing nets with their mothers and grandmothers.[57] Ojibwe women fished with nets fashioned from the fibers of Wood Nettle stalks. After the arrival of Europeans Nettle fibers were replaced with twine obtained through trade. Women also processed fish. They roasted or dried it for consumption or storage.[58] Pivotal celebrations that marked community milestones or observed important events often included fishing or incorporated actions designed to show respect to fishes.

One of the largest Anishinabek festivals, the Feast of the Dead, was a large celebration that took place in the spring and early summer. The feast may have developed as an effort to enhance Anishinabek cooperation and sustain indigenous distinctiveness after the incursion of French explorers into the area. It fostered community identity and reciprocity. It included a variety of gift and food exchanges and ritual celebrations. Rites were performed whereby it was believed that the spirits of deceased community leaders passed into the bodies of the next generation. During the main ceremony from which the feast gained its title, the bones of peoples from participating groups were interred together with various important foodstuffs in a celebration of community. In addition to these events, the feast included communal fishing and agriculture.[59] Wendats also celebrated their own adaptation of the Feast of the Dead. They believed that fish disliked the dead. During their version of the feast they removed their nets from the area of the celebration so the nets would not be desecrated.[60]

These and other rituals demonstrated the holistic perspective these Great Lakes Indian peoples shared regarding the world around them. Nature did not exist as a separate entity in their oral traditions. Everything was viewed as part of the same whole. While they were not conservationists or preservationists in any modern Western definition of those words, they created social practices, taboos and rituals that demonstrated a respect for their world and a desire to maintain reciprocal relationships within it. Reciprocity was an overarching core value among most North American Indian nations.[61] Historically this reciprocity extended beyond human relationships into a perceived kinship with all inhabitants of their world. It fostered bonds of deep respect for resource sources and led to the creation of rituals and behavioral modifications that in many cases worked to maintain those resources through a minimization of needless waste. And while there were undoubtedly individual violations of community proscriptions, those violations do not negate the fact that this is a fundamentally different organizing construct than the utilitarian approaches to resource management and use followed by later European settlers and eventually the governments of Canada and the United States. That some Indian nations chose to adapt to a changed political and economic landscape does not somehow make them less Indian, but neither does it render their traditional worldviews less valid.

In the seventeenth century North America became host to a very different human cultural model. In 1615 Europeans sailed into Georgian Bay via what came to be known as the French River. They were under the command of Samuel de Champlain. Champlain and his men were likely the first Europeans to ever see the Great Lakes.[62] Champlain named the body of water la Mer Douce, meaning freshwater sea. His memoirs speak to the awe the sprawling freshwater body instilled in the first European explorers. Champlain recorded that the waters were rich and

abundant with large trout, pike and sturgeon. He claimed to see trout over four feet in length. He also recorded that the lake's southern coast was "more agreeable" than the rockier north coast.[63] The northern coast was a prolific fishing area for area Indian peoples. The region of the St. Marys River, which connects Lake Superior to Northern Lake Huron was especially productive. Despite that fact, as late as 1670 the French had failed to adapt to the fishing conditions of the northern waters, yet area Ojibwes were very successful at catching large numbers of the whitefishes that teemed in the river system. The expertise they had developed over centuries of fishing was not easily duplicated by the relative newcomers. A French observer estimated that fish caught in the area averaged six or seven pounds.[64] Ojibwe fishermen traversed the rapids of the river in canoes and fished with long dip nets. They would firmly thrust the nets into the water to catch whitefishes making their way through the river system. Fishing was likely the primary form of subsistence for many Indian peoples in the region. They fished in the rushing river from the spring until winter.[65] Fishing was important across North America's lake and river systems. In the Saint Lawrence River system Indian peoples would sometimes take several hundred eels in their weirs. Once caught the eels were removed and carefully smoked and stored. They provided food for the Indian communities during the cold winters.[66]

With the arrival of Europeans, new fishing methods were on the horizon. European technology and market systems soon transformed the inland lakes. On the Saint Lawrence River system French settlers were introducing more efficient methods of fishing motivated by something other than community subsistence and survival. A dramatic rise in the catch and use of aforementioned eels provides a good example. As Jerome Lallemant recorded

> One Fisherman was found to have caught in a single day, in his weir, five thousand Eels, which are very excellent when salted, and keep extremely well. That makes ten casks in a day, selling on the spot at twenty-five francs a cask. . .[67]

Europeans introduced an economic system based on currency exchange. French and later British markets penetrated into the interior of the continent around the Great Lakes Basin. A spreading profit based European market system gradually overshadowed the subsistence and reciprocity that characterized indigenous life and trade for centuries. By the late eighteenth century a commercial fishery operated in Lake Ontario. Because of its location and the strength and resistance of area Indian nations, Lake Huron escaped the introduction of an intensive commercial fishery until after American Independence.

Great Lakes Indian peoples adapted to changed circumstances as best they could. Traditional alliances and patterns of trade were disrupted. Access to resources was often difficult. As Robert Doherty pointed out in his book *Disputed Waters: Native Americans and the Great Lakes Fishery* (1990), the European market system endangered the ability of area indigenous communities to continue their own systems of trade that incorporated generosity and reciprocity. Ojibwes and Odawas "had not suddenly become thick skinned and selfish" Doherty said. "They merely wished to survive."[68]

During the colonial and post-Revolutionary period Great Lakes Indian peoples were gradually stripped of the vast majority of their tribal lands, exchanging physical control of various landscapes in exchange for critical resource access through guaranteed treaty rights. The Treaty of Washington signed in 1836 protected the fishing rights of Ojibwes and Odawas in Michigan. Despite that treaty and others, Indian peoples soon found themselves the target of determined assimilation programs in both the United States and Canada. In the United States

during the twentieth century Indian fishing and hunting rights were further subordinated to state conservation laws in violation of earlier Federal treaties. In the second half of the twentieth century Indian nations across the U.S. fought to reestablish the authority of numerous contravened Federal treaties. It was not until 1976 that the fishing rights guaranteed by the 1836 Treaty of Washington were upheld by the Michigan Supreme Court.[69]

The first commercial fisheries

Great Britain acquired the whole of the Great Lakes Basin from France following Britain's victory in the Seven Years War. Most English settlement was east of the Appalachians and following the war the crown discouraged colonial migration into the interior of the continent. Great Britain's coffers were depleted from its world-wide war with France. Protecting settlers from powerful and defiant Indian peoples within the continental interior was a costly endeavor England wished to avoid. The American Revolution dramatically changed settlement patterns. Following the United States' Independence from England in 1783 the migration of whites into the interior of the continent accelerated. Because of the region's potential for agriculture, forestry and fishing as well as its many navigable waterways, the interior Great Lakes were of special interest.

Fort Ponchartrain du Détroit just south of Lake Huron's southern shore was established in 1701 by the French. In 1760 it fell into British hands and was renamed Detroit. In 1796 Americans gained control of the settlement.[70] Detroit grew rapidly around a salt fish market after 1812.[71] The city served as Michigan's state capitol until 1847 when the seat of state government was transferred to Lansing.[72] Lake Huron hosted other early settlements on the American side of its shoreline. In 1686 the French established Fort St. Joseph at Southern tip of

Lake Huron. Following American Independence Fort Gratiot was built near the same site. In 1857 the city of Port Huron was incorporated near the site of that fort. Anamickee (later Alpena) County was officially established in 1840, although the region was sparsely populated until after 1856. The village of Alpena (known as Fremont from 1856-59), became the county seat in 1857.[73] American settlement also spread to the other interior lakes. For example, Chicago was founded on the southern shoreline of Lake Michigan in 1833. Chicago was subsequently incorporated as a city in 1837.[74]

The area of modern day Canada experienced its own population growth in the nineteenth century. In 1791 there were approximately fifty thousand people living in the area currently encompassed by Ontario. In 1851 that number had grown to 952,004.[75] In 1871 the total had climbed to 1,620,851 and in 1901 reached 2,183,000.[76] A French agricultural settlement was established directly across the river from Detroit as early as 1749. That settlement grew into the village of Windsor and was officially incorporated in 1854. Port Sarnia (later City of Sarnia), was established in 1836, although European settlers were in the region since at least the start of the 1830s. The town of Parry Sound was surveyed in 1869 and subsequently incorporated in 1887.[77]

In Canada commercial fishing in Lake Huron dates back to at least the 1830s when the region was divided between Upper and Lower Canada.[78] Captain Alexander McGregor of Goderich operated commercially around the Fishing Islands on the East side of the Bruce Peninsula. In 1834 he contracted to ship 3,000 barrels of whitefish and ciscoes to Detroit each year. The fish were shipped to the city via schooner. The company in Detroit paid him one dollar a barrel. The fisheries off of the Bruce Peninsula were incredibly productive. A visiting minister commented that it was “a fine fishery” producing as much as four hundred barrels of

ciscoes in "one single haul of the seine." McGregor would post a lookout, often up in a tree. The lookout watched for shining schools of fishes. Once spotted, the men would rush to the site with their seine nets. In order to better manage his successful venture, McGregor erected a large stone headquarters known as "The Fort" on Main Station Island off of the Bruce Peninsula. The fishery headquarters was the first Canadian building erected in Bruce County. McGregor was eventually displaced. Envious onlookers eventually wrestled control of the area's fisheries from him through political maneuvering.[79]

As the Lake Huron fisheries developed, fresh shipments replaced salted fishes. By 1856 fresh fish packed in ice was shipped by railroad from Goderich and Collingwood to Toronto. By the 1880s fisheries icehouses were common around Northern Georgian Bay. Shipping fish fresh became the norm. By the end of the nineteenth century salted fish were uncommon, except for salted ciscoes. In Detroit a freezing method was patented in 1869 and 1875 by W. and S.H. Davis. Freezing allowed marketers to sell fish during times of scarcity in the market.[80] Improved processing methods combined with growing numbers of shipping opportunities via increased lake traffic as well as inland roads and railroad lines. The numbers of fishermen on the Great Lakes multiplied in response to the growing demand for Great Lakes fishes.

Intensive commercial fishing quickly took a toll on the fisheries of Lakes Ontario and eventually Erie. Those two lakes hosted the earliest large commercial fishing operations. As the numbers of fishermen grew so too did American and Canadian migration into the continent. Commercial fishing followed settlement into the interior Great Lakes Basin during the nineteenth century. By the latter half of the nineteenth century Lake Huron hosted a growing commercial fishery. Fishermen in Canada and the United States did not have to look very far to find examples of what lay in store for Lake Huron.

Lake Ontario was the first of the Great Lakes to develop a large commercial fishery. The principal targets of that early fishery were salmons which teemed beneath the lake's surface. Atlantic salmon were trapped in the lake following the glacial retreat at the end of the last great ice age. They adapted to the freshwater environment, but remained taxonomically the same as the Atlantic variety.[81] Whitefishes were also prized by Lake Ontario's commercial fishermen. Both fishes were caught and marketed as early as the 1790s. In the nineteenth century commercial fishing operations grew rapidly on Lake Ontario. As the lake furthest East, Ontario also faced earlier shoreline development, dam building and forestry operations.

John Varret Van Vlack spent much of his life as a commercial fishermen living in Collingwood on the shores of Georgian Bay. However, as a child Van Vlack lived in Whitby near Lake Ontario. He remembered a conversation he had in his youth with an aging community member named Mr. Farewell. Farewell told the boy stories about the early fisheries on the lake. He said that Indian fishermen used to fish the waters around the lake and catch hundreds of thousands of salmons for their own uses. The waters had once abounded with fish. However, as Canadian development moved into the area the number of fishes in the lake quickly declined. Forests were cleared and streams were dammed.[82] Damming streams meant that fish were prevented from swimming upstream to spawn. Over the subsequent years the rich fishery deteriorated. By the second half of the nineteenth century the lake's salmon catch was in decline.

Samuel Wilmot of Newcastle, Ontario spearheaded efforts to restore salmon in the lake. A tributary on Wilmot's own farm supported salmon and he worked directly with the Canadian Government to establish an elaborate hatchery there. Wilmot's hatchery work eventually secured his appointment as Dominion Superintendent of Fish Culture.[83] Pacific salmon were

raised at the hatchery and planted in Lake Ontario, but they failed to establish self supporting populations.[84] In 1892 Samuel Wilmot chaired a commission organized to investigate the Province of Ontario's fisheries, including Lake Ontario. Fishing during the spawning season, the catch and destruction of undersized fishes in seine nets, traps and long gill nets with small mesh sizes were reported as primary catalysts in the collapse of the fishery.[85]

Lake Ontario's whitefish fisheries joined salmon in their own decline in the latter half of the nineteenth century. Fishermen provided numerous accounts of shocking waste in the fisheries. Many fishermen relocated to Lake Huron following the collapse of the Lake Ontario fishery. James A. Smith was one such fisherman. Smith recalled witnessing tens of thousands of fishes drawn up in huge seine nets. Countless numbers were wasted, rotting along Ontario's shorelines. He said that one hundred fish could sometimes be had for as little as twenty-five cents. Thousands of others decayed along the shore. Sometimes they were ground up for fertilizer. Untold millions of juveniles were ensnared and killed in nets. Smith said he observed a haul of twenty-five thousand whitefish in which over 95% were less than two pounds. At the fishery's peak "whitefish were so plentiful" Smith recalled "that in hauling the seine they could not pull it in on the shore, they had to simply dip out what they wanted of the fish with small nets and let the rest go. . .when I left Lake Ontario some fifteen years ago whitefish were almost exterminated."[86]

Albert Hutchins also relocated to Lake Huron following the destruction of Lake Ontario's fishery. In the 1890s he lived on the shore of Georgian Bay. Hutchins recalled the collapse of Lake Ontario's fish populations with dismay. "When I left Lake Ontario, some fourteen years ago, there were no whitefish to be had by the fishermen" he said. The fishery "had ceased to exist, there was no more of it."[87] By 1899 Lake Ontario's salmon and whitefish populations had

been destroyed. Despite Lake Ontario's startling evidence to the contrary, in 1899 Ontario's provincial government exclaimed that it

> remains true. . .there is no country in the world possessing finer fisheries than British North America. As a national possession they are inestimable; and as a field for industry and enterprise they are inexhaustible."[88]

Lake Erie also experienced a great deal of waste and abuse as commercial fisheries multiplied on its waters in the nineteenth century. Blue walleyes and ciscoes were primary targets of the fishery in Erie's waters. William Emery was a pound net fisherman out of Bayham on Erie's northern shoreline. Emery said his largest catch of blue walleyes consisted of twelve tons in one day in 1892. He estimated that one half to three quarters of a ton of some of his catches consisted of immature fishes.[89]

Lake Erie also hosted whitefish populations. They were targeted during their spawning runs. The Detroit River at Lake Erie's east end was an important spawning area for whitefish. Numerous seine net operations were active on both sides of the river during the spawning season. Temporary holding pens were constructed in the water to hold the massive catches of spawning fish. Tens of thousands of spawning whitefish were crammed into pens that ranged anywhere from one hundred feet square to half an acre. "We had 80,000 and 90,000 at one time in a single pen" claimed Canadian seine fisherman Joseph Maloche.[90] Countless numbers of the penned fishes died in the cramped conditions. Remi Laframboise also fished the Canadian side of the Detroit River. Laframboise stated that whitefishes and ciscoes were both held together in penned areas in enormous numbers. He said one year the pens were so crowded with hundreds of thousands of ciscoes and whitefishes that entire days consisted of "scooping dead ones out and throwing them into the river."[91]

Lake Erie had some of the most productive waters for sturgeons. However, throughout much of the nineteenth century they were regarded as a nuisance and of no value to the fishery. Because of their large size and tough exterior sturgeons could damage fishing equipment meant to target other fishes. Fishermen also erroneously believed that sturgeons fed heavily on the spawn of marketable fishes. When sturgeons were caught in nets meant for whitefishes or ciscoes they were often intentionally killed and dumped back in the water, removed and burned on the shore or killed and used as fertilizer. However, in the latter half of the nineteenth century sturgeons were recognized as having flesh that when smoked tasted similar to the popular halibut, an oceanic species. Sturgeon eggs faced a similar makeover. For decades their eggs were fed to pigs. They suddenly became a prized commodity when it was discovered they could serve as a delectable form of caviar. An intensive sturgeon fishery quickly developed on the lake. As a result, Lake Erie's sturgeon population plummeted by eighty percent between 1885 and 1895.[92]

The waste of the early commercial fisheries gradually spread inexorably toward Lake Huron. Early fisheries on the Detroit River just south of Lake Huron and adjacent the city of Detroit proved just as destructive. One fisherman exclaimed "Close seasons were never obeyed here and we fished the whole month of November."[93] The commercial fishing operations that spread through the Lake Huron Basin often targeted whitefish and lake trout. By the 1890s hatcheries were stocking fish fry in the lakes in an effort to maintain declining stocks of fishes. Michael Doyle, a fish dealer out of Toronto charged that Lake Huron fishermen were scooping young fry out of the lake as quickly as the hatcheries were putting them in. He said there was widespread use of illegal, small meshed nets that prevented the young fish from escaping. Doyle

was dismayed by the practice and urged the government to regulate and enforce strict net regulations.[94]

Lake trout were fished heavily in the fall as they moved into shallower waters in preparation to spawn. Some fishermen believed trout were larger and of a better market quality during the spawning season in the fall. They referred to them as "fall trout." Donald McCauley lived in Southampton just west of the Bruce Peninsula. McCauley used a sailboat and gill nets to fish for lake trout and whitefish in the 1890s. He believed lake trout were best when caught in the fall. "They are fatter and better eating" he said. McCauley did not regard fishermen as a serious threat to spawning fishes. He believed "suckers are doing more harm to spawn than all the fishermen put together."[95] H.W. Ball, the fishery overseer in nearby Goderich, Ontario had his own opinions regarding some of the lake's other species. He said after examining the food consumption of various sturgeons under a microscope he was convinced they had all eaten fish spawn. Because of this, he recommended there be "no close season whatever for sturgeon." Like McCauley, he also pointed to suckers as a threat to the spawn of market species. However, trout got a pass. Ball stated he observed them eating "nothing but herring. . .small minnows or chub."[96]

Canadian fishermen sold most of their catches to companies that were either owned by Americans or shipped to American ports. In 1893 Abraham King, a fishermen from Thessalon on Lake Huron's North Channel complained that a wealthier fisherman named Mr. Reeves was able to buy multiple licenses and fish intensively for "his American Company in Detroit. . ."[97] According to King, Reeves had significantly more equipment and multiple boats operating in the area. King also claimed a large pound net company, Gauthier, was wasting numerous undersized whitefishes in its nets due to the small mesh sizes employed. He charged that fish catches had

dropped off by over half because of all the waste. King believed that local fishermen could not compete with the highly capitalized operators. He charged that poorer fishermen were restricted both in the numbers of nets they could license and by the closed seasons. He also believed Canadian fishermen would be better off without closed seasons. He claimed Michigan fishermen from Detour fished in Canadian waters during Ontario's closed season on whitefish while Canadian fishermen were barred from the lake.[98]

By the 1890s lake trout were widely perceived to be in decline in various parts of Lake Huron. The Dominion Fishery Commission believed the closed season law did not adequately protect spawning trout. The commission, headed by Samuel Wilmot, recommended lengthening the closed season to run from October 15th through the end of November.[99] The Canadian commission believed that without intervention the fisheries of Lake Huron and Georgian Bay would soon face conditions similar to those around Lake Ontario.

On the U.S. side of the lakes there was a similar interest in maintaining the profitability of the commercial fishery. During the year 1885 the United States Commissioner of Fish and Fisheries, Stephen F. Baird, initiated an inquiry into the health of the fisheries. In 1885 more people and equipment were operating on and in the lakes than ever before. While the investigation noted a marked decline in fishing fortunes around Lake Ontario and several other localized regions, overall the American fishery was believed to be in good health. Improved fishing and processing methods as well as stocking programs were credited with the then record catches. In the United States stocking was believed to be the best method for maintaining the fisheries. The investigations did document concerns about the damage being done to the spawning beds of various fishes, though the causes of damage were disputed. For example, at Thunder Bay near Alpena, Michigan there were declines in the catches of both whitefish and

lake trout. Gill netters placed the blame on small pound net mesh while pound netters blamed pollution from sawmills and gill nets.[100]

Off the coast of Michigan's Lower Peninsula commercial fishing gradually spread northward in the 19th century. In 1835 John Muncy set up a small gill net fishery on Thunder Bay Island at the mouth of Thunder Bay near where the town of Alpena would eventually be established. His nets incorporated board floats and stones, similar to those used by Indian peoples around the lakes for centuries, although the incorporation of twine netting increased the efficiency of Muncy's nets. Other gill netters followed. In 1858 the first pound net was introduced in the region and put into operation at Whitefish Point. North of Alpena in Cheboygan County pound nets spread to Presque Isle by 1860. The population of the region gradually grew and with it the commercial fishery. By 1884 the state census recorded 9,210 people residing in the town of Alpena. In 1885 fifty-four fishermen were operating out of Alpena County, with twelve operating pound nets, twenty using gill nets and twenty-two using both. Fishermen at Rogers City began employing gill nets in 1862. The lines and webbing for the nets were purchased in Alpena by fishermen who then constructed the nets at home.

Prior to 1872 the majority of the lake's commercial catch was salted, packed in one hundred pound barrels and sent south to Detroit. After 1872 it was increasingly common for fish to be packed in ice and shipped fresh. Alpena lacked railroad connections, so the fish were packed into four wheeled wooden cars in alternating rows of ice, then fish, then ice. The cars typically held 2,000 pounds when fully loaded. They were then loaded onto steam boats and shipped south on Lake Huron to Detroit or occasionally to Bay City. [101]

Fishing on the northern U.S. side of Lake Huron in the North Channel as well as around Mackinaw Island and St. Ignace was done almost exclusively by French Canadians and indigenous fishermen until the mid-19th century. As more U.S. citizens immigrated into the region, the fishery grew. In approximately 1860 cork and lead rigged gill nets replaced the older style that used board floats and stone sinkers. Pound nets were introduced to Mackinaw Island around the same time. The first steam powered fishing vessel also began operating in northern waters in 1860.[102]

Thomas Sims of Detour, Michigan claimed to be the first pound net fishermen in that area of the North Channel. Sims relocated to the region from Glasgow. He set his first pound net off Drummond Island East of Detour around 1864. By 1894 Sims claimed there were twenty times as many pound nets fishing the area as there were in the fishery's early days. Sims fished primarily for whitefish and walleye, but with the rise in the total number of fishermen and nets the walleyes were mostly gone by the 1890s.[103]

Fishermen working around the Straits of Mackinaw between lakes Michigan and Huron faced other challenges. The Straits were known for their strong currents. It was not uncommon for gill nets placed in the straits to drift away resulting in substantial material losses to fishermen operating in the region.[104] When one fisherman set two pound nets off Point Aux Pins on Southern Bois Blanc Island in 1893 the current rewarded his efforts by snapping off the net's stakes and pulling the netting down into a heap beneath the water. By the late nineteenth century the productivity of fisheries around the straits was in decline. Joseph Wilmot of Mackinaw Island blamed an influx of fishermen from Lake Erie. "After they got through ruining the fish in Lake Erie" he charged "they came here with their pound nets."[105]

The nineteenth century was a time of rapid growth for Great Lakes commercial fisheries. Lake Huron became host to profitable fisheries on both the Canadian and U.S. sides of the lake. The latter half of that century brought the first warning signs that Lake Huron's supply of fishes was imperiled. Evidence mounted that populations of marketable fishes were in decline. Great Lakes fisheries technology was evolving as the nineteenth century waned. In the ensuing years fishermen incorporated new net designs and larger amount of equipment to make up for the declining catch. Canadian officials took an early lead in the creation of comprehensive fishery laws and enforcement bodies, but failed to invest the resources necessary to effect significant change. Conflicting state, provincial and Dominion regulations made enforcement of local restrictions difficult. Sensing a possible crisis on the horizon, the governments of the United States and Canada formed an international commission to investigate the overall health of the fisheries. Whether or not the international commission could stem the tide of decline remained to be seen.

Chapter 1 endnotes

---

[1] Alfred M. Beeton, Cynthia E. Sellinger and David E. Reid, "An Introduction to the Laurentian Great Lakes Ecosystem," in *Great Lakes Fisheries Policy and Management: A Binational Perspective,* ed. William W. Taylor and C. Paola Ferreri (East Lansing: Michigan State University Press, 1999), 45 (hereafter cited as *Great Lakes Fisheries Policy*).

[2] "The Great Lakes Atlas, Factsheet No. 1," United States Environmental Protection Agency, last modified July 9, 2008, http://www.epa.gov/glnpo/atlas/gl-fact1.html; "Great Lakes, Lake Huron," United States Environmental Protection Agency, last modified October 1, 2008, http://epa.gov/greatlakes/huron.html; and Grady, *Great Lakes Natural History,* 24-25.

[3] Hugh M. Smith and Merwin-Marie Snell, *Review of the Fisheries of the Great Lakes in 1885*, (Washington: Government Printing Office, 1890), 205 (hereafter cited as *Review of the Fisheries*).

[4] Beeton, Sellinger and Reid, "Laurentian Great Lakes Ecosystem," 4, "Lake Huron," Ontario Ministry of Natural Resources, last Modified March 5, 2010, http://www.mnr.gov.on.ca/en/Business/GreatLakes/2ColumnSubPage/STEL02_173901.html.

[5] Beeton, Sellinger and Reid, "Laurentian Great Lakes Ecosystem," 12-49.

[6] Travis O. Brenden, Mark P. Ebener, and Trent M. Sutton, "Assessing the health of lake whitefish populations in the Laurentian Great Lakes: Foreword," *Journal of Great Lakes Research* 36 (July 2010): 1, doi: 10.1016/j.jglr.2010.01.001.

[7] Richard A. Ryder and Judith A. Orendorff, "Embracing Biodiversity in the Great Lakes Ecosystem," in *Great Lakes Fisheries Policy*, 119.

[8] W.B. Scott and E.J. Crossman, *Freshwater Fishes of Canada* (Ottawa: Fisheries Research Board of Canada, 1973), 273 (hereafter cited as *Freshwater Fishes*); and Michael Hutchins et al., eds., *Grzimek's Animal Life Encyclopedia* 2nd ed. (Detroit: Gale, 2003), 4:410.

[9] Travis O. Brenden et al., "Assessing the health of lake whitefish populations in the Laurentian Great Lakes: Lessons learned and research recommendations," *Journal of Great Lakes Research* 36 (July 2010): 135.

[10] Thomas F. Nalepa, David L. Fanslow, and Gretchen Messick, "Characteristics and potential causes of declining Diporeia spp. populations in southern Lake Michigan and Saginaw Bay, Lake Huron," in *Proceedings of a workshop on the dynamics of lake whitefish (Coregonus clupeaformis) and the amphipod Diporeia spp. in the Great Lakes*, technical report 66, ed. Lloyd C. Mohr and Thomas F. Nalepa (Ann Arbor: Great Lakes Fishery Commission, March 2005), 158.

[11] Gordon G. McNickle, Michael D. Rennie, and W. Gary Sprules, "Changes in Benthic Invertebrate Communities of South Bay, Lake Huron Following Invasion by Zebra Mussels (Dreissena polymorpha), and Potential Effects on Lake Whitefish (Coregonus clupeaformis) Diet and Growth," *Journal of Great Lakes Research* 32 (2006): 184-192, doi: 10.3394/0380-1330(2006)32[180:CIBICO]2.0.CO;2; and Mark P. Ebener et al., "Whitefishes and Ciscoes," in

The State of Lake Huron in 2004," Special Publication 08-01, ed. James R. Bence and Lloyd C. Mohr (Ann Arbor: Great Lakes Fishery Commission, August 2008), 45.

[12] Nalepa et al., "Characteristics and potential causes of declining Diporeia spp. Populations," 184-185; and James F. Kitchell et al., "Sustainability of the Lake Superior Fish Community: Interactions in a Food Web Context," *Ecosystems* 3, no. 6 (November-December 2000): 554.

[13] Gerald R. Smith, *Guide to Great Lakes Fishes* (Ann Arbor: University of Michigan Press, 2010), 60 (hereafter cited as *Great Lakes Fishes*).

[14] Carl L. Hubbs and Karl F. Lagler, *Fishes of the Great Lakes Region* , rev. ed. (Ann Arbor: University of Michigan Press, 2004), 145; Scott and Crossman, *Freshwater Fishes*, 269 (hereafter cited as *Fishes of the Great Lakes*).

[15] John Van Oosten, "Maximum size and age of whitefish," *The Fisherman* 14, no. 8 (1946): 17-18.

[16] Scott and Crossman, *Freshwater Fishes*, 270-275.

[17] Mark P. Ebener et al., "Spatial and Temporal Distributions of Lake Whitefish Spawning Stocks in Northern Lakes Michigan and Huron, 2003–2008," *Journal of Great Lakes Research* 36 (July 2010): 48; and Scott and Crossman, *Freshwater Fishes*, 273.

[18] Scott and Crossman, *Freshwater Fishes*, 220; and Smith, *Great Lakes Fishes*, 71.

[19] Scott and Crossman, *Freshwater Fishes*, 220-223.

[20] Oliver H. Smith and John Van Oosten, "Tagging experiments with lake trout, whitefish, and other species of fish from Lake Michigan," *Transactions of the American Fisheries Society* 69, no. 1 (January 1940): 82-83, doi: 10.1577/1548-8659(1939)69[63:TEWLTW]2.0.CO;2; and Sara A. Adlerstein et al., Lake Trout Movements in U.S. Waters of Lake Huron Interpreted from Coded Wire Tag Recoveries in Recreational Fisheries," *Journal of Great Lakes Research* 33 (2007): 198-199.

[21] Scott and Crossman, *Freshwater Fishes*, 225.

[22] David Belrose, interview by William Wakeham and Richard Rathbun, September 17th, 1894, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, 1894 Georgian Bay Interviews and Notes, vol. 2, p. 60, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at

College Park, College Park, MD, (hereafter cited as RJC, GB, USFWS, RG22, NACP). The Joint Committee's archived records of interviews for Lake Huron are often split up in different folders and boxes according to subject. Thus the same interview will often be divided between different subject folders. Because of this, additional descriptive information has been retained in the short form citations for this collection in order to distinguish which subject folder a given portion of an interview appears in. The date of each interview is only cited once for each individual. The collection materials have page numbers that correspond to the subject file they are included in. Cited notes from Georgian Bay interviews refer to two bound volumes. Pages in those volumes are numbered by interviewee, and restart from one for each person interviewed. Page numbers for all materials have been retained.

[23] W. E. Robinson, interview by William Wakeham and Richard Rathbun, 1894, p. 4, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, Lake Erie-Lake Huron, Lake Trout-Lake Huron, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Lake Trout, USFWS, RG 22, NACP).

[24] Scott and Crossman, *Freshwater Fishes*, 226.

[25] Ibid., 83, 86.; and Smith, *Great Lakes Fishes*, 14.

[26] Nancy A. Auer, "Lake sturgeon: A Unique and Imperiled Species in the Great Lakes," in *Great Lakes Fisheries Policy*, 516.

[27] Grady, *Great Lakes Natural History*, 242-243.

[28] Nancy A. Auer, "Lake Sturgeon," 517-522.

[29] Scott and Crossman, *Freshwater Fishes*, 768, 771.

[30] Smith, *Great Lakes Fishes*, 99; and Scott and Crossman, *Freshwater Fishes*, 771.

[31] Scott and Crossman, *Freshwater Fishes*, 772.

[32] Scott and Crossman, *Freshwater Fishes*, 772-773.

[33] Richard Rathbun, 1894, p. 10, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, Lake Erie-Lake Huron, Fishes- General-Lake Huron, Field Notes, 1894, Records of the U.S. Fish and

Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD. (hereafter cited as RJC, LE-LH, Fishes, General, USFWS, RG 22, NACP).

[34] Smith, *Great Lakes Fishes*, 99; Scott and Crossman, *Freshwater Fishes*, 768-769; Hubbs and Lagler, *Fishes of the Great Lakes*, 185; "Species at Risk Public Registry, Species Profile: Blue Walleye," Government of Canada, last modified 01/11/2010, http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=68.

[35] Mark V.H. Wilson and Robert R.G. Williams, "Phylogenetic, biogeographic, and ecological significance of early fossil records of North American freshwater teleostean fishes," in *Systematics, Historical Ecology, and North American Freshwater Fishes*, ed. Richard L. Mayden (Standford: Stanford University Press, 1992), 237.

[36] Scott and Crossman, *Freshwater Fishes*, 356.

[37] Ibid., 357-360, 363-369; and Smith, *Great Lakes Fishes*, 52-53.

[38] When directly quoting commercial fishermen the terms lake herring and herring have been retained. Otherwise these fish are referred to as ciscoes throughout this project.

[39] Smith and Snell, *Review of the Fisheries*, 218.

[40] Scott and Crossman, *Freshwater Fishes*, 239-242.

[41] Wayne Grady compares the youth of the Great Lakes to Lake Baikal in Siberia, which has existed for tens of millions of years. Its ecosystem has endured its share of shoreline development and pollution. See Grady, *Great Lakes Natural History*, 236-237.

[42] For further information on the role of large fishes and their role in the health of aquatic ecosystems see Gary A. Polis, Wendy B. Anderson, and Robert D. Holt, "Toward an Integration of Landscape and Food Web Ecology: The Dynamics of Spatially Subsidized Food Webs," *Annual Review of Ecology and Systematics*, 28, (1997): 291-292.

[43] Shepard Krech III, *The Ecological Indian: Myth and History* (New York: W.W. Norton, 1999) (hereafter cited as *Ecological Indian*).

[44] Krech III, *Ecological Indian*, 27.

[45] Melissa Nelson, "Ravens, Storms, and the Ecological Indian at the National Museum of the American Indian," *Wicazo Sa Review*, 21, no.2 (2006): 52.

[46] Bruce Trigger, *The children of Aataentsic: a history of the Huron People to 1660*, rev. ed. (Montreal and Kingston: McGill-Queens University Press, 1987), 31, 41 and 112 (hereafter cited as *children of Aataentsic*).

[47] Jean de Brébeuf, *Jesuit Relations and Allied Documents*, ed. Reuben Gold Thwaites, 10 (Cleveland: Burrows Brothers, 1901), 328 (hereafter cited as *Jesuit Relations*).

[48] Georges E. Sioui, *Huron-Wendat: The Heritage of the Circle*, trans. Jane Brierley, rev. ed. (Vancouver: UBC Press, 1999), 110-111 (hereafter cited as *Huron-Wendat*).

[49]Chrestien Le Clercq, *First Establishment of the Faith in New France*, ed. John Gilmary Shea, 1 (New York: John G. Shea, 1881), 411.

[50] Sioui, *Huron-Wendat*, 110.

[51] For an explanation of the different types of fishing nets see chapter two.

[52] Jean de Brébeuf, *Jesuit Relations*, 328.

[53] Sioui, *Huron-Wendat*, 108.

[54] Trigger, *children of Aataentsic*, 76.

[55] Ibid., 779-780.

[56] J. Baird Callicott and Michael P. Nelson, *American Indian Environmental Ethics: An Ojibwa Case Study* (New Jersey: Upper Saddle River, 2004), 133-134 (cited hereafter as *Environmental Ethics*).

[57] Carol Green Devens, "Anishnabek Childhood: Nineteenth and Early Twentieth Centuries," *Michigan Historical Review*, 20, 02 (1994): 190.

[58] Priscilla K. Buffalohead, "Farmers Warriors Traders: A fresh Look at Ojibway Women," *Minnesota History* 48, no. 6 (Summer 1983): 239.

[59] Melissa A. Pflug, "Politics of Great Lakes Indian Religion," *Michigan Historical Review*, 18, no. 2 (Fall 1992): 23-24.

[60] Sioui, *Huron-Wendat*, 110.

[61] Callicott and Nelson, *Environmental Ethics*, 113-116; and R. David Edmunds, Frederick E. Hoxie, and Neal Salisbury, *The People: A History of Native America*, vol. 1, *To 1861* (Boston: Houghton Mifflin, 2007), 2.

[62] While Norse explorers under Leif Ericson established a temporary colony in what is now Newfoundland, it is unlikely that they penetrated to the interior Great Lakes. See Robert

McGhee, "Contact between Native North Americans and the Medieval Norse: A Review of the Evidence," American Antiquity 49, no. 1 (January 1984), 4-6, 22-23.

[63] Champlain, Samuel de, *The Works of Samuel de Champlain*, ed. H.P. Biggar, vol. 4 (Toronto: Champlain Society, 1936), 237E; and Champlain, Samuel de, *The Works of Samuel de Champlain*, ed. Biggar, vol. 6, 251E.

[64] Louise Phelps Kellog, ed., *Early Narratives of the Northwest*, (New York: Charles Scribner's Sons, 1917), 207.

[65] Pierre Millet, *Jesuit Relations*, 54 (Cleveland, OH: Burrows Brothers, 1899), 131-133.

[66] Paul Le Jeune, *Jesuit Relations*, 6, 310-313.

[67]Jerome Lallemant, *Jesuit Relations*, 48, 174.

[68] Robert Doherty, *Disputed Waters: Native Americans and the Great Lakes Fishery* (Lexington: University Press of Kentucky, 1990), 10 (cited hereafter as *Disputed Waters*).

[69] Ibid., 68.

[70] Melvin G. Holli, "The Founding of Detroit by Cadillac," *Michigan Historical Review*, 27, no. 1, Detroit 300 (Spring, 2001), 133; and Willis F. Dunbar and George S. May, *Michigan: A History of the Wolverine State*, 3rd rev. ed. (Grand Rapids: William B. Eerdmans, 1995), 46, 60-61, 101-102 (hereafter cited as *Michigan: A History*)..

[71] A.B. McCullough, *The Commercial Fishery of the Canadian Great Lakes*, (Hull, Quebec: Minister of Supply and Services, 1989): 15 (hereafter cited as *Commercial Fishery*).

[72] Dunbar and May, *Michigan: A History*, 239.

[73] Ibid., 40; Western Historical Company. *History of St. Clair County, Michigan* (Chicago: A.T. Andreas, 1883), 496; and John Wesley and Deloris A. Law, *Home was Alpena* (Alpena: Village Press, 1975), 8, 11.

[74] Alfred Theodore Andreas, *History of Chicago* (1884; repr., New York: Arno Press, 1975), 133.

[75] A.B. McCullough, *Commercial Fishery*, 15.

[76] *Censuses of Canada. 1665-1871*, Statistics of Canada, 4 (Ottawa: I.B. Taylor, 1876), lxxxvi; and J.M. Careless, *Ontario: A Celebration of Our Heritage*, vol. 2 (Mississauga, Ontario: Heritage, 1992), 170.

[77] "Sarnia History," on City of Sarnia's official website, last modified April 25, 2008, http://www.city.sarnia.on.ca/visit.asp?sectionid=112; and Wendy Shroeder, "History of Parry Sound," on Parry Sound Public Library's official website, accessed October 11, 2010, http://www.pspl.on.ca/localhistory.htm.

[78] Upper and Lower Canada were united as the Province of Canada in 1840. On July 1st, 1867 the British North America Act created the Dominion of Canada. The provinces of Quebec and Ontario were created as a result of that act.

[79] William Sherwood Fox, *The Bruce Beckons: the Story of Lake Huron's Great Peninsula* (1952; repr., Toronto: University of Toronto Press, 1958): 110-114.

[80] McCullough, *Commercial Fishery*, 45, 47.

[81] Grady, *Great Lakes Natural History*, 241.

[82] John Barrett Van Vlack, interview by William Wakeham and Richard Rathbun, September 11th, 1894, RJC, GB, vol. 1, NACP, 3-4.

[83] William Knight, "Samuel Wilmot, Fish Culture, and Recreational Fisheries in late 19th century Ontario," *Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine* 30, no.1 (2007): 79-80.

[84] John Richardson Dymond, ed., *Fish and wildlife; a memorial to W.J.K. Harkness* (Toronto: Longmans Canada, 1964), 78-79 (hereafter cited as *Memorial to W.J.K. Harkness*).

[85] *Report and Review of the Dominion Fishery Commission on the Fisheries of the Province of Ontario, 1893* (Ottawa: S.E. Dawson, 1894), VII-XI, XV, (hereafter cited as *Dominion Fishery Commission, 1893*).

[86] James A. Smith, interview by Samuel Wilmot, December 8th, 1892 , *Dominion Fishery Commission, 1893*, 237-238.

[87] Albert Hutchins, interview by Samuel Wilmot and Edward Harris, November 30th, 1892, *Dominion Fishery Commission, 1893*, 228.

[88] Canada, "Remarks by F. Gourdeau, Deputy Minister of Marine and Fisheries," Sessional Papers, 1898, 9, p. xxix.

[89] William Emory, interview by Samuel Wilmot and Edward Harris, November 8th, 1892, *Dominion Fishery Commission, 1893*, 114.

[90] Noah Jolie, interview by Samuel Wilmot and Edward Harris, November 16, 1892, *Dominion Fishery Commission, 1893*, 51; and Joseph Maloche, interview by Samuel Wilmot and Edward Harris, November 16, 1892, *Dominion Fishery Commission, 1893*, 70.

[91] Remi Laframboise, interview by Samuel Wilmot and Edward Harris, November 16, 1892, *Dominion Fishery Commission, 1893*, 54.

[92] Dymond, *Memorial to W.J.K. Harkness*, 77.

[93] Daniel Maloche, interview by Samuel Wilmot and Edward Harris, 17 November 1892, *Dominion Fishery Commission, 1893*, XVIII.

[94] Michael Doyle, interview by Samuel Wilmot and Edward Harris, December 5th, 1892, *Dominion Fishery Commission, 1893*, 287-288.

[95] Donald McCauley, interview by Samuel Wilmot and Edward Harris, November 24th, 1892, *Dominion Fishery Commission, 1893*, 129, 131.

[96] H.W. Ball, interview by Samuel Wilmot and Edward Harris, November 22nd, 1892, *Dominion Fishery Commission, 1893*, 114.

[97] Abraham King, interview by Samuel Wilmot and Edward Harris, November 3rd, 1893, *Dominion Fishery Commission on the Fisheries of the Province of Ontario, 1893*, Part II (Ottawa: S.E. Dawson, 1894), 77.

[98] Ibid., 77.

[99] *Dominion Fishery Commission, 1893*, H.

[100] Smith and Snell, *Review of the Fisheries*, 15, 216.

[101] Ibid., 213, 217-218.

[102] Ibid., 209-219.

[103] Thomas Sims, interview by William Wakeham and Richard Rathbun, August 18th, 1894, pp. 3-4, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, Lake Erie-Lake Huron, Pound nets – Lake Huron, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Pound nets, USFWS, RG 22, NACP).

[104] C. Corlett, interview by William Wakeham and Richard Rathbun, August 22nd, 1894, p. 2, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters

Contiguous to Canada and the U.S., 1893-95, Lake Erie-Lake Huron, Physical notes, etc.: Lake Huron, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Physical notes, USFWS, RG 22, NACP).

[105] Joseph Wilmot, interview by William Wakeham and Richard Rathbun, August 20th, 1894, p. 14, RJC, LE-LH, Pound nets, USFWS, RG 22, NACP.

Chapter 2 - Fishing the lake in the middle: technology, exploitation and governmental intervention in the Lake Huron commercial fisheries

Before man's interference nature had adjusted the reproduction of fish to their extermination by natural enemies. When man was added as an enemy he upset the balance and so nearly exterminated the fish.[1]

The evolving gear of the commercial fisheries

As commercial fisheries spread through the Great Lakes Basin fishermen applied a variety of gear in their quest for commercialized species. In order to successfully and consistently land large, profitable catches of fishes the industry developed an assortment of boat designs, net styles and other related equipment. As the number of marketable fishes declined many of the instruments of the trade were further refined to help fishermen maximize their catch in the face of dwindling numbers.

During most of the 19th century, Great Lakes fishermen on both sides of the international border were fishing from small boats and sailing vessels. Long gangs of nets were hauled by hand. Mackinaw and Huron style boats were two of the most widely utilized types of watercraft. Mackinaw boats were relatively slender at each end and bulged slightly in the middle. They were extensively used on Lake Huron and other lakes. Mackinaws were regarded as sturdy craft in the unpredictable waters of the lakes.[2] "They fish what they call the Mackinaw boats here" fish dealer W.E. Robinson said of gill net fishermen operating out of Mackinaw City in 1894. Robinson said most of the boats were made across the straits at the Upper Peninsula town of St. Ignace.[3] A variation of the Mackinaw style known as the Collingwood Skiff became very

popular with fishermen operating in the Canadian waters of the lake. They were also in wide use by the 1880s.[4]

Another type of sailed vessel, the Huron (sometimes referred to as Hayward), was preferred by Lake Michigan's gill net fishermen. It was also used on Lake Huron by both Americans and Canadians. Unlike the narrow, sloped aft of the Mackinaws, Huron boats had a square stern. This afforded fishermen a larger area in which to store their nets and catches. On average the boats ranged from thirty to forty feet in length. They were typically larger and were believed faster than Mackinaws. The larger size and storage capacity of Huron boats made them attractive vessels for fishing in deeper waters, farther from shore. Unfortunately for the fishermen who used them, Hurons had a reputation for frequently being lost in the lake with a corresponding great loss of life. During the height of their popularity the reasons for the high losses were unknown, though longer trips into deeper waters were suspected due to the increased risk.[5] Subsequent investigations into the design demonstrated that the wide, weighted stern led to a dragging keel and made the boat especially susceptible to broaching in bad weather.[6] In the unpredictable waters of the Great Lakes, such a deficiency was a dangerous Achilles heel.

In the latter half of the nineteenth century the first steam tugs and steam driven gill net lifters began to appear. The use of sailboats gradually waned and tugs became the norm. As the twentieth century dawned mechanization of the industry increased. The powered tugs were able to manage larger numbers of nets farther from shore. In the race for dwindling numbers of fishes that was a huge advantage. In the twentieth century semi-diesel Kahlenberg Oil Engines and gasoline engines gradually replaced steam power on tugs.[7] It became common for tugs to have enclosed decks to protect the crews from the elements, giving the twentieth century fish tugs of the Great Lakes a distinctive and unique appearance. New technologies were often readily

adopted and the amount of gear being fished by individuals rose dramatically in response to declining fishery fortunes. Mechanization continued. By 1936 only one commercial sailing vessel operated in Michigan waters.[8]

In addition to the various types of watercraft a variety of nets were used in Lake Huron. Nets varied by size, both in the overall size of the net and the size of the mesh openings in individual nets. Smaller mesh openings meant smaller fish were unable to escape. Individual mesh openings were often measured according to bar size. Bar size measurements refer to the length of netting from knot to knot inside the individual squares of nets within square fishing mesh. This differs from stretched net measurements that measure the space diagonally across mesh openings from corner to corner.

Seine nets were one of the oldest types of fishing apparatus used on the lakes. They were limited to near-shore use. Seines were an active technology. Fishermen would grasp each end of the seine net and drag it through the water toward shore, sweeping up fishes and trapping them in the middle of the net. Seines ranged in length from several yards to hundreds of feet. Seines were often used around spawning areas and many immature fish were caught and destroyed in the bycatch. Since the net was moving and often difficult to handle when full, it was easy to damage and kill fishes in the process. Canadian seine fishermen were early lightening rods for criticism when questions arose about the health of the fishery. By the 1890s the Canadian Government began limiting the numbers of seining licenses and the areas seine nets could be deployed.[9]

Gill nets were the primary type of net used by fishermen working far from shore. The nets were hauled out into the lake by sailboats or fishing tugs and then strung along in the water in long lines. The bottoms of the nets were weighted while floatation devices were attached to the top to keep the net vertical in the water. The nets ranged in size in both length and height as well as in the size of their mesh openings. Like seines, gill nets pre-dated the commercial fisheries. They were used by pre-contact Indian peoples. Gill net use by the commercial fisheries dated to at least the early 19th century. Gill nets evolved through time, as older twine nets were replaced by linen and eventually cotton. Linen and cotton nets required frequent removal to treat and dry them to prevent rotting.

As the fish catches fluctuated and began their decline in the twentieth century, new technologies were often looked at with suspicion by fishermen who were not using them. The bull net fit that trend. It was developed around 1905. The bull net was a modified gill net that allowed fishing in great depths very near the bottom and was typically much taller than a standard gill net. They proved especially effective in Lake Erie's cisco fishery. Over the ensuing years their use spread. By the 1920s cisco populations in Lake Erie were in a tailspin. Chief of Great Lakes Fishery Investigations Dr. John Van Oosten said fishermen often set bull nets from the top to the bottom of Lake Erie. "The vast majority of Lake Erie fishermen condemn the bull net" he stated in 1928. In fact Van Oosten claimed that even fishermen using the nets acknowledged them as "one factor in the apparent extermination of the herring." Fishermen also blamed blue walleyes for cisco declines.[10] Blue walleyes were themselves overfished and driven to extinction a few decades later. Ontario banned Bull nets in 1922 and they were prohibited in many U.S. states by the mid 1930s.[11]

In the 1940s fishermen began experimenting with and using nylon gill nets. Again there was a jump in catch efficiency. John Van Oosten contacted Fred Westerman, head of Michigan's Fish Division within the Michigan Department of Conservation in Lansing regarding the new netting material. Van Oosten said reports conflicted "on their desirability and efficiency." While some fishermen said the nets tended to pick up more trash and waste materials, others claimed the nets increased "the catch of marketable fish from two to three times" beyond what cotton procured. Van Oosten worried that nylon created a new problem for lake management and "a new threat to the stability of fisheries."[12] He recommended a general conference to discuss the possible impacts and regulation of the new technology.

W.H.R. Werner in Ontario's Department of Lands and Forests said fishermen in Ontario claimed nylon nets were "three times as efficient as cotton or linen nets of the same mesh size" and many believed that was "a very conservative estimate." He said all the reports his department received verified the efficiency claims.[13] The Detroit Free Press declared the nets "fiendishly efficient" and warned there would be no stopping their adoption if they were not swiftly outlawed.[14] Some fishermen were worried about the same effort being expended using nylon as had been used when fishing with linen and cotton. They feared nylon netting might drain the fishery due to the material's greater catch efficiency. Despite their concerns, many fishermen still wanted to be able to use the new material. In addition to the improved catch numbers, the nets were easier to use and care for, promised greater longevity and required less material expense.[15]

Pound nets were introduced into North America from Scotland in the 1830s. Their use did not become widespread on Lake Huron's Canadian shoreline until after 1880. Canadians primarily used them along the southeastern shore, on Manitoulin Island's south shore and in the North Channel.[16] They were used to varying degrees around Michigan's side of Lake Huron. They were especially favored in the Saginaw Bay area. Pound nets are held in place by stakes and usually limited to shallow water use. Their maximum depths of utilization ranged between fifty to eighty feet. The long stakes were driven in to the lake bed by pile drivers affixed to flat bottom boats. The early pile drivers were hand driven, and setting pound net stakes was considered the most arduous process of the season. Eventually some of the pile drivers were steam driven. [17]

In 1932 there were 796 known pound nets set in Michigan waters.[18] The front end of pound nets consisted of one or more long leaders of netting stretching toward the shore. Fishes encountered the leader and followed along its length. The leader guided the fishes into a funnel shaped area of netting, sometimes called the heart. The heart then channeled them toward a sharply funneled section of the netting, commonly referred to as the tunnel. The tunnel led directly into the pound or pot. There the fishes were held until retrieved by a fisherman. Pound nets typically did not have any sort of covering over the top of the pound.[19] The pots of early pound nets typically had a two inch mesh. Fishermen believed the two inch mesh helped prevent larger fish from getting gilled. However, it also prevented large numbers of small fishes from escaping. Pound nets were used from late March until the summer. During the summer they were dismantled, cleaned and tarred (a process intended to help preserve the netting), and then put back in the lake until early November. [20]

Pound net fishermen typically used a flat bottom craft when managing their nets. The boats often had masts affixed to them in a style similar to Mackinaw vessels. Some had no masts and were simply rowed. Pound net boats tapered at the bow, bulged in the middle and had a squared off stern. Their steering rudders were large cuts of wood designed to provide maximum turning capabilities in the shallow waters they operated in. The boats handled poorly in rough waters. Like Hurons and Mackinaws, pound net boats were open craft. Fishes extracted from pound nets were loaded into the body of the boat and then transported to shore.[21]

Trap nets were another passive form of net consisting of a leader, a heart and a pot. However trap nets were held in place by moveable anchors instead of affixed stakes. This allowed the nets to be completely submerged and also made it easier to relocate them. In 1928 a modified form of trap net, the deep trap net, was introduced near Alpena in Lake Huron's Thunder Bay. Trap nets captured fish alive. They were especially effective at capturing whitefish. Deep trap nets were taller than the standard trap net and were placed in much deeper waters. The pot of the trap net was enclosed on all sides to prevent fishes from escaping. [22]

The deep trap net design proved very effective and popular. By 1932 over 500 deep trap nets were being used in Lake Huron.[23] The largest whitefish catch in Lake Huron prior to 1930 occurred in 1880. In that year approximately 2,701,000 pounds of whitefish were caught. Between 1889 and 1929 the total whitefish catch never reached two million pounds, and only once rose above 1,500,000. That was in 1916, when the total catch reached 1,919,000. In 1930, just over a year after the introduction of deep trap technology to the lake, the total catch rose to a startling 2,979,000. The following year 4,140,000 pounds of whitefish were taken. In 1932 4,050,000 pounds were caught. In 1933 3,334,000 were taken.[24]

Van Oosten compared the deep trap nets to bull nets. "The supposed destruction of young fish by trap nets in general is tremendously increased with the introduction of deep trap nets" he said. Because they were larger than regular trap nets and could be placed in much deeper waters, Van Oosten believed they were more likely to inflict damage on the existent fisheries. "These deep trap nets. . .are practically equivalent to bull nets in that they fish the waters nearly from top to bottom and give the adult fish little chance to escape" he charged.[25] Deep trap nets produced an outcry from some fishermen who feared their efficiency would destroy whitefish populations. Numerous fishermen wrote to their legislators asking for trap nets to be regulated or abolished. However, some qualified their requests, perhaps out of fear that new regulations might also be aimed at their own activities. Martin Mechalson, a steam tug operator out of St. Ignace near the straits of Mackinaw wrote that the nets "should not be allowed in water deeper than 65 ft." He added that other than the new depth regulation "present laws should not be changed."[26] Other fishermen adopted more direct methods of limiting the use of deep trap nets. In 1934 a group of deep trap netters attempted to set up their equipment in the southern end of Lake Michigan. When local gill net and pound net fishermen found out they drove the newcomers out of the area.[27] Trap net fishermen often viewed their critics as jealous competitors out to serve their own interests.

> Some of our conservation officials would insist on every fisherman going back to the gill net or pound net. . .Most opposition to the submarine net comes from fishermen that have not got any of them, and are not in a position to speak in regard to their use. . .Most of the proposed legislation during the past 20 years has been started by men with selfish interests, or against some kind of gear being used by the other fellow.[28]

The Bureau of Fisheries, then operating under the Department of Commerce, agreed with other critics that the nets were too effective. They recommended the State of Michigan limit their use to waters eighty feet or less deep. They believed the extreme depth of some of the nets placed them within refuges that were essential to the preservation for the whitefish. The bureau also recommended enlarging the mesh size to ensure smaller fish including juvenile whitefish would not be caught. Eventually deep trap nets were limited to depths of no more than eighty feet.[29] Despite the chorus of accusations that often accompanied the introduction of new equipment, fishermen predictably tended to point at their neighbor's gear when asked what type of fishing was driving the erosion of fishing fortunes. Gill netters claimed "the trap net is very destructive to the fisheries" while trap netters maintained that "gill nets are a ruination to the industry."[30]

There were other modified types of nets on the lakes. The fyke net was primarily used by U.S. fishermen. It typically consisted of a cylindrical pot formed by netting attached to a series of hoops or frames. When round hoops were used the fyke net was sometimes called a hoop net. Two wings of netting extended from the mouth of the pot in a funnel shape. Fyke nets, like pound nets and trap nets, had a leader extending from the front of the net that fish would encounter. The fish then followed along the leader until they encountered the wings. The wings acted as a funnel and the fish were guided into the pot. In the 1930s Michigan regulations limited the leader of fyke nets to three hundred feet or less. A funnel net was a simpler, but similar form of net. Funnel nets were identical to fyke nets except that they lacked a leader and wings.[31]

Improved nets and boats were not the only new equipment drawing attention on the lakes. A variety of technologies were experimented with and incorporated into the lake fishery. Gill nets were lifted by hand during much of the nineteenth century. In the early 1890s steam gill net lifters were developed. These typically wound the gill nets around a turning steam powered drum which usually had affixed teeth designed to catch the net and pull it on board. The innovation saved considerable time and energy. In 1913 the Crossley gill net lifter was introduced. The Crossley lifter had two rows of powered teeth which alternately clamped and released the netting as it pulled it on board. The Crossley lifter increased the amount of netting tugs could fish in a day.[32]

Individual fishermen occasionally tried to improve their catch numbers through novel means. In 1946 commercial fishermen Edward Landry and Lawrence Trombley constructed two mechanized lake tractors capable of traveling through the waters of Saginaw Bay at depths up to ten feet. The unique vehicles were constructed out of various automobile and truck parts. They were completed in time for the 1946 commercial fishing season. Each man drove one tractor. Each tractor was attached to one end of a two thousand four hundred foot long seine net. The tractors hauled the sprawling apparatus in a wide arc toward shore. Large sections of Saginaw Bay were shallow enough to accommodate the ten foot depth limitations of the vehicles. Using their large tractors and lengthy seine net, Landry and Trombley quickly eclipsed the harvests of their local commercial fishing competitors. The partners said their lake tractors were developed as a response to the souring economic fortunes of the commercial fisheries. "You have to find ways to cut corners these days or else you can't stay in business" Trombley explained.[33] Michigan Conservation Officer A.J. Neering claimed the Trombleys' operation had caught more

walleye than the entire Bay Port Fish Company. At the time Bay Port Fish Company was operating approximately eight hundred trap nets in the bay.

Despite the huge hauls Landry and Trombley were taking, their method proved problematic. Sweeping up so many fish at once with their sea tractors took a tremendous toll on their catches. After one five thousand pound haul of fish the partners received no pay. The fish had been too badly injured during the seining operation. In addition, the tractors likely inflicted significant damage on the lake bottom as they crisscrossed their fishing areas, crushing and uprooting aquatic plants, destroying underwater formations and disrupting spawning areas. Officer Neering recommended quick action be taken to outlaw the lake tractors. He feared the Bay Port Fish Company would copy the partners and build their own version of the fishermen's tractors. Neering said that without intervention even larger versions might appear and their use would spread. "The outfit is a getter and destroyer" he charged.[34]

Eden exploited

As the nineteenth century approached the twentieth, Canadian and United States policies reflected their regional interests. Meaningful cooperation between the two nations seemed unlikely. The development of America's railroad infrastructure had eroded the importance of earlier canal systems. International trade via the shared lakes and rivers of the borderlands had slowed.[35] Around the Great Lakes Basin eight U.S. states, the United States Federal Government, the Province of Ontario and the Dominion of Canada carved out their respective niches in freshwater management. Individual states continued to operate under a myriad of local regulations, most of them poorly enforced.

Lake Huron reflected those divided and competitive interests. Instead of a common resource, linkage and route of exchange, Lake Huron was a continuing source of conflict between regional interests. Commercial catches began to fluctuate as more and more fishermen entered the trade. Michigan's Lake Huron waters were essentially an open, unregulated fishery as the new century approached. The focus on hatcheries continued. During the summer of 1893 a temporary research facility was established on the shores of Lake St. Clair just south of Lake Huron. Professor Jacob Reighard investigated what areas of the lakes were suitable for planting whitefish fry. The following year the investigation moved to Lake Michigan under the direction of Dr. Henry B. Ward of the University of Nebraska. The surveys increased scientific knowledge of whitefish and their habitat.[36] In Canada officials created a regulatory framework for their fishery. However, Canada's regulations were poorly enforced. Canadian fishermen were irritated by restrictions their U.S. competitors did not have to follow.

As human population centers grew around the lakes so did commerce. The abundant forests of the interior Great Lakes fueled a rapid growth in the timber industry during the mid-nineteenth century. With lumbering operations came roads, horses, wagons, lumber camps and sawmills. Staggering amounts of cut timber were floated down rivers and streams in order to transport the material to sawmills. Massive amounts of sawdust were deposited in the tributaries of the lake system. The removal of trees from along rivers, streams and lakes led to increased soil erosion and runoff. The total extent of the damage done to fish populations and their spawning habitats is impossible to know for certain. Sport anglers complained about the harm done by logging, but the courts sided with logging interests. Streams were considered public highways, with logs given as much right of way as any other water craft.[37] Commercial fishermen complained about the substantial amounts of sawdust being deposited in the lake as

well as the tendency for cut logs to drift into their nets and ruin them. Bark deposited from giant rafts of logs also found its way into fishermen's nets. In 1894 Alpena commercial fisherman Casper Alpern said many of the mills operating in the vicinity of Thunder Bay did "not take care of their sawdust at all" and let it run into the lake despite recent regulations that were passed to curb the practice. Alpern charged that sawmills around the neighboring town of Alcona had completely destroyed the fishery there. [38]

Thunder Bay just west of Alpena suffered from huge deposits of sawdust and other waste materials originating from the timber industry, including massive amounts of bark. Alpena fisherman Captain James Cleary shared Alpern's opinions regarding the affects of the timber industry on the fisheries. Cleary operated one of the largest fishing tugs on Lake Huron in 1894. He had lost nets due to damage from wood waste and chunks of bark. Steamboats also discarded clinkers – lumps of leftover incombustible coal material – in the lakes. Cleary stated that clinkers sometimes fouled the nets of fishermen.[39] The timber industry was not the only source of pollution around the lake. Alpern said raw sewage was a factor in the decline of Thunder Bay area fish populations.[40] These and other aspects of human development and resource exploitation combined with pressures from the commercial fisheries, creating mounting negative repercussions on the living communities of the lakes.

The goal of the industries utilizing the lake's resources was to maximize the profits of their lake industries. This included the fisheries. Fishing for maximum yields in the commercial fisheries was a major contributing factor in the destabilization and eventual collapses of certain fish species. The connections between profits, resource use and resource abuse were not unknown. In 1912 R Malcolm Keir of the University of Pennsylvania's Department of Industry and Geography argued that humankind's relationship to environmental resources progressed

through four stages. He argued that people initially looked at their resources as unlimited, particularly when human population density in a given region is low and the materials they are using seem unlimited. At the second stage, people begin to lavishly exploit their available resources. At stage three people begin to realize that the resources they are depending on are running out due to overuse and abuse. The final step, he argued, is an effort to replenish the vanishing resources. With regard to fishing Keir argued "All thought has been on present gain without any regard for future supply."[41] He charged that fishermen sought quick profits through maximum exploitation.

> Attention is centered on making money quickly. As the supply of fish begins to dwindle the price rises, so men become more and more eager for large catches. The difference in price offsets wastes, so no attention is paid to preventable losses until some outside force compels more careful methods. The outside force may be legal governmental restrictions or it may be the exhaustion of the supply of fish.[42]

Economic gain was a principle motivator behind the first efforts to harmonize resource use and trade laws between U.S. Federal, state and British Canadian interests in the Great Lakes Basin. While other (often related), regional interests sometimes played a role, harmonizing relationships between the major political bodies was unlikely if everyone would not profit in a relatively equitable fashion.

Managing the Borderlands

Lake Huron is both a dynamic, interconnected lake ecosystem and a politically divided international borderland. Its waters serve as a boundary between the State of Michigan and the Province of Ontario. The lake is at once the divide between that state and province, as well as between the national governments of Canada and the United States. However, even as it served as a barrier and dividing line, the lake (and indeed all of the Great Lakes except Lake Michigan which does not border Canada), concurrently fostered exchange and migration between the two nations. The international boundary between Canada and the United States is often referred to as a permeable border. In the nineteenth century the lakes fueled increasing market linkages between the two nations. Agricultural products, fishes and other goods were shipped across the Great Lakes. Similarly, human migrations, particularly in the form of Canadians into the United States, were common.[43] Still, the ebb and flow of trade and immigration often reflected the day to day realities of Canadian/U.S. relations. Indeed, even during the periods of extended collaboration national interests continued to dominate legislative decisions. In their book *Beyond Walls: Re-inventing the Canada-United States Borderlands* (2008) Victor Conrad and Heather N. Nicol likened transnational perspectives in history to a two-legged being with one foot on each side of the border. They argued that the body and mind of the figure sway back and forth across borders through space and time.

> The forces of globalization, de-territorialization and re-territorialization buffet the body but each foot remains planted firmly in the nation-states divided by the boundary. Nation-states continue to play a major role in defining the context in which transnational processes operate.[44]

Their model of international relations along the borderlands was writ large in the Great Lakes commercial fisheries, where regional and national interests both shaped legislative agendas and prevented meaningful cooperation for decades, even as the two countries cooperated in other spheres of commerce.

One early attempt at improving cooperation and trade linkages between Canada and the United States occurred in the mid-19th century. In 1854 the two countries negotiated a treaty of reciprocity. Two of the treaty's seven articles dealt specifically with fisheries. Fishermen from the United States were granted access to Canada's Atlantic coastal waters in exchange for a favorable trade relationship. The treaty was the result of a changing relationship between Great Britain and Canada, as well as the recent consolidation of Canada's North and South provinces under a single government in 1840. The treaty removed duties that had been attached to international intercourse between the U.S. and Canada and eased travel and commerce restrictions on various shared water bodies.[45] International tensions fueled by economic disputes over tariffs and the American Civil War led to the treaty's abrogation in 1865 and eventual termination in March of 1866. Despite its abrogation, the treaty substantially fueled trade between the two nations, which continued at similar and growing levels even after its abrogation.[46] Why was this treaty initially adopted by both nations while later attempts at cooperative resource management failed? The 1854 treaty did not place limits on production. With little give and lots of take it was attractive to both sides. It offered Canada the opportunity to strengthen its economic relationship with its fast growing neighbor to the south and American fishermen open access to rich North Atlantic waters. It promised shared profits to its signatories.[47]

The Joint Commission of 1892

"*There are lots of men I know, if they could save the fish, would not do it, as they are too darn mean.*"[48]

There were early attempts at developing an international management plan for the lakes. During the 19th century Canadian and U.S. governmental organizations were slow to respond to the effects of the rapidly expanding commercial fisheries. Canada took the lead in developing broad regulatory legislation. The first comprehensive fisheries law for the Great Lakes was passed by the Canadian Parliament in 1868. It sought to regulate fisheries through a series of restrictions on water impediments, net mesh sizes, species specific requirements and the establishment of closed seasons. The government then appointed twenty-three officers to enforce the new law on the Great Lakes. The Canadian position contrasted sharply with the United States, where the public favored an open access, unregulated fishery. Public opinion usually shaped local and state regulations.[49] Regulations were sporadic, regional and often conflicted.

The United States Commission of Fish and Fisheries was created in 1871. Under the auspices of the new agency, Assistant Commissioner James W. Milner, a scientist from Kenosha, Wisconsin investigated the lake fisheries. Milner concluded that while the fisheries needed management, new laws and regulations were not the way to do it. He was critical of the Canadian system which he viewed as intrusive and expensive. Instead, Milner recommended the states focus on restocking programs. As a result of the focus on hatcheries as the answer to fluctuating catch numbers, an essentially open fishery existed in the Michigan waters of Lake Huron well into the twentieth century. On both sides of the lake fishermen resisted regulations or ignored them completely.[50]

Those working within the fishing industry believed many species were in decline, even as the industry expanded and evolved. Acting on the growing alarm expressed by both enforcement officers and fisheries experts, the Dominion Government in Canada and the United States Federal Government decided upon joint action to address the needs of the freshwater fisheries. On December 6th, 1892 the two national governments created a Joint Commission to investigate the lakes' fisheries and advise the respective governments as to the best methods for managing the living resources of their shared waters. The British chose Dr. William Wakeham to act on behalf of the Dominion. Wakeham was a medical doctor. He commanded a fisheries enforcement vessel in the Gulf of Saint Lawrence. The United States chose Richard Rathbun of the U.S. Commission of Fish and Fisheries.[51]

The commissioners embarked on an ambitious fact finding mission that took them around the ports of the Great Lakes where they completed extensive interviews with dozens of fishermen, fish processors and dealers. They amassed a sprawling collection of field notes that contain a wealth of information related to the lakes, wildlife, pollution, shoreline industries and human inhabitants around the basin. The heart of their extensive work provided a rich written account of the lake fisheries. They investigated the various fishing technologies deployed in different locales. They chronicled the use of pound nets, gill nets, fyke nets, trap nets, seines and other capture mechanisms. They chronicled dramatic declines in populations of fishes, questioned the logic of disposing mill wastes into tributaries and tried to understand the effects of human activities on fish spawning. Within their voluminous notes they catalogued the growing list of problems that were existent around the lakes. They noted the complaints of area fishermen regarding the gradual decline of fish catches. For example, whitefish were once the most heavily fished species targeted by the fisheries. Area fishermen recounted stories about the

large numbers that had inhabited the Lake Huron. During their investigations Wakeham and Rathbun found that "In all parts of the lake the fishermen are practically unanimous in the statement that the decrease has been very great."[52] Fishermen were increasingly turning to lake trout to fill the void. However, testimonials from individual fishermen suggested that Huron's lake trout were also in decline.[53] In 1894 the commissioners traveled around the perimeter of the lake from Detour near the North Channel to Mackinaw City at the straits between Lakes Huron and Michigan. They went south along the coast to Port Huron, across to Sarnia, Ontario and then Northeast to the northern shores of the Bruce Peninsula. The commission also interviewed fishermen around the coast of Georgian Bay and the North Channel. As the commissioners wound their way through Lake Huron's fishing ports the list of problems they chronicled grew. On the Michigan side of Lake Huron, their southward journey along the lake's coast began at the Village of Detour on the extreme eastern end of Michigan's Upper Peninsula.

Stationary pound nets and boat launched gill nets were heavily utilized around Detour, Michigan. On August 18th of 1894 the commissioners interviewed local fish warden Samuel Butterfield. Butterfield was also a commercial fisherman. He informed the commissioners that two sail boats and three fishing tugs operated gill nets in the waters around Detour in 1894. During the fall the gill netters focused on trout. They would operate their nets until the first of November which included the spawning season. They stopped fishing when the trout moved out to deeper waters.[54] The tugs typically operated an average of one hundred and twenty nets strung out in four long gangs. Sailing vessels maxed out around sixty to eighty nets in three or four shorter gangs.[55] While the ideal was to pull the nets every day, they were left in longer when bad weather or other factors interfered with fishing operations.[56] Butterfield believed that the sizes of mesh openings in the nets were decreasing as the numbers of larger fish declined.

He said when he first began fishing in the area he had never used anything below a five inch mesh gill net. In 1894 four and one quarter inches was the common size for gill nets in the area.[57]

Gill net fishermen shared space with pound net fishermen who worked along the shoreline. Gill nets and pound nets were both typically put in place just after the ice receded in the latter half of April or early May. Pound nets principally caught whitefishes, especially in the spring. While some fishermen tried to fish during the winter, Butterfield guessed less than three tons total was caught by fishermen during the winter. The winter catch was sold locally.[58] Butterfield wished American fishermen could fish "a little" on the Canadian side, though he acknowledged that the strict Canadian Overseer in the region, Major Elliot, was the best "they ever had."[59] Across the channel in Thessalon, Ontario fishermen also recognized the dedication of Butterfield's Canadian counterpart. However, Thessalon Fisherman David Belrose questioned the logic of Butterfield working as both a fisherman and an enforcement officer. Belrose claimed there was widespread use of undersized nets and huge catches of juvenile fishes being hauled out of the waters around Detour.[60]

Thomas Sims was originally from Glasgow, England. He lived for a time in Yarmouth, Massachusetts before coming to Detour around 1862 to fish in Lake Huron.[61] Sims claimed he was the first pound net fisherman to work in the waters at Detour.[62] He set his pound nets as early as April and ran them as late as July. In September he usually deployed his nets again and left them in the water until ice began to form. Sims fished primarily for whitefish and some lake trout. He initially fished for walleyes but gave up due to a substantial decline in their numbers. He explained that the State of Michigan tried to limit the minimum mesh sizes for pound net pots used in the area to three and one half inches in order to let immature whitefishes escape. Sims

pointed out that even if fishermen acquiesced to the rule it still allowed for wiggle room. He pointed out that the mesh openings in nets shrank up to a half an inch after they were tarred - a process meant to better preserve the net when it was submerged in lake waters. The law did not specify whether the mesh size had to be three and one half inches before or after fishermen tarred their nets. Other fishermen chose to circumvent the rule entirely. Sims stated that some commercial fishermen placed a mesh "apron" in front of the pot's main net to prevent smaller fish from escaping. The apron was an even smaller mesh size, but one that could be easily removed and hidden away in the event of an inspection on board or at shore. Sims called the practice cruel and said it was catching and wasting a lot of fish of no value. He recommended the incorporation of stiff fines to deter such behavior.[63] In addition to declines in the numbers of walleye, Sims said lake trout had also declined in the area. He said sturgeon were almost gone.[64]

While interviewing fishermen around Detour Rathbun had occasion to watch one fisherman bring in a load of whitefishes from his pound nets. Rathbun noted that the catch consisted of "very large numbers of small whitefish," ranging from one half of a pound to one pound.[65] A pound net catch brought in from Thessalon, Ontario showed similar immature fishes. Rathbun also witnessed a catch of lake trout brought in by the tug *Little A.* Butterfield was part owner of the tug. The tug had been fishing with sixty three hundred foot long gill nets at depths of forty to sixty fathoms. The operators landed one hundred and fifty two lake trout. Rathbun described the total size of the catch as "very poor" considering the amount of netting deployed.[66]

W.E. Robinson of the firm D.A. Trumpour and Company in Mackinaw City argued that the three and one half inch mesh size was not large enough for pound nets. He said the commercial company of McCloud and Pemble never used anything smaller that four inch mesh. Robinson believed that company's catches were larger and of superior quality to any of those using smaller fishing meshes. He also pointed out that cisco fishermen from other regions would occasionally travel to Mackinaw to fish for ciscoes and take innumerable small whitefishes as a bycatch in the smaller mesh of their cisco nets. Robinson suggested fishermen targeting ciscoes be limited to certain water depths where they would not be able to catch scores of small whitefishes.[67] Robinson charged that the regulations that existed were not sufficiently enforced by the State of Michigan.[68]

While pound net fishermen were especially vulnerable to harsh winter weather conditions, gill netters did not face the same limitations. Robinson pointed out that many fished right through the winter season. When ice covered the water, some fishermen cut a hole in the surface and pushed a net through on a long pole. Robinson estimated between forty to fifty gill net boats operated in the Mackinaw City area. He said area fishermen primarily used Mackinaw sailing vessels manufactured at St. Ignace, Michigan. Each boat typically held two fishermen. They operated two gangs of nets in the water at a time, while a third gang was kept on shore. The nets were rotated through service in that manner. During spawning season gill netters relocated their equipment closer to shore to catch adult fish that were moving into shallower waters. Then in the winter they followed the fish back into deeper waters.[69] Robinson said the spawning season in November was the best time to catch whitefishes around Mackinaw. He said fish "full of spawn" were just as good as others and were readily marketed.[70]

North and slightly east of Mackinaw City in the open waters of Lake Huron sits Mackinaw Island. Mackinaw Island grew into a popular tourist destination in the twentieth century. In the nineteenth century it hosted a number of commercial fishermen. Joe Wilmot moved to the island in 1854 and began fishing in 1858.[71] He noticed a decline in the catch over subsequent years. Wilmot said he used to get good hauls of fishes through the ice using three gill nets. However in 1894 he claimed a fisherman could no longer catch comparable numbers through the ice even if they used twenty nets.[72] Wilmot said November was the month fishermen made a lot of their income. It was also the spawning season for targeted fish. He believed a closed season was the only way to protect spawning grounds from being disrupted. He stated fishermen were using small mesh sizes and echoed Thomas Sims regarding the use of small meshed aprons in their nets.[73] According to Wilmot, Mackinaw Island had once served as a base of operations for approximately thirty fishing boats. As the fisheries intensified Wilmot noted changes in the fishes. He said whitefish were smaller than they used to be and concluded the fish being caught were most likely planted by the hatcheries.[74] Sturgeons were nearly wiped out in the area. Much of their destruction had been intentional. Wilmot said during the early years of the fishery Mackinaw Island fishermen often threw sturgeon carcasses into the woods. They were considered an undesirable fish. Wilmot said around 1876 or 1878 a German named Bennet came to the area and began making caviar out of sturgeon eggs. Suddenly sturgeons were worth money to Mackinaw Island fishermen, but by that time sturgeons were almost gone. Wilmot was not convinced they needed saving. He believed sturgeons destroyed the spawn of other marketable fishes.[75] He said there used to be a lot of ciscoes in the waters as well. He said after catching them area fishermen would salt them for shipping with their "guts and all." In 1894 Wilmot said they were also gone.[76] Most of the marketable fish populations had been on a

steady decline around the island. Wilmot said the decline began as far back as 1865. Since that time the island's fishermen had either passed away or taken up farming. "No one fishes from here now" Wilmot said. "I have not set a net in five or six years."[77]

Mackinaw Island was part of Mackinac County. Mackinac County includes the island and a section of the South side of Michigan's Upper Peninsula. In his book *Disputed Waters* Robert Doherty described the region's fishermen as extremely poor. In the second half of the nineteenth century a significant percentage of local fishermen in the county were Native Americans. However, they were consigned to the bottom of the economic system. In 1870 all of the larger fishing boats were owned by non-indians. Indigenous fishermen survived as paid laborers or worked from small rowboats. Most of the county's fishermen were very poor. Doherty reported that fully 31% owned no property. Thirteen percent of white fishermen owned no property, while 38% of Indian fishermen had none. The largest fishing outfits in the region were owned by well-capitalized outsiders who came to the area in search of profits. Many of the larger commercial enterprises brought hired help with them.[78]

South of Mackinaw Island on the Northeast side of Michigan's Lower Peninsula sits the town of Cheboygan, Michigan. C. Corlett was a pound net fisherman living in Cheboygan at the time the commission completed its interviews. Corlett claimed some cisco fishermen were using their nets to target whitefishes. Corlett explained that some of them were doing so because they could not afford to invest in a proper whitefish net. He said he favored enforcement of four inch mesh for whitefishes provided it was the same for everyone. He said the four inch mesh would likely shrink to three and one half inches once tarred. He expected the fishery to "play out" if something was not done to curb widespread use of small mesh sizes.[79] He believed the larger the

mesh, the larger the fish that would be caught and only large fish would be in danger of gilling (being caught in the mesh at their gills), in pound net pots.[80]

Dan Corlett was another Cheboygan fisherman. Corlett said that whitefishes were plentiful in the region in previous years, but they were fished out by tugs. He blamed a tug operator from Detour for the decimation of both lake trout and whitefish populations in the Cheboygan area. He said only the trout had recovered.[81] He believed pound net mesh sizes needed regulated and wanted small mesh sizes banned from use around spawning whitefish.[82] Overall he believed that populations of all the species of marketable fishes were in a downward spiral. He blamed overfishing and specifically the small mesh sizes being used in pound nets. He lamented that "trout are decreasing and everything is decreasing, herring, trout, menominee, whitefish, and everything else."[83]

William Gill was a fish dealer in Cheboygan. In contrast to the decline at Mackinaw Island, Gill claimed there were more fishermen operating in his region than ever before.[84] However, while the numbers of fishermen were on the rise, Gill explained that the ability for an individual to bring in a good catch had declined dramatically.[85] He echoed the opinion of many fishermen when he stated that the average size of whitefish being caught had dropped. He said individual whitefish averaged at least four pounds when he began his business. In 1894 Gill claimed the average had fallen to about two and one half pounds.[86] Gill suggested the area was being overfished and said fishermen were catching large numbers of juvenile fishes. He claimed there were hundreds of pound nets between Cheboygan and Thunder Bay at Alpena, a distance of less than one hundred miles. He told the commissioners that one fisherman was operating seven pound nets along just one mile of shoreline. He said he could show the commissioners where fishermen who claimed to be using large mesh sizes were mixing barrels of small fishes in

with larger ones.[87] Gill said as recently as the previous fall fishermen were bringing two ton catches in to the market with eight hundred to one thousand pounds of immature fishes mixed in. Gill further charged that many fishermen claiming to target ciscoes with their smaller meshed nets were actually intentionally fishing for whitefish. He believed pound net pots should have netting of at least three and one half or four inches, and that five inch mesh should be the minimum size for gill nets used for trout and whitefish.

Gill acknowledged that fishermen were already supposed to be using three and one half inch mesh in their pound nets, but said that nearly all of the fishermen were using smaller mesh sizes. He feared that the continued catches of juvenile fishes too young to spawn would ruin the fishery for everyone.[88] He said Canada's fishing regulations were the best on the lake. Gill accused Michigan fishermen of doing whatever they wanted and regularly breaking what laws did exist.[89] Gill retrieved a sample of C. Corlett's recent catch and showed it to Rathbun during the commissioner's visit. Rathbun noted that a large number in the sample were small. He estimated that the smaller fishes were on average one third of a pound. Gill said this was typical for Corlett. He said Corlett used small mesh in his nets.[90]

The commissioners interviewed several fishermen operating in the Alpena area. David Lincoln of Alpena claimed that some fishermen set their pound nets and then simply never removed them from the water. He said undersized whitefishes were sometimes intentionally marketed as ciscoes.[91] Lincoln said that while the facilities supporting fishing had steadily improved, total catches were on the decline for individual fishermen. Fish populations near the shoreline had once supported a thriving, sailboat based gill net fishery. By 1894 there were less fishes in shallower waters. Sailboats were scattered. Tugs were by then the primary vessel used

in the area. Tugs allowed fishermen to follow marketable fish species out into the deeper waters of Lake Huron.[92]

Lincoln believed the Canadian Government was doing a better job protecting its fisheries than Michigan's legislature was for the state. He said mesh sizes needed to be larger so that smaller fishes could escape. He also recommended that no fishing be allowed during spawning times. He charged that state laws were ineffective and he believed it was time for the national government to take control of fisheries legislation.[93] "I think the United States and Canada ought to jointly form a law and pass it, and enforce it" he said.[94] He was open to the idea of closed seasons, but recommended that if drafted, they address different times for different regions. Lincoln recognized that spawning times were not uniform across the Great Lakes.[95] Interestingly, he disputed the notion that the nearby sawmills were polluting the area waterways or affecting the fishing. In fact, he claimed they had never deliberately dumped sawdust and other waste in the Alpena area.[96]

Despite Lincoln's claims regarding the timber industry, the commissioners were not convinced. Rathbun himself recorded heavy pollution in the Thunder Bay area that appeared to originate from logging. The commissioners experienced the effects of the industry's waste firsthand during their initial approach into the Alpena harbor aboard the side-wheeled paddle ship *City of Mackinaw*. The vessel was forced to shut down its drive wheels on account of the large amount of driftwood, cut logs and other mill waste spilling into the lake from the Thunder Bay River. Rathbun also recorded the deleterious affect huge rafts of pine logs floated from Georgian Bay, Canada were having on the lake. The cut logs would shed their bark as they were floated to ports at Bay City and Alpena. Numerous fishermen also reported the effects chunks of freed bark had on their fishing nets.

Additional sources of pollution raised concerns for the commissioners. During a trip to the Alpena Sulphite Fibre Company mill owned by George N. Fletcher, Commissioner Rathbun recorded that the mill regularly dumped its waste acid used during the pulping process directly into the nearby river. The river in turn flowed into Lake Huron a short distance away. Rathbun recorded that the acid was released on a daily basis from tanks measuring twenty feet wide by seven and one-half feet deep. There were four acid "digestor" tanks in the mill. Rathbun was told the tanks contained five percent acid, but mill operators were unable to tell him how strong the acid actually was. Rathbun assumed it probably became too diluted in the water to harm the fishery.[97]

While visiting the pulp mill the commissioners interviewed S.H. Case. Case was a former fisherman who worked for the mill. Case had given up fishing entirely about eight years earlier. He said that many fishermen believed the timber mills had destroyed the area fishery, but he thought fishermen played a significant role by fishing their nets during the spawning season. He admitted to using mesh as small as one inch bar in size to catch ciscoes and said small whitefishes often became trapped in the nets. Case believed fishing with the smaller nets "had a good deal to do with the decrease" in whitefishes.[98] Case said it was possible to release some of the juvenile whitefishes if fishermen were very careful when lifting their nets, but he said most fishermen would not take the time to do it.[99]

At Saginaw Bay Michigan, two and a half inches was the required size for nets used in the bay's cisco fishery. Bay City fisherman George Penniman said state authorities had recently confiscated numerous nets smaller than the required size.[100] Saginaw Bay fishermen operated their nets during the spring and in the fall. Nets were first distributed after winter's ice thawed. They were kept in the bay as late as July. They were then removed until about September when

they were again returned to the water. Fishermen typically did not remove their nets again until mid November when ice threatened to ensnare them.[101] Thus, nets were in use during the spawning periods of both ciscoes and whitefishes in the bay.

Robert Beutel was a commercial operator out of Bay City, Michigan. Beutel estimated that at least one hundred and fifty pound nets were in operation in Saginaw Bay in 1894. During fall fishing in Saginaw Bay he said that he usually removed his own nets by November 25th.[102] Fishermen and fisheries officials offered various suggestions for minimizing the loss of spawn. One recommendation suggested fishermen mix eggs and milt on site while they fished. Beutel did not think fishermen could be relied on to fertilize whitefish spawn and place it back in the lake. He believed fishermen would look at it as extra unpaid work and neglect it in favor of maximizing their fishing efforts.[103] In addition to whitefishes, Saginaw Bay fishermen targeted ciscoes. Beutel said they caught ciscoes in November and also in the spring. He claimed Saginaw Bay had larger ciscoes than Green Bay, but smaller than Lake Erie. The claim that Saginaw Bay ciscoes were smaller than other ciscoes was echoed by fisherman H.A. Benson of Bay City. Beutel said ciscoes spawned all over the bay and began spawning in early November.[104] Beutel became well known to state and federal regulators in the following century when a second commission formed to devise an international regulatory system for the Great Lakes.

Louis Dubey lived at Bay Port, west of Bay City on the East side of Saginaw Bay. He had fished the bay since 1874. Dubey said there were just as many pound nets in the bay as there had ever been and that the numbers were growing. He believed the shallowness and warmth of the bay in the summer made it "poison" for the fishes and that the fishes correspondingly retreated to deeper waters.[105] Dubey contradicted those who said ciscoes were smaller in the

region. He said the ciscoes he caught averaged about twelve inches. He said he had heard numerous Lake Erie fishermen state Lake Huron ciscoes were larger than those in Lake Erie. He did not favor any new net regulations. He feared new restrictions would mean fishermen would no longer be able to catch any fish.[106] Rathbun noted that Saginaw Bay fishermen were strongly opposed to any new regulations in the ciscoe fishery. Perhaps hoping to avoid any legal restrictions most of the bay's fishermen claimed that cisco populations were just as plentiful as ever. Overall Rathbun found it difficult to obtain reliable information in the size ranges of ciscoes and questioned the accuracy of the data he was given. [107]

South and east of Saginaw Bay lies Port Huron. Avery Selkirk and other fishermen around Port Huron kept their nets in until about December 10th. Port Huron sits at the base of Lake Huron where the lake drains, via the St. Clair River, into Lake St. Clair. Because of the strong current ice did not form as early in the year as in other parts of the lake and thus fishermen could keep their nets in the water longer.[108] Selkirk ran the Port Huron Fish Company and had been in the area for forty years.[109] He said the Canadian Government recently outlawed fishing with seines along their shoreline. The St. Clair River was less than a mile in width and Selkirk said the Canadians were able to watch the American fishermen using seine nets with impunity. Selkirk was not a fan of seining. He said fishermen usually ordered nets of two and one-half inch mesh. He suspected seining operations were destroying spawn.[110]

In addition to pound nets, Selkirk operated gill net boats including one tug and one sailboat. The tug worked three gangs in the water at one time. A fourth gang was left onshore as part of the rotation. Each gang consisted of thirty-six nets. Each net measured two hundred and seventy eight feet in length, with each gang being approximately ten thousand feet long. The sailboat worked primarily in the spring using the same netting, with three gangs of twenty nets

each in the water at once. Selkirk targeted trout with his gill nets and said he opposed the taking of undersized fish. He told the commissioners he would support a five inch minimum mesh for gill nets.[111] He said Michigan's poorer fishermen had a hard time competing with wealthy operators. He suggested the governments of Canada and the United States "get their heads together and make their laws exactly alike. . .and fix them so that the small man can live as well as a rich man. . .I do not know why it would not be a good thing."[112] Selkirk's frustration reflected the reality of the commercial fishery. Modernized equipment and larger numbers of nets were necessary in order to keep up with declining numbers of fishes. The ability of individuals to make a living working in the fisheries depended on their access to capital to invest in fishing gear. Poor fishermen could not compete with wealthy operators.

Selkirk claimed commercial fishermen were having little effect on the overall populations of fishes. He said he was not completely in favor of a closed season. While he was of the opinion that the growing numbers of tugs were running too many long nets and taking an inordinate amount of fish out of the lake, he said fishermen could "never fish these upper lakes out as long as we live."[113] In fact, Selkirk believed some commercial activities helped certain species of fishes. He suggested his trout fishing helped to protect whitefish. He charged that large numbers of trout regularly visited nearby waters where whitefish eggs were planted in order to feed on the eggs and young whitefish. He stated that "wherever you have planted those fish you will find the best trout fishing in the world."[114]

Local interests typically determined what meager regulatory policies existed on the United States' side of the lake. The new effort at international cooperation and legislation faced a gauntlet of entrenched interests and Constitutional tradition that favored local control. Local fishermen were prepared to resist any changes that might negatively affect the profitability of

their trade. The commissioners recognized the influence of entrenched commercial interests during their investigations. Perhaps no Lake Huron fisherman better personified that willingness to fight for an open fishery better than Casper Alpern of Alpena, Michigan.

Alpern had come to the states from Germany in 1857. In 1858 he moved from New York to Texas, where he worked as a clerk. From 1861 until 1865 Alpern served in the Confederate Army during the American Civil War. Following the end of that war he worked as a grocer in Mobile, Alabama. In 1871 he moved to Alpena, Michigan. In Alpena he started a clothing store which he operated until 1873. In 1873 Alpern switched to commercial fishing. In 1885 he started the Alpena Fish Company.[115] By 1894 Alpern was head of the influential Michigan Fishermen's Association. He operated both gill nets and pound nets and among his vessels was the tug *Maxwell A,* one of the largest fishing tugs on the Great Lakes at the time.[116] Alpern said his tugs pulled gangs of nets measuring approximately eight miles. The nets were pulled by hand. It took about four hours to pull all eight miles of netting onto a boat. Normally Alpern's gill net operations fished into late December. Steam net lifters were available by 1894, but Alpern still relied on human power. He favored pulling nets by hand over a mechanized lift because he said the netting often became fouled on the bottom.[117] Alpern pointed to increasing amounts of refuse around the lakes, as well as the buildup of slime on the lake bottom, as primary causes of a decline in fishing fortunes.[118] The timber industry was thriving in the Alpena area during the latter portion of the nineteenth century. Tributaries were disrupted with long log runs, with a resulting stir up of sediments as well as erosion of shorelines from tree removals. Sawdust from area mills seeped in from waste piles or was dumped directly into Lake Huron's tributaries. Alpern's concerns in regard to the timber industry echoed those of other

fishermen and the commissioner's own observations. While Alpern readily blamed the timber industry for affecting fishing, he gave commercial fishermen a pass.

Unlike many other fishermen, Alpern claimed lake trout were "increasing steadily in abundance."[119] While Alpern operated both gill nets and pound nets, he admitted he had "not made any money out of pound net fishing for the last seven or eight years."[120] He said he had previously planted some German carp in a nearby lake. The lake connected with Lake Huron and Alpern said he suspected that the carp had migrated into the big lake because he caught two German carp the previous year. Rathbun concluded Alpern was a poor business manager who was prone to extravagant expenditures designed to perfect his fishing apparatus. His investments failed to foster profitable returns. Rathbun also questioned Alpern's standing in the Alpena area. Despite those factors, the commission acknowledged that Alpern was very influential within the fishery.

In addition to his work fishing, Alpern was active in the political defense of his profession. Rathbun believed Alpern would oppose any regulations that threatened his business. Rathbun noted that the Michigan Fishermen's Association had been organized primarily to defeat "all State legislation that did not meet with their approval."[121] In his notes Rathbun referred to Alpern as a "very shrewd, active, German Jew" who blamed the timber industry and pollution for the declining catches.[122] The Alpena fisherman's ability to coalesce the state's fishermen into organized resistance was a major obstacle facing any effort to pass comprehensive fisheries legislation.

C.S. Hampton, the Michigan State Fish and Game Warden at Petosky, Michigan attested to Alpern's influence. Hampton told the commissioners that overfishing "beyond all question, has caused the main destruction of the fish."[123] Hampton believed gill nets were the most destructive form of fishing because of the sheer numbers and lengths fishing tugs could operate. He lamented the fact that fish tugs could lay miles of nets across spawning grounds. Hampton said the state's fish commissioners had recently tried to get the legislature to pass a new set of stricter regulations. The bill had generated fierce resistance from members of the commercial fishing industry. The bill failed to pass. Hampton said Casper Alpern of Alpena was one of the most outspoken critics of the defeated proposal.[124]

Other U.S. fisheries officials adopted a more defensive stance toward fishermen and believed in a free market approach. S. P. Wires was the Superintendent of the Federal Fish Hatchery in Duluth, Minnesota. Although he was stationed in Duluth, Wires had experience with Lake Huron's fisheries and shared his opinions with the commissioners. He mentioned the use of small aprons over the larger mesh in some of the pound nets pots. Wires claimed that the application of an apron was done as a way of modifying larger whitefish nets so they could be used to fish for ciscoes. He opposed the enforcement of larger mesh sizes on pound net pots. He claimed that enforcing enlarged mesh sizes on pound nets would be a mistake as more fish would get gilled in the nets and subsequently die than with a smaller mesh size.[125] He suggested that fishermen be allowed to regulate their respective net sizes on their own.[126]

While Wires acknowledged there were a large number of pound nets operating along the shoreline between Bay City and Mackinaw, he said the numbers peaked around 1882 and were in decline. He believed the high numbers of nets both removed the fishes and broke up their runs. Wires said the pound net fishery was largely fished out. He said gill netting was now the

preferred fishing method in the region since gill netters could follow the fish into deeper waters.[127] Wires said gill net fishing on Huron started as soon as the lake opened to navigation during the spring thaw and ended with the onset of winter in late November. While fishermen sometimes were able to get their nets in as early as March, he said April was more common. He lamented that winter prevented vessels from heading out to their fishing grounds due to ice and storms. He speculated that the fishing would continue to be very good if commercial fishermen were able to work past November.[128]

Wires confirmed that spawning grounds were a favored fishing area. He said it was commonplace for commercial gill net fishing vessels to entangle or tear their nets when they fished the rocky areas lake trout preferred to use for spawning.[129] He opposed the incorporation of any closed season and like many fishermen believed the industry could regulate itself. He assumed if fish populations collapsed fishing would stop and eventually the fish would recover. He believed spawning operations could replace the fisheries by planting fish fry. He said the only regulation that should be considered was a limit on the amount of gear fishermen could use. Wires believed there were too many people in the fishing business and too much gear in the lakes.[130] He painted a different picture of whitefish declines than many fishermen. He said he did not think the decrease in whitefish numbers had been very great. He considered the reports of dramatic declines in the Lake Huron fishery to be exaggerations. Wires said if any restriction was placed on the size of whitefish sold it should not require anything larger than three quarters of one pound.[131]

While fishermen around Port Huron on the United States' side of the lake claimed to be sheltered from Northwest winds in the late fall the Canadian shoreline felt the brunt of oncoming winter.[132] Across from Port Huron on the Canadian side of Lake Huron's main basin rests the town of Sarnia. Milton and David Wees of Sarnia were primarily seine net fishermen. They claimed pound nets and gill nets destroyed more fish than seine nets. They said if seining were the primary means of fishing the fish populations would quickly recover. They operated two pound nets and claimed the pound nets destroyed more small fish in one season than they would in three seasons using seine nets.[133]

Canadian pound net fishermen targeted a variety of species including cisco, whitefish, walleye, sturgeon, pike and a few other species. Pound nets were very rare north of Goderich and south of Manitoulin Island. Most of the fishing in the Goderich region was done by gill netters. A. McClean was a fisherman out of Goderich. McClean fished with pound nets. He said fishermen on the Canadian side seldom left fixed nets placed into November because of the danger of storms destroying the gear. He thought that if the weather would cooperate November would be the best month for cisco fishing.[134] McClean ranked seine nets as the most indiscriminate and destructive equipment used in the fishery.[135] He was one of several fishermen who still argued for the destruction of sturgeons. He believed fishermen should "kill them off" as fast as they could because he believed they ate the spawn of other marketable species. He said if he caught undersized sturgeons he would "not throw the small ones overboard."[136]

Captain John Cragie had fished the area around Goderich for twenty three years. He said half of his catch had at one time consisted of whitefishes, but by 1894 the fishery was "almost entirely trout."[137] He estimated the dramatic decline in whitefish had started around 1878. Despite the shift in fish populations, he speculated that overall catches were about as good as

they had ever been. Cragie also said fishery sailboats were being replaced by more efficient tugs. He said that while the sailing vessels required a three man crew, tugs needed six. Five men worked to haul the nets. Cragie was one of multiple commercial fishermen who stated fishes found dead in nets and decomposing were still utilized. Salt curing was used to make the rotting fish market ready. He claimed if the net sizes were regulated any larger the fishermen in his region would be compelled to quit fishing because the fish would simply go through their nets. The largest nets he reported using had mesh sizes of $4\ ^{5}/_{8}$ inches.[138] While he opposed regulating the size of mesh, he did not support fishing with seines. Cragie, a gill netter, believed seines were too destructive to the fishery.[139] In fact, he blamed seining operations for the whitefish decline in his region.[140]

According to Cragie, most of the region's fishes were marketed abroad. He said that outside of a small amount that was sold locally, most of the fish were sold to the Buffalo Fish Company out of New York and shipped via railroad. Cragie expressed a competitive spirit toward American fishermen across the border. He was of the opinion that he and his Canadian neighbors were better fishermen than the Americans they observed across the lake.[141] He singled out Casper Alpern of Alpena for specific criticism. He said Alpern repeatedly caught undersized fishes. He claimed that the Buffalo Fish Company had refused Alpern's fish in 1894 because they were so small.[142] Cragie was also upset by the disparity between Canadian and U.S. fishing laws. He was frustrated by the failure of U.S. States to pass closed season laws. He said he supported having a closed season, but he believed the legislation needed to be in place on both sides of the border for it to be fair and have the desired effect.[143]

Captain James Eingster of Goderich shared Cragie's opinion regarding the closed season. He did not think the current system did much good. He believed the Canadians were protecting the fisheries for their American competitors. He said the closed season "should be the same on both sides."[144] Rafts of cut logs were floated across Georgian Bay from Canadian forests, often routed to markets on the Michigan side of the shore. Eingster complained of slime and bark deposited in his nets from the rafts. The waste material dislodged from the logs as they crossed the lakes.[145] Eingster also noted the advancements in net technologies over the preceding years. He remembered the days of improvised floats along the tops of gill nets and stones to weight the bottom. In 1894 fishermen used cork floats and lead weights. He said the nets were made of finer twine than in past decades. Eingster blamed technological innovations for the declines in the catch. He pointed to the growing adoption of fishing tugs as detrimental to the supply of fishes. He believed the same limitations of sailing vessels that kept them operating a maximum of fifteen to twenty miles from shore also allowed marketable fishes safe harbor in the deepest waters of the lake. However, fishing tugs faced no such limitations and were able to steam their way almost anywhere on Lake Huron. He said the tugs in the area typically operated with four gangs of nets in the water with a fifth gang left on shore. Each gang measured approximately five miles in length. He did not favor enforcing a larger mesh size. He did not think a larger mesh would be profitable.[146] Rathbun noted that the Canadian fishermen operating around Goderich did not report much change in the lake trout populations. However, whitefish had once been caught in high numbers. By 1894 the whitefish were almost gone.[147]

Donald McCauley fished the waters around Southampton, Ontario following his arrival in 1855.[148] McCauley believed trout populations were cut in half by 1894.[149] He also said that whitefish populations declined significantly. McCauley claimed that in the early years of the fishery the whitefish he caught near the shores of the Fishing Islands north of Southampton averaged between five and ten pounds. In 1894 the average was much less. [150] McCauley blamed the accumulation of debris on the lakebed from rafts of cut logs as well as overfishing for the decline. He suspected some of the area sawmills were dumping waste directly in the lake. He wondered if they might be covering up spawning beds with their sawdust. McCauley also said that the log rafts floated across the lake to the United States were a problem. He lost nets to the bark sheared off from floating log rafts.[151] The logs rubbed together as they crossed the lake and much of their bark was released into the water.

McCauley believed there were too many men engaged in the fishing trade. He also said seine fishing had a destructive effect on the fisheries.[152] He said area fishermen sold their catches to both the Buffalo Fish Company and the firm Long and McCauley. Most of the fish were shipped out via railroad.[153] He thought the fish periodically traveled from one side of the lake to the other. McCauley was not opposed to having a closed season. Like many other Canadian fishermen he believed that both sides of the lake needed to adopt a closed season for it to be effective.[154]

Other fishermen opposed the closed season and opposed the incorporation of new restrictions. George McCauley of Southampton did not support any regulations at all. He felt the winter weather already limited fishing in his area more than enough. He said he "would not limit the fishermen, but would let everybody go in who wanted to."[155] He said ciscoes in the Southampton region were "about like" those in Lake Erie, "but might be a little longer."[156]

George McCauley was one of several fishermen who said they often captured suckers as a bycatch in their nets. He said he had thrown many tons of them overboard. He apparently hated having to deal with them and said he wished "they were all killed out of the lake."[157]

Captain John Dobson of Southampton had fished the area for thirty-five years. Dobson gill netted from a sailed vessel. He noted that Indian fishermen used to use seines at the nearby Fishing Islands. He said they would sell their catch in an effort to make "a living out of it." However, Dobson believed seine fishing damaged the fishery.[158] Like some of his other contemporaries, he noted the advent of new technologies including fishing tugs. He claimed the use of sailing vessels had peaked about fifteen years prior. He believed sailboats had declined as a growing percentage of the fishing was handled by the more efficient tugs. Dobson said sailboats typically stayed within twenty to twenty five miles of shore, although he claimed he took considerably greater risks in past years. He said at one time he would have "gone as far as 45 miles" from shore in a sailboat.[159] Rathbun himself noted that while the number of sailing vessels around Southampton had "greatly lessened" the number of tugs were on the rise. He recorded that five tugs operated in the Southampton area during the 1894 investigations.[160]

Dobson tried to support the Canadian market when possible. He marketed his fish locally through Canadian channels and avoided using the Buffalo Fish Company. He voiced his anger about the imposition of a Canadian closed season while the Michigan side had none. He believed Americans were responsible for the depletion of fishes in the lake. "The Americans have drained the fish out pretty well" he said, though he did credit the American market for providing Canadians with economic outlets. Still, the lack of a closed season on the American side incensed the aging fisherman. He thought it a "very unjust thing" that Canadian fishermen sat idle while Michigan fishermen continued to fish.[161] Dobson said whitefish had declined

dramatically, but he did not know why. He doubted that timber refuse was a factor. He admitted that fishermen likely killed them off and suspected seining operations of playing a role. Despite the decrease in whitefishes he scoffed at the notion that lake trout would ever experience a similar decrease.[162]

Canadian fishermen around the North Channel and Georgian Bay had their own share of concerns. The bay was fished primarily with gill nets as pound nets were prohibited within the bay east of a line that extended from Cape Hurd at the tip of the Bruce Peninsula to the Eastern end of the North Channel.[163] However, west of the boundary in the North Channel pound net operators were more common than gill netters. Fishermen around the bay complained of a decline in both whitefish and lake trout. Rathbun concluded the declines in the bay were due to overfishing. He noted that the North Channel region provided a "striking illustration of the waste of immature whitefish" due to the widespread use of small mesh sizes and marketing of small fish.[164]

Major Elliot was the overseer in Sault Ste. Marie, Canada. He claimed that walleye populations in the bay had dropped dramatically. Elliot stated that over the previous five years the number of walleyes along Georgian Bay's North shore had dropped by over half. Despite Canada's recent legislation against seining, Elliot said he had caught seine fishermen operating around Burnt Island in Georgian Bay. Their catch contained many undersized fishes. Elliot said seine nets made "some terrible hauls."[165] Elliot said area Indian fishermen operated successful trolling operations in the bay. They caught "a great many lake trout" that they then sold.[166]

At the South end of Georgian Bay on the East side of the Bruce Peninsula sits the town of Wiarton, Ontario. S.T. Reeves was a commercial fisherman from the area who operated gill nets. Reeves echoed many of his Canadian contemporaries regarding Canada's closed season. He said it was unfair for Canadians to sit idle during their closed season while American fishermen continued to operate without seasonal restrictions. He believed the closed season had to be in effect for everyone for the fish to truly benefit and the fishery to operate fairly for all participants. Like other fishermen, he was skeptical of the idea of having fishermen try to mix milt and eggs and return them to the lake. He did not believe fishermen would take the time to do so. He said fishermen typical just threw spawn overboard when they caught it. He said the waters around fishing tugs resembled bee hives as minnows fought to eat the spawn. He said he often threw spawn overboard to watch the small fish fight over them. Reeves said he typically dumped offal (consisting of butchered fish remains and unmarketable fishes), about one hundred feet from the water. He said shore birds typically cleaned up the remains. He declared that area Indians were "very greedy" in their quest for sturgeon heads among the remains and as a consequence the birds had taken to hiding those pieces in the surrounding shrubbery where they would return for them later.[167] Numerous fishermen reported that offal was not returned to the water for fear it would pollute fish habitats and become ensnared in their nets. David Baker of Midland echoed Reeves on that point. However, where Reeve's response to the Canadian closed season was qualified, Baker was a conscientious supporter. He said it did "not seem right though that fish should be caught in the close season when they are spawning any more than you should shoot deer when they are breeding. You not only destroy the fish but you destroy all the eggs."[168]

The interviews chronicled the growing friction between commercial fishermen and sport fishermen. "One sportsman requires about as much room as ten other men" reported John Barret Van Vlack, a commercial operator in Collingwood, Ontario.[169] Henry Yates, a fisherman in Midland, Ontario reported that sport fishing was typically done during the summer months. He said he and other commercial operators spent that time "shaking in our shoes every minute" for fear the government would restrict commercial fishermen to deeper waters in an effort to protect sport fishing. He said sportsmen were "trying their best" to drive out commercial operators.[170] "The majority of those people come from the American side" reported Midland's David Baker.[171]

Georgian Bay had its share of nets lost due to bark and waste released in the lake. Captain Alexander Clark, a fisherman operating out of Collingwood, Ontario observed hundreds of dollars worth of nets in Georgian Bay discarded after being destroyed by bark deposits. He said he stripped five hundred dollars worth of his own nets of bark and was only able to save the leads (the line the mesh of the net connects to along the bottom of the net) and the cork floats. He estimated five thousand dollars worth of damage had been done to nets in Byng Inlet, located near Parry Sound and at that time host to a thriving lumber business. Clark further stated that the buildup of bark along the bottom of the lake covered food sources that fishes depended on.[172]

Clark complained of dramatic declines in the numbers of fishes. However, while he believed timber interests were causing some damage he principally blamed overfishing. He estimated that the total number of whitefish in the North Channel had dropped by at least seventy-five percent over the preceding twenty years. He recommended enforcement of larger mesh sizes on netting and reducing the amount of equipment allowed in the lake. He said the decline in Georgian Bay was similar to that within the North Channel. Clark further stated that

he believed lake trout numbers dropped as much as whitefish. As in other areas of the lake, gill net operations were divided between fishing tugs and sail boats. Clark said sailboats usually operated three gangs of nets totaling about eight miles of netting, while the average tug operated four longer gangs of nets which totaled approximately twenty miles of netting. He believed the closed season interfered with the best time for fishing. Despite the poorer and often dangerous weather in November, Clark said he wished the closed season ran from September to October. He said he would take his chances with the weather in November because the fishing was better. He said he used to fish right through into January, but with the Canadian closed season in November it took too much time and money to set his nets back up again in December.[173]

Collingwood was home to several other fishermen the commissioners interviewed. The lakeside community on the Southern shore of Georgian Bay was host to both a sizable commercial fishery as well as boat manufacturing. Collingwood fisherman Charles Duffey said while fishermen might "do a little ship carpentering or boat building," they were usually fishing, readying nets or "doing nothing."[174] Collingwood fishermen offered a variety of opinions as to why certain lake species were in decline. Collingwood's Samuel Corson placed poachers high on his list. Corson said poachers were especially prevalent and were taking a toll on the fishery. He claimed he could show the commissioners twenty to thirty boats that had never purchased a license and that fished during the closed season in November. He believed lake trout numbers had declined even more than whitefish. Corson also added his voice to the complaints of lumbering refuse in the water. He stated that huge rafts of logs were floated over area spawning grounds. He said in some regions the lake bottom had been completely covered by bark. Corson, like many other fishermen, had lost nets due to bark getting caught in them. A gill netter

by trade, Corson supported the abolition of pound nets from Georgian Bay. He thought they were more destructive to fish because they caught fish at a faster rate.[175]

Fish were not the only animals being ensnared in nets around the lake. Other animals often turned up as a bycatch in the equipment of commercial fishermen. For example, waterfowl frequently turned up in their nets. Various avian species around the lakes dive under the water in search of fish to eat. Collingwood fisherman John Barret Van Vlack reported that ducks were a common bycatch. He said during the month of June he usually pulled one or two from his nets every time he went out to retrieve his catch. Sometimes the bycatch was much larger. Van Vlack said he knew one fisherman who caught fifteen hundred ducks in gill nets set below waters near the shoreline.[176]

On the North coast of Georgian Bay is the lakeside town of Killarney. John Noble was a well known fisherman in the region. He fished in Georgian Bay for forty years and in Killarney for twenty. Noble claimed the abolition of pound nets from Georgian Bay proper was passed due to pressure from a commercial fisherman named Gautier who fished pound nets just west of the restriction line. He charged that Gautier had a license for ten pound nets but was fishing forty. Noble claimed he had never made money faster than when he could use pound nets. However, he said his operations were repeatedly driven out of the choicest fishing areas by other interested parties. He agreed with other fishermen with the belief that the numbers of fish were down. He said the fish were "decreasing every year."[177] He said fishermen compensated for the decreasing numbers of trout by increasing the numbers of nets they deployed. Noble also lost nets to bark deposits from the large flotillas of cut logs being rafted across the bay. He claimed the bark was covering spawning beds wherever the huge rafts went. He charged that the log flotillas would eventually ruin the fishery.[178]

Killarney fisherman Donald Cameron placed the blame elsewhere. He said gill netters caused the declines in populations of marketable fishes. He said they left their nets in the water far too long without checking them and retrieving their catches. Often huge numbers of fish were rotted beyond use by the time the nets were retrieved. He claimed that recently a fisherman came in with half a day's catch that was deemed worthless. It was left to rot along the shoreline.[179]

Captain Joseph King fished the waters outside Thessalon, Ontario on the northern Shoreline of the North Channel. King was one of the first white fishermen in the region. His father had worked as a trader and lived in the region years before any large white settlements developed. King said the area's very first commercial fishing began around 1836. He said fishes had been in decline for the last thirty years. He placed the blame on pound nets. "Those pound nets were the ruination of our country" he said. Like Noble, King accused Gautier of abusing the fishery. King believed Gautier played a role in the decline of marketable species by using more pound nets than he was authorized to and by catching juvenile fishes. King charged that Gautier had single-handedly destroyed sturgeon spawning runs in the nearby Mississauga River by choking it with pound nets. He also echoed the complaints of other fishermen regarding heavy deposits of bark and other waste from the timber industry. "Between Gautier, sawdust and the bark the fish have gone" he said.[180]

King considered the Canadian closed season unfair since it did not affect fishermen from the United States. He said Americans came within half a mile of the Canadian shoreline during the closed season and caught fish. King said he and other Canadian fishermen could only "smoke our pipe and look at them raise the fish."[181] He said Americans fished in Canadian waters, but if Canadians fished in American waters their nets would be seized. He directed the

brunt of his hostility toward the American town across the North Channel from Thessalon. "Those fellows at Detour are a regular pack of scoundrels" he charged.[182]

Despite his anger toward the fishermen at Detour, King did not believe his Canadian contemporaries were entirely innocent. He said some fishermen used an apron over the larger mesh of their nets so that smaller fishes could not escape. He said the only way to prevent taking undersized fishes was to fine both the guilty fisherman and the fish dealer when small fish found their way onto the market.[183] Thessalon also produced additional criticism of sturgeons. Captain Larry King of Thessalon said sturgeons were a destroyer of other marketable species. He said he believed "sturgeon do more harm than they do good by destroying the spawn."[184] The misinformed assumption that sturgeons were major spawn destroyers was widespread around the entire lake basin. Like Joseph King, he advocated fining dealers as a way to close the market to undersized fishes. He believed fishermen were more likely to release small fish if they knew they could not sell them.[185]

Captain E. Dunn worked on the front lines of enforcement within the Canadian fishery. He captained the vessel *D.S.S. Petrel* and worked enforcing Canadian fishing regulations around Georgian Bay. Dunn stated that violators of Canadian regulations were numerous and sophisticated in their methods. Unlicensed use of trap nets was common around the islands of the bay. Dunn believed one could distinguish illegal trap netters because they would use small rowboats to work their nets. Dunn believed anyone in a rowboat with tar on his hands or tar where they held on to the oars was likely a trap net fisherman. The tar was deposited on their hands when they placed their nets in the water or later checked them. Dunn said he had confiscated many illegal nets around the bay. He admitted trap nets were one of the most difficult to control because they were usually set completely below the water and impossible to

see.[186] Many of the region's poor fishermen could only afford rowboats to work their nets. Unfortunately for them, Dunn's comments suggested their meager equipment would predispose them to extra scrutiny from authorities.

Dunn said fishermen supposedly fishing for ciscoes in November would sometimes illegally fish for trout and whitefish. While the net closest to the buoy (marking the net's location), would be a ciscoe net, the subsequent attached nets in the line would be trout nets. He believed the best way to curb the decline of marketable fishes was to limit the number of licenses being granted to fishermen.

Dunn felt that the Canadian enforcement system was a hardship on all participants. Overseers were assigned to enforcement areas that were often not logical in their size or layout. Some officers were expected to travel great distances for meager pay. Dunn stated that one officer located at Midland, Ontario was responsible for more coastline than ten others in similar positions. Dunn pointed out that licensed fishermen were assigned areas to fish that fell within a designated overseer's enforcement area. If a fisherman strayed outside of the allocated area, knowingly or otherwise, they were considered poachers and risked confiscation of their gear.[187] Despite the Canadian government's early lead in resource conservation, Dunn's experiences demonstrated the enforcement and effectiveness of the Dominion's legislation remained a problematic affair.

Numerous fishermen operating around Lake Huron reported great decreases in both whitefish and trout. However some fishermen reported that their overall catches remained just as large, or minimized the extent of the decrease. It is unlikely that decreases numerous fishermen claimed occurred over decades were overlooked by others. It is likely that at least some of the fishermen who claimed there was no change in the numbers of fishes wished to avoid

encouraging any new regulatory scheme. Fishermen developed their own methods of addressing the loss of fishing resources. As the numbers of fishes dropped precipitously, commercial operators increased the amount of gear they used to catch them. The increases in gear and effort depressed populations of marketable species still further.

After completing its exhaustive survey of the commercial fisheries operating in the waters shared by Canada and the United States, the Joint Commission recommended a comprehensive new set of regulations based on feedback gathered from fisheries participants and experts, as well as from their personal observations. The commission's recommendations included the incorporation of closed seasons, regulation of lakeside industries to prevent further pollution of the lake, limits on obstructions on tributaries that could affect the fisheries, further efforts to prevent abuses by the fishing industries themselves and creating and maintaining stocking programs that would ideally increase existing populations of lake fish. Part of the commissioners' efforts to limit the deleterious effects of the commercial fishing industry included recommendations for limiting the use of certain technologies in the lakes. For example, they recommended restricting the number of pound nets in certain areas and regulating the mesh openings on various nets. Wakeham and Rathbun further argued for pollution controls on sewage facilities and other industries.[188]

It was a bold cooperative plan designed to address an abused and embattled water resource. However, its comprehensive nature probably ensured it would not come to fruition. The commission faced entrenched and powerful fishery adversaries on both sides of the border. They attempted to construct legislation for marine fisheries on two oceans as well as for the largest freshwater fishery in the world. In the United States the commission faced fishermen who operated under Constitutional traditions that favored local and state management of fishing

resources. As author Margaret Beattie Bogue pointed out in her book *Fishing the Great Lakes* (2000), adoption would have meant Federal seizure of the power to regulate fisheries in the United States, a power not enumerated in the Constitution.[189] The subsequent election of Republican President William McKinley and an end to the years of serious depression that had accompanied the Panic of 1893 only served to further erode interest in regulating the markets of the Great Lakes. Their report was referred to the House Committee on the Merchant Marine and Fisheries in 1897 where it languished into political oblivion. In Canada the Liberal Party became the majority in 1896. They allied with the commercial fishing industry which favored no new regulations.[190]

Despite the cries of many individual fishermen that declines of numerous species of marketable fishes needed addressed, few were willing to sacrifice any of their personal profits to affect any change. Instead, fishermen chose to invest in more apparatus to offset the dwindling numbers, a move many of them recognized was detrimental to the fishes they depended on. As the nineteenth century drew to a close the future of Lake Huron's aquatic ecosystem appeared grim.

Chapter 2 endnotes

---

[1] R. Malcolm Keir, *Bulletin of the American Geographical Society*, 44, No. 8 (1912): 589, http://www.jstor.org/stable/200102.

[2] Smith and Snell, *Review of the Fisheries*, 22 (see chap. 1, n. 3).

[3] W.E. Robinson, interview by William Wakeham and Richard Rathbun, August 20th, 1894, pp. 6-7, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, Lake Erie-Lake Huron, Gill Nets – Lake Huron, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22; National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP).

[4] Claire Elizabeth Campbell, *Shaped by the west wind: nature and history in Georgian Bay* (Vancouver: UBC Press, 2005), 76.

[5] Smith and Snell, *Review of the Fisheries*, 21.

[6] Howard Irving Chapelle, *American small sailing craft, their design, development, and construction* (New York: W.W. Norton, 1951), 185.

[7] James P. Barry, *American Power Boats: The Great Lakes Golden Years* (St. Paul: MBI Publishing, 2003), 13; and Margaret Beattie Bogue, *Fishing the Great Lakes* (Madison: University of Wisconsin Press, 2000), 258 (hereafter cited as *Fishing the Great Lakes*).

[8] John Van Oosten, "Michigan's Commercial Fisheries of the Great Lakes," *Michigan History Magazine* 22, no.1 (1938): 17 (hereafter cited as *Michigan Fisheries*).

[9] McCullough, *Commercial Fishery,* 26-27 (see chap. 1, n. 67).

[10] John Van Oosten, Second Great Lakes Fisheries Conference, February 8th, 1928, File 4, History of Commercial Fishing up to 1962, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 15, Archives of Michigan, Lansing (hereafter cited as SGLC, Archives of Michigan, Lansing).

[11] A.B. McCullough, "Commercial Fishing on the Great Lakes: Resource Management and Technological Efficiency," *Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine* 11, no. 1 (1987): 14.

[12] John Van Oosten, Chief of Great Lakes Fishery Investigations to Fred A. Westerman, Fish Division, Michigan Department of Conservation, July 1st, 1943, File 1; Statistics on Fishing Gear, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 13, Archives of Michigan, Lansing.

[13] W.H.R. Werner, Ontario Department of Lands and Forests (hereafter DLF), to Fred A. Westerman, Fish Division, Michigan Department of Conservation, June 18th, 1949, File 1; Statistics on Fishing Gear, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 13, Archives of Michigan, Lansing (hereafter cited as Werner to Westerman, 18 June 1949).

[14] "Scourge Hits Lake Fishing And the Fishermen Blame Their Losses on Nets, Not Lampreys," *Detroit Free Press*, October 9th, 1949, File 1; Statistics on Fishing Gear,

Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 13, Archives of Michigan, Lansing.

[15]Werner to Westerman, June 18th, 1949, Archives of Michigan, Lansing. For further information on nylon netting see Russell W. Brown, Mark Ebener, and Tom Gorenflo, "Great Lakes Commercial Fisheries: Historical Overview and Prognosis for the Future," in *Great Lakes Fisheries Policy*, 311-312. (see chap. 1, n. 1) For research disputing the extent of efficiency increases due to nylon see Walter J. Hogman, "The Relative Efficiency of Nylon Gill Nets After Transition From Cotton Nets in a Multispecies Fishery," Transactions of the American Fisheries Society 102, no. 4 (October 1973) 778-785.

[16] McCullough, *Commercial Fishery*, 28.

[17] Brown, Ebener and Gorenflo, *Great Lakes Fisheries Policy*, 310; and McCullough, *Commercial Fishery*, 35.

[18] "Pound Nets in 1932," September 15th, 1932, File 6; Pound Nets, 1928-1950, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 14, Archives of Michigan, Lansing.

[19] John Van Oosten, "Description of Commercial Fishing Gear to be Licensed on the Great Lakes," January 11th, 1937, File 1; Statistics on Fishing Gear, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 13, Archives of Michigan, Lansing (hereafter cited as DCFG, Archives of Michigan, Lansing); and Brown, Ebener and Gorenflo, *Great Lakes Fisheries Policy*, 310.

[20] McCullough, *Commercial Fishery*, 27.

[21] Smith and Snell, *Review of the Fisheries*, 21-22.

[22] Van Oosten, *Michigan Fisheries*, 12. See also Fred A. Westerman, "The Deep Water Trap Net and its Relation to the Great Lakes Fisheries," *Transactions of the American Fisheries Society* 62 (1932): 64-71, doi: 10.1577/1548-8659(1932)62[64:TDWTNA]2.0.CO;2.

[23] Van Oosten, *Michigan Fisheries*, 12.

[24] Henry O'Malley, United States Fish Commissioner, to George R. Hogarth, Director, Michigan Department of Conservation, 13 April 1933, File 7; Deep Trap Nets, 1931-1935, House and Senate Bill #529 Introduced in 1933 Legislature, Commercial Fish Material, 1867-

1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 14, Archives of Michigan, Lansing.

[25] Van Oosten, SGLC, Archives of Michigan, Lansing.

[26] Martin Mechalson, Michigan Department of Conservation Interoffice Communication, File 7; Deep Trap Nets, 1931-1935, House and Senate Bill #529 Introduced in 1933 Legislature, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 14, Archives of Michigan, Lansing.

[27] Tom Kuchenberg and Jim Legault, *Reflections in a tarnished mirror: the use and abuse of the Great Lakes* (Sturgeon Bay, Wis.: Golden Glow, 1978), 30-31; and Robert Doherty

[28] Peter Dutcher, "Submarine Nets Defended by Fisherman," in *The Fisherman*, vol. 2, 3 (1933): 8.

[29] Van Oosten, *Michigan Fisheries*, 12.

[30] Van Oosten, SGLC, Archives of Michigan, Lansing.

[31] Van Oosten, DCFG, Archives of Michigan, Lansing.

[32] Bogue, *Fishing the Great Lakes*, 258; Van Oosten, "Description of Commercial Fishing Gear," Archives of Michigan, Lansing; and Russell W. Brown, Mark Ebener, and Tom Gorenflo, "Great Lakes Commercial Fisheries: Historical Overview and Prognosis for the Future," in *Great Lakes Fisheries Policy*, 313.

[33] "Home Made 'Gizmo' Cuts Fishermen's Work in Half," July 21st, 1946, *Bay City Times*, File 1; Statistics on Fishing Gear, 1926- 1963, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 13, Archives of Michigan, Lansing.

[34] A.J. Neering, Michigan Conservation Officer to Harold Treat, Regional Supervisor, Michigan Department of Conservation, June 6th, 1946, File 1; Statistics on Fishing Gear, 1926-1963, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 13, Archives of Michigan, Lansing.

[35] John J. Bukowczyk "Migration, Transportation, Capital and the State in the Great Lakes Basin, 1815-1890," in *Permeable Border: The Great Lakes Basin as Transnational Region, 1650-1990* (Pittsburgh: University of Pittsburgh Press, 2005), 50.

[36] Van Oosten, *Michigan Fisheries*, 25-26.

[37] William G. Rector, "From Woods to Sawmill: Transportation Problems in Logging," in *Agricultural History*, vol. 23, 4 (October 1949): 240.

[38] Casper Alpern, interview by William Wakeham and Richard Rathbun, August 24th, 1894, pp. 19-20, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, Lake Erie-Lake Huron, Pollution – Lake Huron, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Pollution, USFWS, RG 22, NACP).

[39] James Cleary, interview by William Wakeham and Richard Rathbun, Aug 26 1894, pp. 23-26, RJC, LE-LH, Pollution, USFWS, RG 22, NACP.

[40] Casper Alpern interview, p. 22, RJC, LE-LH, Pollution, USFWS, RG 22, NACP.

[41] R. Malcolm Keir, "Fisheries an Example of the Attitude toward Resources," in *Bulletin of the American Geographical Society*, vol. 44, 8 (1912): 584 (cited hereafter as "Fisheries an Example"), 584.

[42] R. Malcolm Keir, "Fisheries an Example," 584-585.

[43] John J. Bukowczyk "The Production of History, the Becoming of Place," in *Permeable Border: The Great Lakes Basin as Transnational Region, 1650-1990* (Pittsburgh: University of Pittsburgh Press, 2005), 6-7.

[44] Victor Konrad and Heather N. Nicol, *Beyond Walls: Re-inventing the Canada-United States Borderlands* (Burlington: Ashgate Publishing, 2008), 60.

[45] Frederick E. Haynes, "The Reciprocity Treaty with Canada of 1854," Publications of the American Economic Association, vol. 7, 6 (November, 1892): 7-9 (cited hereafter as "Reciprocity Treaty").

[46] Haynes, "Reciprocity Treaty," 25-33.

[47] While the economic promise of the treaty seemed great, not all scholars have agreed that it ultimately benefited Canada to any great material extent. See Lawrence H. Officer and Lawrence B. Smith, "The Canadian-American Reciprocity Treaty of 1855 to 1866," in *The Journal of Economic History*, vol. 28, 4 (December 1968): 598-623.

[48] Robert Gillingham, p. 53, Records of the Joint Committee, Lake Erie-Lake Huron, Regulations-Lake Huron, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service,

Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Regulations, USFWS, RG 22, NACP).

[49] Margaret Bettie Bogue, "To Save the Fish: Canada, the United States, the Great Lakes, and the Joint Commission of1892," in *The Journal of American History*, vol. 79, 4 (March 1993): 1438-1439 (hereafter cited as *To Save the Fish*).

[50] Bogue, *To Save the Fish*, 1439-1440, 1447-1448.

[51] Ibid., 1441.

[52] *Report of the Joint Commission Relative to the Preservation of Fisheries in Waters Contiguous to Canada and the United States* (Ottawa: S.E. Dawson, 1897): 95 (hereafter cited as *Report of the Joint Commission*).

[53] *Report of the Joint Commission*, 93.

[54] Samuel Butterfield, interview by William Wakeham and Richard Rathbun, Aug 18 1894, p. 1, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[55] Thomas Sims, p. 4, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP; and W.E. Robinson interview, p. 7, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[56] Thomas Sims, p. 4, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[57] Samuel Butterfield, p. 1, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP, g 2; and Samuel Butterfield, RJC, LE-LH, General, USFWS, RG 22, NACP, (see chap. 1, n. 34).

[58] Samuel Butterfield, pp. 1-3, Records of the Joint Committee, Lake Erie-Lake Huron, General Acct. of Fishing, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (Hereafter cited as RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP)

[59] Samuel Butterfield, p. 2, Records of the Joint Committee, Lake Erie-Lake Huron, Whitefish, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Whitefish, USFWS, RG 22, NACP).

[60] David Belrose, pp. 29-30, RJC, GB, vol. 2, USFWS, RG 22, NACP (see chap. 1, n. 22).

[61] Thomas Sims, p. 1, Records of the Joint Committee, Lake Erie-Lake Huron, Regarding Informants, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22,

National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Informants, USFWS, RG 22, NACP).

[62] Thomas Sims, p. 6, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[63] Thomas Sims, p. 4-7, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP, (see chap. 1, n. 95).

[64] Thomas Sims, p. 6, RJC, LE-LH, Fishes, General, USFWS, RG 22, NACP.

[65] Richard Rathbun, August 1894, p. 6, RJC, LE-LH, Fishes, General, USFWS, RG 22, NACP.

[66] Ibid., 7-9.

[67] W.E. Robinson, pp. 11-12, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[68] W.E. Robinson, p. 2, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[69] W.E. Robinson, p. 5-8, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[70] W.E. Robinson, p. 7, RJC, LE-LH, Whitefish, USFWS, RG 22, NACP.

[71] Joseph Wilmot, p. 2, RJC, LE-LH, Informants, USFWS, RG 22, NACP.

[72] Joseph Wilmot, p. 9, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[73] Joseph Wilmot, p. 4, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[74] Joseph Wilmot, p. 8, RJC, LE-LH, Whitefish, USFWS, RG 22, NACP.

[75] Joseph Wilmot, pp. 3-4, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, Lake Erie-Lake Huron, Sturgeon – Lake Huron, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Sturgeon, USFWS, RG 22, NACP).

[76] Joseph Wilmot, p. 2, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, Lake Erie-Lake Huron, Herring – Lake Huron, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Herring, USFWS, RG 22, NACP).

[77] Joseph Wilmot, p. 15, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[78] Doherty, *Disputed Waters*, 28-29 (see chap. 1, n. 68).

[79] C. Corlett, pp. 17, 19, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[80] Richard Rathbun, "General Statement of Condition of Fishery, Cheboygan," p. 25, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[81] Dan Corlett, interview by William Wakeham and Richard Rathbun, August 23rd, 1894, p. 16, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[82] Dan Corlett, pp. 23-24, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[83] Dan Corlett, pp. 26-27, RJC, LE-LH, Fishes, General, USFWS, RG 22, NACP.

[84] William Gill, interview by William Wakeham and Richard Rathbun, August 22nd, 1894, p. 24, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[85] Richard Rathbun, "General Statement of Condition of Fishery, Cheboygan," p. 27, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[86] William Gill, p. 12, RJC, LE-LH, Whitefish, USFWS, RG 22, NACP.

[87]William Gill, p 20, 22, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[88] William Gill, pp. 21-23, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[89] William Gill, p. 25, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[90] Richard Rathbun, "General Statement of Condition of Fishery, Cheboygan," pp. 28-29, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[91] David Lincoln, interview by William Wakeham and Richard Rathbun, August 25th, 1894, p 26, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[92] David Lincoln, p. 26, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[93] David Lincoln, pp. 39, 41, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[94] Ibid., 38.

[95] David Lincoln, pp. 38-39, RJC, LE-LH, Fishes, General, USFWS, RG 22, NACP.

[96] David Lincoln, p. 27 RJC, LE-LH, Pollution, USFWS, RG 22, NACP.

[97] Richard Rathbun, pp. 28-32, RJC, LE-LH, Pollution, USFWS, RG 22, NACP.

[98] S.H. Case, interview by William Wakeham and Richard Rathbun, August 25 1894, pp. 28, 30, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[99] Ibid., 30.

[100]George Penniman, interview by William Wakeham and Richard Rathbun, August 28 1894, p. 41, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[101] John Gillingham, interview by William Wakeham and Richard Rathbun, August 30 1894, p. 55, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP; and Louis Dubey, interview by William Wakeham and Richard Rathbun, August 30 1894, p. 59, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[102] Robert Beutel, interview by William Wakeham and Richard Rathbun, August 29 1894, pp. 45, 47, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[103] Robert Beutel, pp. 53-54, RJC, LE-LH, Fishes, General, USFWS, RG 22, NACP.

[104] Robert Beutel, pp. 11-12, RJC, LE-LH, Herring, USFWS, RG 22, NACP; and H. A. Benson, interview by William Wakeham and Richard Rathbun, August 29, pp. 12-13, RJC, LE-LH, Herring, USFWS, RG 22, NACP.

[105] Louis Dubey, p. 60, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[106] Louis Dubey, pp. 17-18, RJC, LE-LH, Herring, USFWS, RG 22, NACP.

[107] Richard Rathbun, p. 18, RJC, LE-LH, Herring, USFWS, RG 22, NACP.

[108] Avery Selkirk, interview by William Wakeham and Richard Rathbun, September 1st 1894, p. 64, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[109] Avery Selkirk, p. 51, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP; and Richard Rathbun, p. 52, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[110] Avery Selkirk, p. 26, Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, Lake Erie-Lake Huron, Miscellaneous Fishing – Lake Huron, Field Notes, 1894, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as RJC, LE-LH, Misc. Fishing, USFWS, RG 22, NACP).

[111] Avery Selkirk, pp. 34-38, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[112] Avery Selkirk, pp. 57-58, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[113] Avery Selkirk, pp. 51, 48-49, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[114] Avery Selkirk, p. 65, RJC, LE-LH, Fishes, General, USFWS, RG 22, NACP.

[115] "The City of Alpena, Brief Early History" *Alpena Weekly Argus*, January 1, 1891.

[116] Richard Rathbun, p. 31, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[117] Casper Alpern, pp. 18-20, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[118] Casper Alpern, p. 24, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[119] Casper Alpern, p. 9, RJC, LE-LH, Lake Trout, USFWS, RG 22, NACP.

[120] Casper Alpern, p. 24, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[121] Ibid., 4.

[122] Richard Rathbun, pp. 31-32, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[123] C.S. Hampton, interview by William Wakeham and Richard Rathbun, 1894, p. 10, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[124] Ibid., 11-12, 16.

[125] S.P. Wires, interview by William Wakeham and Richard Rathbun, 1894, pp. 36, 38-39, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[126] S. P. Wires, p. 41, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[127] Ibid., 38.

[128] S.P. Wires, 29-30, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[129] S.P. Wires, p. 24, RJC, LE-LH, Lake Trout, USFWS, RG 22, NACP.

[130] S.P. wires, pp. 43-44, 47, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[131] S.P. Wires, pp. 30-31, RJC, LE-LH, Whitefish, USFWS, RG 22, NACP.

[132] Avery Selkirk, p. 64, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[133] Milton and David Wees, interview by William Wakeham and Richard Rathbun, September 3rd, 1894, p. 57, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[134] John Cragie, interview by William Wakeham and Richard Rathbun, September 5th, 1894, p. 69, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP; and A. McClean, interview by William Wakeham and Richard Rathbun, September 5th, 1894, pp. 71-73, RJC, LE-LH, Pound Nets, USFWS, RG 22, NACP.

[135] A. McClean, p. 37, RJC, LE-LH, Misc. Fishing, USFWS, RG 22, NACP.

[136] A. McClean, p. 23, RJC, LE-LH, Sturgeon, USFWS, RG 22, NACP.

[137] John Cragie, p. 41, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[138] Ibid., 42-44, 49, 51-52.

[139] John Cragie, p. 59, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[140] John Cragie, pp. 53-54, RJC, LE-LH, Whitefish, USFWS, RG 22, NACP.

[141] John Cragie, p. 58, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[142] John Cragie, p. 66, RJC, LE-LH, Fishes, General, USFWS, RG 22, NACP.

[143] John Cragie, p. 60, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[144] Jame Eingster, interview by William Wakeham and Richard Rathbun, September 5th, 1894, p. 62, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[145] Jame Eingster, p. 51, RJC, LE-LH, Pollution, USFWS, RG 22, NACP, pollution.

[146] Jame Eingster, pp. 53, 56-57, 60, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[147] Richard Rathbun, p. 65, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP.

[148] Donald McCauley, interview by William Wakeham and Richard Rathbun, September 7th, 1894, p. 10, RJC, LE-LH, Informants, USFWS, RG 22, NACP.

[149] Donald McCauley, p. 68, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[150] Donald McCauley, p. 58, RJC, LE-LH, Whitefish, USFWS, RG 22, NACP.

[151] Donald McCauley, pp. 52-54, RJC, LE-LH, Pollution, USFWS, RG 22, NACP, pollution.

[152] Donald McCauley, p. 60, RJC, LE-LH, Whitefish, USFWS, RG 22, NACP.

[153] Donald McCauley, p. 68, RJC, LE-LH, General Acct. Fishing, USFWS, RG 22, NACP, general.

[154] Donald McCauley, p. 64, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[155] George McCauley, interview by William Wakeham and Richard Rathbun, September 7th, 1894, p. 65, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[156] George McCauley, p. 26, RJC, LE-LH, Herring, USFWS, RG 22, NACP.

[157] George McCauley, p. 55, RJC, LE-LH, Misc. Fish, USFWS, RG 22, NACP.

[158] John Dobson, interview by William Wakeham and Richard Rathbun, September 7th, p. 45, RJC, LE-LH, Misc. Fishing, USFWS, RG 22, NACP.

[159] John Dobson, p. 92, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[160] Richard Rathbun, pp. 94-95, RJC, LE-LH, Gill Nets, USFWS, RG 22, NACP.

[161] John Dobson, p. 67, RJC, LE-LH, Regulations, USFWS, RG 22, NACP.

[162] John Dobson, p. 65, RJC, LE-LH, Whitefish, USFWS, RG 22, NACP.

[163] Alexander Clark, interview by William Wakeham and Richard Rathbun, September 11th, 1894, RJC, GB, vol1, pp.19-20, USFWS, RG 22, NACP.

[164] Richard Rathbun, September, 1894, RJC, GB, vol1, pp. 6, 8, 12, USFWS, RG 22, NACP.

[165] Major Elliot, interview by William Wakeham and Richard Rathbun, pp. 48-49, RJC, LE-LH, Misc. Fishing, USFWS, RG 22, NACP.

[166] Ibid., 50.

[167] S. T. Reeves, interview by William Wakeham and Richard Rathbun, September 8th, 1894, RJC, GB, vol1, pp. 24, 33, 39-40, 20, USFWS, RG 22, NACP.

[168] David Baker, interview by William Wakeham and Richard Rathbun, September 12th, 1894, RJC, GB, vol2, pp. 18, 19, 25, USFWS, RG 22, NACP.

[169] John Barret Van Vlack, RJC, GB, vol1, p. 20, USFWS, RG 22, NACP.

[170] Henry Yates, interview by William Wakeham and Richard Rathbun, September 12th, 1894, RJC, GB, vol2, pp. 19-20, USFWS, RG 22, NACP.

[171] David Baker, RJC, GB, vol2, p. 9, USFWS, RG 22, NACP.

[172] Alexander Clark, RJC, GB, vol1, pp. 11, 49-50, USFWS, RG 22, NACP.

[173] Ibid., 32, 33, 44, 36-37, 40.

[174] Charles Duffey, interview by William Wakeham and Richard Rathbun, September 11th, 1894, RJC, GB, vol1, p. 3, USFWS, RG 22, NACP.

[175] Samuel Corson, interview by William Wakeham and Richard Rathbun, September 12th, 1894, RJC, GB, vol1, pp., 27, 23, 28, 31, 37-38, USFWS, RG 22, NACP.

[176] John Barret Van Vlack, RJC, GB, vol1, p. 17, USFWS, RG 22, NACP.

[177] John Noble, interview by William Wakeham and Richard Rathbun, September 14th, 1894, RJC, GB, vol2, pp. 3, 6, 9, USFWS, RG 22, NACP.

[178] Ibid, 21, 20.

[179] Donald Cameron, interview by William Wakeham and Richard Rathbun, September 14th, 1894, RJC, GB, vol2, p. 1, USFWS, RG 22, NACP.

[180] Joseph King, interview by William Wakeham and Richard Rathbun, September 17th, 1894, RJC, GB, vol2, pp. 6-7, 14, 1-2, 32, 35, USFWS, RG 22, NACP.

[181] Ibid., 4.

[182] Ibid., 39.

[183] Ibid., 20-21.

[184] Larry King, interview by William Wakeham and Richard Rathbun, September 17th, 1894, RJC, GB,, vol2, p. 39, USFWS, RG 22, NACP.

[185] Ibid., 46.

[186] E. Dunn, interview by William Wakeham and Richard Rathbun, September 13th, 1894, RJC, GB, vol2, pp 6-7, 9-10, USFWS, RG 22, NACP.

[187] Ibid, 28, 12, 18.

[188] *Report of the Joint Commission*, 109-110, 117.

[189] Bogue, *Fishing the Great Lakes*, 247.

[190] Ibid., 247-248.

Chapter 3 - A failed mandate: The 1908 International Fisheries Commission, its aftermath and the continuing problem of Great Lakes fisheries management

Limiting the competition

Despite their success using increased amounts of modernized fishing gear to generally keep pace with depleted numbers of fishes, commercial operators were anxious about the fisheries. Heightened anxieties tended to increase the focus on perceived competition. White commercial fishermen and government regulators disproportionately blamed Indian fishermen for endangering the catch. Indigenous subsistence patterns were completely disrupted by relocation as well as intensive lumbering and commercial fishing operations. Indian fishermen did their best to adapt to the new system, often working in the employ of American and Canadian owned fishing operations. Sometimes commercial outfits encouraged Indians to fish during the closed season and then bought their catch. Margaret Beattie Bogue described such an arrangement between the Noble Brothers of Killarney, Ontario and the Indians of Manitoulin Island.[1]

Lake Huron Ojibwes and other area nations negotiated treaties with both the United States and the Dominion of Canada to protect their rights to fish. Some of the most significant included the aforementioned 1836 Treaty of Washington between the United States Government and Ojibwes and Odawas. In Canada the Robinson Treaties of September 7th and 9th, 1850 ceded most of the land around Lake Superior and much of the northern Lake Huron region. In 1854 Ojibwes ceded a further 1.5 million acres of Southern Lake Huron lands known as the Saugeen

Tract. In exchange the signatory Indian nations retained their right to hunt and fish on ceded lands.[2]

In Canada the Dominion's Department of Marine and Fisheries adopted policies that interfered with indigenous fishermen and contravened earlier treaties. For example, in 1894 the department accused Indians of Walpole Island of being unnecessarily cruel in their sturgeon fishing methods. The Walpole Indians were using fishing methods identical to white fishermen and their gear belonged to an American company that employed them. Officers raided the fishing site and confiscated the gear. Samuel Wilmot and Edward Prince were among the Dominion's officials who opposed upholding treaty rights on the grounds that commercial fishing companies would just continue to employ Indian fishermen during the closed season. Conservation officers in the Dominion sought to subjugate Indians to the same conservation laws followed by other commercial operators regardless of treaty agreements. When the Saugeen Reserve Ojibwes wished to fish for food in 1894 and 1895 the Department of Marine and Fisheries initially denied them access. The department lifted the ban only when they decided the Ojibwes' seriously needed food and their fishing activities would not negatively affect the commercial industry. In the United States Michigan officials followed a comparable course of enforcement toward indigenous fishermen in waters claimed by the state.[3] Indians were expected to adhere to state conservation laws in clear violation of Federal treaty guarantees. While state, provincial and national government officials failed to implement a cooperative regulatory system, they followed remarkably similar courses in their enforcement of existent legislation on Indian peoples.

Renewed hope in a new century

The twentieth century started with promise. The 1800s ended on a bright note for the commercial fisheries, with record total catch in 1899 of 146,617,000 pounds of fish.[4] Despite Rathbun and Wakeham's failure to induce Canada and the United States to jointly regulate the embattled fisheries of the Great Lakes, support for an international compact continued to simmer. In the United States various parties interested in curbing the widespread abuse of Great Lakes fish resources coalesced to push for change. In April of 1905 the Minnesota State House of Representatives introduced a remarkable resolution that requested the United States government take "full control" over the Great Lakes and that the State of Minnesota cede "any jurisdiction claimed" over the lakes.[5] The influential American Fisheries Society joined the call for action. At its 1905 convention the society affirmed its support for Federal action and pledged "its membership individually and as a society, to get their respective Congressmen and Senators committed to the support of this measure."[6] The following year the society amplified its support, declaring the depletion of various fishes an "evil" and urging joint international control of "not only the stocking but the protection" of fishes.[7]

A. Kelly Evans of the Ontario Fish and Game Protective Association urged Washington to act. Kelly questioned whether the U.S. Federal Government had the ability to legislate over the sovereign control the states had on the lakes, but viewed some sort of cooperative effort with Canada as essential to better management. The Ontario Fish and Game Protective Association waged its own regional effort at protecting sturgeon in the Lake Nipissing and French River regions in Ontario. Local fishermen asked for netting privileges in specific areas of those water

bodies. They alleged that the sturgeons inhabiting those areas were spawn eaters that disproportionately damaged other populations of fishes. The association played an important role in blocking those efforts.[8] "I would like to see the stable door locked before the horse is stolen" Evans said. He charged that if the status quo remained in effect conditions "in our waters will be even more alarming than at present."[9]

Others continued to protect the status quo Evans critiqued. Pennsylvania's commissioner of fisheries declared it would be a "national misfortune to have a close season during the spawning period" for catfish, herrings and walleyes - including the now extinct blue walleyes.[10] In the midst of the tug of war over regulations officials in Washington decided to act. A renewed effort to establish international fishery regulations in the boundary waters between Canada and the United States came to fruition. "We are taking up the work of the Joint High Commission" Elihu Root wrote to George M. Bowers, the Commissioner of Fish and Fisheries in January of 1906.[11]

On April 11th, 1908 the Boundary Waters Fisheries Treaty was signed by President Theodore Roosevelt. Part of the treaty provided a framework for designing a new management scheme for fisheries in the boundary waters between Canada and the United States. The treaty created a new international commission to again survey the fisheries in boundary waters and develop a set of recommendations for future management. Dr. David Starr Jordan represented the United States. Canada initially chose former Ontario Deputy Commissioner of Fisheries Samuel Torel Bastedo. Bastedo resigned in December 1908 in order to take another governmental position. He was replaced by Dr. Edward Prince. The commissioners were given six months to develop a series of recommendations for the joint management of fisheries resources.[12] The treaty was given a four year life span. It would then expire one year after

either government called for revisions. On July 12th of 1908 the Toronto Globe heralded the progress that had been made toward international regulation. The Globe saw the treaty as the successful fruition of years of "persistent agitation by officials and private citizens interested in fish preservation on both sides of the line."[13]

The treaty represented a huge break with state rights precedent over the lakes. The American Society of International Law devoted a special section of the July, 1908 issue of its journal to a consideration of the then new treaty. In an editorial comment they declared:

> . . .on account of the division of powers between the Federal and State governments under the Constitution the regulation of the fisheries in these boundary waters within the territorial limits of the several States is a subject of State rather than of Federal jurisdiction, and that Congress has no authority, in the absence of a treaty giving such authority, to pass laws to regulate or protect the fisheries in such waters. Notwithstanding this exclusive jurisdiction of the several boundary States over these fisheries in the absence of a treaty, the right of the treaty-making power to take jurisdiction over these fisheries is recognized. . .and such power has been exercised in full measure in entering into the present treaty.[14]

Not all legal theorists welcomed extending Federal power into the Great Lakes. In a 1910 essay in the *American Journal of International Law* Harry E. Hunt examined the application of U.S. Federal criminal law in the region through consideration of an 1890 act that gave Washington jurisdiction for various crimes. Hunt discussed the Constitutional tradition of states rights and the erosion of those rights in ominous terms. He warned;

> While the states have adjusted themselves to changed conditions, and their loss of jurisdiction along certain lines is not being openly deplored, there will come a time when to stretch rather than to amend the Constitution, in matters which involve great losses of state jurisdiction, will mean national unpleasantness.[15]

Others were elated with the renewed effort at joint management. The American Fisheries Society expressed glowing optimism. They claimed joint regulation would mark a "distinct epoch" in American fisheries history and they pledged their support to the new commission.[16]

The commissioners visited various fisheries located in shared boundary waters from the East Coast to the Pacific Northwest. Their time was limited. A number of associates assisted in compiling information. Frank N. Clark was Superintendant of the United States hatchery at Northville, Michigan. Clark was interviewed by Barton W. Evermann. Evermann was head of the scientific division within the Bureau of Fisheries and assisted the commission in their accumulation of data. Clark told Evermann that the fisheries around Alpena were no longer productive. They had been destroyed, Clark argued, by Alpena's discharge of raw sewage, the accumulation of sawdust and other timber waste from area mills, and by the fishermen themselves. Clark said too many juvenile fish were caught. Large hauls of logs were still towed out into the lake through the bay as they were transported to markets to the south. They rolled and bumped together as they were towed, which continued to release large quantities of bark into the lake. Area fishermen continued to find large pieces of bark and debris in their nets, sometimes as far as fifty miles out in the lake. Clark favored increasing the minimum size restrictions on lake trout and whitefishes.[17]

A.B. Alexander, Chief of the Division of Statistics and Methods within the Bureau of Commercial Fisheries also assisted with interviews. At Alpena, Michigan Alexander interviewed a Mr. I. Lincoln, who had worked both as a dealer and a fisherman. Lincoln favored joint U.S. and Canadian control of the lakes. He believed fishermen would respect international law once it was in place. William Beebe was the manager for the commercial fishing business of A. Booth and Company in Alpena. Beebe stated that whitefish were generally not caught in cisco gill nets which typically 2 ¾ inch mesh in the Thunder Bay area.[18] This statement may have influenced the commission's eventual decision to legislate the size of cisco nets at 2 ¾ inches.

Lincoln and some other Alpena area fishermen claimed Canadian tugs were regularly fishing in American waters. The fishermen further alleged that A. Booth and Company was operating tugs under the auspices of the Dominion Fish Company and that the two shared fishing waters across the international border. They charged that the American company actually owned the Dominion Fish Company. They claimed that Booth affiliated tugs working for the Dominion Fish Company would transfer their catch to company tugs operating on the American side in order to avoid paying duty fees. The company was accused of violating the laws in other ways. The twine used in Lake Huron was primarily of Scottish manufacture and carried a large import fee. Some fishermen claimed A. Booth and Company was transferring twine from Canadian to American tugs. "I am inclined to think that there is some truth to the above statements" Alexander wrote in his journal. "The day I left Alpena a tug belonging to I. Lincoln brought in 14 boxes of fish, and 2 tugs belonging to A. Booth and Co. brought in 67 boxes."[19] In fact, the Dominion Fish Company had been incorporated as a subsidiary of A. Booth and Company's Chicago based business in 1899.[20]

Fishermen continued to offer contradictory advice. For example some fishermen wanted regulations on the size of fish that could be sold, while some said the size of mesh should be regulated. Others wanted no new regulations. A former fishermen and dealer named Joseph Gansey in Sault Ste. Marie recommended regulations on both fish and nets. Others wanted the laws changed to level the playing field between individual fishermen with limited resources and larger operators with greater capital and equipment. Michigan started experimenting with closed seasons at the end of the nineteenth century, but certain fishermen were still authorized to fish so long as they also gathered spawn for state hatcheries. Frank King, a commercial fisherman stationed at Mackinaw Island complained that the large wholesaler A. Booth and Company could fish during the closed season on whitefish, but individual fishermen could not. King believed "poor fishermen" deserved the same fishing privileges as the large company.[21]

Henry Platt of Rogers City claimed that state game wardens never investigated his catch when he used A. Booth and Company as an intermediary to markets. However, when he tried to handle the sale of his fish, wardens would check his catches for undersized fish on an almost daily basis. Numerous other fishermen and even the Deputy Collector of Customs shared Platt's convictions that state authorities showed significant favoritism toward A. Booth and Company, but scrutinized individual fishermen.[22]

A. Booth and Company wielded far more resources than the average fisherman. The Booth Company was incorporated on July 20, 1898 with a capital of 5.5 million. It operated its own fishing vessels and purchased fishes caught by competitors. It was the largest fishing operation on Lake Huron at the time the second international commission made its rounds of the lake. It remained an influential business on the Great Lakes until the time of the Great

Depression.[23] For self-employed fishermen, A. Booth and Company was the elephant in the room. Superintendant of Michigan's State Hatchery Harry Marks claimed A. Booth and Company operated pound nets around Whitefish Bay, Michigan at incredible depths. He said the company connected individual pound net piles together at their ends in order to double their lengths.[24] The pound nets at Whitefish Bay may have been the deepest pound nets ever operated in the lakes.

Despite the efforts of commissioners the informational trips lacked the depth of the voluminous and detailed transcripts taken by the previous decade's international commission. The time frame given to the commission to complete their interviews and prepare their recommendations, a scant six months, likely contributed to their apparent failure to interview numerous interested parties. The commission's decision to withhold their subsequent recommendations from the public also contributed to a growing atmosphere of suspicion and dismay among commercial operators.

Many fishermen reported that they felt left out of the process. Seymour Bower, the Superintendent of Michigan's State Board of Fish Commissioners wrote to Evermann in dismay. Bower said sources at Mackinaw had informed him that "commercial fishing interests west of the Soo to the Wisconsin line have been absolutely ignored" and that "practically the same situation" existed along Lake Huron's Michigan shoreline. Bower urged better communication and less secrecy. He said the commissioners were risking a "rocky road" by not promulgating their legislative plans. "As one who has for many years preached Federal control of interstate and international waters, I urgently recommend that the revised proof sheets be placed in the hands of commercial fishermen all along the line."[25] While discontent and apprehension simmered in various locales, there were people working in the fisheries who supported the

commission. For example, wholesaler August J. Anderson of Marquette Michigan on Lake Superior stated he "sided with the International Fisheries Commission" on its various proposed net regulations.[26]

The commissioners created drafts of their proposed ordinances and then further trimmed the recommendations. Several preliminary regulations did not make the final cut, including a rule banning fishing between nine PM Saturday and six o'clock AM the following Monday morning. Another code banning all commercial fishing with nets from Lake Champlain was also cut from the final list.[27] The compiled regulations were forwarded to President Taft on January 31st of 1910. On February 2nd Taft passed the regulations on to Congress for their consideration. In Canada there was resistance to the treaty, especially within Parliament's House of Commons where members worried the treaty usurped their law making power.[28] Nonetheless, the treaty was signed into law by the Canadian Parliament in 1910.[29] However, in the United States strenuous objections arose.

The power of an idea: the small cisco of Saginaw Bay

One of the new regulations called for a 2 ¾ inches minimum mesh opening for catching ciscoes in the Great Lakes. Rathbun and Wakeham had suggested bifurcating Lake Huron into separate pound net enforcement zones. They proposed pound nets north of a line running from North Point, Michigan (near Presque Isle) to Clark Point, Ontario should be no less than four inches after net shrinkage from tarring. South of the line they recommended pound net pot mesh be no smaller than 2 ½ inches after initial shrinkage.[30] In 1909 Michigan passed a law that established minimum mesh sizes for pound nets at 2 ¼ inches.[31] The 1908 commission proposed a line from Thunder Bay Light, Michigan to Cape Hurd, Ontario. North of the line the regulated

size of netting in the back of pound net pots was fixed at no smaller than 3 $^{1}/_{8}$ inches. South of the line the recommended minimum mesh size for the back of the pot was 2 ¾ inches.[32] That quarter inch difference in the legislation proved pivotal for Michigan fishermen. At Saginaw Bay on Lake Huron the outcry was especially vociferous. Saginaw Bay fishermen relied heavily on pound nets and seines. Pound nets used for ciscoes in the bay were included under the recommended 2 ¾ inch mesh minimum. Saginaw Bay fishermen and processing facilities argued that the 2 ¾ minimum mesh for ciscoes was too large.

The Robert Beutel Company played a central role in organizing resistance. Beutel and his allies wrote to various officials in Washington. They claimed the regulations would destroy the Saginaw Bay fishery. They argued that they had not seen any of the proposed regulations and had to rely on hearsay, but stated that the legislative proposal was already damaging the fishery. They said the lack of definite information caused confusion among fishermen. With a possible change in mesh requirements on the horizon, fishermen around the bay were unsure of what sized nets they should buy.[33] Fishermen were unwilling to adopt larger meshes unless legally compelled to. Additionally, Beutel claimed that larger mesh would gill more undersized whitefish in Saginaw Bay's pound nets. However, the centerpiece of their resistance was the claim that Saginaw Bay was home to a smaller variety of cisco than Lakes Erie and Superior.[34]

During their 1908 investigations, A.B. Alexander concluded Saginaw Bay fishermen were taking large numbers of undersized fish. Alexander stated that the fishermen of the area were primarily concerned with "a large share regardless of the injury they might do to any one branch of the fisheries."[35] He believed that they were landing "larger quantities of small fish" than most other fishing operations and argued that the "most effective way to prevent the destructive waste" was to restrict both the numbers of nets fished and increase the mesh sizes.[36]

There likely were a large number of small ciscoes in Saginaw Bay. Historically the bay provided a key spawning area for ciscoes, so it is hardly surprising that high numbers of smaller ciscoes would have been in the vicinity.[37] In fact, later research showed that in general adult Saginaw Bay ciscoes were not significantly different in size from ciscoes in other regions. Years later Biologist John Van Oosten and others concluded the fishermen of the bay were in fact catching juvenile fishes.[38]

Incredibly, Commissioner and famed fisheries biologist David Starr Jordan apparently took the fishermen at their word. In a letter to the Beutel Company Jordan suggested the commission might have erred by including Saginaw Bay in its regulations and admitted the commission did not have adequate information about the bay's fishing gear and the possibility of different cisco sizes in the bay at the time they formulated their regulations. He said he now knew the claims of slender ciscoes in the bay were a "fact" and he agreed to work with Commissioner Prince to remedy the situation.[39] These admissions suggest Jordan was not familiar with all of the field reports from his own commission or he dismissed them, as he made no mention of Alexander's conclusions. Instead, he quickly equivocated on the commission's position regarding pound net mesh. Nevertheless, Jordan urged Beutel to trust that the commission would look out for the interests of bay fishermen after the bill was passed. He argued that changes to the bill were only possible through amendments after its passage.[40] Since the Canadian government had already approved the regulations any last minute changes on the U.S. side threatened to bring the legislation to a halt in order to allow Ottawa time to reexamine and approve any revised version.

While the revolt of Saginaw Bay fishermen and processors was only one of several outcries opposed to the proposed regulations, it quickly became the most damaging. Jordan's frank admissions to Beutel only emboldened the coalition forming against the commission. Beutel and his allies appealed directly to their Congressmen and Senators. The treaty was submitted to President William Taft on January 31st. Taft turned the treaty over to Congress for their consideration on February 2nd, 1910. At the same time a contingent of Saginaw Bay fishermen made their way to Washington to appeal their case directly to Congress. They brought some cisco samples from Saginaw Bay in order to prove the fish could easily escape a 2 ¾ inch mesh. On February 16th the fishermen appeared before the Senate Committee on Foreign Relations "armed with nets, bait and a few live ciscoes in pails of water."[41] The results were swift. On February 17, 1910 the New York Times reported the Senate Committee on Foreign Relations' decision. "Against Fisheries Treaty" sounded the article. The Senate sent the treaty back to the Secretary of State, claiming it would destroy the Lake Huron cisco industry.[42] Another newspaper aimed its sites directly on Jordan when it sniped:

> David Starr Jordan probably wishes he had interviewed those Saginaw Fishermen first. As it stands, a senate committee got the first word and the luster of the Californian's reputation as a piscatologist has departed. A song of triumph is wafted from the camp of the Saginaw fishermen.[43]

Republican Congressman Joseph W. Fordney of Saginaw, Michigan argued that the regulations "would be disastrous to Saginaw Bay fishermen."[44] When U.S. Commissioner of Fish and Fisheries George Bowers expressed skepticism regarding whether fishermen would have bothered to bring any larger cisco specimens to Washington, Fordney defended his constituents. He said he regretted that the commissioner questioned the intentions of the

fishermen and whether the fish presented to the Senate Committee on Foreign Relations were of average mature size. "I am no fisherman" Fordney admitted, "but those gentlemen brought what they claimed to be matured herring" to Washington.[45] In June of 1910 the Detroit Free Press announced that the fisheries commissioners were finally convinced that ciscoes in Saginaw Bay were "smaller than others."[46] Canadian officials could only sit on the sidelines while the legislation ground to a halt in the United States. Canadian supporters of the agreement were displeased with Washington's handling of the treaty. They believed too many details were made public prior to Congressional review.[47]

Meanwhile, the argument that Saginaw Bay ciscoes were a smaller variety steadily gained ground with the fisheries commissioners. By the following April even the previously skeptical George Bowers was acknowledging the dubious claim as "fact" in his correspondence with Beutel.[48] In June of that year the Detroit Free Press announced that both Jordan and an initially skeptical Prince agreed that Saginaw Bay should have been exempted.[49] As the treaty descended into limbo, numerous Great Lakes fishermen were unsure about what regulations were in force. August Anderson, a fisherman in Marquette, Michigan wrote the commission wondering when the new regulations would go into effect. Anderson said he supported the new larger mesh sizes and protecting the fishes, yet he said he could not order nets for the following year until he knew if the regulations were in effect. His willingness to protect resources by purchasing larger nets was apparently dependent on the new restrictions being shared by all.[50] Like the fishermen of Saginaw Bay, Anderson was reluctant to adjust his mesh sizes unless compelled to do so. The commission urged Anderson to contact his local representatives and ask them to support pushing through the legislation so he could move forward with his business. They charged that "Certain fishing interests at Saginaw Bay" had successfully delayed passage

of the legislation.[51] Secretary H. Hinrichs Jr. of the Keystone Fish Company in Erie wrote to Commissioner Barton Evermann in April of 1911. Hinrichs Jr. stated that the larger $3\ ^{1}/_{8}$ inches mesh size recommended by the commission for Lake Erie were working out fine but his company had been "unable to ascertain the status" of international regulations.[52] The commission was quick to seize upon the statements about the effectiveness of the mesh in order to deflect criticism from other corners. When another Lake Erie fisherman wrote to the commission objecting to the proposed $3\ ^{1}/_{8}$ inch mesh size for that lake, the commission responded that the size was "agreeable to the Keystone Fish Co., perhaps the largest users of gillnets in Lake Erie."[53]

In the spring of 1911 Dr. Jordan resigned his position. He was replaced by Job Hedges. Hedges had little direct experience in fishery matters. The commission attempted to get the bill through Congress by simply removing large, controversial sections. In May of that year a modified version of the bill was given to the Senate Committee on Foreign Affairs. The new version lacked several divisive components included in the original treaty. It excluded entire regions from enforcement, including Saginaw Bay, Puget Sound and all of Lake Erie. No further action was taken on the treaty. [54] Lamenting the failure of Congress to enact the regulations, Fisheries Commissioner George Bowers stated that

> No set of fishery regulations can be drawn which will have any value whatever in the preservation of the fisheries which will not meet with opposition from some local interest. And if local interests are permitted to control, the large problems of fishery conservation can never be properly handled.[55]

Stripping Lake Erie and the other districts from the legislation effectively nullified it. The new version was unacceptable to Canada. Bowers lamented that the new version was "only a fragment of a body of fishery legislation that should be considered as a whole."[56]

Saginaw Bay was not the only region to voice its objections to the proposed regulations. Once the commission had formulated its set of regulatory measures, determined opposition arose from several locales. Because the commission's report recommended regulations for both marine and freshwater fisheries, objections arose from the West Coast and the East, in addition to opposition from fishing interests in the Great Lakes. Fishermen from various regions rejected proposed regulations on net mesh sizes, types of fishing equipment and other components. However, it was the Saginaw Bay fishermen who appeared before the Senate and they were credited by the commissioners for stalling the legislation's passage. The delay ultimately led to a permanent rejection. In an attempt to both get the legislation passed while satisfying its numerous critics; the commission stripped it of its most controversial components. The changes were significant, both weakening the proposal and rendering it unpalatable to the Canadian Government, which had approved the report in its original form. Despite efforts at revision, the treaty was withdrawn by the British 1914.[57]

In Canada utilization of fisheries remained an important topic for the provincial and Dominion governments. The Dominion drafted its own set of revised fishery legislation after the failure of the International Commission's legislation.[58] Shortly thereafter National Fish Day was established in Canada as a day to raise awareness of Canadian fisheries and boost sales of their products.[59] In 1923 the Canadian Fisheries Association authored an article on the importance of Canada's fisheries. The publication of the article coincided with National Fish Day that year. The Department of Marine and Fisheries in Ottawa then distributed the article to Canadian

newspapers with a request to publish.[60] The article, aimed at "educating the public" used ocean fisheries for its examples, but was meant to apply to both oceanic and inland fisheries. It began;

> If the young of one single species of fish – for example the herring – were allowed to mature without interference by man or molestation by natural enemies in the seas, in the matter of a few years the seas would be unable to contain that species alone. And if all the thousands of fishes matured one hundred percent of their progeny, in a surprisingly brief time the seas would be impassable to ships.
>
> This probably illustrates better than anything else the copiousness of the fishery resources of the world, and fortunately for Canada, we dominate waters which are the most fertile on earth. . .
>
> . . .We have the mechanical resources and the intrepid, hardy citizenship to prosecute our fisheries to the maximum, but unfortunately our population does not patronize the industry to justify more intensive fishing than at present."[61]

The Great War and afterward

In the United States World War I led to support for a different kind of cooperation with Canada in regard to shared fishing waters. William Redfield, then Secretary of Commerce, urged United States Food Administrator Herbert Hoover to support the opening of U.S. ports to Canadian fishing vessels. With Canada and the United States allied in World War I, Redfield believed the measure would lead to a "considerable increase in the amount of fish food" available in the United States.[62] In 1918 U.S. ports were opened to entry by Canadian fishermen. However, suspicion of the Canadians and a desire to limit their competition remained widespread.

Animosity toward Canadian fisheries was not limited to the Great Lakes. Luther Maddocks of Boothbay Maine had a long history with the Atlantic fisheries, including ownership of Maddocks Packing Company in Boothbay, Maine.[63] He was a long time opponent of fishing regulations and he also opposed allowing Canadian fishermen to use American ports. He had much to say on both subjects. "The migratory fishes that visit our coast" he said of Maine's Atlantic waters in 1911 "need no protection and the efforts of man cannot perceptibly diminish the supply."[64] He believed Canadians had nothing to offer in return for the use of American ports. He stated that most U.S. deep sea fishing vessels were already commanded by "Canadians, Newfoundlanders and Italians."[65] United States Pacific Coast fisheries lodged their own series of complaints to Congress around 1916 and 1917. The group charged that Canada was attempting complete "absorption" of United States fisheries.[66] Federal officials were far from unanimous in their support of the plan. Deputy Commissioner of Fisheries Henry F. Moore opposed opening the ports. He believed it would be "impossible" for American fishermen to compete and that they would be driven from the coastal boundary waters. He accused Canada of acting out of "self interest and the desire to drive an advantageous bargain."[67] On the East Coast some processors did voice support for the initiative. Charles F. Wonson of the Gloucester Salt Fish Company supported allowing Canadians use of area ports. He believed people in the United States needed all the fish they could get.[68] Nonetheless, the rights extended in 1918 were abrogated shortly after the end of World War I.

By the early 1920s there had been virtually no further Federal action related to international management of Great Lakes fisheries. In 1922 a convention was proposed for the prevention of pollution in the boundary waters between Canada and the United States. The convention focused on a paragraph from a boundary waters treaty of January 11, 1909 that

restricted pollution that might damage property on either side of the border. Deputy United States Fisheries Commissioner Henry F. Moore said he assumed property would include the fishes that were "owned" by the states, Ontario and the Dominion government. He warned that since fish were migratory, pollution could damage "property rights" on both sides of the international boundary, regardless of who the actual polluter was.[69] Moore, who strenuously opposed opening American ports to Canadian fishermen during World War I, here demonstrated the widespread perception that the lakes were property with resources owned by the political entities that claimed their waters. He was willing to work with Canada to protect those property rights from damage by other industries.

When it came to regulation of commercial fisheries, Moore favored a minimalist approach. His view of the fisheries was shaped entirely by economic considerations. In November of 1922 the Central States Food, Drug and Dairy officials Association passed a series of resolutions asking for Federal control of the Great Lakes fisheries. They recommended a treaty with Canada "for the purpose of uniform conservation, propagation and utilization" of Great Lakes fishes.[70] Despite the interest in regulating pollutants, the overall direction of the Federal Bureau of Fisheries at the time can be ascertained through an exchange Moore had with the Ontario Department of Marine and Fisheries regarding the use of certain Alaskan fishes as fertilizer. Moore said he favored regulations only so far as they provided an early precedent should fisheries interests become so large and powerful that developing regulations later from the outside could prove difficult. However, fishes were given no regard beyond their economic value. Moore said the Fisheries Commissioner, Henry O'Malley, shared his views. "The Commissioner and I. . .both agree" he said "that there is nothing gained by merely permitting the fish to live in the sea without some effort to utilize them for economic purposes" as long as

future supplies were not jeopardized. Moore did not favor strong regulations, instead recommending "moral suasion" to maintain aquatic resources.[71]

By May of 1926 the mood in Washington was again shifting toward support for some kind of intervention in the Great Lakes fisheries. Henry O'Malley continued as fisheries Commissioner in Washington. Lewis Radcliffe was by then Deputy Commissioner in O'Malley's department. Radcliffe did not share his predecessor's hands off approach to Great Lakes management. He warned that investigations by the Bureau of Fisheries concluded the fisheries of the Great Lakes were in serious trouble. Using Lake Erie as an example, he said the fisheries were threatened with the "danger of exhaustion."[72] Populations of ciscoes and whitefish were believed especially endangered. Radcliffe and O'Malley believed the 1908 treaty failed due to its breadth in attempting to cover boundary waters fisheries from coast to coast. Radcliffe advocated a new international agreement focused solely on the Great Lakes.[73]

Secretary of Commerce Herbert Hoover was also convinced negotiating a boundary waters treaty with Canada was the only way the Great Lakes fisheries would "be saved from ultimate exhaustion. . ." Hoover pointed to Lake Erie, control of which was shared by four states, the Province of Ontario and Canada's Dominion Government. The plethora of interests led to legislative chaos and a lack of cooperation. Hoover recommended creation of a treaty that would provide both a joint study of the conditions of the lakes and establish a centralized regulatory agency.[74] In July of 1928 Michigan Senator Arthur H. Vandenberg discussed the idea of an international treaty with Commissioner O'Malley. Vandenberg wondered whether the numerous, competing, individual interests of the Great Lakes were "insurmountable." He suggested "Federal leadership" might be the only way "formidable progress" could be made.[75] With a key Michigan Senator apparently on board and renewed support within the United States

Bureau of Fisheries it appeared that a cooperative international management scheme for the Great Lakes fisheries was again a real possibility. The lines of communication between the Bureau of Fisheries and Senator Vandenberg grew.

The subject was referred to Deputy Commissioner Radcliffe. Radcliffe supported the idea of Federal intervention. He told Vandenberg that he believed "a number of the important fisheries" were "threatened with economic exhaustion" without significant intervention. Radcliffe said the tendency of the competing states was to "revise the laws downward to the standards of the State with the least effective regulations."[76] Vandenberg responded with interest and asked Radcliffe to develop a proposal outlining exactly how they might go forward with the development of an international regulatory agency. He suggested that the State Department assume responsibility for negotiating international talks and the Bureau of Fisheries take charge of interstate discussions. Vandenberg said he was interested in pursuing the matter further during the next session of Congress.[77] In August Commissioner of fisheries Henry O'Malley told Commissioner Radcliffe he initially supported letting the states "work out their own salvation" but admitted it appeared they never would. O'Malley said he would cooperate with Vandenberg "to the fullest extent" if Vandenberg proved willing to get things moving forward in Michigan.[78]

In September Radcliffe again wrote Vandenberg, advising him of O'Malley's support and new conviction that the states would not cooperate effectively without Federal guidance. Radcliffe suggested that Vandenberg contact the state department and ask them to in turn contact Canadian authorities regarding the possible development of a new international fisheries treaty.[79] In his response Vandenberg retreated from his earlier statements that appeared to favor Federal intervention. Ignoring Radcliffe's suggestions for moving the international process forward, he

now said he agreed with O'Malley's initial contention that the states should be allowed to "work out their own salvation." He said he had submitted the "entire matter" to the Michigan Department of Conservation and would get back in touch with Radcliffe when the "situation clarifies at the state capital."[80] With that the renewed effort to design an international compact fizzled. Radcliffe and Vandenberg initially asked each other to take the first steps at bringing the various affected parties together. Vandenberg's sudden rejection of pursuing an international agreement likely reflected his isolationist convictions. He opposed President Wilson's League of Nations and was a strident isolationist until World War II. He gradually came to advocate internationalism only after the Japanese attack on Pearl Harbor and his subsequent conviction that the postwar world would require more effective and modernized international security.[81]

Life of the lake

The first half of the twentieth century was a time of change for Lake Huron. For the numerous communities of fish and other aquatic species beneath its surface, the century brought a swift erosion of native ecological diversity and the introduction of numerous new competitive species. On its surface and shores, commercial fishermen and their lakeside communities struggled to find economic viability in the fisheries as catch totals fluctuated wildly. Ineffectual efforts at resource conservation collided with individual, regional and corporate economic interests. Fishermen, government bureaucrats and conservation officials in Canada and the United States eyed each other warily. Mutual suspicions and regional interests slowed the development of joint regulation to a lethargic pace. Economic instability only fueled the lack of cooperation as people dependent on fisheries markets sought to maximize their share of the shrinking pie. The numbers of recreational fishermen were steadily growing and with them the

friction between commercial operators and sport fishing interests. It was a time that demanded swift and sweeping legislative intervention to stem the tide of fisheries decline. Unfortunately for the industry, it was also a time of little meaningful change in the management of the lakes.

In the first decades of the twentieth century sailing vessels, rowboats, gas boats and tugs dotted the waters of the Great Lakes seeking their fortunes. For many fishermen the commercial catch was the only livelihood they knew. When he applied for a license to net sturgeon on the French River in 1926, David Lamonday of Byng Inlet, Ontario said fishing was the only thing to do where he lived.[82] A.G. Bowie returned home to Ontario after serving overseas in World War I. Bowie wanted to become a commercial fisherman. He applied for a license to set up two pound nets in Georgian Bay. Bowie stated he had "considerable experience as a fisherman" which he acquired while fishing with his father. He said his father's expertise was based on "60 years of fishing in the Georgian Bay and Lake Superior."[83]

At the beginning of the twentieth century Michigan's commercial fishery had little regulatory control. Although the state experimented with short closed seasons beginning in 1897, some fishermen were allowed to keep fishing so long as they gathered spawn for hatcheries. In 1919 Lake Trout fishing was closed state wide from October 10th through November 8th. Whitefish season was closed from November 20th through December 15th. Additional state wide regulations on pike, suckers and yellow perch followed in 1927.[84] Spawn fishing was still allowed by permit during the closed seasons. More permits were issued than were necessary and the system provided fishermen with an excuse to continue fishing during the closed seasons.[85]

The Department of Agriculture's Chicago Station undertook a comprehensive investigation of the Great Lakes commercial fisheries operating in Lakes Michigan and Huron

beginning in 1920. They subsequently issued their findings in 1922. The primary investigator was one J. Feldbaum. The research uncovered shocking conditions in the Great Lakes fisheries. Sanitary conditions at fish packing plants were declared "abominable." The inspectors observed widespread abuse of fish resources as well as considerable deception in the marketing of fishes. Fishermen were observed operating as many as eight to ten gangs of gill nets in the water at once. Since most fishermen could only effectively pull one gang a day, innumerable fishes died in the nets and slowly decayed before being delivered to the packing house. Commercial operators had access to ice in order to prevent widespread spoilage on board fishing vessels. Using ice was especially important on hot days. However, very few fishing boats were seen carrying ice for preserving the catch. The inspection noted some fishermen bringing in catches with approximately 75 percent of the fish dead and decaying.[86]

Even fish that decayed in submerged nets for days were brought to the docks without ice. At the docks the fish were often packed in ice to await transport. At various docking areas the investigators noted a lack of shade in which to store fish. Catches were often left in the sun until the arrival of transportation to a processing and packing facility. This meant the ice could be long melted by the time the catch reached a processing plant. None of these issues prevented rotting fish from being sold to consumers. A system had developed to support the processes in place. Similar methods of marketing spoiled fish the previous century were carried on into the twentieth. Decayed fish were routinely declared soft fish or "smokers." They were soaked overnight in brine and bicarbonate of soda and then smoked anywhere from two to seven hours. Smoked chubs and other less desirable species were sometimes relabeled as trout and whitefish and sold. The investigation found that fish labeled as "smokers" were unfit for human

consumption. Smoking houses were using food coloring to hide imperfections in the spoiled fish. [87]

Further issues plagued the U.S. industry. In addition to the filthy conditions at processing plants, the fishermen were given used boxes to haul fresh fishes. Fishermen lacked facilities to clean out the boxes so new fresh catches of fishes were exposed to the remains and refuse of previous catches. At fishing plants in Alpena, Bay City, Cheboygan and Frankfort Michigan processing facilities drew their wash water from streams shared by the raw waste of the municipal sewage systems. The water was in turn used to wash fishes, clean out used fish containers and make ice for packing and storage. Perhaps not coincidentally, Frankfort, a town on Lake Michigan, was the site of repeated typhoid outbreaks.[88]

After their discouraging findings, the Chicago Station and the State of Michigan cooperated on an "educational campaign" in June of 1922. Their intervention was timely. Estimates in 1922 suggested over two billion pounds of fish were annually consumed in the United States. They urged packing plants to clean up their facilities and encouraged fishermen to incorporate more sanitary methods for handling fishes. Commercial fishermen were urged to limit their numbers of nets in the lake and to haul sufficient ice to preserve their catches. On a follow-up trip in September investigators noted improvements at most packing facilities. Approximately fifty percent of observed fishermen carried packing ice on their boats. However, investigators did not see any changes in the large numbers of gill nets being fished. Further, they expressed skepticism regarding certain improvements they witnessed. For example, they suspected area smoking houses would not reject or destroy partially decayed fishes without the inspectors' presence. Federal investigator Feldbaum recommended new legislation to limit the

number of gill nets employed by fishermen and follow-up inspections and seizures of decaying fish to ensure compliance with the new sanitary recommendations.[89]

Following the embarrassing discoveries and recommendations by the Federal inspectors, the State of Michigan's Department of Agriculture passed a new sanitary code with the approval of the Michigan Fishermen's Association in January of 1923. The new code called for a separate room at packing facilities to be used exclusively for the cleaning, handling and packing of fishes. Rooms were to be kept clean and "free of flies." The revised rules called for clean washroom facilities and washable caps for employees. Tables and utilities were to be cleaned "one or more" times per day. Water was not to be used from contaminated sources. Fishing boats were also ordered to be kept in a sanitary condition.[90]

Among fishermen tensions remained high between competitors on different sides of the international border. Canadian fishermen were wary of their American neighbors. Many Canadians were convinced that Americans ignored Canadian laws on land and water. Neil MacNaughtan worked as the Game and Fisheries Overseer for the Parry Sound district from 1920 until 1946. He often walked a line between enforcement of the region's fish and game laws and listening to discontented locals complain about insufficient or unfair enforcement of Canada's fishery legislation. Often American fishermen and tourists were the source of local complaints. A "large number of Americans were here this summer and treated our game law as a joke" complained a resident of Dwight, Ontario in the fall of 1925. The American tourists had been overheard bragging "that they had never been asked for and never had a license." Shortly thereafter they were safely across the border in the United States.[91] Abuse by recreational anglers was a growing occurrence. Many Canadians considered American tourists notorious for breaking Canadian catch laws. "They can catch as many fish as they like and shoot all the deer

they like" complained Pickerel River resident Angus Prisk.[92] An innkeeper in Muskoka, Ontario stated that some tourists were good sportsmen, and "others not, and either through ignorance or otherwise make a big catch of trout down to 5 or 6 inches and less." He said "It gets my goat when I see a string of the undersized trout caught" and stated when tourists made the mistake of showing him their undersized fish he did not hide his displeasure.[93]

Recreational fishermen from the United States were not the only ones garnering criticism in Ontario. It was common for commercial fishermen to cross international waters and fish illegally with nets. In the early 1930s the Ontario Game and Fisheries Department in Toronto received numerous complaints about illegal netting by Americans in the Canadian waters of Lake Huron. One complaint even originated from an American fisherman.[94]

The Canadian enforcement boat *Miseford* was subsequently dispatched on May 26th, 1935 to inspect fishing waters near the international boarder. The captain of the *Miseford* found a buoy numbered 245. The buoy lacked a name as required by regulations. The officer estimated the buoy at a full four miles inside Canadian waters. He followed the nets and discovered them to be about seven miles in length, with no buoy marking the opposite end of the net. The officer estimated the end of the net to be fully six miles within Canadian waters. A total of fourteen boxes of gill nets were lifted and confiscated. Within two months the Port Huron, Michigan based fisherman who had placed the nets wrote his Congressional representative in regard to the confiscation. The constituent likely hoped added political pressure would convince Canadian authorities to return his nets. He claimed his nets were two and a half miles west of the international boundary in U.S. waters. After a series of exchanges between Canadian and American representatives and an internal investigation of the issue by Canadian authorities, Ontario's Lieutenant Governor H. A. Bruce wrote to the Secretary of State in Ottawa

and advised him of Ontario's decision. Bruce said the Ontario Department of Game and Fisheries believed the officer's actions were fully justified and the department was prepared to present their evidence in any court of law.[95]

Americans were not the only fishermen who continued to profit through dubious means in the Canadian waters of Lake Huron. At the turn of the century James and Charles Noble operated a commercial fishing enterprise running boats out of Killarney, Collingwood and other locations within Georgian Bay. At the time Killarney was isolated. It was fifty miles from the nearest railroad station and only accessible overland or by boat. The Nobles caught, bought and sold fish and operated a general merchandise store that catered to the area fisheries. The Nobles were widely suspected of numerous illegal fishing infractions. By the late 1880s they were being monitored – such as they could be – by Canadian law enforcement. In 1893 Pierre de Lamorandier, the local lighthouse keeper in Killarney, started supplying the Department of Marine and Fisheries with information about the Nobles' illegal activities. At least two years of virulent harassment, intimidation and violence followed as the Nobles and their associates targeted Lamorandier and his family because of his willingness to work with authorities.[96]

The bay's insufficient number of patrol officers continued to try to enforce the fishing codes for the region. In 1894, four of the Nobles' tugs were impounded when they were caught fishing without licenses. Although the Nobles eventually secured the release of the fishing tugs they sued the Canadian Department of Marine and Fisheries for damages. The Nobles, long time Canadian Conservatives, shrewdly courted the influence of the out of power Liberal opposition and their case subsequently became a political football in the Canadian House of Commons. In 1902 they were awarded $18,563 in damages. At their height the Nobles were probably worth around $200,000, a very substantial sum for fishermen of the day. Their financial power gave

them the ability to defend themselves against regulation at a level poorer fishermen could not achieve. Following the Noble's political and financial victory over the Department of Marine and Fisheries locals claimed they were soon out violating the fishing laws all over again.[97]

Illegal netting continued to be a serious problem as the twentieth century progressed. Overseer MacNaughtan regularly heard from citizens complaining about illegal and out of season fishing both by locals and tourists. Individual violations were most common. For example, in April of 1927 a commercial tug operator complained that some gill net license holders along the North shore of Georgian Bay were fishing from row boats with seine nets and threatening the livelihood of legitimate gill net fishermen.[98] During a patrol in May of 1931 MacNaughtan confiscated a seine net from two fishermen operating without a license in Georgian Bay.[99] While these small scale violations were the most frequent type officers encountered, more sophisticated criminal operations were occasionally discovered. In May of 1926 District Warden P. Stevenson sent MacNaughtan information from the office of the Minister of Game and Fisheries. An illegal fishing and shipping operation was believed to be operating out of Point Au Baril, North of Parry Sound. The perpetrators were illegally catching and delivering bass to area buyers. Some of the catch was turning up in area restaurants. MacNaughtan was ordered to seize the operation's nets and shut the group's activities down.[100]

Despite the efforts of Canadian authorities, many people were unconvinced they were doing enough to curb abuses within the fishery. On July 12th of 1927 *The Globe* published a letter from one angry resident of Parry Sound. "Times without number complaints and protests have been made. . .but thus far without any results" they charged. "Illegal fishing is going on up and down the shore. . .The men engaged in it have grown so bold that they drive their stakes for

seines and other illegal methods openly. . .relying. . .on their complete immunity from interference."[101]

While MacNaughtan and other fish and game officials struggled to maintain the laws in their districts, a lack of sufficient manpower and equipment hampered travel and enforcement in the Canadian waters of Lake Huron. MacNaughtan maintained detailed journals of his travels around the Georgian Bay region, much of it on foot. Other barriers to enforcement also arose. In August of 1927 enforcement officials received a tip regarding illegal trap nets in use near the Limestone Islands East of Parry Sound in Georgian Bay. Captain H. Gidley was ordered to Parry Sound. He was instructed to cooperate with Overseer MacNaughtan in the seizure of the nets. However, Gidley failed to show up. His patrol boat was out of commission.[102]

At other times enforcement of conservation measures conflicted with basic subsistence practices. In May of 1931 as most of North America shuddered under the aftershocks of the United States' stock market crash of 1929, Deputy Minister McDonald blasted members of his department for targeting hungry, impoverished people illegally fishing for something to eat. He suggested officers "lay off" enforcing game laws on subsistence fishing intended to keep families from starving. "It is this class of enforcement" he charged "that makes it difficult for the Department to maintain public sympathy in the interest of conservation."[103] Members of Ontario's First Nations were also targets of provincial enforcement. Indians were expected to abide by the same laws as Ontario's other residents. For example, while patrolling Shawanaga Township near Parry Sound in May of 1940, MacNaughtan twice seized fish from Indigenous fishermen. They had been caught fishing during Ontario's closed season.[104]

Not all Canadians were convinced illegal fishing caused the decline in fishing fortunes. The same day *The Globe* ran its angry letter, the Georgian Bay Tourist Company of Midland, Ontario wrote to Deputy Minister McDonald to congratulate his department for their "exceptionally good work" controlling illegal fishing and to point out what they believed were the real threat to stocks of desirable fish. They believed suckers and carp bore the primary responsibility for declines in other species. The company representative claimed he watched a large number of suckers ravage a bass spawning bed while he was on a houseboat. The company offered to operate under a government bond in order to assist authorities in the destruction of the undesirable fish. If something was not done quickly, they warned, "the waters will have practically no game fish."[105]

Overfishing remained a serious problem as well. During MacNaughtan's tenure with the Ontario Department of Game and Fisheries the issue of overfishing sometimes worked to shape policies on the local level. For example, in April of 1926 Byng Inlet fisherman Joe Hubert was denied a license to fish in Georgian Bay with a pound net. The department stated that the area in question was "already overfished."[106] Hubert reapplied in May, changing his request to a gill netter license and switching to a slightly different region in the bay. He also included some additional information related to illegal seining he had witnessed, perhaps hoping to positively influence his request.[107]

Canada's sport fishermen and the tourist enterprises that served their needs were anxious to push commercial netters away from the streams and rivers recreational fishermen used. The records for the Parry Sound region demonstrate the conflict that simmered between commercial fishermen and sport fishing interests. The same year Hubert initially failed to secure a license for Byng Inlet another pound net operator came into conflict with a local recreational fishing

club that catered to tourists. The club began to complain to government officials about the effect commercial pound nets were having on the sport fishery. The pound net operator responded that he saw his own livelihood threatened by "those yankee."[108] In January of 1927 C.W. West and Son complained to MacNaughtan of "fishing dropping off at an alarming rate" due to commercial nets that were placed near the mouths of the French and Bad Rivers in Georgian Bay. They worried about the impact the loss of fish would have on the region's tourist industry.[109] Similarly, N. L. Martin, the secretary-treasurer of the Hartley Bay Club asked the Deputy Minister of Game and Fisheries to investigate a commercial fisherman believed to be ruining the fishing for the club's tourists.[110] All around Georgian Bay, clubs and other businesses that catered to the growing sport fishing industry complained about the numbers of fish being taken by commercial netters.

Within the Canadian commercial fisheries individual profitability varied widely. In 1920 the Pillgrem brothers fished near the mouth of the French River on Georgian Bay, in the vicinity of the Bustard Islands. They ran a four man crew on a nearly twenty-seven ton fishing tug. They valued their tug at approximately five thousand dollars. They had sixty thousand yards of gill nets valued at an additional five thousand dollars. In 1920 they hauled in an estimated 38,900 pounds of Whitefish valued at 10 ¾ cents a pound Canadian, or $4,181.75. They also caught 25,660 pounds of trout sold at the same price per pound for a total of $2,758.45. Together their grand total for the year was $6,940.20 Canadian.[111]

Contrasting the better equipped tug boat fishermen were men like W.R. Wallace. Wallace valued his unpowered boat at thirty dollars. He had 2,500 yards of gill nets which he valued at $125.00. In 1920 Wallace caught 650 pounds of trout which he sold salted at fourteen cents a pound. He caught an additional 140 pounds of trout which he sold fresh for thirteen cents

a pound. This put his total profit for the season at $109.20.[112] These numbers do not take into consideration gear purchases and upkeep, fuel, license fees and other additional costs.

Michigan regulations and a renewed call for cooperative management

Michigan's commercial fishery was the largest of the Great Lakes states. Surrounded by freshwater along most of its borders, Michigan hosted commercial netters who operated in Lakes Erie, Huron, Michigan and Superior. In 1859 the approximate value of the Great Lakes commercial fishing catch was $900,000. $650,000 of that total originated from Michigan waters. In the first half of the twentieth century Michigan produced more freshwater commercial fishes than any other US state. In 1934 Michigan produced 18.8 percent of the United States' freshwater commercial fishes. Among the Great Lakes states, Michigan produced 30.8 percent of the total catch that year. At that time Lake Huron was regarded as the most import commercial repository among Michigan's lakes. For example, from 1931-35 Lake Huron accounted for 52.2 percent of the total commercial yield for Michigan. Lake Michigan was a distant second, at 28.5 percent. Despite the large hauls, populations of fishes in Michigan's waters were declining. New and modified fishing gear and increased mechanization improved efficiency and helped sustain catch numbers as overall fish populations declined. As the years rolled by, the situation continued to worsen. In 1937 Dr. John Van Oosten, director of the Great Lakes Biological Laboratory in Ann Arbor, Michigan stated "the formerly abundant fisheries of the State of Michigan, at one time universally believed to be inexhaustible, have been depleted and in many localities exterminated."[113]

As the decline continued, so did various attempts to create some sort of cooperative framework for better managing the fisheries. On March 3, 1927 representatives from several Great Lakes states as well as from Canada met in Michigan to discuss how they might better share information and improve cooperation. As a result of the meeting the International Fisheries Conservation Council of the Great Lakes was formed.[114] The first conference was followed by another meeting the following year. On February 8, 1928 the Second Great Lakes Fisheries Conference met in Lansing, Michigan. The meeting was organized by Michigan Governor Fred W. Green. Illinois, Indiana, Ohio, Michigan, New York, Pennsylvania and Wisconsin all sent representatives. While several states had neglected to send a representative to the previous year's meeting, Minnesota was the only state bordering the Great Lakes system that failed to send a representative to the 1928 meeting. Two representatives from Ontario also attended the 1928 conference. The meeting focused on relations between the states and the Province of Ontario. Attendees shared information from their respective regions and discussed how they could all collaborate in managing the lakes. Governor Green warned that without cooperation the fisheries faced "annihilation."[115]

Dr. John Van Oosten, director of the then newly established Great Lakes Biological Laboratory was among the attendees. Van Oosten's laboratory was established in response to dramatic declines in Lake Erie's profitable cisco fishery. Van Oosten would go on to devote forty-two years of his life working in the United States Bureau of Fisheries and the United States Fish and Wildlife Service. During his long career he authored over ninety scientific papers and worked diligently to better understand and thus improve management of the fisheries of the Great Lakes.[116]

Van Oosten warned that despite the discouraging trends in fish populations, recent surveys of the lakes' fishermen exposed a continuing resistance to any suggestion of new regulations. Fishermen who operated on Lake Erie were especially vociferous in their rejection of the idea. "The dissension among the Lake Erie fishermen" he stated "has reached the point where all efforts put forth at the present time to effect cooperation in the framing of regulatory measures are practically doomed to failure."[117] He recommended an impartial investigation of all of their objections. He believed finding the solutions to their grievances might lead to the development of uniform regulations not only for Lake Eerie, but for all of the Great Lakes. Lake Erie fishermen pointed to pollution, bull and trap nets, small net mesh sizes, the number of nets employed and predatory blue walleye feeding on herring eggs as the various causes of that lake's decline in choice marketable species.[118] Blue walleye, a subspecies of yellow walleye, were driven extinct by the fisheries a few short decades later.[119]

The attendees discussed the rise in fishing gear and nets in the lakes as well as the decline of various fishes. They conferred about methods for improving their systems for obtaining statistics on fish populations. Different localities tracked fish populations differently and used some species names interchangeably. For example, the United States Bureau of Fisheries included statistics on chubs, bloaters and lake herrings (ciscoes) together under the heading ciscoes. Ontario included chubs and bloaters under herrings. Most attendees at the meeting said they were willing to modify the way in which they gathered statistics in order to make them more uniform. However, they voiced concerns about the reliability of fishermen to record them consistently.[120]

Despite the eagerness of most attendees to share concerns related to their individual regions, disagreements and age old competitiveness arose when the meeting turned to the stickier topic of harmonizing individual laws and regulations. Toronto's Inspector of game and Fisheries, H.G. Cox, was asked what Canada's minimum size restriction was on yellow pickerel. What Canadians often called yellow pickerels were known as walleyes in the United States. "Fifteen inches" he responded.[121] The representative from New York stated that would equate to about a pound in weight. Someone in the room then accused Cox's government of dragging its feet on instituting strong regulations. "Hasn't your commission been promising to come up to a pound and a half and you never came to it. I understand it has been promised for the last six or eight years." Cox explained that they would adjust their regulations when the states modified theirs as well. He went on to point out that Canada had maintained a true closed season on whitefish, salmon and trout for years. Every year Canadian fishermen petitioned the government to lift the closure because the American states had no such closed season and operated freely while Canadian fishermen sat idle. Ignoring Cox's salient point, an American delegate continued the rebuke. "You are making hijackers out of our fishermen because they don't like to throw away pound fish and have your fishermen take them." [122]

The meeting underscored the divided interests at play in the lakes. Some attendees claimed they were unable or unwilling to impose certain changes on their fishermen. The divisions between the U.S. States and the Federal Government as well as Ontario and the Dominion Government were also apparent. While the Dominion Government in Canada did not arbitrarily pass fisheries laws without input from the provinces, it carried the ultimate legislative authority. J. A. Rodd, a representative from the Department of Marines and Fisheries in Ottawa stated "The absolute power to make fisheries regulations rests with the government. . .So far as

making the laws, that is done by the Dominion Government."[123] That reality contrasted sharply with the chorus of regional interests and claims represented by the several states. The U.S. States had enjoyed a longstanding ability to regulate the fisheries as they saw fit without significant intervention from Washington. Governor Green called the conference together a third time on December 5th of that same year. One of the biggest successes of the conference was the increased awareness of the importance of good recordkeeping. Other states adopted more detailed records, likely influenced by the pioneering work in Michigan. Aside from some informal agreements on fish and mesh sizes and on the need for improved pollution control, little cooperative intervention developed in the immediate aftermath of the meetings.[124]

In May of 1933 the Smith Brothers, commercial fishermen out of Port Washington, Wisconsin visited some fishing ports along Lake Huron. They recorded that the area fishermen were financially struggling. Fishing returns were poor. The Smith Brothers claimed that fishermen they talked to were in general favorable to increased restrictions on mesh sizes as a way of protecting the fishery. Nonetheless, the Smith Brothers worried that they were witnessing "the beginning of the end" for the commercial industry.[125] With profits tumbling fishermen scrambled to maximize their catches even as they worried about a complete collapse of the fisheries. The Great Lakes were at a critical juncture that demanded sweeping changes to the status quo.

For decades the various U.S. States and many Federal officials believed hatcheries could offset declines in the numbers of various fishes. Michigan's first state hatchery was built at Pokagon, Michigan in 1873.[126] Numerous others followed. The hatcheries in turn often worked with fishermen to obtain spawn from caught fishes. However, by the early twentieth century it was evident hatcheries alone were not capable of filling the growing population voids in

commercialized species of fish. The Michigan Legislature established the first statewide closed season in 1897.[127] However, spawn licenses allowed fishermen to collect spawn for the hatcheries during the closed season. It was an open invitation to continue fishing. Fishermen were expected to turn in spawn to collection stations. The early closed seasons were designed to provide some protection to lake fishes during their spawning times. The Michigan Department of Conservation developed its early restrictions based on the varying depths and temperatures of the lakes around Michigan and how those factors appeared to affect the spawning cycle. Many commercial fishermen resisted what legislation existed and continued to fight for minimal regulations. In 1929 the State of Michigan passed legislation that declared fishes inhabiting state waters to be property of the state. Trout fishing on Lake Huron was closed from October 10th to November 4th. On Lake Michigan it was closed from October 20 to November 22nd.[128] One angry fisherman expressed his dismay over the longer closed season on Lake Michigan saying:

> I will agree that there may be a different time that the fish in different lakes might spawn but I do not believe that it takes longer for our trout to spawn in Michigan than in Huron and Superior. Is it fair that we have these extra eight days?[129]

In 1925 Fred A. Westerman became chief of Michigan's Fisheries Division in the Department of Conservation. Westerman directed the unit for the following thirty-four years. Westerman's father John H. Westerman also worked in the Michigan fisheries. John H. Westerman first worked at a hatchery in Paris, Michigan and later served as the overseer for a state hatchery at Harrietta, Michigan until his death in 1923. The elder Westerman discouraged his son from entering work with the fisheries.[130]

In 1933 the United States Bureau of Fisheries decided to close two spawning stations in the State of Michigan at Alpena and Charlevoix. Westerman concurrently recommended strengthening Michigan's closed season laws. He had observed a lot of abuses in the system. He believed that some licensed commercial operators abused their freedom to fish during the spawning season and wasted a lot of by-catch that were not ready to spawn. "I have for a long time held the belief" Westerman contended, "that it would be better to allow no fishing during the closed season, but rather allow the fish to spawn naturally."[131] Westerman developed a list of modifications to the existent closed seasons in Michigan waters. Lake Huron's closed season for Lake Trout would continue to run from October 10 through November 4th, but with no fishing for lake trout during the closed season. He made similar recommendations for the whitefish closed season running from November 5th through December 15th. Westerman believed sufficient spawn could be gathered for the state's hatchery operations just after the closed seasons ended. His recommendations were approved on September 6th.[132]

That same year, a further proposal by the Michigan Department of Conservation to classify lake trout as a sport fish raised objections within the commercial fisheries. Individual fishermen expressed their opposition to the plan, worrying that such a maneuver could eventually threaten their ability to harvest various lake fishes. Westerman attempted to assuage the fears of commercial operators by stating;

> We understand that a rumor has gained some circulation to the effect that lake trout were to be placed on the game fish list and their taking with nets for commercial purposes prohibited. . .the only possible direction such a movement may take might lead to the eventual closing of some local bay or area where such

trolling can be successfully carried on. It is preposterous to suppose that the Great Lakes will be closed to commercial fishing.[133]

Despite Westerman's reassurances, time was not on the side of the commercial fisheries. The century that opened with promise led instead to decades of failed proposals and continued abuse of dwindling lake resources. Overfishing, a lack of managerial cooperation between various political entities, continued lakeshore industrialization and pollution, the added pressure and hostility of a competitive sport fishery and a host of other issues threatened to undermine and destroy both the commercial fishery and the resources it harvested. In the environment of uncertainty fishermen scrambled to get all they could while there was still any money to be made. The ecosystem of Lake Huron reeled under the massive scale of ongoing environmental change.

The 1940s brought a time of new, unprecedented economic growth to the United States following the Great Depression. The rapid economic recovery was stimulated by the material demands of World War II. In the Great Lakes conservationist principles took a back seat to maximum food production in support of the war effort. However, before the war in Europe and Asia was over conservationists and lake fishermen alike were outmaneuvered at home by a new species that had migrated into the interior Great Lakes. Parasitic sea lampreys first entered Lake Erie via the Welland Canal over a decade earlier. By the 1940s the species had spread through the interior lake system. The number of lampreys in the lakes quickly multiplied. The introduced parasite added its own significant environmental impact to the list of factors affecting populations of native Great Lakes fishes already struggling to survive. Out of the chaos that followed a new and concerted effort to develop a cooperative international Great Lakes management system was born.

Chapter 3 endnotes

[1] Bogue, *Fishing the Great Lakes*, 77-78.

[2] Olive Patricia Dickason, *A Concise History of Canada's First Nations* (New York: Oxford University Press, 2006), 157-158, 139-140.

[3] Ibid., 78-79.

[4] Ibid., 170.

[5] "Federal Control of International Waters," copied from the Journal of the Minnesota House of Representatives, 18 April 1905, Reports and Other records Concerning State Fishing Regulations, 1905-1910, Records of the U.S. fish Commission and the Bureau of Fisheries, General Records, Records Concerning Relations with Canada, 1905-1936, Int'l Fisheries Comm., 1908-1911, State Fishing Regulations, 1905-1910, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD (hereafter cited as U.S. FC, BF, Canada, Int'l Comm., States, USFWS, RG 22, NACP).

[6] American Fisheries Society, Proceedings, 1905, State Fishing Regulations, U.S. FC, BF, Canada, Int'l Comm., States, USFWS, RG 22, NACP.

[7] American Fisheries Society, Proceedings, 1906, State Fishing Regulations, U.S. FC, BF, Canada, Int'l Comm., States, USFWS, RG 22, NACP.

[8] A. Kelley Evans, Secretary, Ontario Fish and Game protective Association, to H.M. Smith, Acting Commissioner of Fisheries, Washington, DC, 15 August 1907, Fisheries in International Waters – Great Lakes, 1906-1913, Records of the U.S. fish Commission and the Bureau of Fisheries, General Records, Records Concerning Relations with Canada, 1905-1936, Alexander's Notes, Amer. Fishery Rts: Newfoundland, 1906, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD (hereafter as U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP).

[9] A. Kelley Evans, Secretary, Ontario Fish and Game protective Association, to H.M. Smith, Acting Commissioner of Fisheries, Washington, DC, 27 August 1907, Int'l Waters – Great Lakes, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[10] W.E. Meehan, Pennsylvania Commissioner of Fisheries, to Barton W. Evermann, Bureau of Fisheries, Washington, DC, 12 November 1908, International Fisheries Commission Correspondence, 1909-1911, 1, Records of the U.S. fish Commission and the Bureau of Fisheries, General Records, Records Concerning Relations with Canada, 1905-1936, International Fisheries Commission Correspondence, 1908-1911, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD. (hereafter cited as U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP).

[11] Elihu Root to George M. Bowers, Commissioner of Fish and Fisheries, Washington, DC, 29 January 1906, Int'l Waters – Great Lakes, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[12] Bogue, *Fishing the Great Lakes*, 313 (see chap. 2, n. 7).

[13] "A Fisheries Treaty," *Toronto Globe*, July 12, 1908, Clippings, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[14] "The Boundary-Fisheries Treaty" *The American Journal of International Law* vol. 2, 3 (July 1908): 638. http://www.jstor.org/stable/2186341

[15] Harry E. Hunt, "How the Great Lakes Became "High Seas," and Their Status Viewed from the Standpoint of International Law," *The American Journal of International Law* vol. 4, 2 (April 1910): 313, http://0-www.jstor.org.library.unl.edu/stable/2186615.

[16] American Fisheries Society, Proceedings, 1908, State Fishing Regulations, U.S. FC, BF, Canada, Int'l Comm., States, USFWS, RG 22, NACP.

[17] Frank N. Clark, 31 July 1908, Alexander's Notes, pp. 55-56, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[18] I. Lincoln, August 1908, Alexander's Notes, U.S. FC, BF, Canada, Alexander's Notes, p. 35, Amer. Rts, NL, USFWS, RG 22, NACP; and William Beebe, August 1908, Alexander's Notes, p. 36, Int'l Waters – Great Lakes, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[19] A.B. Alexander, "Dominion Fish Company," 1908, Alexander's Notes, pp. 39-40, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[20] Bogue, *Fishing the Great Lakes*, 264.

[21] Gansey (sic), 6 August 1908, Alexander's Notes, p. 23, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP; and Frank King, 3 August 1908, Alexander's Notes, p. 16, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP. See also Ganley, 6 August 1908, Evermann's Journal, p. 68, U.S. FC, BF, Canada, Int'l Comm., States, USFWS, RG 22, NACP.

[22] Henry Platt, August 1908, Alexander's Notes, p. 38, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[23] Bogue, *Fishing the Great Lakes*, 264, 271-272.

[24] Harry Marks, 6 August 1908, Alexander's Notes, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP, 21. Alexander recorded that several pound nets were in ninety fathoms of water. If the pound nets consisted of two piles wired together, approximately thirty fathoms is likely closer to the maximum depths the pound nets were at.

[25] Seymour Bower, Superintendent of the Michigan State Fish Commission, to Barton W. Evermann, Bureau of Fisheries, Washington, DC, 14 December 1908, International Fisheries Treaties and Related Material, 1908-12, U.S. FC, BF, Canada, Int'l Comm., States, USFWS, RG 22, NACP.

[26] August J. Anderson, to Barton W. Evermann, Bureau of Fisheries, Washington, DC, 19 December 1908, Int'l FCC, 1, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[27] "Statutes not adopted," International Fisheries Commission, Work of the Commission, 1908-1911, U.S. FC, BF, Canada, Int'l Comm., States, USFWS, RG 22, NACP.

[28] Bogue, *Fishing the Great Lakes*, 317.

[29] Ibid., 317; and Van Oosten, *Michigan Fisheries*, 36 (see chap. 2, n. 8).

[30] *Report of the Joint Commission*, 110. (see chap. 2, n. 50)

[31]Michigan, *Public Acts of the Legislature of the State of Michigan Passed at the Regular Session of 1909* (Lansing: Wyncoop Hallenbeck Crawford, 1909): 380.

[32] H.R. Doc. N. 638, at 10, (1909).

[33] W. M. McCormic, to George A. Loud, House of Representatives, Washington, DC, 31 January 1910, Int'l FCC, 1, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[34] Ibid.; and Robert Beutel to George M. Bowers, Commissioner of Fish and Fisheries, Washington, DC, Int'l FCC, 2, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[35] A.B. Alexander, "Saginaw Bay," 1908, Alexander's Notes, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[36] Ibid.

[37] William L. Organ et al. "Past and Presently Known Spawning Grounds of Fishes in the Michigan Coastal Waters of the Great Lakes," TR 79-1, (Ann Arbor: Michigan Department of Natural Resources, 1979), 56-57.

[38] Walter Koelz, "Coregonid Fishes of the Great Lakes," Bulletin of the Bureau of Fisheries, 43 (Washington: US Government Printing Office, 1929): 492-493.

[39] David Starr Jordan, Commissioner, International Fisheries Commission, to W.M. McCormick, Bay City, MI, 11 February 1910, Int'l FCC, 1, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[40] Ibid.

[41] "Fish Treaty Turned Down," *Baltimore American*, February 17, 1910, Clippings, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[42] "Against Fisheries Treaty," *New York Times*, February 17th, 1910, Clippings, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[43] "A Tale of Three Fishermen," *Cleveland Plain Dealer*, February 22, 1910.

[44] Joseph W. Fordney, House of Representatives, to George M. Bowers, Commissioner of Fish and Fisheries, Washington, DC, 1 March 1910, Int'l FCC, 3, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[45] Ibid.

[46] "Saginaw Bay is to be Exempted," *Detroit Free Press*, June 2, 1910, Clippings, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[47] "Fisheries Action Agitates Canada," Chicago Tribune, February 14th, 1910, Clippings, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[48] George M. Bowers, Commissioner of Fish and Fisheries, to Robert Buetel Company, Bay City, MI, 19 April 1910, Int'l FCC, 2, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[49] "Saginaw Bay is to be Exempted," *Detroit Free Press*, June 2, 1910, Clippings, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[50] August J. Anderson, to Barton W. Evermann, Bureau of Fisheries, Washington, DC, 22 March 1910, Int'l FCC, 1, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[51] Barton W. Evermann, Bureau of Fisheries, to August J. Anderson, Marquette, MI, 26 March 1910, Int'l FCC, 1, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[52] H. Hinrichs Jr., to Barton W. Evermann, Bureau of Fisheries, Washington, DC, 8 April 1911, Int'l FCC, 1, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[53] Commissioner, Bureau of Fisheries, to Frank Nschbacher, Erie, PA, 28 February 1910, Int'l FCC, 1, U.S. FC, BF, Int'l FCC, USFWS, RG 22, NACP.

[54] "Memorandum re International Fisheries Treaty," International Fisheries Commission, Work of the Commission, 1908-1911, U.S. FC, BF, Canada, Int'l Comm., States, USFWS, RG 22, NACP.

[55] George M. Bowers, Commissioner of Fish and Fisheries, to Irvine L. Lenroot, House of Representatives, Washington, DC, Int'l Waters – Great Lakes, U.S. FC, BF, Canada, Alexander's Notes, Amer. Rts, NL, USFWS, RG 22, NACP.

[56] George M. Bowers, Commissioner of Fish and Fisheries, to JD Bigger, 3 February 1913, Toledo, OH, Int'l Waters – Great Lakes, U.S. FC, BF, Canada, AN, AR, NL, USFWS, RG 22, NACP.

[57] Bogue, *Fishing the Great Lakes*, 319.

[58] Ibid., 319.

[59] "February 29th A National Fish Day," *Canadian Fisherman*, 3 (1916), 70.

[60] J.J. Cowie, Acting Assistant Deputy Minister of Fisheries, to newspapers, 15 October 1923, Relations with Canada, Conferences, and Fisheries, 2, Records of the U.S. fish Commission and the Bureau of Fisheries, General Records, Records Concerning Relations with Canada, 1905-1936, Fishery Controversy; 1916-19, Privileges in Can. Ports, 1911-21, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD. (hereafter cited as U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP).

[61] National Fish Day, October 31, 1923, RCCF, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[62] William C. Redfield, Secretary of Commerce, to Herbert Hoover, Food Administrator, 23 February 1918, Privileges of American Vessels at Canadian Ports, 1, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[63] Francis B. Greene, *History of Boothbay, Southport and Boothbay Harbor, Maine 1623-1905* (Portland, ME, Loring, Short & Harmon, 1906), 375.

[64] Luther Maddocks, "Some Events in Maine Fisheries," *Lewiston Saturday Journal*, October 7, 1911.

[65] Luther Maddocks to William C. Redfield, Secretary of Commerce, Washington DC, PAVCP, 1, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[66] Pacific Coast Fishery Interests, *Canada Attempts Absorption American Fisheries*, (n.p.: 1916), PAVCP, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.; and Pacific Coast Fishery Interests, *Canada Attempts Absorption American Fisheries*, (n.p.: [1917?]), PAVCP, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[67] Henry F. Moore, Memorandum to the Commissioner, 14 January 1918, PAVCP, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[68] Public Hearing in regard to coming conference before the International Fisheries Committee, 29 January 1918, PAVCP, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[69] Henry F. Moore, Deputy Commissioner of Fisheries, to Herbet Hoover, Secretary of Commerce, 26 August 1922, RCCF, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[70] Resolutions of the Central States Food, Drug and Dairy Officials' Association, November 1922, RCCF, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[71] Henry F. Moore, Deputy United States Commissioner of Fisheries, to William A. Found, Assistant Deputy Minister of Fisheries, Ottawa, CA, 31 July 1923, RCCF, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[72] Lewis Radcliffe, Deputy Commissioner of Fisheries, to J. F. Gould, Minnesota Department of Conservation, 25 March 1926, RCCF, 1, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[73]Lewis Radcliffe, Deputy Commissioner of Fisheries, to Henrik Shipstead, Senator, Washington DC, 30 March 1926, RCCF, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22,

NACP; and Henry O'Malley, Commissioner of Fisheries, to J. F. Gould, Minnesota Department of Conservation, 1 October 1925, RCCF, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[74] Herbert Hoover, Secretary of Commerce, to Frank B. Kellogg, Secretary of State, 5 May 1926, RCCF, 2, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[75] Arthur H. Vandenburg, Senator, to Henry O'Malley, Commissioner of Fisheries, Washington DC, 23 July 1928, RCCF, 1, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[76] Lewis Radcliffe, Deputy Commissioner of Fisheries, to Arthur H. Vandenburg, Senator, Grand Rapids, MI, 25 July 1928, RCCF, 1, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[77] Arthur H. Vandenburg, Senator, to Lewis Radcliffe, Deputy Commissioner of Fisheries, Washington DC, 28 July 1928, RCCF, 1, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[78] Henry O'Malley, Commissioner of Fisheries, to Lewis Radcliffe, Deputy Commissioner of Fisheries, Washington DC, 23 August 1928, RCCF, 1, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[79] Lewis Radcliffe, Deputy Commissioner of Fisheries, to Arthur H. Vandenburg, Senator, Grand Rapids, MI, 17 September 1928, RCCF, 1, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[80] Arthur H. Vandenburg, Senator, to Lewis Radcliffe, Deputy Commissioner of Fisheries, Washington DC, 20 September 1928, RCCF, 1, U.S. FC, BF, Canada, FC, PCP, USFWS, RG 22, NACP.

[81] James A. Gazell, "Arthur H. Vandenberg, Internationalism, and the United Nations," *Political Science Quarterly*, 88, no. 3 (September 1973): 376-385.

[82] David Lamonday, to Neil MacNaughtan, Game and Fishery Overseer, Parry Sound, 4 November 1926, Neil MacNaughtan Fonds, F 4330-1-1-11, box 2, Archives of Ontario. (hereafter cited as NMF, Archives of Ontario).

[83] A.G. Bowie, to Deputy Minister of Game and Fisheries, Toronto, 13 December 1926, NMF, F 4330-1-1-11, box 2, Archives of Ontario.

[84] Michigan Department of Conservation, Closed Season for Lake Trout, Michigan waters of the Great Lakes, since 1919, File 3; Fishing Legislation, Commercial Fish Closed Seasons, 1927- 1963, Fish, Department of Natural Resources, Record Group 85-94, Box 5, Archives of Michigan, Lansing (hereafter cited as FL, CFCS, Fish, DNR, RG 85-94, Box 5, Archives of Michigan, Lansing); and the following four memos from the Michigan Department of Conservation: Memo for files, Re: Closed season on whitefish; Memo for files, Re: closed season on Northern Pike; Memo for files Re: Closed season on suckers; Memo for files Re: closed season on yellow perch, in File 3; FL, CFCS, Fish, DNR, RG 85-94, Box 5, Archives of Michigan, Lansing. See also Dean A. Brege and Niles R. Kevern, *Michigan Commercial Fishing Regulations: A Summary of Public Acts and Conservation Commission Orders, 1865 through 1975*, Michigan Sea Grant Program, MICHU-SG-78-605, (November 1978): 34-35, 38 (hereafter cited as *Michigan Commercial Fishing Regulations*).

[85] Randy L. Eshenroder et al., "Lake Trout Rehabilitation in Lake Huron," *Journal of Great Lakes Research* 21, supp. 1 (1995), 111, doi:10.3394/0380-1330(2008)34[287:PTTROL] 2.0.CO;2.

[86] J. Feldbaum, Project Report on Fish, Chicago Station, Fiscal Year 1922, Laboratory Library Subject Files-Fish, 1918-1969, pp. 2, 11, 13, 11, File 3, Laboratory Division, Laboratory Library Subject Files, Fe-Fo, 1918-1975, Department of Agriculture, Record Group 89-13, Box 13, Archives of Michigan, Lansing.

[87] Ibid., 2, 15, 21.

[88] Ibid., 3, 14-15.

[89] Ibid, 19.

[90] Sanitary Code Governing Commercial Fisheries; as approved by unanimous vote at the annual meeting of the Michigan Fishermen's Association, held at Bay City, Michigan, Friday, January 19, 1923, File 4, History of Commercial Fishing up to 1962, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 15, Archives of Michigan, Lansing.

[91] Dave Langford to Neil MacNaughtan, Game and Fishery Overseer, Parry Sound, 25 October 1925, NMF, F 4330-1-18, box 2, Archives of Ontario.

[92] Angus Prisk to [Neil MacNaughtan?], n.d., NMF, F 4330-1-1-12.2, box 2, Archives of Ontario.

[93] Granite Valley Inn to John Mossop, 16 July 1927, NMF, F 4330-1-1-12.2, box 2, Archives of Ontario.

[94] D.J. Taylor, Deputy Minister of Game and Fisheries, to F.V. Johns, Assistant Provincial Secretary, Toronto, ON, 1 February 1936, Seizure of American fishing nets in Canadian waters, F 100.1497, Despatches of the Department of the Provincial Secretary, 1910-1967, box 41, RG 8-20, Archives of Ontario.

[95] H.A. Bruce, Lieutenant-Governor of Ontario, to E.H. Coleman, Under secretary of State, Ottawa, 11 March 1936, Seizure of American fishing nets in Canadian waters, F 100.1497, Despatches of the Department of the Provincial Secretary, 1910-1967, box 41, RG 8-20 Archives of Ontario.

[96] Bogue, *Fishing the Great Lakes*, 233-234.

[97] Ibid., 235-237.

[98] Jim to [Neil MacNaughtan?], 25 April 1927, NMF, F 4330-1-1-12.1, box 2, Archives of Ontario.

[99] Neil MacNaughtan, Report of Seizure, Game and Fisheries Department, 29 May 1931, NMF, F 4330-3-0-7.2, box 9, Archives of Ontario.

[100] D. McDonald, Deputy Minister of Game and Fisheries to P. Stevenson, District Warden, Orillia, ON, 14 May 1926, NMF, F 4330-1-10, box 2, Archives of Ontario.

[101] "Illegal Fishing," letter to the editor, *The Globe*, July 12, 1927, in NMF, F 4330-1-1-12.1, box 2, Archives of Ontario.

[102] P. Stevenson, District Warden, to Warden to H. Gidley, Midland, ON, 27 August 1927, NMF, F 4330-1-1-12.2, box 2, Archives of Ontario.

[103] D. McDonald, Deputy Minister of Game and Fisheries to P. Stevenson, District Superintendent of Game and Fisheries, Orillia, ON, 4 May 1931, NMF, F 4330-1-1-13.3, box 2, Archives of Ontario.

[104] Neil MacNaughtan, Report of Seizure, Game and Fisheries Department, 5 May 1940, NMF, F 4330-3-0-7.2, box 9, Archives of Ontario.

[105] Georgian Bay Tourist Co. of Midland to D. McDonald, Deputy Minister of Game and Fisheries, Toronto, ON, 12 July 1927, NMF, F 4330-1-1-12.1, box 2, Archives of Ontario.

[106] D. McDonald, Deputy Minister of Game and Fisheries, to Joe Hubert, Byng Inlet, ON, 9 April 1926, NMF, F 4330-1-1-9, box 2, Archives of Ontario.

[107] Joe Hubert to [Neil MacNaughtan?], 21 May 1926, NMF, F 4330-1-1-10, box 2, Archives of Ontario.

[108] [L. Petrins?] to Neil MacNaughtan, Game and Fishery Overseer, Parry Sound, 7 August 1926, NMF, F 4330-1-10, box 2, Archives of Ontario.

[109] C.W. West and Son to Neil MacNaughtan, Game and Fishery Overseer, Parry Sound, 7 January 1927, NMF, F 4330-1-11, box 2, Archives of Ontario.

[110] N.L. Martin to D. McDonald, Deputy Minister of Game and Fisheries, 30 November 1916, NMF, F 4330-1-11, box 2, Archives of Ontario.

[111] Pillgram Bros., Fishermen's Returns, 1920, NMF, F 4330-3-0-6, box 9, Archives of Ontario.

[112] W.R. Wallace, Fishermen's Returns, 1920, NMF, F 4330-3-0-6, box 9, Archives of Ontario.

[113] Van Oosten, *Michigan Fisheries*, 16, 19-20.

[114] Ibid., 33.

[115] Second Great Lakes Fisheries Conference, Lansing, MI, 8 February 1928, p. 1, File 4, History of Commercial Fishing up to 1962, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 15, Archives of Michigan, Lansing, (cited hereafter as Second Great Lakes Fisheries Conference).

[116] Mission and history," USGS Great Lakes Science Center, last modified January 31, 2008, http://www.glsc.usgs.gov/main.php?content=aboutus_theglsc_mission&title=The%20GLSC0&menu=aboutus; and "About the John Van Oosten Library," USGS Great Lakes Science Center, last modified Janaury 30, 2009, http://www.glsc.usgs.gov/main.php?content=library_about_oosten&title=About%20the%20John%20Van%20Oosten%20Library1&menu=library_about.

[117] Second Great Lakes Fisheries Conference, 17.

[118] Ibid., 17.

[119] "Species at Risk Public Registry, Species Profile: Blue Walleye," Government of Canada, last modified 01/11/2010, http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=68, see also chap. 1, n. 32.

[120] Second Great Lakes Fisheries Conference, 25, 27-28.

[121] Ibid., 54.

[122] Ibid., 54.

[123] Ibid, 56.

[124] Van Oosten, *Michigan Fisheries*, 33.

[125] Smith Brothers to John Van Oosten, Director of the Great Lakes Biological Laboratory, 31 May 1933, General Information on Nets, 1932-1947, File 4, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 14, Archives of Michigan, Lansing.

[126] Latta, W.C., "The Early History of Fisheries Management in Michigan," *Fisheries* 31, no. 5 (May 2006): 231.

[127] Brege and Kevern, *Michigan Commercial Fishing Regulations*, 11, 24-25.

[128] Ibid., 39-40.

[129] Henry Fase, "Why the Extra Eight Days?" *The Fisherman* 1, no. 1 (1931): 6.

[130] Taube, Clarence M., "Biographical Profiles, Persons Notably Engaged in Michigan's Fisheries," in *Michigan Fisheries Centennial Report 1873-1973*, ed. DNR staff and others (Lansing: Michigan Department of Natural Resources, 1974), 162, 164.

[131] Fred A. Westerman, Fish Division, Michigan Department of Conservation, to Director George Hogwarth and Conservation Commission, 1 September 1933, Fish Hatcheries for Commercial Species, 1918-1955, Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Box 13, Archives of Michigan, Lansing.

[132] Ibid.

[133]Fred A. Westerman, "Changes in Michigan Laws," *The Fisherman* 2, no. 9 (1933): 6.

Chapter 4 - Invasive by design: nonindigenous species and the role of humankind in destabilizing the Great Lakes biome

The growing pains of Great Lakes market systems

Numerous environmental changes in and around Lake Huron were fueled by the activities of human beings working within the commercial fisheries. However, human beings affected the ecology of the lake in a variety of other ways as well. In response, the nonhuman inhabitants of the lake reacted to human induced environmental change in a variety of ways. The twentieth century brought a tide of widespread economic development to the basin. The interlocking lakes and the industrial centers that dotted their shorelines provided a network of production and shipping centers linked via the lakes and their growing fleets of ships. Enlargement and modernization of the waterways and canal systems connecting the interior lakes to the Saint Lawrence Seaway and Atlantic Ocean beyond promised a world of markets and goods to the ports of the Great Lakes states and the Province of Ontario.

Massive construction projects meant to improve accessibility and fuel industrial growth throughout the basin opened the interior lakes to both intended and unintended consequences. Growing commercial activity led to a rapid increase in both the size of lake vessels and in lake surface traffic in general. The desire for brisk economic development led to the construction of numerous harbors, canals and an overall industrialization of shoreline in many areas. The desire for profit and the belief that human ideas of modern industrialization meant progress affected staggering physical changes throughout the Great Lakes Basin. Sustained development caused widespread changes among the living inhabitants of the lakes. Species experienced

displacement, migrations and population blooms and collapses. Manufactured connections between previously separated bodies of water led to the introduction of numerous nonindigenous species. Unseen migrations of a growing number of non-indigenous aquatic species accompanied increased shipping and commercial saturation. Canals and lock systems provided ready avenues to marine aquatic species capable of colonizing the interior freshwater lakes. In addition, ballast water from oceanic shipping released large numbers of transported species into the interior lakes. However, not all of the new introductions were accidental. Humans had already acquired a history of introducing nonindigenous species to the Great Lakes in the hope of new species creating additional profitable populations for harvest.

The introduction of common carp

An early candidate selected by the United States Federal Government for widespread dissemination into numerous North American freshwater systems was the common carp. Carp were being widely distributed throughout the United States by the United States Fish Commission by the 1880s. State agencies also began stocking carp. It did not take long before carp were thriving in the Great Lakes. In Canada carp may have spread into public waters after a dam broke in Newmarket, Ontario in 1896 and released carp from a pond into the nearby Holland River.[1] Though the fish had a long history as a food source in both Asia and Europe, it was quickly relegated to the status of a rough fish in North America. Carp did not obtain a high price per pound in the fisheries. They also proved destructive to pre-existing aquatic fauna. It was not long before many were questioning the logic of the U.S. introductions.

James Gillingham, a commercial fisherman operating out of Bay Port Michigan said carp offered little advantage to fishermen but conceded they could if "there was a good market for them."[2] Edward Harris was a Canadian author and the former president of the popular Long Point Company, a private hunting and fishing preserve on Lake Erie. In the late nineteenth century he worked as a commissioner for the Dominion of Canada gathering information on the Great Lakes fisheries. Harris was a well known critic of waste in the commercial fisheries. He was especially critical of American fishermen. Nor did Harris think much of the United States Government's decision to stock that nation's waterways with carp. In his 1905 book *Our Great Lake Fisheries: A Vanishing Heritage* Harris charged that it required "the exaggerated descriptive talent, or hyperbole peculiar to the Americans to understand carp as a table luxury."[3] Both Harris' book and *The Mixer and Server*, the official journal of the Hotel and Restaurant Employees International Alliance reprinted the following recipe in their respective publications in 1905;

> Proper Way To Prepare Carp. When fishing, if you catch a German carp, clean it and hang it out in the sun six weeks to dry, then nail it to a pine board and cover it thoroughly with salt or mud. Let it stand for two months longer and then bake it two days. Remove the nails, throw the carp over the back fence and eat the board, but never eat the carp.[4]

In addition to the public's reluctance to view carp as a desirable food resource, the nonindigenous fish dramatically altered the environment of areas where they flourished. Carp are omnivores, but prefer feeding along the bottom where they dig into the lakebed for plant roots and other materials. As a result of their vigorous feeding habits, large expanses of aquatic plants that provide shelter and habitat for other aquatic life are uprooted and killed.[5] Water

where carp thrived became cloudy. Increased sediments in the water meant less sunlight penetrating beyond the surface and thus less favorable conditions for lakebed plants to replenish themselves. Carp can affect other species in a myriad of additional ways as well. They can directly compete for resources, damage spawning areas with their feeding activities, decrease the hunting efficiency of vision dependent fishes and reduce the level of dissolved oxygen in the water that other fish breathe through their gills.[6]

Smelts

Smelts were originally introduced as a food source for planted salmon. On April 6th of 1912 salmon and smelt eggs were planted in Benzie County at Crystal Lake. Smelts were soon thriving in the lakes.[7] In 1936 Dr. John Van Oosten labeled smelt a "problem of major proportions" and predicted they would require coordinated state, federal and provincial intervention.[7] Smelt populations were initially regarded as a menace by commercial fishermen.

> The food of the adult smelt is usually young fishes and insect larva. . .it is easy to understand that the smelt will disturb the balance of nature in the fisheries in several important respects, both as a competitor and as an enemy.[8]

In February 1932 smelt were creating problems for commercial fishermen in the waters off of Green Bay, Wisconsin. Fishing nets were becoming clogged with the small fish. Individual smelt attached to gill nets with their teeth and then were unable to free themselves. Nets filled with smelt prevented other marketable species from being caught in desirable numbers. Some believed the small size of smelts ensured they would not have significant market value.[9]

After their introduction in 1912 smelts gradually spread throughout the Great Lakes system, spawning in the millions in the streams and tributaries of the lakes. They were initially considered an undesirable pest by people working in the fisheries. Commercial fishermen believed smelt would have a negative effect on their trade. By February of 1936 smelt were confirmed in the far western end of Lake Superior, completing their migration through the entire Great Lakes system.[10]

Despite the initial warnings of fisheries experts, smelt eventually proved valuable to the fisheries. When Great Lakes fish markets began to experiment with selling smelt the small fish proved to be a popular item. By 1935 the commercial fisheries were changing their tune. They reported that smelt had shown a "great increase as a market fish." Over a million pounds were harvested, with a total value somewhere between $30,000 and $50,000. In Delta County in Michigan's Upper Peninsula, 219 tons of smelt had been taken from streams.[11]

By the 1940s four to five million pounds of smelt were being harvested each year by commercial fishermen. Approximately twice as many were taken by recreational fishermen around the Great Lakes.[12] When a huge die-off occurred in the winter of 1942-43 the reaction was not relief, but alarm as the former nuisance had proven itself both a desirable game fish and useful as a commercial species. Two years later the effects of the "mysterious disaster" (which may have been caused by a water born fungus), had passed and high numbers of smelt were once again part of the commercial fisheries' harvests.[13]

The Welland Canal

In addition to the intentional introduction of non-indigenous species, numerous other species were granted access or transported into the interior Great Lakes through human environmental modifications. One of the most significant vectors for introducing new species is the Welland Ship Canal. The canal cuts across the Ontario's Niagara Peninsula. The peninsula extends East between the northern coast of Lake Erie and the southern shoreline of Lake Ontario, meeting western New York at Buffalo. The Niagara River serves as the border between the two countries at that juncture. The river also provided an impassable barrier to shipping heading south from Lake Ontario or North from Lake Erie.

Beginning in 1829 the Welland Canal served as a bypass for shipping crossing between those lakes. The canal provided shipping with a convenient way of circumventing Niagara Falls. Prior to the completion of the first Welland Canal ships had to unload their cargo at Queenston, Ontario. The freight was then transported overland to Chippewa Creek south of the falls. The decision was made to build a bypass around Niagara Falls. The Welland Canal Company was formed under the leadership of William Hamilton Merit. Upon completion of the original canal an American schooner and a British schooner sailed through the bypass. The boats served as symbols of human triumph over the natural barrier to economic development. The first canal could accommodate a maximum boat draft of about eight foot. In 1841 the Government of Upper Canada purchased the canal. [8]

Further enlargements and modifications were completed in the 1840s, 50s and 80s. Horses were used to tow vessels through the canal until 1882, when enlargements made the use of tugs possible for almost all watercraft. One ship, the four-masted schooner *Minedosa* was so large that horses still had to be used to haul it through the canal because there were not any tugs

small enough to fit in the locks along with the schooner.[9] In 1887 dredging and other improvements deepened the canal sufficiently to accommodate 14 foot drafts.[10] By 1900 the canal's route ran from Port Dalhousie on Lake Ontario, south to Port Colborne on Lake Erie. In addition to being an important commercial route, the canal even became the target of domestic bombing. On April 21, 1900 three men attempted to blow up lock number twenty-four at the town of Thorold. The plot failed because the conspirators placed their dynamite in a container that floated and thus the explosion traveled upward from the water's surface and did not damage the lock.[11]

As freight tonnages steadily rose agitation grew for a still larger canal system capable of handling the lengthening steel hulls of twentieth century cargo ships. In 1913 construction began on a new canal route that followed the valley of the Ten Mile Creek across Ontario's Peninsula. The primary entry point from Lake Ontario became Port Weller instead of Port Dalhousie. The canal was deepened to twenty five feet and constructed in such a way as to make future dredging to accommodate thirty foot depths relatively easy.[12] Construction proceeded slowly and was interrupted by World War I. The project continued into the 1920s and early 30s. The new route was straighter and required less locks. The work on the canal was arduous and demanding on both men and equipment. The construction process was not without its tragedies. The worst occurred approximately four years before its completion. On August 1st 1928 at Lock number six near Thorgold a crane sitting on the upper edge of the canal and engaged in lifting a heavy steel beam suddenly toppled over into the canal bed. The beam crashed into a huge steel lock gate weighing approximately three hundred tons. The massive gate tumbled into the dry canal bed. Nine workers were killed. Twenty-three others were injured, twelve or thirteen of them seriously.[13] Despite the accident and other setbacks, construction was finally completed in

1932. The enlarged bypass was dubbed the Welland Ship Canal. The 633 foot long *SS Lemoyne*, the largest ship then operating in the Great Lakes, became the first vessel to pass through its waters.[14] Shipping grew exponentially. The restructured Welland Ship Canal provided an enlarged and modernized route for international commerce traveling to and from the interior Great Lakes.

The canal also served as an access point for what became a growing list of aquatic species that were not indigenous to the inland Great Lakes. During the renovations the canal was again deepened and the numbers of locks were reduced making it easier for organisms to swim into the interior lakes. The smaller schooners and wooden vessels of the past were gone. New steel cargo ships of ever growing sizes dominated the regional and international commerce of the Great Lakes. Increasing numbers of larger ships meant more opportunities for organisms attached to hulls to be carried into the interior. Modern ships also carried and transported large quantities of ballast water. Cargo ships utilize ballast water to compensate for their lighter weight when they are not carrying the heavy loads of cargo they are designed for. Ballast water aides in keeping a ship level and stable in the water. A ship will discharge water from its ballast tanks when it is loaded with cargo. Ballast tanks on cargo ships operating in marine waters can contain organisms that are later released into Great Lakes when the ships discharge the contents of the tanks. By the end of the twentieth century a host of newly introduced non-indigenous species were established in the Great Lakes. Many of them hitch-hiked a ride in the ballast water of oceanic freighters. Each new species brought its own set of environmental challenges to the lakes.

Alewives

Alewives were an early migrant into the interior lakes via the Welland Canal system. Alewives are a small schooling salt water fish. Originally they were considered useless as a commercial species due to their diminutive size. Within a few years they swarmed in the millions throughout the Great Lakes ecosystem and competed with other species for food sources. Schools of alewives reached astronomical numbers in their new freshwater home. They also proved to be rapacious resource competitors with other species of Great Lakes fishes. For example, alewives were a primary catalyst in the population crash of bloater ciscoes in Lake Michigan during the 1960s and 1970s. An emergency closure of the bloater fishery followed in 1976.[15]

By 1964 ninety percent of the fish in Lake Michigan by weight were alewives. As alewives spread through the lakes planktivore communities in each successive lake of the alewives' migration fell into decline. In addition to their predation on the foodstuffs of native fish species, alewives are highly destructive consumers of other species' spawn. The kidneys and liver of alewives are negatively affected by the freshwater environment to the extent that their populations occasionally experience mass die-offs in the Great Lakes. Millions of rotting alewives littered the shores of nearby beaches after the periodic die-offs.[27] While alewives inflicted staggering changes on the interior lake environments, sea lampreys were the most infamous of the numerous new species introduced through the Welland Canal.

The origins of sea lampreys in Lake Huron

Sea lampreys were one of the numerous species introduced to the lakes as a result of the modernized Welland Ship Canal. Lampreys quickly became the most well known new species to commercial fishermen and state, federal and provincial conservationists. The Canadian Department of Marine and Fisheries was formed in 1867. England born E.E. Prince, a specialist in fish embryology, was appointed as Canada's Commissioner of Fisheries in 1893. Prince subsequently lobbied for the establishment of a marine biological station for fisheries research. The idea was further discussed at the meeting of the British Association for the Advancement of Science at Toronto in 1897. With the assistance from a government grant, the Marine Biological Station of Canada was opened at St. Andrews, New Brunswick in 1899. The Georgian Bay Biological Station followed in 1901. Professor B. Arthur Bensley was curator of the new station. A Pacific Coast station was opened in 1907. In 1912 Canada's research stations were placed under the authority of the newly created Biological Board of Canada. [16] The research center generated a great deal of scientific data on the fish and fauna of the bay region. Unlike much of the scientific work being done related to hatcheries and fisheries statistics in the United States, the Georgian Bay station focused on life histories of various species as well as taxonomic work with various species.[17] Research papers were published on various fishes, insects, plants and fungi.

Professor Bensley, an associate professor of Zoology at the University of Toronto, compiled research of the region's fishes and published his research in 1915. Bensley's work included an early discussion of Great Lakes lampreys. He concluded there were then two species of lampreys that were active in Georgian Bay. Several silver lamprey had been removed from the Go Home River east of Honey Harbour. The immature lamprey ranged from four to six

inches in length. Bensley estimated that adults would reach maximum lengths of ten to twelve inches based on his findings and the research of other scientists. Bensley also included a second lamprey species which he called lake lamprey. While Bensley did not have any actual specimens, he had heard accounts from fishermen who claimed they caught fish with lampreys up to fifteen inches in length attached to them. These lamprey were believed to be too big to be silver lamprey. Bensley theorized that they may have been accidentally introduced and that factor could account for their low numbers.[18] Historian Margaret Bettie Bogue suggested Bensley's lake lampreys may have been sea lampreys that had traveled through the Trent-Severn Waterway – a man-made waterway which linked the Trent River, which drains into Lake Ontario, with the Severn River, which drains into Georgian Bay. This hypothesis was an interesting one, which brought into question the Welland Canal as the original vector for sea lamprey migrations. A similar hypothesis was brokered by Isobel Radforth in 1944 and was later considered and dismissed by the United States Fish and Wildlife Service.[19] There are several factors that eliminate the Trent-Severn Waterway as a possible vector.

The Department of the Interior dismissed the notion because of the complexities and obstructions present in the Trent-Severn system. Even more convincing is the fact that throughout the twentieth century sea lampreys were unknown in the majority of the Trent-Severn Waterway east of the Big Chute Marine Railway. In fact, the Big Chute Marine Railway, a critical connection in waterway, was not even operational until 1918, several years after Bensley's supposed sea lampreys were found in the lake.[20] Decades later plans to update Big Chute with locks were scrapped because the railway proved itself a formidable barrier to lamprey migration. Additionally, the Trent-Severn Waterway did not begin regular service through its many locks until 1920. The remarkable success sea lampreys seemed to enjoy from the moment

they were conclusively identified in Lake Huron also suggests they were not introduced years earlier. Once they were conclusively identified in Lake Huron their populations quickly skyrocketed.

Sea Lampreys were first verified in Lake Erie in 1921. In 1933 G. C. Toner published an updated list of Georgian Bay fishes. While Toner acknowledged the presence of silver lampreys, he found no record of the larger species mentioned in Bensley.[21] If sea lampreys were already in Lake Huron at the time of Bensley's writing, they should have been relatively easy to locate by 1933. Ironically, by the time Toner's research was actually published the first sea lampreys were likely in Lake Huron. Lake Huron's first lampreys migrated west from the Welland Ship Canal through Lake Erie. Sea lamprey did not enter Lake Huron via the Trent-Severn Waterway.

Understanding the origins of sea lampreys in the interior lakes was also muddled by the early notion of a larger variety of freshwater lampreys. Was Bensley's larger variety of lamprey an unidentified native species? Freshwater lampreys were believed to be a distinct species from silver lamprey. What about the notion of a larger, freshwater lake lamprey species? In the 1918 edition of *Copeia* David Starr Jordon discussed lake lampreys. Jordan referenced a variety inhabiting Cayuga Lake in New York, part of Lake Ontario's drainage system. [22] Is it possible there was a larger lake lamprey that was indigenous to the interior Great Lakes prior to the arrival of sea lampreys? Even more convincing than scattered early accounts, recent Mitochondrial DNA testing suggests that the lampreys of Lake Ontario are native to that lake. If so, decades of assumptions about Lake Ontario's lamprey populations and by extension the foundation for control efforts in that lake may be wrong.[23] Was there a distinct variety of freshwater lamprey, larger than the known silver lampreys, inhabiting the inner lakes prior to the

migration of sea lampreys in the twentieth century? Did those original lampreys die out or were they absorbed into a possibly genetically similar native species from Lake Ontario?

Similar Despite the intriguing possibilities, the most likely scenario is also, perhaps, the most obvious. The fishermen reporting to Bensley likely caught fish with large lampreys attached to them, but the parasites they captured were freshwater silver lamprey that had attained their maximum adult size. Bensley believed silver lamprey grew to a maximum of ten to twelve inches in length.[24] Subsequent research has shown that silver lampreys are capable of reaching lengths greater than fifteen inches. Bensley had estimated the lengths of the lampreys reported to him at fifteen inches. Adult sea lamprey can reach lengths of over 35 inches. If someone had reported a parasite of that length it likely would have shown up in Bensley's report. Thus, reports of large freshwater lampreys distinct from silver lampreys in Lake Huron were likely nothing more than cases of mistaken identity. This is not to suggest Lake Ontario's sea lampreys are not an indigenous species to that lake and the primary source for the subsequent colonization of the interior lakes. It only means the interior lakes were free of sea lampreys until their migration through the Welland Canal.

Perhaps no species introduced to the interior lakes has caused greater concern nor generated more cooperative control efforts than sea lampreys. The first verified sea lamprey in Lake Erie was taken at Merlin, Ontario on November 8th, 1921. In May of 1932 spawning sea lampreys were verified in Michigan's Huron River on the western end of Lake Erie. This suggested the lake had been colonized from end to end in about eleven years. Writing for *Copeia* in 1932, Charles Creaser of the Colleges of Detroit warned that the sea lamprey, along with another recently introduced species, the smelt, would "act as great disturbers of the natural balance of the large fisheries."[25] During the 1930s large numbers of fishermen around Lake

Huron complained about fish damaged by lamprey wounds.[26] Subsequent complaints of marked fishes led eventually to a confirmed spawning run in the Ocqueoc River in 1937.[27] By 1936 lampreys had penetrated the inner lakes at least as far as Milwaukee, Wisconsin on Lake Michigan. In 1938 the first lampreys were confirmed in Lake Superior.[28] Sea lampreys had devastating effects on the imperiled fishery in subsequent years. The added demands of lampreys on populations of fishes already under heavy pressure by commercial fishing operations proved devastating. Between 1945 and 1948 the commercial fishery for lake trout in Lakes Huron and Michigan collapsed. While trout fisheries in those lakes went into a tailspin, sea lampreys spread into Lake Superior via the St. Marys River. Large numbers of wounded fishes and lampreys were then caught in Lake Superior as well.[29]

The troubled waters of the 1930s

In Canada the Biological Board established research stations on both coasts and in Georgian Bay. While the Georgian Bay station produced some remarkable research of the region, its efforts at improving understanding of the bay's inhabitants had little demonstrative affect on the day-to-day operations of the commercial fisheries. The Georgian Bay station was closed in 1914. Bensley went on to establish the Ontario Fisheries Research Laboratory in 1924 at the University of Toronto. He focused his energies on the smaller, inland lakes of Canada.

By the 1930s there was widespread recognition that the marketable fishes of the Great Lakes were in serious peril. Overfishing via a vast array of gradually improving technologies had strained populations of whitefish, lake trout, herrings and others to the breaking point. With the introduction of sea lamprey and other non-native competitors to the freshwater lakes, the downward population spirals accelerated into a vortex that threatened to finally destroy what

economically profitable species remained and finally sink the struggling commercial fishing industries that depended on them. A growing sense of urgency and desperation motivated national, regional and local governments toward the development of a cooperative management plan to save the fishing industries. The various regional and international conferences of past decades had accumulated significant data and offered numerous recommendations, but by 1930 little tangible change had been instituted.

In the 1930s there were a series of efforts, both regional and international, to harmonize management of the various lakes. On December 20th, 1929 representatives from Michigan and Ontario met in Toronto, Canada at an informal conference. They discussed their different approaches to resource management on Lake Huron. A second conference between representatives from both Michigan and Ontario occurred in Toronto in March of 1936. Attendees sought to develop a uniform approach to managing the lake. While a tentative agreement to work toward uniform regulations was struck at the 1936 meeting, it languished in abeyance and ultimately went nowhere.[30]

Wisconsin's Conservation Director also organized a meeting of regional representatives for the purposes of creating a more uniform system of management for Lake Michigan in January of 1933. The effort went nowhere. In 1936 another conference was held at Chicago for the purposes of creating cooperative management over both lakes Michigan and Superior. Once again the attendees left without widespread agreement, although Michigan and Illinois did pass some of the suggested legislation.[31]

The decade's first substantial international agreements at cooperative management did not result from efforts at joint or uniform management of the entire Great Lakes Basin. The first apparent success at an international agreement was related specifically to Lake Erie. In 1931 a conference was organized by New York State's Commissioner of Conservation. The conference was intended to foster harmonization in the management of Lake Erie's shared waters. The International Lake Erie Advisory Committee was formed as a result. The committee included one representative from each of the states bordering the lake, the U.S. Bureau of Fisheries and the Province of Ontario. In 1933 the committee developed a list of five proposed management recommendations. Incredibly, all of the recommendations save one were approved by each represented locale. It was the first time the states and the Province of Ontario had successfully negotiated uniform regulations on their own. For a moment it looked as if a model for future cooperation had been developed. It was not to be. The following year the State of New York withdrew from the agreement, bowing to local political resistance to unified closed seasons. In October of that year another meeting of the committee was held. Additional signatories decided to follow New York's lead. Before the meeting was over the treaty was abrogated entirely and the committee dissolved. On April 27th, 1937 the representatives met again and decided that any efforts at cooperative management of the lakes were a pointless undertaking due to the lack of widespread public support and the continued resistance of commercial fishermen.[32]

Outside of the Great Lakes commercial fisheries support for Federal intervention and cooperative management remained strong. The organization's resolutions calling for management beyond the state level continued into the 1930s. Beginning in 1891 the American Fisheries Society repeatedly recommended that the United States Federal Government assume control over the lake fisheries. The Fourth International Fisheries Congress met in Washington

D.C. in 1908. They recommended Federal control of the Great Lakes fisheries. At its national convention in May of 1937 The Izaak Walton League of America adopted resolutions urging international control of the Great Lakes fisheries.[33] Numerous other organizations and government representatives similarly continued to push for U.S. Federal or international intervention in the management of the Great Lakes.

While efforts at cooperative state and international management repeatedly stalled, professional scientific research of the lakes and their fishes continued. In the United States the focal point of fisheries research and its resultant management strategies gradually evolved beyond its nineteenth century roots focused on hatcheries and statistical surveys. Dr. John Van Oosten was at the forefront of Great Lakes fisheries research from the late 1920s until after the end of World War II. Like Bensley over a decade earlier, Van Oosten was studying classification and the life history of fishes at the University of Michigan in the 1920s. The Great Lakes Biological Laboratory was established in 1927. Van Oosten was appointed director of the new facility. The laboratory had grown from a wellspring of agitation following the collapse of the cisco fishery in Lake Erie in 1925.[34] Van Oosten was also head of Great Lakes Fisheries investigations within the Department of Commerce and later the Department of the Interior.

Sufficient funding for the laboratory's research was slow to develop. Van Oosten often struggled with financial shortfalls and insufficient staff. In the years leading up to World War II he was able to occasionally augment his resources through project grants. For example, in order to complete a 1938 statistical and biological study of the Great Lake fisheries Oosten applied for a $2,500 grant through Roosevelt's Works Progress Administration.[35]

During the subsequent war financial support for fisheries research was especially slim. In November of 1943 Van Oosten requested that the Fish and Wildlife Service publish a paper he had completed on the effect deep trap nets on populations of whitefish. Edward W. Bailey, the acting Chief of Fishery Biology at Chicago gave him discouraging news. Bailey informed him there was practically no chance of his work being published. The law mandated that certain materials be published, and the Fish and Wildlife Service lacked the funds to publish those materials. The basic day to day operational expenses of various offices could not be met if research was published.[36] During the summer of 1946 Van Oosten complained "Numerous past researches on the Great Lakes have lost much of their usefulness because their results were published too late or not at all."[37]

Throughout Van Oosten's tenure as head of Great Lakes Fisheries Investigations a lack of sufficient political interest and financial support hindered the accumulation and dissemination of critical biological data and undermined even the most basic efforts at imbuing lake management with twentieth century conservation theories. Despite the serious shortcomings, Van Oosten and a slowly growing list of other Great Lakes scientists began to make inroads into the veil of ignorance surrounding the fisheries of the Great Lakes. Under Van Oosten's guidance numerous new scientific studies of various aspects of the Great Lakes fishes and the commercial fisheries were completed. When on May 18th, 1939 Fred Westerman of Michigan's Department of Conservation phoned Van Oosten asking about research being done related to Michigan's coastal waters, he was sent a lengthy list of current projects that were either ongoing or recently completed. Investigations had been done of several major bays around the state, including Saginaw Bay. Van Oosten's office was examining the ongoing effects of deep sea trolling in Lakes Michigan and Superior. Ongoing investigations were being completed related to size

restrictions on certain fishes, the effect of non-native smelts on other lake fishes and the effects of baited hooks on populations of young fish.[38]

Despite fisheries research in the United States branching off into numerous new directions and an evolution in the equipment and methods used to gather data, the primary goal remained support of a profitable fishery through conservation. However, even meager conservation efforts often met with organized and powerful resistance. In December of 1933 fishermen met in Chicago to discuss a Federal Great Lakes Fishery Code being developed by Van Oosten and others. At the meeting Van Oosten was approached by the meetings organizers. He was asked not to speak about the code. Instead, they requested he only make general comments. He was subsequently barred from attending the small business sessions that took place at the conference. The entire proceeding was facilitated by one Mr. Lambert, a representative of trap net fishermen out of Harbor Beach, Michigan and Chaired by John Schacht, a lawyer from Philadelphia. "I am sure that you got the worst humiliation you ever received" Captain William Muntinga later wrote to Van Oosten. "I sure felt sorry for you. Trying to be fair and good does not have any place with paid crooks and law violators" Muntinga said. He informed Van Oosten that during the business session he attended Van Oosten's code was presented and then quickly cast aside. The majority of attendees showed little interest in reading the recommendations, claiming they already knew them and then quickly voted them down. A few fishermen pushed their own regional agendas at the meeting. Muntinga said fishermen from Indiana and Illinois voiced support for a closed season everywhere except in their own fishing waters. He claimed the meeting was held to support fishermen who wanted no conservation in the fisheries. He said the fishermen were trying to design their own fishing codes that would protect violators from existing state laws.[39]

A series of letters were sent to various Congressional representatives from various fishermen opposed to the proposed code. For example, the following June A.H. Matt, General Manager of the Huron Fish Company in Huron, Michigan appealed to his Congressman to block the passage of a uniform fishery code. Matt argued that the individual states were better able to manage the fisheries than Federal officials in Washington. He said the United State Bureau of Fisheries was taking away the rights of the states to regulate their fisheries. He claimed any new size restrictions on caught fish would cause ninety percent of the commercial fisheries operations to close within one year and means the loss of thousands of jobs.[40] Martin Tansey wrote in from Vermilion, Ohio in support of the proposed code. Tansey said something needed to be done to stem the tide of undersized fish being caught and destroyed in trap nets.[41] The proposed code did not include any limitations on mesh sizes. The focus was on legislating minimum sizes for various species fishes. The restrictions were to be uniform for all of the Great Lakes. Bureau of Fisheries Commissioner Frank T. bell said he was hopeful that state legislation would cover the areas the proposed code did not address.[42] The code was ultimately defeated. Van Oosten claimed many fishermen supported the proposed federal code, but lamented that a minority of fighting "pirates" successfully derailed any chance of it becoming law.[43] While the proposed regulations went nowhere, the State of Michigan passed its own legislation in 1934 that limited trap nets to waters of eighty feet or less in depth.[44]

As fishes declined, the conflict between sport fishermen and commercial operators grew. Van Oosten became the target of criticisms leveled by a leader among sport fishermen in the region of Potagannissing Bay on the Western end of Lake Huron's North Channel, near Detour, Michigan. Father T.G. Bateski and W.H. Lewis, the President of the Detour Chamber of Commerce, charged Van Oosten with improprieties in scientific investigations carried out in

their area.[45] Bateski charged that Van Oosten was using his office protect commercial fishing criminals who worked in Potagannissing Bay. Bateski argued that black bass in the bay were being wholly impounded in commercial nets. He also spread a story in which the former governor of the state, William Comstock, had ordered a net pulled out of the water so he could examine its contents during an unsatisfactory sport fishing trip to the bay. Van Oosten felt personally stung by the charges. He charged Bateski with "extreme exaggeration" and "misrepresentation or misinterpretation" of both the work of Van Oosten's office and conditions in the bay. "It is because Bateski is a religious leader" he concluded, "that his unscrupulous tactics in the Potagannissing Bay propaganda have become unusually irritating and exasperating to those who know the facts."[46] Gradually, as other people quoted in Bateski's stories were sought out and questioned, including former Governor Comstock, Bateski's credibility came apart. Van Oosten felt bruised from the affair.[47] "I must confess" he confided to Elmer Higgins "that my first contact with the organized sportsmen has been a great disappointment."[48]

In 1940 John Van Oosten stated that most sport fishermen were "a fine lot" but believed them "ignorant of the commercial fishing industry." Further, he felt they were too often "misled, by a few equally ignorant but radical sportsmen who want to abolish all commercial fishing."[49] Despite his misgivings, Van Oosten expressed hope that better leaders would guide sportsmen in the coming years.[50] Conflict between the commercial fishing industry and sport fishing interests only grew.

In August of 1942 Harry Gaines, then secretary of a recently formed umbrella organization of sport hunting and fishing clubs in Michigan known as Michigan's United Conservation Clubs, contacted I.N. Gabrielson, the director of the Fish and Wildlife Service in Washington D.C. Gaines said the organization wished to "correct" aspects of the commercial

fishing industry.[51] He went on to criticize recent actions in the Michigan House of Representatives where bills intended to bar all trap net fishing in Lake Huron, ban netting in parts of Grand Traverse Bay on Lake Michigan and extend the closed season on Lake Trout were blocked. Gaines blamed Representative Louis Anderson of Northport, pointing to the strong commercial fishing interests in his district. Gaines indicated his organization was working to reintroduce the measures again in the coming year and they were considering adding Thunder Bay, near Alpena, to their list of areas recommended for closure.[52]

Gabrielson responded in defense of commercial fisheries. He pointed to the war effort and the focus on food production. He stated "regulations proposed by sportsmen to restrict commercial fishing and increase angling opportunities" should not be passed. He said conservation programs needed to focus on "producing every pound of fish possible this year and every year until the war is won."[53] H.J. Deason, chief of the conservation section within the Office of the Coordinator of Fisheries also reviewed the letter. "There is a tendency for sportsmen's organizations" he stated "to urge the enactment of regulations that have little or no justification as conservation measures." He believed sportsmen's groups too often operated "under a smoke-screen of conservation" pushing for regulations that would create "angler's monopolies" on the lakes.[54] During the first half of the 1940s the food production goals of the United States' war effort served as a protective shield for commercial operators, blocking the passage of legislation backed by the growing sport fishing industry. The production protections of World War II vanished in the postwar years.

In 1940 the Bureau of Biological Survey was combined with the Bureau of Fisheries to create the United States Fish and Wildlife Service. Early on officials in the service considered ways to reduce the amount of commercial fishermen that worked the lakes. Assistant Director of Fish and Wildlife Charles E. Jackson believed over the coming years they would need to devise "methods of reducing the number of fishermen on some equitable basis." Jackson believed a licensing system based on quotas was a viable method to initiate reductions. While the number of fishermen would be reduced, Jackson envisioned higher personal profits for those who remained and an overall increase in commercial production through streamlining of the industry.[55]

World War II and the Great Lakes Fisheries

In the United States during World War II maintaining fisheries resources competed with the Federal Government's wartime goal of maximum food production. Prior to the war Van Oosten and some of his contemporaries working in fisheries management sought to administer the fisheries through the incorporation of conservation principles. After Japan bombed Pearl Harbor on December 7th, 1941 everything abruptly changed. Van Oosten believed overfishing was a major factor in the decline of various fish species. He believed numerous marketable populations had been negatively affected by overfishing and was convinced excessive fishing had destroyed the cisco fishery in Lake Erie in 1925.[56]

Nonetheless, during the war much of his work gradually moved away from conservationist efforts to a focus on the maximized harvest of fishes for wartime food. He operated with the title Office of the Coordinator of Fisheries in the Great Lakes Region, and produced a manual field officers could use when working with commercial fishermen in order to

assist them in securing the necessary supplies for their trade.[57] Van Oosten was personally responsible for approving certain acquisitions and the construction of new fishing vessels on the lakes. However, embracing wartime patriotism and casting aside his convictions regarding his conservation responsibilities was no easy process for Van Oosten. As late as June of 1942 he continued to view the biological research of his office as outside of the overall war effort. He refused to use language that framed his department's research in terms of strengthening the home front and damaging the enemy. He said he could not connect the work of his department with the ongoing war. He believed their "efforts must stand or fall on their benefits within this country rather than their injury to our enemies."[58]

In November of 1942 when Elmer Higgins, the Chief of the Division of Fishery Biology within the United States Fish and Wildlife Service expressed misgivings about publishing one of Van Oosten's essays on trout because it did not seem to relate to the war effort and the goal of maximum production, Van Oosten was clearly annoyed. In a remarkable five page letter to Higgins he expressed his growing irritation at having to justify research activities as part of the overall war effort. He complained that it was "ridiculous to try to attach ourselves to the war effort under the guise that we are increasing production." He said the war time goals of fishery biologists were the same as their peacetime goals. He believed "protection of the existing natural resources. . .to insure a continuous supply" remained the central focus of his department. He said it was important not to let their "war emotion run riot" and continue to "guard zealously our natural resources from over exploitation."[59]

Higgins responded that "certainly all of our research is or should be directed toward increasing production of food" in both peace and war. Higgins stated that by definition conservation contributed to food production through "protection of the supply." He said various localities should be pressured into easing regulations in order to fuel greater production. This did not conflict with the role of conservationists, Higgins reasoned, because peacetime regulations might not fit wartime realities. Higgins claimed fisheries biologists increased production and said sustained yield models provided excellent working models. He further charged that if the areas of fisheries expansion were halted it would surely damage the country as much as any military defeat. "I cannot believe" Higgins challenged "that you will disagree with any of these statements."[60] Van Oosten thus found his scientific convictions challenged in an environment electrified with calls for patriotism and conformity to the national cause.

Field work declined during the war and apparently the social and professional pressures on Van Oosten gradually won out. In January of 1943 he suggested a number of dramatic changes in management of the Great lakes fisheries during the war. He wanted the available fishing vessels used to their fullest extent. Van Oosten pointed out that one fishing outfit in Bay Port, Michigan only utilized eight or twelve boats in the fall of 1942 due to manpower shortages. He believed all available boats should be out fishing. He advocated for the opening of untapped fishery reserves, a suspension of various protective state laws, an increased amount of gear fishing the lakes and additional marketing of various species of so-called rough fishes.[61]

Van Oosten compiled data on targeting rough fishes for increased production in the fall of 1942. Despite his support for the effort and for advertising rough fishes, he was skeptical that the focus on less desirable species would take hold. Commercial fishermen, he said "are neither philanthropists not fools. They must show a profit or be bankrupt. . .the surest way to a profit

lies in the exploitation of the more valuable varieties."[62] One of the rough fishes Van Oosten suggested for intensified harvesting were chubs, claiming they could withstand an expansion from 4.5 million to six million pounds annually.[63] Van Oosten's predictions conflicted with another scientist. Several months earlier Dr. Frank W. Jones who also worked in Ann Arbor, Michigan had concluded that chubs were already in decline and possibly headed for their own collapse in Lake Michigan.[64] In April of 1943 Van Oosten summed up the changed focus of his day to day duties. He said he was going to give "war-time activities precedence over biological studies" and address research already underway as time permitted.[65] Considering his clear dedication to conservation principles, Van Oosten may have privately found some solace in the fact that maximum wartime production would lack the potential teeth an unrestricted fishery might have otherwise inflicted on the lakes. There were fewer fishermen on the lakes due to military service requirements so the total number of vessels harvesting fishes dropped during the war.

The war affected the lakes in other ways. During the war areas around and on the lakes were used for training ground forces and aircraft. For example, in December of 1943 fishermen operating near Michigan's port town of Holland on Lake Michigan were warned to exercise caution when operating in areas where bombing practice was taking place. They were urged to keep their boats at least a mile from designated targets on the lake.[66]

In addition to his own work and research, Van Oosten was sometimes called upon to review the work of other specialists writing in the fields of fish and fishery research. He read and reviewed a variety of research articles and reports written by professionals studying aquatic environments. In 1943 Edward Bailey passed along a manuscript written by Rachel Carson entitled "Fishes of the Middle West" for Van Oosten to read and comment on. Van Oosten said

was it was "well written," but added "in spots there is evidence that the most recent publications have not been consulted."[67] Rachel Carson became well known around the world with the publication of her seminal work *Silent Spring* (1962) nineteen years later.[68]

Despite the growth in research the conservation focus of Van Oosten's office remained squarely on the fisheries – the marketable fishes and the species that affected the marketable fishes of the Great Lakes. The era's conservationist approach to Great Lakes resource management was not a holistic model of environmental stewardship. There was no perceptible intrinsic worth assigned to lake fishes beyond their importance as a human resource. To fisheries biologists of the day the fishes of the lakes existed to support the fisheries. Preserving the economic viability of fishing operations through conservation measures designed to sustain or enhance catch yields was the ultimate goal. In 1943 a Great Lakes Lake Trout Committee was formed to consider various aspects of lake trout management, including the effects of fishing for lake trout during the closed season. Van Oosten chaired the committee. During the committee's meeting 1944 meeting the question arose as to whether trout should be protected from commercial fishing during their spawning period. Local interests won out when the idea was rejected. It would have been too difficult, the committee members decided, for some states to adopt a completely closed season for the entire spawning period.[69] Initially the committee was limited to American membership. After Canadian officials expressed interest in joining membership was extended to them in 1946.[70] Coordinated regulations at the state level remained an elusive goal.

Despite the growing interest in conservation principles. Van Oosten's office did not stand in the way when other economic endeavors unrelated to the fisheries encroached on the lakes. When the Reserve Mining Company wanted to erect a taconite beneficiation plant on Western Lake Superior's shoreline at Beaver Bay, Van Oosten's office was supportive. "Dr. Van Oosten has expressed the belief" Ralph Hile reported "that this plant will have little effect on the fisheries of Lake Superior." Van Oosten had studied the turbidity of Lake Erie and concluded turbidity had little effect on the overall populations of fishes.[71] Apparently the assumption was made that the inorganic turbidity of mine tailings would be similar to the mixture of organic and inorganic turbidity that occurred in Lake Erie's shallower waters. Van Oosten was not alone. Other state experts came out in support of the new plant.

The ultimate effects the mine tailings could have on the lake were not well understood at the time. The Reserve Mining Company's operations on Lake Superior provided an economic boom to Northwestern Minnesota's economy. Unfortunately they were an ecological disaster for western Lake Superior. The company dumped a staggering 67,000 tons of taconite tailings into Lake Superior on a daily basis. The United States Government eventually sued Reserve Mining Company in 1972. It was determined that the taconite tailings also contained asbestos fibers. Although the case initially focused on the massive amount of waste being dumped into the lake, by the time of the trial the heart of the case shifted to asbestos and Duluth's drinking water. Reserve Mining Company eventually agreed to an alternate disposal method for their waste.[72]

Industrial development long occupied a corner of the Great Lakes economy that conflicted with the interests of the commercial fisheries. The problematic relationships of commercial fishermen and the timber industry in the nineteenth and early twentieth centuries were relived decades later through the general unease that accompanied sharing fishing areas

with twentieth century industrial development. In 1945 United States Game Management Agent Stephen Creech warned of the expansion of oil explorations around Saginaw Bay. Creech was concerned about the potential for pollution and the effect oil explorations would have on fish and wildlife. In this instance John Van Oosten sided with the developers. Van Oosten pointed to the "8 or 9 proven oil wells" at Essexville, a shoreline community along Saginaw Bay. "If oil wells are drilled near the shore" Van Oosten confidently reassured him, "you may be certain that proper safeguards have been taken by the department to avoid pollution of state waters."[73] Creech responded that the wells Van Oosten spoke of were about one mile from his house. He expressed his dismay over the rapid spread of leases to Pure Oil and Gulf Company as well as to Consumers Power Company. He said sportsmen voiced a growing distrust for the state's Department of Conservation, since they appeared very willing to approve widespread development projects by the oil and power companies despite the dangers to lake resources. Referring to the well that operated nearest the shore where he lived, Creech said a breakage would wreck Saginaw Bay.[74] Michigan's Department of Conservation drafted a bill designed to clarify the department's authority to extend drilling rights into the lake if the oil companies deemed it necessary. Commercial fishing interests and sportsmen aligned briefly and killed the bill.[75]

With catches declining and consistent cooperation between states almost nonexistent, problems within the Great Lakes fisheries were further compounded by increasing competition from oceanic fishing enterprises. Salt water rose fish are not members of the order Perciformes, which includes freshwater perch. They are Scorpaeniformes. Marketers of oceanic seafood labeled rose fishes as "rose perch" and "ocean perch" and marketed them as such in the Great Lakes regions.[76] The less expensive rose fish undercut the market for the costlier freshwater

perch. Fishermen claimed it also damaged the reputation of freshwater perch due to its less desirable flavor. Norman Macaulay, the manager of Booth Fisheries in Bay City said purchasers in the Great Lakes would buy them thinking "they are buying yellow perch and they're getting rose fish."[77] Booth stated Great Lakes perch sold for around thirty to thirty five cents a pound by the early 1940s, while relabeled rose fish were usually less than half that price.[78]

George S. Wolff, a commercial fisherman out of Conneaut, Ohio was concerned the fish might turn off customers to his quarry. "If some housewife got those in and cooked them she would probably chase the whole family out of the house and nobody would ever want to touch perch again. . .That is one of the things that is hurting our markets more than anything else."[79] H. R. Beutel of Sebewaing, Michigan agreed. "If they are classed as perch they will think they are Saginaw Bay perch. . .We couldn't fillet a carp and call it a white bass."[80] Robert Ludiwg, a commercial fisherman and fish dealer out of Michigan City on Southern Lake Michigan summed up the situation saying "There has been an awful lot of poor quality ocean perch sold around here."[81] John Van Oosten pointed out that even the highly respected David Starr Jordan stated that rose fish resembled perciforms. Despite the resemblance, Van Oosten strongly sympathized with Great Lakes fishermen whose catches had to compete with the deceptively labeled imports. "If I were a Hitler, a Stalin, or a Mussolini" he said;

> I would force every commercial fisherman to label every package of rose fish as. . .*Sebastes marinus (Linneaus); family Scorpaenidae; the scorpion fish*. With this label attached I believe that there would be little difficulty in retaining our Great Lakes market for the yellow perch.[82]

Other fishermen pointed to what they saw as continuing abuses of lake resources. Two days before the bombing of Pearl Harbor, a frustrated Herbert W. Clow of Beaver Bay, Minnesota wrote to Claude R. Wickard, the Secretary of Agriculture in Washington D.C. Clow complained of intensive fishing by well capitalized fishing outfits with multiple tugs that operated on Lake Superior during the ciscoes spawning season. He said fish dealers were "parasites" who controlled the fishing industry of the Great Lakes.[83] He believed state laws worked in favor of the larger dealers. Clow favored Federal or international regulation and wanted a closed season on ciscoes so their spawning areas could be protected. He said the larger outfits that fished during the spawning periods glutted the market and made it nearly impossible for smaller fishermen to get decent prices for their own catches later. Clow apparently felt trapped by the system. He drew comparisons between the competition over the embattled fisheries of his region and patriotic slogans that proclaimed that America should fight for democracy and freedom. "I am of the opinion" he said, "that most of us are about as free as a fly in a spider's web."[84]

Even as the perceived food demands of World War II eroded conservation efforts in the Great Lakes other forces were at work to devise more effective management strategies for the marketed fish populations. The desire for cooperative management of the Great Lakes was given new impetus through the support of scientists such as Van Oosten and the continued decline of various species throughout the 1930s and early 40s. "It has been established definitely" wrote the Division of Fishery Biology within Fish and Wildlife "that overfishing and inadequacy and lack of uniformity in regulations" had contributed to a dramatic decline in the fisheries. [85]

Concern about the effects of overfishing was soon joined by anxiety about sea lampreys. Lampreys spread throughout the lakes during the 1930s and early 1940s. In August of 1941 A.M. Sandberg, an agent within the Fish and Wildlife Service, canvassed the Great Lakes region to gather statistical data. While in Escanaba, Michigan Sandberg reported that "a large blood sucker or sea lamprey" had been turning up in fish catches around Fayette, Michigan. Sandberg received his information from local fisherman Frank DeVet. Sandberg wondered if anyone in Fish and Wildlife knew what the creatures were or where they came from.[86]

As lamprey spread, many believed the introduced parasite could lead to the professional ruin of commercial fishermen. Sea lampreys added significant additional pressure to lake fishes already reeling under the intensive fisheries. Catches of market species, especially Lake Trout, began to drop dramatically as the numbers of lampreys increased. Increasing numbers of fishes caught in nets bore ferocious looking wounds, attached lampreys or were dead or dying from a recent lamprey attack. Over the ensuing years the governments of the Great Lakes states, Washington D.C., Ontario and Ottawa faced increased pressure from fisheries shareholders to do something. Once again cooperative management appeared to be the only solution to the shared lake problems.

John Van Oosten and the International Board of Inquiry

The International Board of Inquiry that came together in the 1940s began as an effort to address widespread declines in the populations of commercialized Great Lakes species. Initially contributors believed that coordinating legislation across state and national boundaries was the best method for addressing declines in the fisheries. Predictably, widespread resistance again formed within the commercial fisheries. As the numbers of sea lampreys multiplied the central

focus of conservation management shifted from commercial operations to the introduced species. Over the ensuing years control of sea lampreys dominated the work of the new international coalition.

After a series of communications between officials in the United States and Canada a new International Board of Inquiry was established on February 29th, 1940. President Franklin Roosevelt appointed Hubert E. Gallagher and John Van Oosten as the United States' members of the commission, while D.J. Taylor and A.G. Huntsman represented Canada.[87] While John Van Oosten was the Chief of Great Lakes Fisheries Investigations for the United States Fish and Wildlife Service, Gallagher was the Assistant Director of the Council of State Governments. Gallagher's state coalition formed during the height of the Great depression. The council functioned as an information cooperative for states to use to share and glean information in order to weather challenging times. The idea in appointing two men with such different backgrounds was to provide a balanced board. The regional interests of the states would presumably be represented by Gallagher, providing a balance to the biological and conservation ideas embodied by Van Oosten.[88] The council played a key role in providing the impetus for the formation of the new International Board of Inquiry. In 1938 the Council of State Governments arranged a meeting at Detroit to study Great Lakes management. As a result of the meeting the council recommended the formation of the new board of inquiry.[89] The International Board of Inquiry sent surveys to over four thousand fishermen across the Great Lakes shorelines in both Canada and the United States. A series of hearings were held around the lakes. The commissioners sought input from commercial fishermen, conservationists, sport fishermen and welcomed input from other interested persons. [90]

Opposition to the commission quickly surfaced. John R. Schacht, President of the Great Lakes Fisheries Association leveled criticism at the necessity of an international regulatory body. In dire language he warned that the commission would have "absolute autocratic power over the fisheries, and from their judgment there would be no appeal." He said his association viewed such "absolute arbitrary power" as "inimical to the best interests of the American commercial fisherman of the Great Lakes, and we are therefore opposed to it." Schacht charged that the commission would bring "ultra-conservationists" to power. Schacht blasted recent state and national conferences as fomenting propaganda against commercial fishermen. He argued that commercial fishermen were "progressive in their ideas" and "amenable to reasonable regulation based on common sense and experience," but that they were opposed to "regulation dictated by conservation hysteria."[91]

When he was urged to respond, Van Oosten dismissed Schatcht's criticisms as "sop." Van Oosten claimed the best way to handle Schatcht was to ignore him. Schacht focused much of his argument on trying to disprove that fishes were being depleted. Van Oosten said that approach did not resonate with fishermen.[92] However, Schatcht was not alone. Dr. A.G. Huntsman, Secretary on the International Board of Inquiry for the Great Lakes Fisheries was himself a critique of theories of overfishing affecting fish populations. In February of 1944 *Canadian Fisherman* published an essay by Huntsman that questioned whether fishing had any lasting effect on fish populations. He instead pointed to "natural fluctuations" as a common culprit. He warned that applying limitation on the fisheries when "natural fluctuations" might be the cause of population declines would be "needlessly" make "a bad situation worse."[93] Huntsman's writings were reprinted by the Howard K. Balch Commercial Fisheries Supplies Company out of Milwaukee, Wisconsin and distributed amongst commercial operators. Howard

Balch said Huntsman should be "congratulated" for his "cautious and thoughtful" approach. Balch questioned the logic of imposing new regulations that might serve no other purpose that to create additional burdens for commercial fishermen.[94]

Despite resistance from some sectors, there remained widespread support for international regulations. In 1940, 1941, 1942 and 1943 the Izaak Walton League reaffirmed its support for international regulation.[95] In spite of the renewed impetus for international cooperation, funding problems initially hampered the International Board of Inquiry's work. No significant budget allocations were made during its initial establishment. In March of 1940 Higgins said he was "very much afraid that the work of the board will be severely hampered in the immediate future because of a lack of funds."[96] As the first hearings were scheduled in late May and early June, Higgins repeatedly warned Van Oosten that his own depleted travel funds were the only funding options available to pay for the commission's expenses.[97] Finally on July 17th Van Oosten was sent word that Congress had allocated requested funding for the Great Lakes International Board of Inquiry.

Regional hearings began in earnest the following October, when the board met with fisheries representatives in Sault Ste Marie, Ontario on October 17th, 1940. The twenty-nine regional meetings, surveys and one site data collected by the international commission would result in what was arguably the most comprehensive examination of current conditions within the lake fisheries yet completed. "Without doubt," one of Van Oosten's colleagues would later state "the best single reference to the Great Lakes Fisheries is the report of the International Board of Inquiry for the Great Lakes Fisheries issued in 1943."[98] World War II interrupted any chance of taking immediate action on the information the board compiled. Thoughts of

conservation evolved into calls for ever increasing food production, of which fish was a key component.

Following the board's report in 1943 Van Oosten and others pushed for cooperative intervention by the United States and Canada in order to better manage the Great Lakes fisheries. Passing legislation to authorize joint international or even Federal intervention proved as difficult a challenge as it had for the investigative commissions of past decades. Meanwhile conditions on and in the lakes continued to take a heavy toll on fisheries resources. Even as production was encouraged during the war, non-native species were increasing in the lakes. Sea lamprey predation combined with overfishing to send already endangered populations of lake trout into a precipitous population crash.

The International Board of Inquiry for the Great Lakes Fisheries found that 92% of fishermen operating in the United States' waters of the Great Lakes wanted a standard set of laws governing the lakes.[99] While professional pressure from colleagues and a perceived patriotic duty may have motivated Van Oosten's decision to work for maximum fishery harvests during the war, he continued to believe that something had to be done to stem the tide of declining harvests. He viewed the work of the international board of inquiry as an important step toward better management. He strongly supported intervention into Great Lakes management by either the United States Federal Government or an international regulatory body. He argued that setting up such a system was the only way to establish a management program that would be "logical, sensible, scientific, equitable, and effective." He believed such a system would ensure better treatment of fishermen than under competing legislative systems and that it would improve marketing opportunities for them as well.[100]

Like previous generations of Great Lakes biologists Van Oosten was frustrated by the inability of the individual Great Lakes States to reach any lasting joint accord. When two or more states had conflicting laws over the same shared resources, enforcement was weak. Van Oosten said there was an overall "tendency to lower the standards of a state to the lowest existing level" when conservation legislation of different states came into conflict.[101] Van Oosten pointed to an Ohio law prohibiting the sale of ciscoes after that fishery collapsed in 1925. When populations of ciscoes seemed to be on the rebound fishermen immediately canvassed the lake to catch them. Ohio officials did not enforce the law because other states had no such law and thus they would have discriminated against their own fishermen while fishermen from other locales and Canada continued to fish. Instead, Ohio repealed its ban on the sale of ciscoes. He also cited examples from Michigan. He said the state was obligated to reduce its size limitations on nets for chubs because of less restrictive laws in neighboring states and Canada. Similarly, Michigan reduced the legal catch size of walleyes in response to Ohio's smaller size limitation.[102] Van Oosten lamented that for seventy-one years lake scientists recognized the necessity of uniform regulations yet over two dozen interstate and international conferences failed to achieve that goal.[103]

Without a cooperative, coordinated effort Van Oosten predicted the fisheries of the Great Lakes would continue their precipitous decline and eventually sport fisheries would feel the squeeze as well. Van Oosten strongly believed recommendations published by the International Board of Inquiry in 1942 needed implementation. The findings called for an international agreement patterned after the Migratory Bird Treaty, to be applied to the fishery resources of the Great Lakes. Van Oosten believed there would never be a better time for action. If the board's recommendations failed to achieve the necessary result he said future conferences would be as

futile as those of the past. Unless an international treaty was forged he was "convinced on the basis of 22 years of research on the Great Lakes fisheries that coordinated action will never be attained."[104]

The board issued its report on August 6th, 1942. Officials from both the United States and Canada then collaborated on how they might best implement the board's recommendations. The Great Lakes Treaty was the result. It was signed on April 2nd, 1946 and sent to the U.S. Senate on the 22nd of that month. The treaty would establish a commission consisting of three men from each nation who would work together to make research recommendations to their scientific bodies. More significantly, the treaty bestowed the commission with "full discretionary powers to regulate the fisheries for the sole purpose of securing the maximum use of these Great Lakes resources consistent with their perpetuation." The states and the Province of Ontario would bear the responsibility of enforcing legislation passed by the commission, but if they failed to do so the federal governments of Canada and the United States would be authorized to act.[105] As Van Oosten and other supporters waged a public campaign to get the legislation passed, opponents continued to oppose their efforts. In at least one instance the effort to build public support for the pivotal legislation was damaged by an erroneous interpretation and application of catch data.

In May and July of 1946 articles appeared in Michigan newspapers as well as various fishing publications including *The Fisherman* and *Atlantic Fisherman* that claimed production levels of marketable lake fishes had risen by as much as 42% in Lake Michigan waters over the first four months of that year. The articles claimed the numbers were substantiated by data "compiled by the U.S. Fish and Wildlife Service" and were based primarily on catches of "lake trout and yellow pike."[106] The reports sent Van Oosten and other conservation officials

scrambling to discover where the bizarre figures had originated. Their own data clearly showed lake trout in rapid decline. On Sunday, July 7 1946 the *Detroit News* blasted the article. Conservation Editor Albert Stoll Jr., writing for the *Detroit News* attributed the recent press release to the U.S. Fish and Wildlife Service. Stoll Jr. said the rosy claims about production increases "carried the inference that we are doing quite all right under state and provincial regulations" and international control was therefore not necessary. He charged that was the "same hackneyed argument used in 1916 to block the migratory bird treaty" between the U.S. and Canada.[107]

After Van Oosten's own office was asked where the numbers had originated, Van Oosten realized they had likely originated with the United States Fish and Wildlife Service's Market News Service in Chicago. He then contacted Paul E. Thompson, the Act Chief of the Division of Fishery Biology in Chicago. Van Oosten expressed dismay that regional reports that included non-commercial and inland fishery statistics as well as data on species imported from Canada were being used as a barometer for all of the Great Lakes. The picture they provided was in no way an accurate reflection of Lake Michigan catch statistics as a whole.[108] Charles M. Reardon, the Fishery Marketing Specialist in Chicago subsequently revealed the identity of the person behind the recent news releases and articles. A Mr. Eldridge, An Associated Press reporter, contacted the Market News Service asking if he might have access to four months of market statistics as a way of proving or disproving accounts of rising lamprey predations in Illinois waters. Instead, once the data was in hand, the ambitious reporter had produced several articles claiming a significant increase in overall lake catches. When Reardon contacted Eldridge to ask why the reporter assumed the local market statistics might be valid for the entire lake basin, Eldridge seemed to Reardon to be entirely ignorant of how to accurately interpret the statistics he

was using.[109] Whatever his motivation or understanding of the data he utilized, Eldridge's damaging articles appeared just as Congress was considering the latest proposal for international management of the lakes.

From August until mid November of 1948 Van Oosten was temporarily away from his office and Dr. Ralph Hile assumed the role of acting director.[110] The overall catch of whitefishes had recently risen while lake trout populations continued to slump. When Hile received an inquiry asking whether the population changes among whitefish resulted from recent die-offs of smelt, he cautioned against such an assumption. He compared the recent rise in the catch of whitefishes to an unexpected and temporary rise in cisco populations in Lake Erie during 1944. Hile said the population increases could have been coincidental or caused by other factors. Questioned whether smelt might be blamed for the decreases in Great Lakes populations of lake trout, Hile said the available data did not support the idea. Hile pointed elsewhere for the cause. "From the evidence at hand" he said, "I am inclined to believe that the sea lamprey. . .is to be blamed for the decreased abundance of lake trout."[111]

Sea lamprey populations grew rapidly in the lakes during the 1940s. Following the end of World War II, Van Oosten's office devoted increasing time and attention to studying the parasitic species. In 1946 the cooperative Great Lakes Sea Lamprey Committee was established. The committee included members from the Great Lakes states and Ontario. John Van Oosten chaired the committee. He directed the resources of his Ann Arbor office toward increasing investigations of sea lampreys, including their life cycles, feeding habits, effect on marketable species of fish and other issues. By the mid 1940s sea lampreys were perceived as a serious and growing threat to the stability and longevity of the Great Lakes commercial fisheries.[112]

However, the additional requirements of sea lamprey research further stretched the time and resources of Van Oosten's office.

Even as sea lampreys were affecting the communities of the lakes, their impact was also felt in Ann Arbor as Van Oosten struggled to address the varied and growing areas of fisheries research that required attention. By August of 1947 sea lamprey research was requiring investments in new equipment and vehicles in order to complete necessary field work. Plans were drawn up to establish a test weir at the Ocqueoc River. Expansions in personnel were also under consideration.[113] In November of 1947 Paul E. Thompson, the Assistant Chief of Fishery Biology within Fish and Wildlife contacted Van Oosten asking whether the Ann Arbor office might benefit from the establishment of a new position to head up sea lamprey investigations.[114] A seemingly exasperated Van Oosten replied that he would be "delighted" if a satisfactory candidate could be found. He said an extensive backlog of materials accumulated related to sea lampreys that he would be happy to turn over to a suitable candidate.[115]

Van Oosten's office was also fielding communications from private citizens concerned about sea lampreys appearing in area waterways. In June of 1948 Van Oosten received a letter from Emma Skutt. Skutt complained of sea lampreys on the bodies of trout in the White Cloud River at White Cloud Michigan. White Cloud lies well inside the interior of Michigan's western shoreline. Sea lampreys penetrated deep into the interior rivers and streams of the Great Lakes system, especially during their spawning runs. Van Oosten thanked Skutt for the information. He said lampreys had "raised havoc" with lake trout populations in both Lakes Huron and Michigan.[116]

Van Oosten continued to struggle for the resources needed to execute the multifaceted research demands of the lakes. The lack of adequate resources was a continuous hindrance Great Lakes scientists struggled with while trying to compile research on lake fishes. Funding shortfalls inevitably hampered their research. Because of ongoing shortages of manpower, financing and other challenges basic knowledge of the life cycles of key lake species remained elusive into the mid twentieth century. In December of 1943 John Van Oosten expressed frustration at the lack of understanding they had when it came to determining the age of lake trout, one of the most important fishes in the lakes in terms of its value to the commercial fisheries.

> We have little information on age of lake trout. Apparently the lake trout grow much more slowly than we believed. In the case of the lake trout we do not know what time interval to use to try to correlate planting with harvest, we do not know the average age of the lake trout in the catch. . .age determination is pretty much guess work in the larger trout.[117]

The eventual conclusion of World War II did not signal the end of Van Oosten's funding woes. He continued to struggle for sufficient finances to support the work of his department. In March of 1946 on the eve of the international Great Lakes Treaty's submission to the Congress for consideration, Van Oosten learned that $300 had been cut from his budget allocation, leaving his office with a debt of $18.01 even as an important conference in Toronto loomed. Thus in the midst of the treaty's final push the constant lack of funds threatened to undo his department's work yet again. Upon appeal to Paul E. Thompson, then the Acting Chief of Fishery Biology, it was agreed that the funds would be restored, but first Van Oosten was asked to write up a budget justifying their return. Thus he was thus forced to devote additional time to getting the necessary

dollars restored during the eleventh hour of the push to get the international treaty passed.[118] In early 1947 Van Oosten submitted a memorandum to Elmer Higgins outlining the work of his department and drawing comparisons between Federal allocations for Great Lakes research and allocations for other districts. Van Oosten estimated the fisheries as valued at $11,500,000. At the time $19,000 was allocated for research. He compared this allocation to those given to other fisheries research, including one area of approximately equal value that received $54,000 and one he estimated at less than double the overall economic value that received $240,000. Instead of considering the shortfall, Higgins suggested that Van Oosten devalued the research being done for other fisheries around the nation. Van Oosten assured him that was not the point. Instead, he tried to demonstrate the lack of funding directed at addressing the multifaceted problems of the Great Lakes fisheries, while other districts received much higher levels of funding relative to the respective values of their fisheries.[119]

In 1949 Van Oosten stepped down as Director of the Great Lakes Biological Laboratory, but continued on as a senior scientist. In June of 1951 when Van Oosten's secretary resigned her position, he hoped for a speedy qualified replacement. However, in October of that year he reported that conditions in his office were "becoming intolerable" as he still had no permanent clerical assistant. He said he spent his time doing "the secretarial work and related duties that were absolutely essential."[120] Van Oosten desired the assistance of a specific staff member then working for James Moffett, the new Chief of Great Lakes Fishery Investigations. Van Oosten found himself at odds with the new director, who was himself struggling with the underfinanced day to day operations of the biological laboratory.[121]

Van Oosten's office worked with a variety of conservation departments on numerous issues to better understand and sustain the Great Lakes fisheries. Hatcheries had lost their once preeminent place atop United States fisheries management programs, but they remained an important component of overall management. Hatcheries were plagued by their own sets of issues including a host of fish ailments that were only marginally understood. Fin and eye infections, sores, diseased eggs and other conditions plagued their operations.

The work of fishery conservationists led them in a variety of directions as the field of research broadened and the list of factors recognized as influential in production grew. In October of 1945 a University of Michigan faculty member and friend of Van Oosten's visited their doctor complaining of chest pains. After a series of tests and x-rays they could not find anything wrong with him. His doctor suggested he was suffering from angina pectoris, a condition usually related to heart disease. When the faculty member relayed his story to Van Oosten, he included information on where he thought the condition might have originated. He said he sprayed an enclosed chicken coop with DDT and the insecticide Flit about a week prior to the onset of chest pains. Van Oosten wondered if DDT was the real culprit and wrote the merchandising department of United States Fish and Wildlife to inquire about information on DDT safety. He was concerned, he said, because he might encounter cases of fishermen using it in their fish houses or aboard their boats and he wanted to know what sort of safety data existed.[122] Van Oosten was eventually referred to Paul A. Neal at the National Institute of Health.[123] Two years earlier Neal declared DTT safe for use in multiple forms and would go on record in Life Magazine in 1946 stating that no proven case of a human being poisoned by DDT existed in the United States.[124] Van Oosten's curiosity in regard to the new pesticide was well founded. However, it would be another sixteen years before Rachel Carson, a biologist whose

work Van Oosten had one time critiqued, raised an international alarm about the dangers of DDT through her book *Silent Spring*.

The first half of the twentieth century brought monumental changes to the entire Great Lakes Basin. Urbanization, industrialization, mechanized agriculture, spreading market systems, modernized shipping and a host of other changes effected vast modifications to the lakes. Lake Huron fishermen adopted new and modified types of fishing apparatus in an effort to maintain their catch tonnages as various fishes steadily declined. Numerous efforts at building cooperative interstate and international management programs failed time and again as regional demands superseded comprehensive agreement. Numerous new species were introduced to the interior Great Lakes. A few of them competed directly with native species for lake resources. Sea lampreys preyed on large, marketable species and added their own resource needs to the existent pressure of overfishing. A new international coalition was formed in the early 1940s, but as the years rolled by its ultimate form and function would vary greatly from the model its framers had intended.

Chapter 4 endnotes

---

[1] Scott and Crossman, Freshwater Fishes, 408 (see chap. 1, n. 8).

[2] James Gillingham, interview by William Wakeham and Richard Rathbun, August 30 1894, Records of the Joint Committee, Lake-Erie-Lake Huron, Misc. Fish, NACP, misc. 40. (see chap. 2, n. 117).

[3] Harris, *Vanishing Heritage*, 20 (see chap. 1, n. 88). For further information related to Harris' involvement at Long Point Company see Edward Harris, *Recollections of Long Point* (Toronto: Warwick Bro's & Rutter, 1918).

[4] Ibid, 20; and Clifton Hill, *Missouri Rustler*, quoted in "Chat of the Craft," *Mixer and Server* 14, no. 1 (January 15, 1905): 16. Whether or not Hill was the original author of the tongue-in-cheek recipe is unknown.

[5] Scott and Crossman, *Freshwater Fishes*, 410. Hubbs and Lagler labeled the common carp a "large pest." See Hubbs and Lagler, *Fishes of the Great Lakes*, 106 (see chap. 1, n 14).

[6] Mathew D. Wolfe et al., "Effects of Common Carp on Reproduction, Growth, and Survival of Largemouth Bass and Bluegills," *Transactions of the American Fisheries Society* 138 (2009): 975-983, DOI: 10.1577/T08-115.1.

[7.] John Van Oosten, "The Dispersal of Smelt, Osmerus Mordax (Mitchill), in the Great Lakes Region" *Transactions of the American Fisheries* 66, no. 1 (January, 1937): 161

[7] Ibid., 160.

8. "Introduction and Spread of Smelt Recalled," *The Fisherman* 31, (1979): 16.

[9.] "Smelt Menace Commercial Fishing," *The Fisherman*, 1, no. 3 (1932): 10.

[10.] "Smelt Reach Western End of Lake Superior," *The Fisherman*, 5, no. 3 (1936): 5.

[11.] "Production of Smelt Reaches High Peak," *The Fisherman*, 7, no. 5 (1935:3.

[12.] "Loss of Smelt Still Puzzles Scientists," *The Fisherman*, 14, no. 3 (1944): 3.

[13.] "Smelt Are Making a Comeback," *The Fisherman*, 15, no. 5 (1945): 3, "Statistics Show That Smelt Are Making A Comeback," *The Fisherman*, 18, no. 11 (1948): 18, "Bay Smelt Killed by Fungus Growth" *The Fisherman*, 20 (1950), 11. Van Oosten initially disputed the fungus theory, see John Van Oosten, "Mortality of Smelt, Osmerus Mordax (Mitchill), in Lakes Huron and Michigan During the fall and Winter of 1942-1943," *Transactions of the American Fisheries Society* 74, no. 1 (January 1947): 321. Later research suggested smelt may be

vulnerable to fungus attacks (and subsequent die-offs) after spawning. For an example see Wayne F. Schaefer, Richard A. Heckmanna and William A. Swenson, "Postspawning Mortality of Rainbow Smelt in Western Lake Superior," *Journal of Great Lakes Research* 7, no. 1, (1981): 37-41.

[8] Edwin S. Turner, *Welland Ship Canal, 1929*, p. 1, Edwin Stewart Turner fonds, box 5, Archives of Ontario, (hereafter cited as ESTF, Archives of Ontario).

[9] Henry J. Foster to Edwin S. Turner, 6 February 1946, ESTF, MU 3032, box 5, Archives of Ontario.

[10] Turner, *Welland Ship Canal,* p. 2, ESTF, Archives of Ontario.

[11] Foster to Turner, Toronto, ESTF, Archives of Ontario.

[12] Turner, *Welland Ship Canal,* p. 4, ESTF, Archives of Ontario.

[13] E.G. Cameron to Dubuc, 3 August 1928, in *The Great Swivel Link: Canada's Welland Canal*, ed. Roberta M. Styran and Robert R. Taylor (Toronto: Champlain Society, 2001), 348-349; and "Eight Crushed to Death When Huge Steel Gate Is Toppled Into Canal," *The Globe*, August 2, 1928, ESTF, MU 3032, box 5, Archives of Ontario.

[14] Ronald Stagg, *The Golden Dream: A History of the St. Lawrence Seaway*, (Toronto: Dundurn Press, 2010), 96.

[15] Trygvie Jensen, *Wooden Boats and Iron Men: History of Commercial Fishing in Northern Lake Michigan &Door County, 1850-2005* (De Pere: Paisa (Alt) Publishing, 2007), 78.

[27.] William Ashworth, *The Late Great Lakes: An Environmental* History (New York: Alfred A. Knopf, 1986): 120-121. James A. Rice, "Cascading Effects of Human Impacts on Fish Populations in the Laurentian Great Lakes," in Fishery Science: The Unique Contributions of Early Life Stages, ed. Lee A. Fuiman and Robert G. Werner, (Oxford: Blackwell Science Ltd., 2002), 260-262.

[16] A.G. Huntsman, "Fisheries Research in Canada," *Science* 98, no. 2536 (August 6, 1943): 117-118.

[17] J. R. Dymond, "A History of Ichthyology in Canada," *Copeia* 1964, no. 1 (March 26, 1964): 8.

[18] B.A. Bensley, "The Fishes of Georgian Bay," *Contributions to Canadian Biology*, Sessional Paper No. 39b, Supplement to 47th Annual Report of the Department of Marine and Fisheries, Fisheries Branch (1915): 9-10, (hereafter cited as *Fishes of Georgian Bay*).

[19] Bogue, *Fishing the Great Lakes*, 164 (see chap. 2, n. 7), Vernon C. Applegate, "Natural History of the Sea Lamprey, Petromyzon marinus, in Michigan," Special Scientific Report – Fisheries, Fish and Wildlife Service, Department of the Interior (Washington, DC, 1950), 2-3 (hereafter cited as "Natural History of the Sea Lamprey").

[20] James T. Angus, *A Respectable Ditch: A History of the Trent-Severn Waterway, 1833-1920* (Kingston: McGill-Queen's University Press, 1988), 393-394.

[21] G.C. Toner, "Annotated List of Fishes of Georgian Bay," *Copeia* 1933, no. 3 (1933): 133, http://0-www.jstor.org.library.unl.edu/stable/1436239.

[22] David Starr Jordan, "The Fresh-Water Lampreys of the Eastern United States," *Copiea* no. 64 (December 31, 1918): 93, http://0-www.jstor.org.library.unl.edu/stable/1437181.

[23] John R. Waldman et al, "Mitochondrial DNA Analysis Indicates Sea Lampreys Are Indigenous to Lake Ontario," *Transactions of the American Fisheries Society*, 133, no. 4 (July 2004): 957-958, doi: 10.1577/T03-104.1; John R. Waldman et al, "Mitochondrial DNA Analysis Indicates Sea Lampreys Are Indigenous to Lake Ontario: Response to Comment," *Transactions of the American Fisheries Society* 133, no. 5 (September 2009): 1195-1196, doi: 10.1577/T08-035R.1; and M. B. Bryan et al., Patterns of invasion and colonization of the sea lamprey (Petromyzon marinus) in North America as revealed by microsatellite genotypes," *Molecular Ecology* 14, no.12 (October, 2005): 3767-3769, doi: 10.1111/j.1365-294X.2005.02716.x. For an opposed viewpoint see Randy L. Eshenroder, "Comment: Mitochondrial DNA Analysis Indicates Sea Lampreys are Indigenous to Lake Ontario," *Transactions of the American Fisheries Society*, 138, no. 5 (September 2009): 1178-1189, doi: 10.1577/T08-035.1.

[24] Bensley, *Fishes of Georgian Bay*, 9-10.

[25] Charles W. Creaser, "The Lamprey *Petromyzon Marinus* in Michigan, *Copeia*, 1932, no. 3 (October 7, 1932), 157, http://0-www.jstor.org.library.unl.edu/stable/1436078.

[26] Vernon C. Applegate, "The Sea Lamprey in the Great Lakes," *The Scientific Monthly*, 72, no. 5 (May, 1951): 275, http://0-www.jstor.org.library.unl.edu/stable/20093.

[27] Applegate, "Natural History of the Sea Lamprey," 4-5; and Napier Shelton, Huron: The Seasons of a Great Lake, (Detroit: Wayne State University Press, 1999), 123.

[28] Applegate, "Natural History of the Sea Lamprey," 5-6. For Lake Superior's first confirmed lampreys see B.R. Smith and J.J. Tibbles, "Sea Lamprey (Petromyzon Marinus) in Lakes Huron, Michigan, and Superior: History of Invasion and Control, 1936-78," *Canadian Journal of Fisheries and Aquatic Sciences* 37 (November 1980): 1782 (hereafter cited as *Sea Lamprey Control*).

[29] W.J.K. Harkness, "Progress Report on the Sea Lamprey: Petromyzon Marinus, Studies Conducted in the Thunder Bay District, 1950," Lamprey Barrier Sites – Report, 1950-51, F 9020D.1.1/6, Fisheries Branch, general association and committee files, RG1-289, box 2, Archives of Ontario (hereafter cited as FB, GAC, RG 1-289-1, Archives of Ontario).

[30] Van Oosten, *Michigan Fisheries*, 33-35 (see chap. 2, n. 8).

[31] Ibid., 34-35.

[32] Ibid., 34.

[33] Ibid., 36.

[34] "Mission and History," USGS Great Lakes Science Center, last modified January 31, 2008, http:// www.glsc.usgs.gov/main.php?content=aboutus_theglsc_mission&title=The GLSC0&menu=aboutus.

[35] Works Progress Administration Project Application, Michigan, State Application number 75083, Michigan-Ann Arbor Emergency Relief Appropriation Act – 1938, Records of the Bureau of Commercial Fisheries, General Records, General Classified Files, 1902-1965, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD. (hereafter cited as BCF, GR, GCF, USFWS, RG 22, NACP).

[36] John Van Oosten, Chief of Great Lakes Fishery Investigations, to Ira N. Gabrielson, Deputy Coordinator of Fisheries, 26 November 1943, Van Oosten 1940-1943, BCF, GR, GCF, RG 22, NACP; and Edward W. Bailey, Acting Chief of the Division of Fishery Biology, to John Van Oosten, Chief of Great Lakes Fishery Investigations, 18 December 1943, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[37]John Van Oosten, "Great Lakes Report –Fiscal year 1946," Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[38] John Van Oosten, Chief of Great Lakes Fishery Investigations, to Fred Westerman, Fish Division, Michigan Department of Conservation, 19 May 1939, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[39] W. Mutinga to John Van Oosten, Chief of Great Lakes Fishery Investigations, 8 January 1934, Great Lakes Inves. Drw. 1., Records of the US Fish Commission and Bureau of Fisheries, Records of the Division of Scientific Inquiry, General Correspondence, 1880-1935, Pacific Coast Calif. Trout 1930-31, Great Lakes 1928-34, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD. (hereafter cited as USFC, BF, DSI, GC, PCCT, GL, USFWS, RG 22, NACP).

[40] A.H. Matt to Brooks Fletcher, 23 May 1934, House of Representatives, Great Lakes Inves. Drw. 1., USFC, BF, DSI, GC, PCCT, GL, USFWS, RG 22, NACP.

[41] Martin Tansey to Bureau of Fisheries, June 1934, Great Lakes Inves. Drw. 1., USFC, BF, DSI, GC, PCCT, GL, USFWS, RG 22, NACP.

[42] Frank T. Bell, Commissioner, Bureau of Fisheries, to Martin Tansey, 8 June 1934, Great Lakes Inves. Drw. 1., USFC, BF, DSI, GC, PCCT, GL, USFWS, RG 22, NACP.

[43] John Van Oosten, Chief of Great Lakes Fishery Investigations, to Elmer Higgins, Chief of the Division of Scientific Inquiry, 6 March 1935, Bureau of Fisheries, Great Lakes Inves. Drw. 1., USFC, BF, DSI, GC, PCCT, GL, USFWS, RG 22, NACP.

[44] Brege and Kevern, *Michigan Commercial Fishing Regulations*, 46 (see chap. 3, n. 81).

[45] John R. Gardner, Acting Commissioner, Bureau of Fisheries, to John Van Oosten, Chief of Great Lakes Fishery Investigations, 22 September 1939, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[46] John Van Oosten, Chief of Great Lakes Fishery Investigations, to Elmer Higgins, Chief of the Division of Scientific Inquiry, 7 November 1939, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP (hereafter cited as Van Oosten to Higgins, 7 November 1939).

[47] John Van Oosten, Chief of Great Lakes Fishery Investigations, to William Comstock, 15 December 1939, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP; and John Van Oosten, Chief of Great Lakes Fishery Investigations, to Elmer Higgins, Chief of the Division of Scientific Inquiry, 22 December 1939, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[48] Van Oosten to Higgins, 7 November 1939.

[49] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Charles E. Jackson, Assistant Director, Fish and Wildlife Service, 10 October 1940, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[50] Ibid.

[51] Harry R. Gaines to Ira N. Gabrielson, Director of Fish and Wildlife Service, 19 August 1942, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[52] Ibid.

[53] Ira N. Gabrielson, Director of Fish and Wildlife Service, to Harry R. Gaines, 1 September 1942, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[54] H.J. Deason, Chief of the Conservation Section, Office of the Coordinator of Fisheries, to John Van Oosten, Chief of Great Lakes Fisheries Investigations, 8 September 1942, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[55] Charles E. Jackson, Assistant Director, Fish and Wildlife Service, to John Van Oosten, Chief of Great Lakes Fishery Investigations, 21 October 1940, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[56] John Van Oosten, "The Need of International or Federal Control of the Great Lakes Fisheries," 8 January 1943, p. 2, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP, (hereafter cited as "International or Federal Control").

[57] John Van Oosten, "Instructions on Procedures for use by Area Coordinator of Fisheries on the Great Lakes, University Museums, Ann Arbor, Michigan," 12 August 1943, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[58] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to H.J. Deason, Chief of the Conservation Section, Office of the Coordinator of Fisheries, 9 June 1942, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[59] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Elmer Higgins, Chief of the Division of Fishery Biology, Fish and Wildlife Service, 25 November 1942, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[60] Elmer Higgins, Chief of the Division of Fishery Biology, Fish and Wildlife Service, to John Van Oosten, Chief of Great Lakes Fisheries Investigations, 1 December 1942, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[61] John Van Oosten, "Memorandum on the Fisheries and Fishery Program During the War," 14 January 1943, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[62] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Elmer Higgins, Chief of the Division of Fishery Biology, Fish and Wildlife Service, 2 December 1942, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[63] John Van Oosten, "Estimate of Probable Production (Pounds) of Great Lakes Commercial Fisheries in 1943, with notes on considerations influencing the estimate for each species; estimate of potential sustained production in the Great Lakes with statement for each species of the method by which this production is to be attained," 2 December 1942, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[64] Frank W. Jones, "The Age, Growth, and Bathymetric Distribution of Reighard's Chub, Leucichthys Reighardi Koelz, in Lake Michigan," *Transactions of the American Fisheries Society* 72 (1943): 108-135, doi: 10.1577/1548-8659(1942)72[108:TAGABD]2.0.CO;2.

[65] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Elmer Higgins, Chief of the Division of Fishery Biology, Fish and Wildlife Service, 9 April 1943, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[66] Ralph Hile, Acting Area Coordinator for the Great Lakes, to Robert Breckenridge, 11 December 1943, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[67] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Edward W. Bailey, Assistant Chief of the Division of Fishery Biology, Fish and Wildlife Service, 24 February 1943, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[68] Rachel Carson *Silent Spring* (Boston: Houghton Mifflin, 1962).

[69] Edward Schneberger, Minutes of the Great Lakes Trout Committee, 25 April 1944, p.2, Great Lakes Investigations, BCF, GR, GCF, USFWS, RG 22, NACP.

[70] Edward Schneberger, Minutes of the Great Lakes Trout Committee, 10 September 1946, pp. 3-4, Great Lakes Investigations, BCF, GR, GCF, USFWS, RG 22, NACP.

[71] Ralph Hile, Acting Chief of Great Lakes Fishery Investigations, to Edward Schneberger, Superintendent, Fish Management Division, Wisconsin Conservation Department, 22 August 1947, Great Lakes Investigations, BCF, GR, GCF, USFWS, RG 22, NACP.

[72] Daniel A. Farber, "Risk Regulation in Perspective: Reserve Mining Revisited," *Environmental Law* 21 (1991): 1324, 1327-1328.

[73] John Van Oosten, Chief of Great Lakes Fishery Investigations, to Edward W. Bailey, Acting Chief of the Division of Fishery Biology, Fish and Wildlife Service, 12 April 1945, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[74] Stephen Creech, Game Management Agent, to Oscar H. Johnson, Regional Director, 1 May 1945, Fish and Wildlife Service, 12 April 1945, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[75] "Drilling in Bay Pool is Delayed," *Bay City Times* May 7, 1945, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[76] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Merle Lyon, Federal Trade Commission Trial Attorney, "Excerpts of Testimony," 11 May 1942, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[77] Ibid.

[78] Ibid.

[79] Ibid.

[80] Ibid.

[81] Ibid.

[82] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to William H. Loutit, Chairman, Department of Conservation, 1 May 1940, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[83] Herbert W. Clow, to Claude R. Wickard, Secretary of Agriculture, 5 December 1941, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[84] Ibid.

[85] "International Board of Inquiry for the Great Lakes Fisheries," June 1941, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[86] A.M. Sandberg, Agent of Fish and Wildlife Service, to Fish and Wildlife Service, 15 August 1941, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[87] "Board of Inquiry for the Great Lakes Fisheries," press release no. 98, Department of State, 28 February 1940, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[88] Record of the Meeting of the Board of Inquiry for the Great Lakes Fisheries, Sault Ste. Marie, October 17, 1940, p. 3, International Board of Inquiry for the Great Lakes Fisheries, First Public Hearing, Public hearings of the International Board of Inquiry for the Great Lakes Fisheries, RG1-282-3-1, box 5, Archives of Ontario.

[89] John Van Oosten, "The Great Lakes Fisheries Treaty," 1946, p.4 Great Lakes Investigations, BCF, GR, GCF, USFWS, RG 22, NACP, (hereafter cited as "Great Lakes Treaty").

[90] "International Board of Inquiry for the Great Lakes Fisheries," June 1941, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[91] John R. Schacht, "Should International Commission Govern Great Lakes," copied from *Atlantic Fisherman* 21, no. 6 (July 1940), 6, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[92] John Van Oosten, Chief of Great Lakes Fishery Investigations, to Hilary J. Deason, Associate Aquatic Biologist, 2 August 1940, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[93] A.G. Huntsman, "Prospects for More Fish," reprint (Milwaukee: Howard K. Balch Co, 1944), 4, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[94] Ibid., 2.

[95] "Great Lakes Fisheries," Resolutions adopted March 27, 1943, Izaak Walton League of America, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[96] Elmer Higgins, Chief of the Division of Scientific Inquiry, to John Van Oosten, Chief of Great Lakes Fishery Investigations, 2 March 1940, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[97] Elmer Higgins, Chief of the Division of Scientific Inquiry, to John Van Oosten, Chief of Great Lakes Fishery Investigations, 15 May 1940, Van Oosten 1940-1943, BCF, GR, GCF, USFWS, RG 22, NACP.

[98] Ralph Hile, Acting Chief of Great Lakes Fishery Investigation, to Jerome H. Cahill, 7 September 1948, Dr. Van Oosten, General Correspondence, 1944-1948, BCF, GR, GCF, USFWS, RG 22, NACP.

[99] Van Oosten, Great Lakes Treaty, 3.

[100] Ibid, 3-4.

[101] Van Oosten, "International or Federal Control," 4.

[102] Ibid., 3-4.

[103] Van Oosten, Great Lakes Treaty, 4.

[104] Van Oosten, "International or Federal Control, 6.

[105] Van Oosten, Great Lakes Treaty, 5.

[106] "State Fishing Fleet Play Leading Role in Feeding Hungry World," Ann Arbor News, May 31, 1946, reprint, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[107] Albert Stoll Jr., "Fish stories," 7 July 1946, *Detroit News*, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[108] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Paul Thompson, Acting Chief of the Division of Fishery Biology, 28 June 1946, Ann Arbor, Michigan, (Inland Fisheries), BCF, GR, GCF, RG 22, NACP.

[109] Charles M. Reardon, Fishery Marketing Specialist, to A.W. Anderson, Chief of the Division of Commercial Fisheries, 11 July 1946, Ann Arbor, Michigan, (Inland Fisheries), BCF, GR, GCF, RG 22, NACP.

[110] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Lionel A. Walford, Chief of Fishery Biology, 23 July 1948, Dr. Van Oosten, General Correspondence, 1944-1948, BCF, GR, GCF, USFWS, RG 22, NACP.

[111] Ralph Hile, Acting Chief of Great Lakes Fishery Investigation, to C.F. Culler, Regional Supervisor of Fish Culture in Minneapolis, 15 November 1948, General Correspondence, 1944-1948, BCF, GR, GCF, USFWS, RG 22, NACP.

[112] John Van Oosten, "Great Lakes Investigations," November 10, 1947, pp. 1,6, Dr. Van Oosten, General Correspondence, 1944-1948, BCF, GR, GCF, USFWS, RG 22, NACP.

[113] Charles M. Mottley, Chief of the Section of Inland Fisheries, Record of a trip to Ann Arbor Michigan, 11 August 1947, Dr. Van Oosten, General Correspondence, 1944-1948, BCF, GR, GCF, USFWS, RG 22, NACP.

[114] Paul Thompson, Assistant Chief, Branch of Fishery Biology, to John Van Oosten, Chief of Great Lakes Fisheries Investigations, 4 November 1947, Dr. Van Oosten, General Correspondence, 1944-1948, BCF, GR, GCF, USFWS, RG 22, NACP.

[115] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Paul Thompson, Assistant Chief, Branch of Fishery Biology, 7 November 1947, Dr. Van Oosten, General Correspondence, 1944-1948, BCF, GR, GCF, USFWS, RG 22, NACP.

[116] John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Emma Skutt, 18 June 1948, Dr. Van Oosten, General Correspondence, 1944-1948, BCF, GR, GCF, USFWS, RG 22, NACP.

[117] Transcript of Meeting to Formulate a Cooperative Research Plan for the Management of Lake Trout in Lake Michigan, December 8, 1943, p. 4, Great Lakes Investigations, BCF, GR, GCF, USFWS, RG 22, NACP.

[118]John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Paul Thompson, Acting Chief, Branch of Fishery Biology, 20 March 1946, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP; and Paul Thompson, Acting Chief, Branch of Fishery Biology, to John Van Oosten, Chief of Great Lakes Fisheries Investigations, 22 March 1946, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[119] Elmer Higgins, Chief of the Division of Fishery Biology, Fish and Wildlife Service, to John Van Oosten, Chief of Great Lakes Fisheries Investigations, 17 February 1947, Great Lakes Investigations, BCF, GR, GCF, USFWS, RG 22, NACP; and John Van Oosten, Chief of Great Lakes Fisheries Investigations, to Elmer Higgins, Chief of the Division of Fishery Biology, Fish and Wildlife Service, 21 February 1947, Great Lakes Investigations, BCF, GR, GCF, USFWS, RG 22, NACP.

[120] John Van Oosten to Paul Thompson, Assistant Chief, Branch of Fishery Biology, 4 October 1951, File 821.1, Great Lakes Investigations, Ann Arbor, Michigan, (Inland Fisheries), BCF, GR, GCF, RG 22, NACP.

[121] James W. Moffett, Chief of Great Lakes Fishery Investigations, to Paul E. Thompson, Assistant Chief, Branch of Fishery Biology, 10 October 1951, Great Lakes Investigations, Ann Arbor, Michigan, (Inland Fisheries), BCF, GR, GCF, USFWS, RG 22, NACP; and Paul E. Thompson, Assistant Chief, Branch of Fishery Biology, to John Van Oosten, 15 October 1951, Great Lakes Investigations, Ann Arbor, Michigan, (Inland Fisheries), BCF, GR, GCF, USFWS, RG 22, NACP.

[122] John Van Oosten, Chief of Great Lakes Fishery Investigations, to Edward W. Bailey, Acting Chief of the Division of Fishery Biology, Fish and Wildlife Service, 31 October 1945, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[123] S.W. Simmons to Edward W. Bailey, Acting Chief of the Division of Fishery Biology, Fish and Wildlife Service, 8 November 1945, Ann Arbor, Michigan, Dr. John Van Oosten, BCF, GR, GCF, USFWS, RG 22, NACP.

[124] Edmund Russell, *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring* (Cambridge: Cambridge University Press, 2001), 125, 126; and Anthony Standen, "DDT: It will not rid the world of insect pests but it is still a wonder bug killer," *Life* (July 8, 1946), 47.

Chapter 5 - Managing Huron: The Great Lakes Fisheries Commission and the enduring challenge of freshwater aquatic management

Sea lampreys dominated the work of Great Lakes fisheries experts in the late 1940s and 1950s. On the U.S. side of the lake efforts at lamprey control accelerated in the late 1940s as the lake trout fisheries in Lakes Huron and Michigan collapsed. In October of 1949 sea lamprey investigations were added as an ongoing component of the United States Fish and Wildlife Service's Great Lakes Fisheries Investigations. Scientists focused on several key areas research. Lamprey life cycles were studied in an effort to determine vulnerable points in their growth stages. Spawning areas were monitored and studied. Fish targeted by lampreys were examined in order to determine effects on overall abundance. Finally, physical control mechanisms were built and tested in an effort to control the spread and overall effects of lamprey populations.[1]

The rapid colonization of the interior lakes by sea lampreys further fueled the drive for international cooperation. On September 10th, 1954 the U.S. and Canada signed a treaty for cooperative research and sea lamprey control known as the Convention on Great Lakes Fisheries. The agreement went into force the following year and its operational requirements were established with the passage of the Great Lakes Fishery Act of 1956. The treaty created the Great Lakes Fisheries Commission. The commission was a far cry from the comprehensive oversight envisioned by the International Board of Inquiry. However, its creation marked an important precedent in the history of Great Lakes fishery management. At long last the national, state and provincial governments of Canada and the United States agreed to cooperate on Great Lakes research. The commission lacked the broad legislative authority repeatedly recommended

by various Great Lakes researchers and organizations. In fact the Act specifically protected the legislative authority of the individual states. However, it created specific processes for the commission to recommend conservation measures directly to state governors. The Act also authorized direct United States Federal participation in cooperative sea lamprey control with the commission.[2]

A variety of different methods for controlling the non-indigenous parasites were attempted. Modern chemicals, including DTT and its derivatives, were being widely applied to control insects on land. A chemical solution for sea lampreys seemed to many to offer the most promise. John Van Oosten stepped down as Chief of Great Lakes Fisheries investigations in 1949. In the 1950s James W. Moffet held the position. Moffet was interested in the application of chemicals to control species of fishes deemed less important to the market. "I have always felt that one of the major contributions that will be made from the testing of these chemicals is that one might possibly be used for selective performance where fish management desires. . .The idea of carp control occurs to me too."[3]

However, while the application of chemicals to control less desired species held some future promise for Moffet, by the waning months of 1954 his office had a specific target in mind. "We are interested in finding a compound specific to lamprey larva and relatively harmless to associated fishes" Moffett wrote to Dr. Peter Doudoroff at Oregon State College in November of 1954.[4] Moffett wondered if Doudoroff, who was then working in the Toxicity and Fisheries Unit of Oregon State College's Biological section, had suggestions for chemicals that could prove selectively toxic to lamprey. When contacted by W.F. Carbine, Chief of the Section of Inland Fisheries the following month regarding the use of toxicants to control other species of fishes, Moffett stated the singular purpose of his department's toxicology studies. "It is imperative that

we continue our search for, and development of, specific toxicants for sea lamprey larva. We cannot divert any effort, at present, to explorations in the field of fish toxicology."[5] Moffett estimated at least an additional year would be needed to focus research on using toxin against sea lamprey. He suggested that once that research had been completed they might further explore the application of their findings in relation to other fish species.[6]

Most of the toxicology studies were completed at the Hammond Bay Laboratory near Roger's City, Michigan. Dr. Vernon C. Applegate oversaw activities at the research center. A wide variety of chemicals were utilized. Some chemicals required special handling. For example, in April of 1954 Moffett submitted a travel order to Washington D.C. to cover travel by Applegate in relation to obtaining additional chemicals for testing at the lab. Moffett argued that the chemicals required special handling in order that they would arrive for testing in satisfactory condition. Applegate drove from Hammond Bay, Michigan to Leetown, West Virginia in order to retrieve the substances. Over 2,000 various chemicals were acquiesced in that trip alone. Researchers in Michigan intended to share them with Canadian scientists conducting similar experiments in Ontario.[7] The resignation of two office personnel in 1954 strained Moffett's goal of finding a suitable larva toxicant within a year.[8] When filling the vacancies women applicants were preferred, because, according to the job posting, they were believed to have the higher degree of dexterity necessary for completing the lab's weighing procedures.[9] At the lab chemicals were tested in amounts of five parts per million (ppm) over a twenty four hour period. Compounds that proved lethal in eight hours were then re-tested in amounts of 1.0, 0.1, .001 ppm. In each test two lamprey larvas were tested alongside two each of blue-gill and rainbow trout fingerlings.[10] At the University of Toronto Dr. F.E.J. Fry was also experimenting with the

application of chemicals for controlling sea lampreys.[11] Toxicology studies had taken center stage in state, provincial and federal fishery research for the Great Lakes.

At the same time, other control efforts were also employed. Various types of physical structures designed to manage sea lamprey populations were experimented with. Barrier dams and electrical devices were two types of physical structures that were used in lamprey research and control. In October of 1954 Moffett reported the installation of ten "experimental sea lamprey control devices in streams tributary to Lake Michigan in addition to the seven structures already installed."[12] Electrical barriers were the centerpiece of physical lamprey management in 1954. Forty-seven sea lamprey control devices, in as many streams and rivers, had been constructed around Lake Superior.[13] As more powered barriers were constructed, their upkeep became a source of concern. Commercial contractors were proving costly to employ for the construction and wiring of the devices. In March of 1954 Moffett sought the appointment of a permanent electrician to work for his department in Marquette, Michigan. The new hire was responsible for both with construction and maintenance of the electrical components of the various weirs.[14]

Rivers and streams feeding into Lake Huron also hosted control mechanisms. A permanent electrified barrier was constructed on the Ocqueoc River and in operation by 1949. Ten portable trapping devices were installed in various streams feeding Northern Lake Huron in 1950. The area was designated Control Zone H-1 by the U.S. Fish and Wildlife Service. In 1949 the Ocqueoc barrier captured 24,645 sea lampreys. The following year 18,882 were removed. In 1951 19,393 sea lampreys were captured at the Ocqueoc barrier. Despite the slight drop in Lake Huron's lamprey populations after 1949, biologist Vernon C. Applegate believed sea lampreys were maintaining their populations. In Lake Michigan some streams were

producing three times as many sea lampreys in 1951 as they had one year earlier. The Wisconsin Conservation Department operated six control barriers on its side of Lake Michigan. In 1950 they captured 16,410 lampreys at those sites. In 1951 the numbers had jumped to 42,980. Applegate noted that lamprey numbers in Lake Superior were also on the rise.[15]

Various other studies were carried out to better understand sea lamprey life cycles. Studies of their sex ratios showed that their populations favored males. In 1951 specimens from eight Northern Lake Huron tributaries were examined and their sex ratios were compared. There were 258 males to every 100 females. Samplings of Pendills Creek in Eastern Lake Superior showed ratios of 110 males to every 100 females. (When control efforts eventually shifted to chemicals in the late 1950s and 1960s, those ratios shifted dramatically.) The Hammod Bay Biological Station began experimenting with tagging sea lampreys in the early 1950s. Sixty seven lampreys were tagged in September of 1951. They were then released near the Straits of Mackinaw. Eleven days later one of the lampreys was discovered over fifty miles away. A month after their tag and release, another lamprey was found attached to a chub nearly 100 miles from the release site. The tag and release experiments demonstrated that individual sea lampreys ranged far and wide in the lakes during their parasitic life cycle.[16]

In addition to research related to controlling the number of sea lampreys in the lakes, various ideas were considered for making use of them as a commercial species. The idea of marketing lampreys failed to take hold, despite their use as a food fish in parts of Europe. Occasionally experiments were done in an attempt to utilize lampreys in other ways. In October of 1954 Moffett received a request to supply "a sample of about 25 pounds of salted sea lampreys" to Emmet Andrews in Cambridge, Massachusetts. Andrews experimented with using lampreys as bait for crabs.[17]

While sea lamprey research and control dominated much of the work of Great Lakes fishery investigations, other research continued. In the mid-1950s the sixty foot Great Lakes research vessel *M.V. Cisco* was charged with carrying out experimental fishing tests in Lake Michigan to determine the numbers of bloater chubs in that lake. The combined pressures of the fisheries and invasive species had driven lake trout populations to collapse. Among chubs the smaller bloater chubs were not valued by the fisheries due to their oily nature and smaller size. Initially Moffett hoped for "the development of a market or a processing procedure" that could turn the small fish into a "profitable product."[18] The small bloaters were an important food fish for native lake trout. When lake trout populations crashed bloater chubs multiplied in number and were viewed as a competitor species by fisheries experts. "They compete with the more valuable chubs for space and food and create a nuisance by becoming entangled in vast numbers in fishermen's nets."[19] In order to preserve the fish valued on the market and relieve fishermen of the nuisance of cleaning undesired species from their nets, the *M.V. Cisco* sought a solution to the "bloater problem."[20]

Moffett continued the work started by Van Oosten. In his capacity as Chief of Great Lakes Fishery Investigations he worked to complete research geared toward the conservation of market fishes and the longevity of commercial fisheries. He and his representatives continued both their research and regional meetings with commercial operators in both the United States and Canada. Legislative control of the lakes remained in the hands of their many divided jurisdictions. Lake researchers were increasingly cognizant of the complexity of their charge.

> Ecological conditions and the character of the fisheries vary widely both between and within lakes. We cannot speak of the Great Lakes fishery. Rather we must underscore the plural and think in terms of many Great Lakes fisheries scattered along the nearly 5,000 miles of U.S. shoreline.[21]

In addition to their role investigating Lake Michigan chubs, the crew of the *M.V. Cisco* also recorded various aspects of lake's hydrology and ecology.[22] Lake Huron also had a research vessel working its waters. The 52 foot trap net boat *Musky* operated in that lake in the early 1950s. In 1954 the University of Michigan contacted U.S. Fish and Wildlife to obtain permission to use the vessel for their own limnological study of Lake Huron.[23] Researchers were increasingly aware that maintaining a profitable fishery meant addressing a multiplicity of interconnected issues. The multidirectional research approach was buffeted by an increase in funding over the sparse financial pickings of the Van Oosten years. The Saltonstall-Kennedy Act of 1954 created a fund for fishery research and development that began adding critical funds to investigative efforts in the Great Lakes region.[24] This and other initiatives to restore and maintain the fisheries combined to increase overall funding. For example the State of Michigan was able to construct a new 42,500 square foot research center in Ann Arbor in 1966 for a cost of $1,488,000. The following year Michigan's research efforts were funded at $1,786,000, including $722,000 from the Great Lakes Fishery Commission.[25] The research station at Ann Arbor focused primarily on commercial species and various factors related to their growth and distribution. The Federal Bureau of Commercial Fisheries was created with the passage of the Fish and Wildlife Act of 1956.[26] The bureau was heavily involved in lamprey research and control. In Canada the Canadian Department of Fisheries carried out similar research. The Great

Lakes Fishery Commission worked as a coordination and information sharing body for the programs operating in each nation.[27]

Backlash at chemical control

By the late 1950s and early 1960s resistance was growing toward state and federal programs aimed at controlling various species regarded by government agencies as pests. Most of the outcry was directed at control programs for mammals and insects. Fish and other water based animals, often regarded by human beings as radically different and inferior, living out of site and less accessible, received less attention. However, the freshwater of the Great Lakes system was a source of drinking water for millions. Water purity would play an important role in what would become a protracted and bitter feud over pest control and the widespread use of toxins in the environment. Sodium fluoroacetate, popularly known as Compound 1080, was the Federal government's lethal answer to predator and rodent control. When a concerned resident of Monroe, Michigan wrote to a newly elected President Kennedy in 1961 expressing his concerns about an article he read in *Nature* magazine condemning the widespread use of Compound 1080 by Federal wildlife control officials, his letter was forwarded to Assistant Director of the Bureau of Sport Fisheries and Wildlife Lansing A. Parker.[28] Parker denied the article's claims, saying that the government's poisoning campaigns had no "deleterious" effects on "desirable wildlife."[29] While Parker supported the poisoning campaign, he was not supportive of all of the government's control efforts. He was critical of the government's pesticide use in its fire ant control program.[30] While fire ants did not inhabit the Great Lakes region, DDT and other pesticides were widely used to protect crops and kill other insects. By 1965 a report on the Great Lakes acknowledged that pesticides were "accumulating" in the

environment and affecting both populations of fishes and posing a human health hazard.[31] Even as concern was mounting regarding the application of chemicals to control animals and insects deemed undesirable on land, researchers at Hammond Bay had settled upon their own chemical control compound for the waters of the Great Lakes. In 1958 they discovered TFM (3-trifluoromethyl-4-nitrophenol) was particularly lethal to lampreys and believed relatively harmless to most other fishes. Widespread treatment of Lake Superior's tributaries began thereafter and gradually spread to the other Great Lakes.[32]

The United States Federal Government and maximum consumption

During the administration of President Dwight D. Eisenhower the Federal Government embraced a renewed commitment to maximum production of fisheries resources. In 1959 The National Academy of Sciences and National Research Council published *Turn to the Sea*. Athelstan Spilhaus, Dean of the University of Minnesota's Institute of Technology and a member of the National Academy of Sciences Committee on Oceanography authored the tract. In it he argued that there was little difference between the world's aquatic resources and farmland. With proper management the sea could provide an endless harvest of foodstuffs for the people of the world. The author called for the creation of processing ships that could operate as "huge floating chemical factories." The ships would work in the midst of fleets of fishing vessels, seasoning even the most undesired species of fish into "tasty, nutritive protein." Spilhaus predicted the rise of floating industrial cities around the most plentiful fishing zones. He believed aircraft, sonar, electrical currents and air bubble fences would eventually be employed into the deepest ocean depths to extract the living creatures of the seas from their aquatic homes and plop them onto dinner plates in dining rooms around the world. [33]

In the same year *Turn to the Sea* was published, President Dwight D. Eisenhower congratulated the commercial fisheries of the United States for their contributions to the American diet. He labeled their industry as vital to both the nation's food requirements and its economy. It was the fourth year in a row Eisenhower had sent personal words of encouragement to an industry he held in high esteem. He believed the commercial fisheries needed to use "every possible means" to make their products available to "every American family." He reassured them that as the American population grew, it would increasingly "turn to the sea for more and more of the nutritive food requirements needed to maintain our American standard of living."[34]

Growing concerns over the viability of United States commercial fisheries were key factors in the decision to restructure the United States Fish and Wildlife Service. Secretary of the Interior Fred A. Seaton spearheaded the reorganization drive. Seaton had previously served as a Senator from Nebraska. During his tenure in the Interior Department he confronted the concerns of fisheries head on. In May of 1956, a few months before the dramatic reorganization of the Fish and Wildlife Service, Seaton's department advised the president regarding the major issues involved in the decline of the fisheries. Controlling fluctuations in populations of fishes for the benefit of the fishery industry became a core strategy for the department.[35] Domestic food products from farms and livestock were viewed as growing competitors to the fishing industry, as were imported products from foreign fisheries. In fact, the Interior Department went so far as to equate fishing and farming on equal terms, bemoaning the fact that farmers on land were out producing what they viewed as the farmers of the sea. They called for greater emphasis on the practice and study of "fish husbandry."[36]

Seaton's department suggested promotional campaigns, new products, scientific improvement of food quality and increased gear efficiency as ways to resuscitate the ailing industry and maximize consumption of fishes. They further urged that future studies focus on predicting marketing trends, and investigate possible relationships between national income and consumption rates. Eisenhower's Interior Department pushed for a more aggressive fishery in order that it might close the output gap with land based agriculture. Outside of the assumed economic benefit the fisheries would receive through dramatically increasing fish consumption by the American public, no definitive reason was given as to why the returns of the commercial fisheries needed to be as high as landed agriculture. Seaton and the Interior presented an argument that placed fisheries in a competition with landed agriculture for the stomachs of the American public. The long-term ecological ramifications of initiating an aggressive competition with landed agriculture were not considered. Conservation proposals included "conceivably" making payments to fishermen who avoided fishing in areas depleted of fish or that used larger nets that would not trap young spawn, continued fish stocking and the maintenance of funding for research directed toward maintaining fish populations at "optimum levels of abundance."[37] While focused on the coastal fisheries, the recommendations were applicable to all commercial producers and the reorganization that followed directly affected policies in the Great Lakes.

In response to the commercial fishing industry's economic woes, President Eisenhower charged Seaton with the responsibility of developing a solution. The result was the reorganization of the Fish and Wildlife Service, a key component of which was the creation of the Bureau of Commercial Fisheries (hereafter BCF) and Bureau of Sport Fisheries and Wildlife within the U.S. Fish and Wildlife Service. The move to reorganize Fish and Wildlife demonstrated the administration's commitment to commercial fisheries' interests. Seaton

claimed to formulate his reorganization policy based on meetings held with commercial and sport fishing interests, as well as with representatives of national conservation groups.[38]

Before the reorganization became law a significant amount of opposition arose toward the creation of separate bureaus for sport and commercial fisheries within the United States Fish and Wildlife Service. Among the numerous complaints received by the White House was one from Ralph G. Carpenter II, Director of the State of New Hampshire Fish and Game Department. Carpenter urged the administration to rethink its decision to go forward with the separation of fisheries from wildlife management. He stated that integration of resource management was a sound conservation goal, while the proposed dismemberment of the Fish and Wildlife Department was politically based. He charged that the creation of the BCF was "undoubtedly sponsored by commercial interests."[39]

Representatives of conservation organizations such as the Forest Conservation Society of America, National Parks Association, National Wildlife Federation and the Sport Fishing Institute, among others, condemned the reorganization as political pandering. Collectively, the organizations charged that politicians of both parties were conspiring to win key Senate seats in coastal states where commercial fisheries played an important role. The reorganization would, they charged, destroy the U.S. Fish and Wildlife Service as an effective conservation agency, opening it up to increased control by commercial fisheries' representatives interested in their business profits and not conservation. The representatives of the various organizations pointed to the interrelations of animal species and the importance of managing land and water based wildlife as interdependent species. The groups further charged that the problems besetting commercial fisheries were not ones of poor research and outdated equipment, as members of

commercial fisheries and their various political allies claimed. Opponents instead charged that fishery problems were rooted in years of rapacious fishing practices carried out by the industry.[40]

As part of the reorganization, the Pribilof Islands and their fur seal populations were brought under the management of the Bureau of Commercial Fisheries. The islands were home to huge seasonal seal killings. The Fouke Fur Company of Saint Louis, Missouri operated under contract with the Department of the Interior to carry out the killings, process the skins, and sell the finished product at public auction. The profit potential of the industry was large for the time. For instance, in 1954, 63,882 seals were clubbed to death. The total sales value of the finished furs was approximately $8,260,000.[41] Conservation groups argued that bringing the Pribilof Islands under the control of the commercial fisheries would lead to the wholesale destruction of animals the industry regarded as predator species, such as hair seals, sea lions, walruses, and Beluga Whales. They feared that fisheries interests would regard those species as threats to the commercialized fur seal populations and use that as a justification for their destruction. Conservationists stated that any new positions created to address problems in Fish and Wildlife should be created within the existing services and suggested the creation of an Assistant Secretary of the Interior for Fish and Wildlife was one possible course of action. They pointed to the 1940 consolidation of the old Bureau of Fisheries and Bureau of Biological Survey into the Fish and Wildlife Service as an example of sound policy development, and alleged that dividing the authority for fish and wildlife between two separate bureaus represented a "definite backward step."[42]

The Bureau of Commercial Fisheries and the Great Lakes

Despite the objections of conservation groups across the country, the reorganization was made into law with the passage of the Fish and Wildlife Act of August, 1956. The act chartered an aggressive course for the national fisheries with the goal of establishing the "maximum sustainable production of fish."[43] The act created the BCF and the Bureau of Sport Fisheries and Wildlife. Guided by the act's mandate, the BCF would "increase and maintain forever. . .a fishery resource capable of yielding the maximum annual product." Fisheries would be strengthened by providing "full and fair access" to both the "raw materials" and to the "American market" while protecting free enterprise.[44] Donald L. McKernan was director of the BCF until 1967. McKernan viewed the commercial fisheries of the United States in terms similar to other for profit industries in operation across the country. He believed the fishing "industry, like all others, must have a supply of the raw product before we can do business. Our industry makes use of a natural reproducible resource which comes from the sea."[45] He conceded that fishes were not inexhaustible, but advocated an expansion of fishing effort and sought to increase the amount of fish being consumed domestically through more efficient fishing, processing and marketing.[46]

The Great Lakes were an area of great interest to the BCF. In an article written for publication by the American Fisheries Society, McKernan pointed out that from 1947-1956 the fisheries of the Great Lakes "averaged 77 million pounds," with total annual catches varying less than 10 percent up or down.[47] McKernan said this was done by targeting historically less desirable species. He stated that while catch tonnages had remained more or less consistent, the growing numbers of less desirable species had led to an overall decline in profitability for lake fishermen. He attributed the decline of various historically important species to sea lampreys

and other nonindigenous species.[48] Under McKernan's leadership the BCF embraced its mandate to maximize commercial harvests. In 1965 McKernan expressed the desire for a "twofold to tenfold increase" in oceanic harvesting, both in U.S. waters and worldwide. He believed the United States was "falling hopelessly behind other fishing nations in catching, marketing and in the consumption of fish."[49]

In 1962 McKernan teamed up with Donald R. Johnson, the Bureau of Commercial Fisheries Director of Operations in California to produce the article "The Fisheries in the Year 2000" for *Fishing Gazette*. They predicted an intensification of fishing efforts for the American fisheries. A number of new innovations would make increased catches possible. They predicted that submarine vessels would be developed to follow fish deep into the sea and negate the effects of weather on surface fishing fleets. Large processing facilities would operate at sea and fleets of smaller fishing vessels would unload their catches at the ocean based factories. Fishing vessels would be highly mechanized with small crews and the day's catch would require minimal handling before processing. They painted a picture of aggressive catch, processing and marketing techniques designed to imbue the commercial fisheries with increasing economic profit.[50]

The BCF deemphasized commercial fishing as a factor in the decline of profitable fish stocks. McKernan argued that science had established that "abundance often fluctuates from natural causes" and that the fisheries were often unfairly blamed for those fluctuations. He outlined the bold objectives of the BCF and the commercial fisheries. He said they would strive to "reap maximum sustainable yields from the sea's living resources, reduce to a minimum the cost of locating and catching fish, and eventually to improve yields by controlling physical and biological sources of mortality."[51] Thus the department intended to protect fish from their

biological mortality in order to ensure more of them would instead be caught in the nets of the fishery at the lowest cost possible. Fish were to be genetically steered toward "rapid growth, disease resistance, and good flavor." In a mirroring of the government's predator control program aimed at protecting animal agriculture, the BCF proposed controlling predators who threatened stocks of valuable fishes.[52]

Led by McKernan, the BCF launched "Operation Trident," the long range plan for the bureau's future operations. Operation Trident mandated that the commercial fishing industry be "viable, aggressive, productive and profitable" in the world market. Fisheries were expected to use and apply knowledge of maximum sustainable yield for their respective resources and "find economic ways to fully utilize presently under – or non-utilized fisheries available to our fishermen."[53] Optimum yields were heralded as the goal for fisheries just as they were "for agricultural, forest, and game management." In order to keep pace with other industries, fishing needed to modernize and mechanize. The BCF argued that "age old prejudices" that suggested increased efficiency would lead to depletion needed to be challenged. In the plan the bureau argued that fishery explorations were as costly and difficult as oil exploration, but lacked the incentive to invest capital since it was "intrinsically impossible" to incorporate the same leasing and ownership schemes that accompanied the mineral industries.[54]

The BCF acknowledged the difficulty of completing Federal research on the fisheries. A great deal of information about the aquatic environments of the oceans and inland lakes remained unknown. In Trident they tried to illustrate the challenges of fishery research by drawing comparisons with the management of cattle. They argued that the problems associated with researching the lifecycles of fishes "has been likened to the task of obtaining similar information about a herd of cattle in a field, from a balloon drifting above solid cloud cover, with a lariat as

the only sampling tool."[55] The bureau launched a program of grants to institutions of higher education to encourage and support the training of students interested in fisheries work and research. It was believed that a new era of scholars were essential for keeping the United States fishing industries competitive on the world stage. Fishes were regarded as very valuable for human use, contributing to overall health through consumption and readily available to be processed into a variety of products, from vitamins to industrial chemicals. In their Trident plan the BCF also claimed the seafaring abilities of the American people were honed as they practiced their boating skills in the commercial and recreational capture of fishes.[56] This presumption was an aquatic echo of Frederick Jackson Turner's Frontier Thesis which had so neatly packaged the development of American character with the taming and utilization of the North American wilderness and its inhabitants by white settlers.[57] Fish still garnered little consideration beyond their use as a human commodity.

The BCF's definition of conservation summed up the focus of the department's fishery management scheme. Conservation was "a much abused term" they argued, which meant "different things to different people." For the BCF conservation meant "keeping the resource in a condition that will provide the maximum sustained yield of products useful to man."[58] According to the BCF fish did "not exist in limited quantities" but could "endure forever" with proper management. For the Bureau proper management meant thinning them out by catching them. In an echo of maximum sustained yield theories often applied to forests, the BCF argued that large groups of fish were not healthy. They hypothesized that large groups would starve each other by eating up their resources which would lead to a food shortage. Fish would then be weakened from not eating and more likely to fall prey to other predators. Thus, the older fishes

needed to be removed to protect the younger, faster growing species until they too could be swept up in commercial nets.[59]

While the efforts of the BCF were heavily focused on the oceanic fisheries, the Great Lakes were part of its charge as well. A new 65 foot Federal research vessel dubbed the *Kaho* was put to work on the lakes in early 1962. The vessel was stationed at Saugatuck, Michigan, Southeast of Grand Rapids. During exploratory trawls in Lake Michigan during 1962 the *Kaho* hauled catches dominated by bloater chubs.[60] In their annual report for 1961 the BCF blamed lamprey, smelt and alewives for declines in the trout and chub fishery and for the resultant "severe hardship" suffered by the industry.[61] They estimated the value of the lake trout fishery at eight million dollars but conceded that it had been destroyed by the beginning of the 1960s. Similar declines of whitefish and larger species of chubs were well underway. The BCF assisted in the administration of a combined control effort whereby lampricide was applied to streams and tributaries in order to control lamprey larva, while adult lampreys were captured in weirs.[62] Larger varieties of chubs had been heavily fished by commercial operators. The bloater chub, a variety of cisco, was not valued because of its diminutive size and oily flesh. They were considered a nuisance. By the 1960s bloaters were the dominate form of chub left in Lake Michigan. The BCF estimated that bloater chubs accounted for upwards of ninety percent of the total chub population in that lake.[63] The BCF was determined to fill the economic holes left by the collapse of various fish populations. The BCF viewed fishes of lesser utilized varieties as the foundation of future profitability on the lakes. Varieties of historically less desirable species like bloater chubs were targeted for potential future development.

Advertising and public education were important components of the Bureau's efforts to revitalize the Great Lakes fisheries. The Bureau maintained a marketing specialist and one home economist on its payroll at the laboratory in Ann Arbor. By the mid 1960s the Bureau was spending approximately $13,500 annually on advertising in the State of Michigan. In addition, the BCF conducted outreach which included fish cooking techniques to school lunch administrators, military food service staff, restaurant workers and others. For example, the BCF reported that in 1966 a total of 4 demonstrations were provided in Michigan alone for approximately 170 food service managers along with "three additional smoked fish seminars" for "approximately 150 processors, distributors and retailers of smoked fish products." [64] While they selected a wide variety of fishes for future marketing through processing or smoking techniques to make them more palatable, they believed even the least desirable varieties of carp, gizzard shad and others could fuel a growing demand for pet food and provide a ready source of animal feed for the mink industry. By BCF estimates the mink industry around the Great Lakes required approximately 200 million pounds of fish annually. In addition to minks, planners envisioned a wide array of outlets for processed fish to feed other animal industries. Agricultural animals, zoos and fish farms were considered ready markets for fishes human beings did not care to eat. The growing pet food industry could potentially process tremendous amounts of freshwater fishes. Historically less profitable species were also considered valuable as bait fishes that could be reused in the fishery cycle as bait for both commercial and recreational fishermen.[65]

McKernan played a direct role in formulating and advising research efforts throughout the Great Lakes during his tenure in the BCF. He served on the Great Lakes Fishery Commission from 1957-1967, including two years as chair of the commission. Speaking before the commission at its eleventh annual meeting on June 21, 1966, McKernan lauded the successes

of the sea lamprey control program in Lake Superior and looked forward to the results of recent lampricide treatments in the tributaries of Lake Huron. While McKernan commended many of the efforts of the Great Lakes Fishery Commission, he echoed earlier officials and administrators when he called for increased coordination of policies and regulations across the Great Lakes Basin. The recreational fisheries were beginning to share equal weight in discussions of Great Lakes management. Sport fishing organizations were vocal and organized. They pushed their own legislative agenda with a political strength that by then eluded the shrinking number of Great Lakes commercial operators. Recreational fishing and the support services it fueled also brought growing profits to the Great Lakes States. Despite McKernan's position in the BCF and the long history of dominance by the commercial fisheries when discussing legislative initiatives, he said the "Commission should consider, with the Province and States, how trout stocks are to be shared by the commercial and sport fishermen." He advised that it was essential to compile information on the growing sport fisheries in order to determine future management schemes.[66]

"Too little too late" - Commercial fisheries failures and sea lamprey control success

The influence and political clout of sport fisheries were being felt at the state level. As commercial viability and profitability declined, recreational fishing was on the rise. State offices could increase their operational income from licensing schemes. Sport fishing also promised a boon to tourism. The states began turning away from their tradition of support for the commercial fisheries and instead tied their interests to the growing profitability of the sport fishing industry. While Ontario was experimenting with cross breeding native lake trout with brook trout, Michigan charted an entirely different course and began planting non-indigenous

exotic salt water species that were attractive to recreational fishermen in an effort to turn state waters into a sport fishing paradise. Steelhead and Coho salmon were planted in streams feeding into Lakes Michigan and Superior. The program would bring Michigan into conflict with the Great Lakes Fishery Commission over its continued operation of lamprey weirs in streams where salmon were being planted. Divisions between Michigan and Ontario also deepened. Canadian authorities worried about the intentional introduction of yet more exotic species to the lakes. However, Ontario's Department of Lands and Forests experimented with kokanee salmon plantings, a freshwater variety of sockeye salmon. Michigan's conservation authorities and sport fishermen resented Canadian commercial operators catching what they perceived as their new sport fishes.

The total production of Ontario's commercial fisheries had remained relatively consistent in the years following World War II. In fact, in 1956 the total commercial catch was nearly 60 million pounds across all lakes – a record for the province. There were, however, dramatic changes in the make-up of the catch. In Lake Huron the fishery had historically targeted lake trout, whitefish and chubs. The lake trout fishery had collapsed in Canadian waters just as it had on Michigan's side of the lake. Fluctuations in numbers of chubs were also reported. Due to dramatic changes in the numbers of other species, the whitefish industry was of paramount importance to Canadian fishermen. In 1959 the total take of whitefish in Georgian Bay and the North Channel was 2,600,000 pounds. Gill nets were the primary technology used, with some local areas utilizing pound and trap nets.[67]

During the 1960s the Ontario Department of Lands and Forests expressed growing concerns about the viability of the commercial fishery. In July of 1966 Department Minister A. Kelso Roberts prepared a memorandum that was distributed to all of Lake Huron's commercial operators. The department initiated a program of refusing to renew licenses that were not used over a two year period. The program was intended to strengthen the resources available to commercial and recreational fishermen by weeding out those fishermen who did not depend on the fisheries for their livelihood. When a series of appeals were received from a number of fishermen who were unable to renew their licenses the department reviewed each case and carefully decided who would and would not be granted a renewal.[68] For example, when three brothers in Southampton acquired a commercial license via their father's estate in 1966, the department opted to deny their renewals. Officials cited the fact that the brothers were not themselves fishermen and all had separate sources of income. The province also withdrew licenses for the Sucker Creek Band of Indians at Manitouaning and the Spanish River Band at Sagamok, citing their "failure to make returns."[69]

Some of the fishermen who were denied their license successfully appealed the decision and their licenses were reinstated. The Parr Brothers of Parry Sound appealed and were granted a renewal on "compassionate grounds." They came from a family that had fished for three generations and the department concluded that the new policy had caused them "genuine personal distress."[70] Jay Skilliter was the Mayor of Killarney, Ontario. When his license was not renewed he also appealed. While he was not currently fishing, the community under his charge was heavily involved in the fisheries and he considered the continuance of his license essential for his public image. The department decided the blocked renewal caused the mayor hardship and his appeal was granted.[71] However, even in Killarney where the town mayor

considered having a commercial fishing license important to maintaining the community's respect, resistance to commercial operations was on the rise. In 1964 and 1965 commercial fishermen out of Killarney fished in areas where they were in close proximity to recreational anglers and charter companies catering to tourists. Area anglers complained to the Department of lands and Forests and to the District Forester. In 1966 the Department of Lands and Forests moved forward with plans for additional restrictions and designated new closed areas. The area's commercial fishing association apparently supported the regulations, perhaps to quell the any conflict. The new and expanded restricted areas were specified on the region's subsequent commercial fishing licenses.[72]

Charles H.D. Clarke was born in 1909 at Kerwood, Ontario. He obtained a PhD through the Department of Zoology at the University of Ontario in 1935. After working several years for Canada's Federal Department of Mines and Resources, Clarke joined Ontario's Department of Lands and Forests and eventually became Chief of the Fish and Wildlife Branch.[73] In 1966 Clarke summed up the province's position in regard to the Great Lakes Fishery Commission. While the Province of Ontario and the several U.S. States had been party to the development of the Great Lakes Commission, they were "not parties to the Great Lakes Treaty. The two parties are Canada and the United States as represented by the Federal Governments." Clarke said the Department of Lands and Forests intended to go forward with plantings of splake. He said his department also intended to experiment with kokanee salmon plantings.[74] Clarke blamed lampreys, not fishermen, for the collapse of lake trout populations. The research branch of the Department of Lands and Forests shared his opinion.[75]

By the mid 1960s the Bureau of Commercial Fisheries reported significant progress in their TFM control program. Lake Superior was the first of the Great Lakes to receive widespread lampricide treatments of its tributary streams. On the U.S. side of Lake Superior 16 electric barriers were also in use by the mid 1960s. The barriers served as sampling sites to track lamprey population fluctuations and eventually the effects of TFM treatments. At these sampling sites the BCF charted a marked decline in captured lampreys. In 1961 42,119 sea lampreys were removed from Lake Superior barrier sites. In 1966 that number had plummeted to 2,869. In the spring of 1967 the barrier sites captured 1,613 sea lampreys. At Lake Huron's Ocqueoc River the electric barrier there captured 631 sea lampreys during 1967s spawning runs. That number represented a drop of 834 from the year before although subsequent years would see another rise in lamprey populations at that site. Another tag and release program was initiated in an effort to chart lamprey migration patterns and population distribution. Between 1966 and 1967 1,706 tagged lampreys were released into Lake Huron by United States and Canadian authorities. Due to the cost of TFM and the amounts necessary for successful treatments, United States control agents were also experimenting with different synergists in order to save on the amount of TFM necessary for individual applications. The Hammond Bay facility that had discovered TFM's toxicity to lamprey undertook additional studies to explore the toxicity of lampricide when used in conjunction with the synergist Bayer 73. While the chemicals proved toxic to fish, the concentrations necessary for a lethal dose were deemed high enough above the level necessary to kill lamprey to warrant their combined use when applicable.[76]

On the Canadian side of the lake lamprey control efforts followed a similar vein to those in the United States. The two countries coordinated their efforts in order to maximize the effects of TFM treatments through the auspices of the Great Lakes Fishery Commission. The Province struggled with its own budgetary issues and the widespread treatment of Lake Huron streams was initially delayed because of the substantial ongoing cost of Lake Superior treatments.[77] In December of 1965 Charles H. D. Clark informed district foresters working along Lake Huron's Canadian coastline that he expected the sea lamprey program to soon spread to Lake Huron proper, beginning with treatments of the St. Marys River area. Clarke was optimistic about the rehabilitation of Huron's trout population. He predicted sea lamprey controls combined with Ontario's concurrent program of planting splake hybrids would restore a vibrant trout fishery to the lake.[78]

By the mid-1960s sea lampreys had penetrated deep into the Ontario interior via Lake Huron's numerous streams and tributaries. Government authorities struggled to track lamprey migrations through Canadian waters. Sometimes separating sea lamprey infestations from indigenous lamprey activity proved challenging. In the summer of 1967 a party of pike fishermen on Woseley Bay along the French River reported catching marked pikes and other fishes with attached lampreys on them. It was further reported that a muskellunge (a relative of the Northern Pike), was observed floating in the water with "four or five lamprey hanging on it." The lampreys were described as having the diameter of a pencil and being "dirty white" in color. A biologist in Ontario's sea lamprey control unit believed the lampreys were actually silver lampreys, a freshwater species indigenous to the lakes. Officials were surprised at accounts of such a large number of marked fish in the area.[79]

The chemical treatment of sea lampreys was spreading during a period of increasing public resistance toward the widespread application of chemicals to control various species. In 1962 Rachel Carson's *Silent Spring* was published in the United States. *Silent Spring* criticized the vigorous and often compulsory application of industrial pesticides as a control mechanism for varieties of insects human beings labeled as pests. Carson documented the widespread chain of poisonings that often accompanied those chemical applications. Her title referred to a future spring when no birds would sing. *Silent Spring* uncorked a fountainhead of growing public concern regarding the mismanagement of environmental landscapes and life forms.

In 1966 TFM treatments of streams around Lake Huron's North Channel began in earnest and in subsequent years gradually moved south around the Canadian side of the lake. Lampricide treatments proved controversial in the changing climate of ecological thought. In June of 1966 the Ontario legislature took up the question of lampricide applications in the Root River and other streams near Sault Ste. Marie, Canada. The control program was spreading into Lake Huron from Lakes Superior and Michigan. House member D.A. Patterson asked whether lampricide applications were justified considering the losses of other fishes as a result of treatments. The Minister of Lands and Forests A.K. Roberts assured Patterson losses in other fishes were not significant. Roberts further opinioned that the synergist Bayer 73 was the likely culprit in the deaths of most other non-target species. He was confident of the program and said it would eventually include all tributaries inhabited by lampreys in the Great Lakes.[80] As Roberts predicted, the chemical control program subsequently spread throughout Lake Huron's rivers and streams.

Despite political approval and assurances to the public of the safety of TFM, the Department of Fisheries continued to meet with resistance from localities concerned with the new chemical applications. The Noisy River is a tributary of the larger Nottawasaga River off of Southern Georgian Bay, Ontario. In 1968 the Noisy River Fishing Club was advised to delay its annual stream stocking until after planned lampricide treatments. The advice raised alarm. Applications of TFM occurred in the river system in 1961, but this was the first application since then. A drop in fish wounding and mortality as a result of sea lamprey predation had followed the 1961 application. By 1968 sea lamprey populations had rebounded and officials believed widespread treatment of neglected Canadian rivers and tributaries around Georgian Bay and Lake Huron proper were overdue. They hoped to eventually achieve results similar to those calculated for Lake Superior, where there was an estimated 90% decline in sea lamprey populations following the regular application of TFM.[81]

Officials assured residents that there was little or no danger to other fishes from the TFM applications. If there was no danger as authorities claimed, then why, some residents wondered, were they now warned not to plant fishes until after the treatments? Author Richard S. Lambert took the cause to the local press. In a provocatively titled " '*Silent Spring' on the Noisy*?" Lambert accused officials of poisoning the river, threatening the local water supply and failing to properly notify residents of the chemical applications.[82] Lambert did not go unnoticed. Chief of the Fish and Wildlife, Charles H.D. Clarke wrote Dr. J.J. Tibbles regarding Lambert's article. Tibbles worked in Ottawa's Department of Fisheries and was the Director of the Sea Lamprey Control Experiment. Clarke said he believed Lambert submitted his letter "only to tarnish our images and not to correct any situation particularly."[83]

4,448 gallons of lampricide were used in applications of the Nottawasaga River System in 1968. Ottawa's Department of Fisheries acknowledged that subsequent fish mortality was "much higher than anticipated" in the system. Suckers and carp suffered "heavy mortality" while walleyes, pikes, alewives, bass and other fishes were also killed. The Department of Fisheries believed higher water temperatures potentially contributed to the large die-offs. Nonetheless, they conceded that the TFM applications produced a "spectacular and regrettable fish kill."[84] Following the chemical treatments Lambert again wrote an editorial for the local news questioning the economics of the program and pointed out that he had personally discovered numerous species of fishes killed by the lampricide. He claimed that fishing had been good before the treatments, but declined precipitously afterward. He did concede that a low water level may have contributed to the decline in fishing fortunes.[85] In August Richard S. Lambert contacted Dr. Tibbles and asked about the recent treatments as well as the fish kill. Interestingly, Lambert also expressed his "warm appreciation" for Tibbles' recent approval to stock 428 trout at the location of Lambert's home on the river.[86] Director Tibbles informed Lambert authorities had removed approximately "six truckloads" of dead fishes from the river following the treatments.[87] The Department of Fisheries also released their control data to the press, pointing out that the Mad and Noisy Rivers accounted for 98% of "ammocoetes collected in the entire Nottawasaga River system."[88]

The following year Richard T. Lambert, Secretary of the Noisy River Fishing Club, urged the Department of Fisheries in Ottawa to research "less harmful methods of lamprey control," suggesting that authorities investigate what factors made certain streams unattractive to lamprey migration and spawning and attempt to mechanically recreate those conditions elsewhere.[89] Tibbles responded that it would be a mistake to try to switch gears after the early successes of the

program and that the government lacked the resources to undertake such an ambitious change in their program.[90] Others were supportive of the government's control efforts and believed they were producing positive results. As treatments continued and the numbers of sea lampreys declined in various regions, support for the control program grew. At their annual meeting in 1973 the Lake Huron and Georgian Bay Fish Producers Association passed a resolution which stated in part that they appreciated "the Sea Lamprey Control Program and credit this program for the return of a reasonably good fishery in our area of Huron and Georgian Bay, and are requesting its continuance."[91]

Canadian authorities enlisted the help of commercial fishermen in acquiring samples of sea lamprey specimens. Beginning in 1967 the government offered a $1.00 reward to commercial fishermen who submitted lampreys caught incidental to their main catch. Fishermen were required to provide the place, date and method of capture in order to qualify for the payments.[92] Between 1967 and 1968 Canadian commercial fishermen submitted nearly 5,500 sea lampreys together with information relevant to the circumstances of their acquisition in the catch. Most of the lampreys originated as a bycatch in pound nets and large mesh gill nets meant for whitefish as well as in small mesh gill nets used to target chubs. Based on their various sampling methods Canadian officials believed the North Channel showed declines in the numbers of sea lampreys caught from 1967 until 1968, while Huron's main basin did not. They correlated the declines with treatments of most North Channel streams with TFM. Various sampling statistics also noted a gradual decline in the number of male sea lampreys in favor of more female specimens.[93]

In addition to the chemical treatment program, Canadian authorities continued to take assessments of lamprey populations using fixed electric barrier traps. Barriers predated chemical treatments and the growing costs of the control program inevitably fostered interest in cutting components of the program that might be unnecessary. Because of the initial successes and growing reliance on TFM some organizations such as the Fisheries Research Board of Canada, questioned the desirability of continuing the use of barrier technologies.[94] However, barriers remained a critical component of assessment and control. Most trap designs evolved considerably from their earliest designs. Various traps were examined or experimented with in the early years of the sea lamprey control program. Early mechanical traps functioned in a manner similar to pound nets. The first mechanical barriers laid across streams and guided fishes and lampreys into a holding area at the rear of the barrier. Fish were then removed from the device and allowed to continue upstream while lampreys were removed and destroyed. The earliest barrier devices were difficult to maintain. The wire mesh along the wings extended to the shore and was designed to guide lampreys into the holding area. Rivers and streams often carry significant amount of sediment, leaves and branches. During winters months flows of ice chunks are common in streams and rivers around the Great Lakes. The wings of mechanical traps tended to clog with various water borne deposits. This would lead to area flooding or would cause the structure to collapse from water pressure.[95]

The first electric barrier was put into use in 1951. Electric barriers that utilized AC current became a favored mechanical control structure. In 1960, 162 barriers that combined mechanical traps with electricity were installed by Canadian and U.S. authorities. Early electrical barriers used AC current and were prone to power outrages and other mechanical problems.[96] They also electrocuted non-target fishes. Charles H.D. Clarke expressed his own

concerns with those unintended kills in April of 1966. By then Clarke was a Great Lakes Fisheries Commissioner. He suggested the organization investigate other control means. However, on both sides of the border there were concerns about the affect changing to a new sampling technology would have on tracking overall statistics.[97]

In 1969 Ottawa's Department of Fisheries oversaw the operation of nine electrical barriers on the Canadian side of Lake Huron.[98] The numbers of lampreys caught in those barriers fluctuated from year to year. In some areas there were dramatic declines after the advent of chemical control. For example, at the Still River off of Georgian Bay, 1,621 lampreys were captured in 1969. In 1971 the total dropped to 960. In 1973 only 14 were captured at that location. At the Mad River, a tributary of the Nottawasaga River off of Southern Georgian Bay 42 sea lampreys were captured in 1969. In 1971 that total had dropped to 15, and in 1973 none were captured at the Mad River site. However, even as the chemicals proved effective in various locations, sea lampreys reestablished themselves elsewhere and were discovered in new areas. In 1973 the Department of the Environment at the Sea Lamprey Control Center in Sault Ste. Marie Canada reported that "surveys revealed previously undetected sea lamprey populations in two streams" including the Western Channel of the French River where commercial fishermen had reported an increase in scarred fishes. Sea lampreys had also re-established themselves in areas believed cleared, including numerous streams on St. Joseph's Island in Lake Huron's North Channel.[99]

In Michigan a barrier on the Ocqueoc River showed substantial declines during the same period, although there were fluctuations in the total number of lampreys removed each year. In 1969, 3,291 lampreys were removed from the Ocqueoc barrier. In 1970 the total dropped to 736, but rose again to 2,997 in 1971. 2,847 were removed in 1972. In 1973 the total had again

dropped. 639 lampreys were removed from the Ocqueoc River barrier that year.[100] By comparison, traps in the Ocqueoc River had produced 4,608 lampreys in 1945. Native lampreys were caught in the barriers as well and were sometimes included in overall statistics.[101] There were fluctuations elsewhere. In May of 1968 Frederick H. Dahl of the Bureau of Commercial Fisheries Biological Station in Marquette, Michigan estimated that four times as many lampreys were being captured during lamprey spawning runs compared to the previous year.[102] Barriers sometimes served as tools for the assessment of other species as well. For example, in July of 1969 J.M. Halpenny, the District Forester for the Lake Huron region contacted C.H.D. Clarke in the Fish and Wildlife Branch of the Department of Lands and Forests. Halpenny requested that eye bolts be affixed to the downstream side of several new barriers being built in various streams around the lake. The eye bolts were designed to hold salmon traps that would be placed on the barriers during May and June in order to sample and study migrating fishes.[103]

After the widespread success of chemical treatments many barriers were removed. The remaining barriers were used as a method of sampling lamprey populations and the overall effectiveness of the chemical program. The electric barriers were expensive to build and maintain. Alternating current barriers were eventually phased out due their mechanical instability and ongoing negative impacts on other fishes. Low head barriers dated to the 1950s and by the 1970s became the preferred barrier type. Low head barriers provide a physical impediment that lampreys are unable to pass. Fish pass the barrier either by jumping over it or utilizing a fishway. A fishway is a passage around barriers for migrating fishes that still impedes lampreys. Various barrier designs incorporated slots for fish passages, lamprey traps or passive sorting of fishes and lampreys. Despite the various modifications, barriers still affect non-target species to varying degrees. Prior to 1975 the Great Lakes Fishery Commission did not use

barriers. In 1975 the Commission officially recognized the utility of barriers as a valuable part of an integrated control program and in 1978 allocated the first $250,000 was allocated by the commission to support the construction of barrier technology. In the early 1980s their financial commitment to barriers rose into the millions.[104]

Assessments provided other information as well. One biological change that occurred in sea lampreys appeared particularly ominous. In the 1960s authorities noted a growing preponderance of female sea lampreys over assessment years. Although sea lamprey populations had historically favored male abundance, demographic impacts from TFM and other control measures appeared to contribute to a dramatic population shift. Female sea lampreys significantly outnumbered males in sampled populations as control efforts in Lake Huron intensified in the 1960s. The highly adaptable populations compensated for losses by favoring females. [105]

Granular Bayer 73 (also known as Bayluscide) is used in locations where TFM is less effective. Like TFM, the chemical affects the gill structure of ammocoetes (lamprey larva). Bayer 73 has been found to cause greater damage to the cell structure of lamprey gills than TFM.[106] In areas treated with the granular form of Bayer 73 lamprey larva often emerged from the river bottom mud and could then be collected swimming in the water. Sometimes Bayer 73 is used in conjunction with TFM. When used together the combination proved quite deadly on lampreys. Since Bayer 73 increased the effectiveness of treatments it was possible to reduce the amount of TFM used when both chemicals were used. Despite its apparent benefits, Canadian officials in the Department of Fisheries and Forestry acknowledged that increased non-target fish kills were a problematic side effect of using the granular form of Bayer 73.[107]

The St. Marys River stretches nearly 75 miles and serves as a border between Ontario and Michigan. Its channel provides an outflow from Lake Superior into Lake Huron. The Department of the Environment at the Sea Lamprey Control Center in Sault Ste. Marie, Canada used surface trawling as a way to sample adult lampreys in the St. Marys River in order to gauge their abundance. [108] The trawling operations began in 1963 and in 1966 the department began monitoring the catch rates per hour. Over the ensuing years they charted a gradual decline in overall sea lamprey numbers. As early as 1968 they surmised the decline might indicate that sea lamprey control measures in the North Channel were limiting lamprey access to the St. Marys River. They also assumed that lampreys were not using the St. Marys River as a major spawning area. They concluded the river was primarily a migratory channel lamprey were utilizing to move between lakes and to travel to other preferred spawning areas.[109] In 1973 the Bureau of Sport Fisheries and Wildlife cooperated with Canadian officials in the application of Bayer 73 to sections of the St. Marys River.[110] The numbers of spawning lampreys were assumed to be relatively low in the river.

Over the next two decades the numbers of lampreys utilizing the St. Marys River for spawning rose dramatically. Eventually the St. Marys River was recognized as the most prolific spawning area for sea lampreys in the entire Great Lakes Basin. A variety of scenarios were considered as to why the St. Marys became a key spawning area. Some researchers blamed stream improvements and contaminant cleanups for unintentionally making the river a more lamprey friendly habitat. Others pointed to correlations between increased stocking of salmon and lake trout as well as the prevalence of bloaters, a favored target for smaller lamprey that have just entered the parasitic phase of their life cycle.[111] Sea lampreys demonstrated remarkable adaptation in the face of determined control efforts. Perhaps the lack of secure spawning areas in

heavily treated streams led to eventual migrations into previously underutilized regions such as the St. Marys River. Whatever the cause of their heavy incursions into the river, by 1996 sea lamprey populations in northern Lake Huron were rivaling the numbers existent prior to the development of TFM.[112] In 1998 heavy, targeted applications of Granular Bayluscide from helicopters became a regular cycle at the river as authorities struggled to control lamprey numbers in what was by then the largest and most heavily utilized spawning zone in all of the Great Lakes.[113]

Intentional evolution: bureaucratic efforts to repopulate Lake Huron with profitable species

The 1960s and early 1970s fostered optimism for the chemical control program in the Great Lakes. As sea lamprey populations declined to more manageable numbers, concurrent restocking programs were underway. In the Province of Ontario and State of Michigan officials worked to rebuild the profitability of Lake Huron through the planting of valuable species. Ontario focused substantial time and resources on the production of splakes. Splakes are a hybrid fish. They are the result of breeding brook trout with lake trout. Splakes grow faster than lake trout and their rapid maturity was seen as beneficial if they were to survive and thrive in lamprey infested waters. Splakes were intended to fill the hole in the fishery left by the collapse of native lake trout populations. Many hoped splakes would not only rehabilitate the fishery, but also play an important role as a predator in controlling the large numbers of smelts and alewives in the lakes.

In addition to splakes, the Ontario Department of Lands and Forests experimented with planting Kokanee salmon. The species was selected due to its anadromous physiology. Since they spawned in freshwater they were expected to adapt well to the inland lakes. Kokanee eggs were obtained from the states of Montana, Colorado and Washington as well as the Province of British Columbia. Planting of Kokanees in Lake Huron began in 1964. Hundreds of thousands of eggs, fry and fingerlings were planted at sites around Georgian Bay over the next several years. Researchers found that the Kokanees received less attention from lamprey at maturity than other species. This was attributed to the smaller size of Kokanees overall in relation to other Great Lakes species. The incidence of lamprey markings rose steadily as the examined specimens went up in size. For example, Kokanees with lengths of 32 through 35.9 centimeters had markings on only 2% of the fish caught and examined. Fish with lengths of 40 through 43.9 centimeters had wounds on 3.9% of the fish examined. However, among the largest specimens that measured 44 through 47.9 centimeters 16.7% bore evidence of lamprey predation. This held true for other species as well. For example, when examining Coho salmons – a much larger species introduced by the State of Michigan – 73% were found to have wounding and scars from lampreys. Fishery experts in Ontario's Department of Lands and Forests were confident of the Kokanee plating program, pointing to the diversity of sources sampled for Kokanees and the lack of high numbers of apex predators with which the introduced species would compete. They believed the Kokanees would fill a niche in much the same way sea lampreys and alewifes had.[114] Despite the high hopes, however, Kokanee numbers dwindled after stocking efforts ended in the 1970s.

By the 1960s Michigan's Department of Conservation favored policies supportive of sport fishing over the needs of what remained of the commercial industry. Ralph A. MacMullen became director of the department in 1964. Under his leadership the department charted a new course that favored recreational fisheries. Coho and Chinook salmon became the centerpiece of a new push to stock the lakes with species attractive to the lucrative sport fishing industry. When the introduced species became wildly popular with anglers, the Michigan Department of Conservation introduced new restrictions to commercial licensing legislation, quota fishing and eventually zoning regulations that quickly eroded the number of commercial operators on Michigan's Great Lakes. There were over seven hundred commercial fishermen operating in Michigan's Great Lakes waters in 1967. By 1970 that total plummeted to less than two hundred.[115]

While the introduced species thrived in Lake Michigan, their numbers were much lower in Lake Huron and Superior. MacMullen blamed Canadian commercial fishermen. In 1970 he wrote to Rene Brunelle, Ontario's Minister in the Department of Lands and Forests to complain about commercial fishermen in Ontario catching planted salmon. MacMullen pointed out that Michigan commercial fishermen were forbidden from catching the planted salmon. He suggested that Ontario should do the same thing. Brunelle responded that his department was interested in the maintenance of both recreational and commercial fishing. He pointed out the higher incidence of lampreys in Lake Huron as opposed to Michigan as well as the lower numbers of prey fishes for the salmon to feed on as likely culprits in the depressed numbers. He reported that Canadian fishermen believed the planted salmons were depressing numbers of walleyes in the area. Frustrated by their inability to change Ontario's regulations to suite Michigan's sport fishery, the Michigan Department of Conservation turned to the media. The

Detroit News quoted departmental scientist Dr. Wayne H. Tody's harsh words for Ontario. "I don't know how we can be expected to keep pouring salmon into Lake Huron to have Ontario commercial fishermen make big money off them," he said. The paper reported that department scientists had penned a new letter for the Ontario Minister, but MacMullen decided to tone it down before sending it.[116] Nearly a century after the first Joint Commission recommended cooperative management of the Great Lakes, old suspicions and regional interests continued to influence relations between the province and the states.

No new Wellands: Saving the Big Chute Marine Railway

The collapse of lake trout and other commercialized fish populations had far reaching effects for the Great Lakes Basin. The alarm engendered by sea lamprey introductions had repercussions for a wide variety of industrial and recreational enterprises. While economics continued to guide policies, for some an evolution in thinking occurred. An excellent example of the changed realities of life in the Great Lakes Basin can be seen in plan to modernize the popular Trent-Severn Waterway in the 1960s. The Trent-Severn system provides an aquatic link between Lake Ontario and Georgian Bay. The waterway was used primarily by recreational boaters. Running from Trenton, Ontario East to Port Severn on Georgian Bay, traffic along the waterway increased dramatically in the second half of the twentieth century.

North of Lake Simcoe the waterway passed through two unique marine railways. At those junctures boats would position themselves over top of a submerged carriage. The carriage was then raised out of the water and pulled along a railroad track to the next water body along the route. The railways were originally meant to be temporary structures that would serve smaller vessels until permanent locks could be constructed. One marine railway operated at

Swift Rapids and the second one was at Big Chute, East of Glouchester Pool off of Georgian Bay. Big Chute was the railway closest inland from Georgian Bay. In January of 1962 the Canadian Federal Government announced plans to replace the aging and overburdened marine railways with modern locks. The new locks would improve the speed of the canal system and allow larger vessels passage.[117]

In the mid-1960s the Swift Rapids Marine Railway was demolished and replaced with a permanent lock. The aging marine railway at Big Chute was similarly targeted for replacement. However, concerns mounted that doing so would provide sea lamprey in Georgian Bay access to Lake Simcoe via the waterway. In April of 1962 Minister of Lands and Forests J.W. Spooner contacted Dominion Minister of Transport Leon Balcer asking if there was a danger to the profitable sport fisheries of Lake Simcoe. Spooner pointed out sea lampreys had already migrated into Glouchester Pool on the East side of Big Chute. He highlighted the economic importance of Lake Simcoe and said that investments "catering to ice fishermen in one corner of the lake alone" amounted to over one million dollars.[118] Balcer responded that current conditions on the waterway would require two railway hoists instead of one. "This would leave no room for expansion while doubling our operating costs" he argued. He pointed out that a new lock system could handle four times the amount of traffic of a railway hoist system "at much lower operating and maintenance charges."[119] Balcer was not alone. Ontario's Chief of the Division of Fish and Wildlife Charles H. D. Clarke cautiously expressed skepticism that lamprey would enter the lake, though he admitted it was not impossible. Still, he believed there would probably be "no damage" if they did. He compared Lake Simcoe with inland lakes of the State of New York where he said lampreys "seem to live quite happily with members of the trout

family," though he qualified this statement by saying it was impossible to guarantee that no damage would occur.[120]

Critics were not dissuaded. In an interesting turn of events the Ontario Federation of Hunters and Anglers appealed to the Ontario Department of Lands and Forests and found a sympathetic ear in W.H.R. Werner, Supervisor of the Commercial Fish Section. Werner pushed for a meeting of experts to discuss the issue.[121] On October 18th, 1962 a group of Canadian academics, government officials including Werner as well as Charles Evans from the Ontario Hunters and Anglers Association met to discuss the implications of constructing the new lock systems. While on paper it looked like lamprey could enter Lake Simcoe traveling from the other end of the waterway, the height of the passage, extensive lock system and other environmental factors worked as a natural barrier to lampreys along the opposite end of the waterway. In fact, sea lampreys had only ascended the lower Trent River as far as the first dam. Attendees also noted that lampreys had migrated into two lakes in Michigan after navigating lock systems on connected rivers.[122]

The attendees were unanimous in their conclusions. They believed the new locks would likely lead to sea lampreys becoming established in Lake Simcoe via the waterway from Georgian Bay. They also concluded that other nonnative species such as alewives and smelts would also migrate inland via the waterway. They feared that introducing sea lampreys to the lake would require "perpetual control," and expressed skepticism that the control methods then being developed would ever completely eradicate lampreys from the Great Lakes or Lake Simcoe, should lampreys become established in the latter.[123] They believed it was theoretically possible for a lamprey to be carried into the waterway on one of the marine railway platforms, but thought it unlikely. They recommended the possibility be investigated.[124]

In the meantime, investigations were underway to try to find alternate solutions. R.W. McCauley oversaw experiments for the Ontario Department of Lands and Forests at its Southern Research Station in Maple, Ontario. McCauley investigated the affect of high temperatures on sea lampreys. The idea was to heat water within a lock to a temperature high enough to kill any sea lamprey entering a lock with surface canal traffic. The lock would remain closed while the water was heated. After a period of time the second gate would be opened. McCauley recommended a temperature of 98 degrees be maintained for ten minutes between the closing and opening of a lock's gates.[125]

Despite the desire for increasing the efficiency of the waterway, planners eventually decided the existing construction provided an effective deterrent to lamprey migrations. Since there was no lock, there was a complete break in the water system. Individual boats would be out of the water for some time as they traversed over the railway. The decision was made to construct a newer marine railway capable of transporting larger pleasure craft near the site of the old railway at Big Chute. In 1978 construction was completed on the new, modernized marine railway. The older railway served as a back-up whenever there were problems with the new system. As many as two hundred small craft a day began passing over the marine railway on their way through the Trent-Severn Waterway.[126] Ontario officials had learned from the oversights at the Welland Canal. While economic concerns about the impact on fisheries and tourism at Lake Simcoe played a significant role in the planning and decision to retain a marine railway at Big Chute, the practical effect of the modernized construction protected the integrity of the interior ecosystems of the Trent-Severn Waterway. More recently new problems have arisen that threaten the interior waters of the canal system. Nonindigenous species like zebra mussels and contamination from human generated pollutants threaten the waterway.[127] Despite

the preservation victory at Big Chute, the Trent-Severn system continues to reflect the environmental stresses prevalent throughout the Great Lakes.

Chapter 5 endnotes

---

[1] Vernon C. Applegate, "Progress Report on Sea Lamprey Investigations for the Calendar Year 1951," Paper presented at the Joint Meeting of the Great Lakes Lake Trout Committee and the Great Lakes Sea Lamprey Committee, December 11, 1951, p. 54, GLFC Sea Lamprey Control and Research Committee, 1951-68, F 9040G.1.11, FB, GAC, RG 1-289-1, Archives of Ontario. (see chap. 4, n. 29)

[2] Great Lakes Fishery Act of 1956, 16 U.S.C. §§ 931-939c (1956).

[3] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to W. F. Carbine, Chief of the Section of Inland Fisheries, 24 September 1954, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, July thru Dec., BCF, GR, GCF, USFWS, RG 22, NACP (see chap. 4, n. 35).

[4] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to Peter Doudoroff, 23 November 1954, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, July thru Dec., BCF, GR, GCF, USFWS, RG 22, NACP.

[5] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to W. F. Carbine, Chief of the Section of Inland Fisheries, 15 December 1954, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, July thru Dec., BCF, GR, GCF, USFWS, RG 22, NACP.

[6] Ibid.

[7] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to John L. Farley, Director of United States Fish and Wildlife Service, 8 April 1954, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, Jan. thru June, BCF, GR, GCF, USFWS, RG 22, NACP.

[8] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to Regional Director, 27 April 1954, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, Jan. thru June, BCF, GR, GCF, USFWS, RG 22, NACP.

[9] Job description, Temporary Fishery Aid, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, Jan. thru June, BCF, GR, GCF, USFWS, RG 22, NACP.

[10] Description of Test Technique Used at Hammond Bay Fishery Laboratory in Screening Chemical Compounds for a Specific Larvicide, June 1954, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, Jan. thru June, BCF, GR, GCF, USFWS, RG 22, NACP.

[11] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to W.E. Craig, Fishery Biology, 1954, Great Lakes Invest., Moffett-Hile-Van Oosten, Jan. thru June, BCF, GR, GCF, USFWS, RG 22, NACP.

[12] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to Regional Director, 15 October 1954, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, July thru Dec., BCF, GR, GCF, USFWS, RG 22, NACP.

[13] John L. Farley, Director of United States Fish and Wildlife Service, to John W. Bynes, 19 March 1954, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, Jan. thru June, BCF, GR, GCF, USFWS, RG 22, NACP.

[14] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to John L. Farley, Director of United States Fish and Wildlife Service, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, Jan. thru June, BCF, GR, GCF, USFWS, RG 22, NACP.

[15] Vernon C. Applegate, "Progress Report on Sea Lamprey Investigations for the Calendar Year 1951," Paper presented at the Joint Meeting of the Great Lakes Lake Trout Committee and the Great Lakes Sea Lamprey Committee, December 11, 1951, p. 56, GLFC Sea Lamprey Control and Research Committee, 1951-68, F 9040G.1.11, FB, GAC, RG 1-289-1, Archives of Ontario.

[16] Ibid, 58.

[17] John L. Farley, Director of United States Fish and Wildlife Service, to James W. Moffett, Chief of Great Lakes Fisheries Investigations, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, July thru Dec., BCF, GR, GCF, USFWS, RG 22, NACP.

[18] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to Fred Westerman, Chief of the Fish Division, Michigan Department of Conservation, 13 October 1953, Fishery

Biology, 1953, Moffett-Hile-Van Oosten, July thru Dec., BCF, GR, GCF, USFWS, RG 22, NACP.

[19] U.S. Fish and Wildlife Great Lakes Fishery Investigations, 1954, p. 3, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, July thru Dec., BCF, GR, GCF, USFWS, RG 22, NACP.

[20] Ibid.

[21] Ibid.

[22] Ibid.

[23] James W. Moffett, Chief of Great Lakes Fisheries Investigations, to Regional Director, 20 April 1954, Great Lakes Investigations, Fishery Biology, 1954, Moffett-Hile-Van Oosten, Jan. thru June, BCF, GR, GCF, USFWS, RG 22, NACP.

[24] The Saltonstall-Kennedy Act, 15 U.S.C. 713c-3 (1954).

[25] Bureau of Commercial Fisheries, *State of Michigan Biological Research, 1967*, p. 1, Briefing Material by States, 1962-68, Records of the Bureau of Commercial Fisheries, General Records, Miscellaneous Files, 1941-69, Briefing Material – Correspondence, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as BCF, GR, MF, BM-C, USFWS, RG 22, NACP).

[26] Fish and Wildlife Act of 1956, 16 U.S.C. 742a-742j (1956), (hereafter cited as FWA).

[27] Bureau of Commercial Fisheries, *State of Michigan Biological Research, 1967*, pp. 1-3, BCF, GR, MF, BM-C, USFWS, RG 22, NACP.

[28] George W. Paxson to John F. Kennedy, President of the United States, 24 November 1961, Michigan, Records of the Bureau of Sport Fisheries and Wildlife, Records of the Division of Wildlife Services, State Files, 1941-67, Kansas-Mississippi, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as BSFW, DWS, SF, KS-MS, USFWS, RG 22, NACP).

[29] Lansing A. Parker, Acting Director of the Bureau of Sport Fisheries and Wildlife, to George W. Paxson, 15 December 1961, Michigan, BSFW, DWS, SF, KS-MS, USFWS, RG 22, NACP.

[30] Pete Daniel, "A Rogue Bureaucracy: The USDA Fire Ant Campaign of the Late 1950s ," *Agricultural History* 64, no. 2 (Spring 1990): 111, http://www.jstor.org/stable/3743800.

[31] Bureau of Commercial Fisheries, *Report on the State of Michigan*, 26 May 1965, p.2, BCF, GR, MF, BM-C, USFWS, RG 22, NACP.

[32] Smith and Tibbles, 1787, (see chap. 4, n. 28).

[33] Athelstan Spilhaus, *Turn To the Sea* (Washington, DC: National Academy of Sciences, National Research Council, 1959), 30-34.

[34] Dwight D. Eisenhower, President of the United States, to F.M. Bundy, 11 September 1958, National Fish and Seafood Committee, National Federation of Press Women, Central File, President's Personal Files, Dwight D. Eisenhower Library, Abilene Kansas.

[35] United States Department of the Interior, *Memo on the Whole problem of Commercial Fisheries*, 17 May 56, p. 23.1, Papers of Gerald D. Morgan, Special Counsel and Deputy Assistant to the President, 1953-61, Fisheries Legislation, Dwight D. Eisenhower Library, Abilene Kansas.

[36] Ibid., 14.

[37] Ibid., 4-28.

[38] Fred A. Seaton, Secretary of the Interior, to Jack Martin, 10 July 1956, Re-Establishment of Bureau of Fisheries 17-Y-Con, Commissioner of Fish and Wildlife, General File, Central Files, Dwight D. Eisenhower Records as President, Dwight D. Eisenhower Library, Abilene Kansas (hereafter cited as CFW, GF, CF, DDERP, DDEL.)

[39] Ralph G. Carpenter II to Sherman Adams, 18 June 1956, CFW, GF, CF, DDERP, DDEL.

[40] Citizens Committee on Natural Resources, *Bulletin*, 1956, CFW, GF, CF, DDERP, DDEL (hereafter cited as Citizens Committee).

[41] Department of the Interior, *Audit Report To The Congress Of The United States: Department of the Interior, Fish and Wildlife Service, For the Fiscal Year Ended June 30, 1954*, p. 55, Fish and Wildlife Services (2), Fish and Wildlife Service, Official Files, Central Files, Dwight D. Eisenhower Records as President, DDEL.

[42] Citizens Committee, 2.

[43] FWA.

[44] Bureau of Commercial Fisheries, *Operation Trident: A Long –Range Program for the Bureau of Commercial Fisheries*, Circular 142, April 1962, p. 20, Records of the Bureau of

Commercial Fisheries, General Records, Administrative Records, 1926-68, Operation Trident-Status Report on Scientific and Technical Information, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as BCF, GR, AR, OTSRSTI, USFWS, RG 22, NACP).

[45] Donald L. McKernan, "Conditions for Profit from Fisheries," Address given to the Association of Pacific Fisheries, November 11, 1957, p. 1, Records of the Bureau of Commercial Fisheries, General Records, Speeches & Articles by Director Donald McKernan, 1957-66, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD, (hereafter cited as BCF, GR, SA-DM, USFWS, RG 22, NACP).

[46] Ibid, 1, 5.

[47] Donald L. McKernan, "Present Status of Commercial Fisheries in the United States," *Transactions of the American Fisheries Society* 88, no. 3 (July 1959): 173.

[48] Ibid.

[49] Donald L. McKernan, "The Future of North American Fisheries – A Summary," Address given at the North American Fisheries Conference, May 5, 1965, pp. 27,29, BCF, GR, SA-DM, USFWS, RG 22, NACP.

[50] Donald L. McKernan and D.R. Johnson, "Fisheries in the Year 2000," May 1962, BCF, GR, SA-DM, USFWS, RG 22, NACP.

[51] Donald L. McKernan and J.L. McHugh, "Bureau of Commercial Fisheries," *AIBS Bulletin* 13, no. 5, (Marine Biology, Oct., 1963), 31-32, http://www.jstor.org/stable/1292954.

[52] Ibid., 32.

[53] Bureau of Commercial Fisheries, *Operation Trident*, April 1962, ii.

[54] Ibid., 18.

[55] Ibid., 22.

[56] Ibid., iv, 2.

[57] Frederick Jackson Turner, "The Frontier in American History," reprint of the 1893 essay (New York: Henry Holt, 1920).

[58] Bureau of Commercial Fisheries, *Operation Trident*, April 1962, 28.

[59] Ibid., 29.

[60] United States Department of the Interior, *Report of the Bureau of Commercial Fisheries for the Calendar Year 1961*, (Washington DC: Government Printing Office, 1963), 22(hereafter cited as *Report of the Bureau of Commercial Fisheries 1961*); and United States Department of the Interior, *Report of the Bureau of Commercial Fisheries for the Calendar Year 1962*, (Washington DC: Government Printing Office, 1964), 23.

[61] *Report of the Bureau of Commercial Fisheries 1961*, 23.

[62] Bureau of Commercial Fisheries, *Briefing Material for Secretary Udall on the Fisheries of the Great Lakes*, BCF, GR, MF, BM-C, USFWS, RG 22, NACP (hereafter cited as *Briefing Material for Secretary Udall*).

[63] *Report of the Bureau of Commercial Fisheries 1961*, 23.

[64] Bureau of Commercial Fisheries, *State of Michigan Accomplishments, Calendar Year 1966*, April 20, 1967, Briefing Material by States, 1962-68, BCF, GR, MF, BM-C, USFWS, RG 22, NACP.

[65] *Briefing Material for Secretary Udall*.

[66] Donald L. McKernan, Address given at the opening session of the Eleventh Annual Meeting of the Great Lakes Fishery Commission, Sault Ste. Marie, ON, 21 June 1966, pp. 2, 4, BCF, GR, SA-DM, USFWS, RG 22, NACP.

[67] W.H.R. Werner, *Commercial Fishing in Ontario*, reprint from The Annual Review of Fisheries Council of Canada, 1961, Policies, 1960-72, Commercial Fish Section, General Subject Files, Series RG 1-296, box 14, Archives of Ontario (hereafter cited as CFS, GSF, RG 1-296, box 14, Archives of Ontario).

[68] A. Kelso Roberts, *Letter to all commercial fishermen on Lake Huron, Georgian Bay and North Channel*, 8 July 1966, Lake Huron and North Channel Policy, 1966-71, CFS, GSF, RG 1-296, box 14, Archives of Ontario.

[69] *1967 Licenses not eligible for renewal if applied for*, p. 9, Lake Huron and North Channel Policy, 1966-71, CFS, GSF, RG 1-296, box 14, Archives of Ontario.

[70] *Appeals granted on compassionate grounds*, n.d., Lake Huron and North Channel Policy, 1966-71, CFS, GSF, RG 1-296, box 14, Archives of Ontario.

[71] Ibid.

[72] Department of Lands and Forests, *Areas closed to commercial fishing: North Channel and Northern Georgian Bay*, December 21, 1965, Lake Huron-Georgian Bay, General, 1965-68, F 610.92, Fisheries Branch, Lake Research Management Files, RG 1-294, box 6, Archives of Ontario (hereafter cited as LH-GB, F 610.92, FB, LRMF, RG 1-294, Archives of Ontario).

[73] "Charles Henry Douglas Clarke, 1909-1981," Biographical Sketch, Online finding aid for the Charles Henry Douglas Clarke Papers, Thomas Fisher Rare Book Library, University of Toronto, accessed November 20, 2010, http://www.library.utoronto.ca/fisher/collections/findaids/clarke367.pdf.

[74] C.H.D. Clarke, Chief of the Fish and Wildlife Branch, Department of Lands and Forests, to District Forester, Department of Lands and Forests, 17 February 1966, LH-GB, F 610.92, FB, LRMF, RG 1-294, box 6, Archives of Ontario (hereafter cited as C.H.D. Clarke to District Forester, 17 February 1966).

[75] A.P. Leslie, Chief of the Research Branch, Department of Lands and Forests, to T. Arthur Davidson, 15 August 1966, LH-GB, F 610.92, FB, LRMF, RG 1-294, box 6, Archives of Ontario.

[76] Bureau of Commercial Fisheries, "Progress Report on Sea Lamprey Control," 1967, GLFC Sea Lamprey Control and Research Committee, 1951-68, F 9040G.1.11, FB, GAC, RG 1-289-1, box 10, Archives of Ontario.

[77] C.H.D. Clarke to District Forester, 17 February 1966.

[78] C.H.D. Clarke, Chief of the Fish and Wildlife Branch, Department of Lands and Forests, to District Foresters, 3 December 1965, Lake Huron and North Channel Policy, 1966-71, CFS, GSF, RG 1-296, box 14, Archives of Ontario.

[79] A.K. Lamsa to J.J. Tibbles, Director of the Sea Lamprey Control Experiment, 9 August 1967, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[80] Excerpt from the Debates and Proceedings of the Ontario Legislature, June 10, 1966, Lamprey Barrier Sites, General Correspondence, Sea Lamprey Control, F 9020D.1.1/5, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[81] J.J. Tibbles, Director of the Sea Lamprey Control Experiment, Department of Fisheries, to Editor of Creemore Star, 22 May 1967, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[82] Richard S. Lambert, "'Silent Spring' on the Noisy?," *The Creemore Star*, 16 May 1968, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[83] C.H.D. Clarke, Chief of the Fish and Wildlife Branch, Department of Lands and Forests, to J.J. Tibbles, Director of the Sea Lamprey Control Experiment, 24 May 1968, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[84] Department of Fisheries, Report on the Lampricide Treatment of the Nottawasaga River, June 1968, n.d., Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[85] Richard S. Lambert, "Lampricide Treatment On Noisy Viewed as Ineffective and Costly," *The Creemore Star*, 20 June 1968, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[86] Richard S. Lambert to J.J. Tibbles, Director of the Sea Lamprey Control Experiment, 1 August 1968, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[87] J.J. Tibbles, Director of the Sea Lamprey Control Experiment, to Richard S. Lambert, 29 August 1968, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[88] "Department of Fisheries issues report on Noisy River Lampricide Treatment," 19 December 1968, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[89] Richard T. Lambert to J.J. Tibbles, Director of the Sea Lamprey Control Experiment, 15 October 1969, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[90] J.J. Tibbles, Director of the Sea Lamprey Control Experiment, to Richard T. Lambert, 6 November 1969, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[91] E.F. Mudra to Jack Davis, Minister, Ministry of Environment Canada, 8 March 1973, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[92] J.J. Tibbles, Director of the Sea Lamprey Control Experiment, to All Ontario Department of Lands and Forests District Foresters in the Great Lakes Districts, 25 April 1969, Lamprey Barrier Sites, General Correspondence, Sea Lamprey Control, F 9020D.1.1/5, FB, GAC, RG 1-289-1, box 2, Archives of Ontario (hereafter cited as Tibbles to all, 25 April 1969).

[93] Review of the Annual Report, 1968-69, 8-10.

[94] R.A. Weir to G. A. Hamilton, District Forester, 21 March 1961, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[95] "Mechanical and Electrical Weirs," U.S. Fish and Wildlife Service, Marquette Biological Station, last modified July 14, 2010, http://www.fws.gov/midwest/Marquette/weir.html; and Smith and Tibbles, *Sea Lamprey Control*, 1786.

[96] Smith and Tibbles, *Sea Lamprey Control*, 1786.

[97] C.H.D. Clarke, Chief of the Fish and Wildlife Branch, Department of Lands and Forests, to J.J. Tibbles, 25 March 1966, Director of the Sea Lamprey Control Experiment, Lamprey Barrier Sites, General Correspondence, Sea Lamprey Control, F 9020D.1.1/5, FB, GAC, RG 1-289-1, box 2, Archives of Ontario; and A.L. Pritchard, Vice Chairman of the Great Lakes Fishery Commission, to C.H.D. Clarke, Chief of the Fish and Wildlife Branch, Department of Lands and Forests, 5 April 1966, Lamprey Barrier Sites, General Correspondence, Sea Lamprey Control, F 9020D.1.1/5, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[98] Tibbles to all, 25 April 1969.

[99] Lamprey Control Huron, 1973, 1-2.

[100] Ibid., 1.

[101] Shetter, David, "A Brief History of the Sea Lamprey Problem in Michigan Waters," *Transactions of the American Fisheries Society* 76, no. 1 (January 1949): 165, doi: 10.1577/1548-8659(1946)76[160:ABHOTS]2.0.CO;

2. Shetter specifically mentions the inclusion of an unknown number of native lamprey species in the 1945 account. The weir operator reported being unable to distinguish between the various types of lampreys. He estimated that ninety percent or more of the lampreys were of the marine variety.

[102] Frederick H. Dahl to Ann Arbor Laboratory Director, Bureau of Commercial Fisheries, 26 May 1968, Lamprey Barrier Sites, General Correspondence, Sea Lamprey Control, F 9020D.1.1/5, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[103] J.M. Halpenny, District Forester, to C.H.D. Clarke, Chief of the Fish and Wildlife Branch, Department of Lands and Forests, 2 July 1969, Lamprey Barrier Sites, General Correspondence, Sea Lamprey Control, F 9020D.1.1/5, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[104] Smith and Tibbles, *Sea Lamprey Control*, 1786; and Dennis S. Lavis et al., "History of and Advances in Barriers as an Alternative Method to Suppress Sea Lampreys in the Great Lakes," supplement 1, *Journal of Great Lakes Research* 29 (2003): 363-365, doi:10.1016/S0380-1330(03)70500-0.

[105] Review of the Annual Report, 1968-69, 10-11; and Harold A. Purvis, "Variations in Growth, Age at Transformation, and sex ratio of sea lampreys reestablished in chemically treated tributaries of the upper Great Lakes," technical report 35 (Ann Arbor: Great Lakes Fishery Commission, May 1979): 30-34.

[106] Jon Mallatt, "Effects of TFM and Bayer 73 on Gill Ultrastructure of Sea Lamprey Ammocoetes and Rainbow Trout Fry," Project Completion Report. (Great Lakes Fishery Commission, May 20, 1987): 17-20, last modified May 27, 2003, http://www.glfc.org/research/reports/MallattTFM.pdf.

[107] Review of the Annual Report of the Department of Fisheries and Forestry, Sea Lamprey Control Station, Sault Ste. Marie, to the Great Lakes Fishery Commission, covering the period April 1, 1968 to March 31, 1969, p. 4, Sea Lamprey Control – Lake Huron, 1958-73, F

9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario (hereafter cited as Review of the Annual Report, 1968-69).

[108] Department of the Environment, Sea Lamprey Control, Lake Huron, 1973, pp. 5, 8, Sea Lamprey Control – Lake Huron, 1958-73, F 9020D.1.1/3, FB, GAC, RG 1-289-1, box 2, Archives of Ontario (hereafter cited as Lamprey Control Huron, 1973).

[109] Review of the Annual Report, 1968-69, 5-7.

[110] Lamprey Control Huron, 1973, 5.

[111] R.J. Young et al., "Effects of habitat change in the St. Marys River and northern Lake Huron on sea lamprey(Petromyzon marinus) populations," supplement 1, *Canadian Journal of Fisheries and Aquatic Sciences*, 53 (1996): 102-103, doi:10.1139/cjfas-53-S1-99

[112] Ibid., 101.

[113] "A Milestone for Sea Lamprey Control: Treatment of the St. Marys River," *State of the Great Lakes: 1998 Annual Report*, ed. Martha Waszak, (1999): 28-29; and Michael F. Fodale et al., "Planning and Executing a Lampricide Treatment of the St. Marys River Using Georeferenced Data," supplement 1, *Journal of Great Lakes Research* 29 (2003): 711-714, doi:10.1016/S0380-1330(03)70525-5.

[114] John J. Collins, "Introduction of Kokanee Salmon (Oncorhynchus nerka) into Lake Huron," *Journal of the Fisheries Research Board of Canada* 28, no. 12 (1971): 1858, 1864, 1869.

[115] Kristin M. Szylvian, "Transforming Lake Michigan into the 'World's Greatest Fishing Hole': The EnvironmentalPolitics of Michigan's Great Lakes Sport Fishing, 1965-1985," *Environmental History*, 9, no. 1 (January, 2004), 110-11, 117.

[116] James A.O. Crowe, "Commercial fishing perils coho in Ontario waters," *Detroit News*, June 7, 1970, Lake Huron/Georgian Bay, General, 1968-70, F 6010.92, FB, LRMF, RG 1-294, box 6, Archives of Ontario.

[117] Farmer Tissington, "Little Chance New Locks to Spread Lamprey Inland," *Daily Packet and Times*, 11 January 1962, C.O.R.T.S., 1958-62, F 9020C.6, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[118] J.W. Spooner, Minister of Lands and Forests to Leon Balcer, Minister of Transport, 3 April 1962, C.O.R.T.S., 1958-62, F 9020C.6, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[119] Leon Balcer, Minister of Transport, to J.W. Spooner, Minister of Lands and Forests, 17 April 1962, C.O.R.T.S., 1958-62, F 9020C.6, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[120] C.H.D. Clarke, Chief of the Fish and Wildlife Branch, Department of Lands and Forests, to J.W. Spooner, Minister of Lands and Forests, 21 March 1962, C.O.R.T.S., 1958-62, F 9020C.6, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[121] W.H.R. Werner, Supervisor, Commercial Fish Section, Department of Lands and Forests, to G.C. Armstrong, Game Fish and Hatcheries Section, Department of Lands and Forests, 21 September 1962, C.O.R.T.S., 1958-62, F 9020C.6, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[122] Notes RE Meeting October 18, 1962, Regarding Canal Locks in the Severn River, C.O.R.T.S., 1958-62, F 9020C.6, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[123] Probable Effect of Replacing Marine Railways on Severn River by Canal Locks on Lake Simcoe Fisheries, n.d., C.O.R.T.S., 1958-62, F 9020C.6, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[124] Notes RE Meeting October 18, 1962, Regarding Canal Locks in the Severn River, C.O.R.T.S., 1958-62, F 9020C.6, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[125] R.W. McCauley, "Upper Lethal temperatures Killing Sea Lampreys Within Ten Minutes," 1962, p. 5, C.O.R.T.S., 1958-62, F 9020C.6, FB, GAC, RG 1-289-1, box 2, Archives of Ontario.

[126] Josie Newman, "Swooshing Down the Big Chute," *The Globe and Mail*, May 24, 1996, LexisNexis Academic.

[127] Samuel Cayer and Peter Sibbald, "Lakes & ladders," *Canadian Geographic*, 116, no. 4 (July/August 1996), 47.

Afterword

The Great Lakes Basin is a huge ecosystem – one might argue an interconnected freshwater biome - of interacting communities of plants, water and land based animals including human beings, and a huge variety of rich and unique landscapes. It took millions of years for the rich and diverse biota of the region to develop the complex and awe inspiring dance of reciprocity that characterized the region. The first human beings in the area considered much of the region and its inhabitants sacred and incorporated them into human origin stories and rituals. While there was undoubtedly an occasional waste of resources, Indian technologies were built to sustain patterns of subsistence. Rituals and respect that often recognized a shared interdependence guided much of the regional indigenous use of living resources. With the influx of the first European explorers and settlers into the region, a western market system was introduced.

After Independence the United States moved along a fast track of capitalist development that shouldered aside older craft trades and replaced them with assembly lines, industry, and mass production. The raw materials of North America, both plant and animal, were intensively harvested with an eye toward maximum yields for maximum profits. These were the economic processes that defined the Great Lakes commercial fishing industry. The rich aquatic populations of the lakes fueled the rapid dissemination of fishermen and market outlets. When Lake Ontario's fisheries collapsed commercial harvesters moved farther inland to Lakes Erie, Huron, Michigan and Superior. While many fishermen operated with limited means, those who could afford it embraced mechanization and change. Steam tugs and gasoline boats began traversing the lakes in the last quarter of the nineteenth century. The replacement of twine gill netting with first cotton and later nylon greatly improved catch efficiency. The 1913

development of the Crossley lifter reduced the amount of time required to fish long gangs of nets. Nets and traps were improved, enlarged and set deeper. As fish catches decreased the number of nets and other fishing gear in the lakes increased. Technologies were further modified and fishermen strove to maximize their catch totals in the increasingly competitive and precarious fishery.

Fishermen did not intend to destroy the fishes of the lakes, but made little effectual effort to preserve them. If fish markets became glutted with a given species fishermen often responded with even more intensive efforts at still higher yields to improve their profits. Efforts at management and regulation of fishing resources incorporated the same profit motive. Fish were managed for maximum yield, similar to the usage patterns applied to the Northern forests of the day. Just as the woodlands of the Great Lakes region were clear cut with wild abandon, so too were the rich biota of the lakes fished to near oblivion. The living communities within the lakes were viewed as either commodities or pests, with no apparent intrinsic value of their own. Species that existed outside the market system were almost always viewed as pests because it was believed they competed with marketable fish for resources. The complex ecological interconnections of Huron's aquatic ecosystem were not understood nor cared for. Introduced species were welcomed only when they proved to have some monetary value for the fisheries. Of the numerous nonindigenous species introduced to Lake Huron in the first half of the twentieth century; smelts, sea lampreys and alewives generated some of the greatest controversies and brought dramatic changes to the ecology of the lakes.

In his 1968 essay "The Tragedy of the Commons" Garrett Hardin outlined a model that described the problems inherent in sharing environmental resources within a profit based market system. Hardin used the example of herdsmen grazing animals in a shared field. Individual herdsmen experience disproportionate benefit by increasing the number of animals they graze. Although overgrazing eventually occurs, the negative effects of overgrazing are shared by all. Thus, argued Hardin, a herder experiences a +1 gain with the addition of a single animal, while the negative impact of overgrazing is significantly less than -1, as it is divided between all herders. Without controls, the tendency is for each herdsman to add as many animals as they can until the pasture is destroyed. Destruction is not the goal, but it is the result of maximizing individual benefit at the expense of the group and the resource.[1] In a 1998 follow-up to his famous thesis Hardin applied his theory to marine fisheries.[2] He concluded that coercive controls were necessary to prevent resource destruction in a shared commons. Hardin's conclusions reflect the history of commercial fisheries on the lakes. Free of legislative oversight or consistent enforcement individual fishermen abused the resources they depended on. When resource depletion occurred, fishermen did not attempt to preserve their livelihood over the long term. Instead they strove to maintain their profits in the short term. Fishing effort (and by extension resource destruction), intensified, sometimes spectacularly so.

In his book *The Fisherman's Problem, Ecology and Law in the California Fisheries, 1850-1980* (1986) Arthur F. McEvoy argued that Hardin's model did not accurately reflect the West Coast marine fisheries. McEvoy believed fishermen, fisheries and government bodies evolved together. He believed the California fisheries operated as communities and legislative controls grew from cooperation between government and industry. At the time of his writing McEvoy was upbeat regarding the future of California's fisheries and pointed to the Fishery

Conservation and Management Act of 1976 as charting a bold new course in fisheries management.[3] So too did Great Lakes fishermen contribute to, support or forestall state, provincial, national and international legislation. The various regional and international commissions faced tremendous political obstacles when they failed to mollify the concerns of commercial fishermen. However, these facts do not disprove Hardin's central argument. Individual fishermen went to great lengths to ensure their personal profits at the expense of any commitment to the greater community. Edward Landry and Lawrence Trombley's Saginaw Bay seining operations are an obvious example among many. Hardin's belief that resource extractors must be coerced through legislative controls is not somehow negated because government responses were historically ineffective and often beholden to industry. It simply illustrates the failure to administer sufficient controls to avert the destruction of the commons. McEvoy's own example of the Fishery Conservation and Management Act of 1976 might just as easily be incorporated into Hardin's model as a form of coercive legislation. The history of the Great Lakes commercial fisheries was a tragedy of the commons writ large.

This is not meant to suggest the rush for resources and the profits they entail are unavoidable. While McEvoy's challenge did not invalidate Hardin, his optimism regarding the ultimate possibilities of increased environmental education are well founded, even if in practice they often fail to generate truly altruistic controls. The Great Lakes experienced a series of its own forward thinking managerial decisions, sometimes coming in what seemed to be its darkest ecological hours. The decision to retain the marine railway at Big Chute contrasted sharply with much of the decision making in the Great Lakes' industrial past. In retrospect the history of Lake Huron's commercial fisheries has the appearance of an unfortunate march to economic self destruction at the expense of a unique and inestimable ecosystem. While the aquatic ecosystems

of the lakes themselves often paid the heaviest initial toll in the name of human progress, the ramifications of rapid development bore consequences for the human populations who were dependent on the lakes. Sometimes those consequences were direct and immediate. Many fishermen paid the ultimate price fishing the dangerous and unpredictable waters of the Great Lakes. The lakes are famous for their hazardous waters. The desire for maximum profits in a dangerous profession that demanded work in the worst navigation seasons was a treacherous mix.

Nor was the rush for resources limited to the fisheries. The history of the Great Lakes is littered with the sunken hulls of numerous shipping disasters. Just as fishermen worked their nets into the winter months, so too did cargo ships haul valuable loads late into the dangerous winter months. There are abundant examples of rushed, overburdened or aged ships and crews pushed beyond their limits in the name of Great Lakes commerce. Many people have heard of the *SS Edmund Fitzgerald*, the huge cargo ship that sank with all hands on Lake Superior in November of 1975. However, no event better personified the dangers of Great Lakes shipping than the staggering losses that occurred during the November Storm of 1913. The brand new 529 foot long *James C. Carruthers*, then Canada's newest and largest vessel on the lakes, was among eight large freighters that were swallowed whole by Lake Huron during a fierce November gale.[4] Construction on the modernized Welland Ship Canal began the same year the *Carruthers* took twenty-two of her crew to the bottom of Lake Huron. The canal would allow even larger international ships and their cargos access to the interior lakes and their ports. It further fueled the scale and pace of the waterborne market networks of the interior lakes. Little thought was given to the possible environmental ramifications of that structure.

More shipping meant more foreign ballast water. More shipping meant increased surface traffic, pollution and greater pressure on the ecology of the interior lakes. A large, modern canal with minimal lock obstructions meant a virtual freeway for nonindigenous species migrations. Two of the most influential new species to enter the interior lakes through the Welland Canal were alewives and sea lampreys. While it is not certain which exact factors in the modernization process opened the proverbial door to those two early emigrant species, numerous factors eventually made the waterway an easier passage for both ships and aquatic life. The canal was widened and deepened. Much of its flow was redirected into different channels. The number of locks was greatly reduced.

The rush for profit eventually proved quite costly in its own right. The door human engineering opened unleashed unforeseen ecological consequences that eventually cost billions in lost revenues and control efforts. Once the first signs of damage appeared, the introduced species were referred to as "invaders" and "invasive species" – terms that removed human complicity and instead blamed the species for the changes they caused. When the staggering economic ramifications of sea lamprey introductions became clear the United States and Canada finally came together to try to orchestrate cooperative control measures. The Great Lakes Fisheries Commission was the result. Despite its creation, the commission still lacked the long coveted power to legislate. Individual local, state and regional interests still carried the day. The commission was charged with implementing a program of lamprey control. Beyond that, it served only as an advisory body. The commission recommended procedures for maximizing the productivity of fishes important to the fisheries of both nations. The population disaster visited upon lake trout and other species through the combined pressures of heavy commercial fishing and the arrival of sea lampreys finally forced substantial cooperation across borders.

Nonetheless, old tensions remained. Canadian and American authorities soon disagreed on what constituted the best methods for restoring the lake fisheries.

Throughout the legislative processes of the late nineteenth and twentieth centuries Great Lakes Indian peoples were left out. Despite their own unique historical and cultural experiences their opinions were not considered by the fisheries biologists, conservationists and government bureaucrats who designed regulatory policies for the commercial fisheries. Treaties meant to protect retained fishing rights went unenforced. Most indigenous fishermen lacked the capital necessary to compete in the commercial fisheries. Individual indigenous fishermen were usually among the poorest commercial operators in Michigan. Often Native fishermen worked as laborers for some of the larger fishing enterprises.[5] Indian laborers competed for jobs with growing numbers of whites. Native peoples of the Great Lakes fought to reestablish their treaty fishing rights in the late twentieth century. In the case *People v. LeBlanc* in 1976 the Michigan Supreme Court ruled that Ojibwes and Odawas retained fishing rights guaranteed by the 1836 Treaty of Washington. In the case *United States v. Michigan* in 1979 Federal District Judge Noel P. Fox again ruled in favor of Indian peoples and against the State of Michigan and the cadre of conservation officials who testified on the state's behalf.[6]

Despite the court victories, exercising their treaty rights proved a challenging and sometimes dangerous affair. Sport fishermen, often with the support of officers from the Michigan State Department of Conservation organized protests and sued to halt indigenous fishing. Sport fishing and hunting publications such as *Outdoor Life* and *Michigan Out-of-Doors* printed misleading and sensationalized stories to fuel resistance to Indian fishing. *Northwoods Call*, a publication out of Charlevoix, Michigan was especially virulent. Writer Glenn Sheppard went so far as to publish a fictionalized account of the murder of Federal Judge Noel Fox by

enraged sportsmen. Vigilantes shot at Indian fishermen, destroyed indigenous fishing gear and dubbed Indian peoples the enemies of conservation.[7] Decades after the rulings in 1976 and 1979, hostility toward Indian fishing continues to simmer.

In 2002 the Great Lakes Fisheries Commission published a reassessment of the collapse of Great Lakes lake trout during World War II. Randy L. Eshenroder and Kathryn L. Amatangelo examined both the influx of sea lampreys and the effects of the commercial fishing industry on lake trout populations. Drawing on reports and data from the 1940s and early 1950s, including a largely overlooked research article by John Van Oosten, they concluded that lake trout populations in Lake Michigan were already failing to adequately reproduce prior to the establishment of large populations of sea lampreys. Juvenile lake trout were being overharvested by the fishery. In addition, the chub fishery on Lake Michigan was sometimes catching more lake trout in its bycatch than the lake trout fishery itself. Thus the commercial fisheries were taking a deleterious toll on lake trout prior to widespread sea lamprey abundance in the lake.[8] The perilous condition of lake trout populations left them open to demographic disintegration with the added pressures of sea lampreys.

Recent trawling experiments charted drastic declines in numerous species of fishes in the lake. According to the results, between 1994 and 2006 seven species of fishes, including whitefishes, alewives and sculpins declined over ninety percent. Lake trout declined by over eighty-five percent. Numerous endemic factors may be to blame including competition from increasing numbers of exotic species, climate change, predation by competitors and increased rates of diseases.[9]

Ecological challenges in the Lake Huron Basin continue. In the final years of the twentieth century zebra mussels, round gobies, spiny water fleas and a host of other exotic species were introduced to the lake. Each of these new species brought with it a new set of environmental challenges. For example, zebra mussels are blamed for driving some species of native bi-valves to the brink of extinction. Furthermore, the mussels are believed to be a contributing factor in the growth of toxic algae blooms. Zebra Mussels avoid blue-green algae, a form of potentially toxic bacteria, and consume competing species instead. This reduces beneficial algaes in favor of the toxic type.[10] Zebra Mussels and other introduced species were transported into the interior Great Lakes by international shipping. The most problematic vector for transmission is ship ballast water.[29]

Environmental changes continue to affect the basin in other ways. Double-crested cormorants were nearly driven extinct from toxic contamination between the 1950s and 1970s. However, over the subsequent decades their numbers surged bringing with them their own set of environmental issues. Since cormorants feed on fishes, sport fishermen usually view the birds as competitors for resources. Increased knowledge of pesticides and other contaminants led to further changes in the fishery in the 1970s. Fish were contaminated with various toxins. Increased limitations were placed on commercial operators. Sport fishing enthusiasts and all fish consumers were warned to limit their consumption of Great Lakes fishes. And around the lake the byproducts of human industrialization continue to pose challenges for the aquatic communities that endure today. Enmeshed in a virtual net of ecological issues, Lake Huron remains an entangled Eden.

Afterword endnotes

---

[1] Garrett Hardin, "The Tragedy of the Commons," *Science* 162, no. 3859 (December 13, 1968): 1244.

[2] Garrett Hardin, "Extensions of "The Tragedy of the Commons,"" *Science* 280, no. 5364 (May, 1998): 683.

[3] Arthur F. McEvoy, *The Fisherman's Problem: Ecology and Law in the California Fisheries, 1850-1980* (Cambridge University Press: New York, 1986, Cambridge University Press: New York, 2004), 174-175, 241-247, 253-257.

[4] David G. Brown, *White Hurricane: A Great Lakes November Gale and America's Deadliest Maritime Disaster* (Camden: International Marine/McGraw Hill, 2002), 25, 203. On page 177 Brown alleges that twenty-four men lost their liv es on the *James Carruthers*. That total appears to be an error as it conflicts with his statistic on page 203 and with other accounts.

[5] Doherty, *Disputed Waters*, 26-28.

[6] Ibid., 68, 99

[7] Ibid., 73-85.

[8] Randy L. Eshenroder and Kathryn L. Amatangelo, "Reassessment of the Lake Trout Population Collapse in Lake Michigan During the 1940s," technical report 65, (Ann Arbor: Great Lakes Fishery Commission, December 2002): 23-25, Last modified February 2, 2003, http://www.glfc.org/pubs/TechReports/Tr65.pdf.

[9] Stephen C. Riley et al., "Deepwater Demersal Fish Community Collapse in Lake Huron," *Transactions of the American Fisheries Society* 137 (2008): 1884, DOI: 10.1577/T07-141.1

[10] "Research and Management Priorities for Aquatic Invasive Species in the Great Lakes," International Association for Great Lakes Research, 2002, 7-8, http://www.iaglr.org/scipolicy/
ais/index.php.

[29.] Ibid & James T. Carlton, "Man's Role in Changing the Face of the Ocean: Biological Invasions and Implications for Conservation of Near-Shore Environments" Conservation Biology, Vol. 3, No. 3. (Sep., 1989), 269.

Bibliography

Archived Collections

Annual Statistics for the Commercial Fishing Industry, sub-series Record Group 1-260-2, Archives of Ontario.

Commercial Fish Material, 1867-1967, Fisheries Division, Department of Natural Resources, Record Group 75-34, Archives of Michigan, Lansing.

Commercial Fish Section, General Subject Files, Series Record Group 1-296, Archives of Ontario.

Commissioner of Fish and Wildlife, General File, Central Files, Dwight D. Eisenhower Records as President, Dwight D. Eisenhower Library, Abilene Kansas.

Despatches of the Department of the Provincial Secretary, 1910-1967, box 41, Record Group 8-20, Archives of Ontario.

Edwin Stewart Turner fonds, Archives of Ontario.

Environmental Review, General Correspondence, 1943-1974, Natural Resources, Record Group 79-26, Archives of Michigan, Lansing.

Fish and Wildlife Service, Official Files, Central Files, Dwight D. Eisenhower Records as President, Dwight D. Eisenhower Library, Abilene Kansas.

Fisheries Branch, general association and committee files, Record Group 1-289, Archives of Ontario.

Fisheries Branch, Lake Research Management Files, Record Group 1-294, Archives of Ontario.

Fish, Lake and Stream Project Improvements, 1950-1962, W-Z, Fishing Legislation, 1927-1966, A-D, Natural Resources, Record Group 85-94, Archives of Michigan, Lansing.

Fishing Legislation, Commercial Fish Closed Seasons, 1927- 1963, Fish, Department of Natural Resources, Record Group 85-94, Archives of Michigan, Lansing.

International Board of Inquiry for the Great Lakes Fisheries, Public hearings of the International Board of Inquiry for the Great Lakes Fisheries, Record Group 1-282-3, Archives of Ontario.

Laboratory Division, Laboratory Library Subject Files, Fe-Fo, 1918-1975, Department of Agriculture, Record Group 89-13, Box 13, Archives of Michigan, Lansing.

National Fish and Seafood Committee, National Federation of Press Women, Central File, President's Personal Files, Dwight D. Eisenhower Library, Abilene Kansas.

Neil MacNaughtan fonds, Archives of Ontario.

Papers of Gerald D. Morgan, Special Counsel and Deputy Assistant to the President, 1953-61, Fisheries Legislation, Dwight D. Eisenhower Library, Abilene Kansas.

Records of the Joint Committee Relative to the Preservation of the Fisheries in Waters Contiguous to Canada and the U.S., 1893-95, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the Bureau of Commercial Fisheries, General Records, Administrative Records, 1926-68, Operation Trident-Status Report on Scientific and Technical Information, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the Bureau of Commercial Fisheries, General Records, General Classified Files, 1902-1965, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the Bureau of Commercial Fisheries, General Records, Miscellaneous Files, 1941-69, Briefing Material – Correspondence, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the Bureau of Commercial Fisheries, General Records, Speeches and articles by Director Donald L. McKernan, 1957-66, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the Bureau of Commercial Fisheries, Records Relating to the Saltonstall-Kennedy Act of 1954, 1954-1960, Federal Aid – Congressional Record, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the Bureau of Sport Fisheries and Wildlife, Records of the Division of Wildlife Services, State Files, 1941-67, Kansas-Mississippi, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the U.S. Fish Commission and the Bureau of Fisheries, General Records, Records Concerning Relations with Canada, 1905-1936, Alexander's Notes, Amer. Fishery Rts: Newfoundland, 1906, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the U.S. Fish Commission and the Bureau of Fisheries, Records Concerning Relations with Canada, 1905-1936, Fishery Controversy; 1916-19, Privileges in Can. Ports, 1911-21, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the U.S. Fish Commission and the Bureau of Fisheries, General Records, Records Concerning Relations with Canada, 1905-1936, International Fisheries Commission Correspondence, 1908-1911, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the U.S. Fish Commission and the Bureau of Fisheries, General Records, Records Concerning Relations with Canada, 1905-1936, Int'l Fisheries Comm., 1908-1911, State Fishing Regulations, 1905-1910, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the US Fish Commission and Bureau of Fisheries, General records, Records Concerning Societies, Councils, Conferences, and other groups, 1904-37, Ice Patrol 1915-37, Great Lakes Conference, 1928-30, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Records of the US Fish Commission and Bureau of Fisheries, Records of the Division of Scientific Inquiry, General Correspondence, 1880-1935, Pacific Coast Calif. Trout 1930-31, Great Lakes 1928-34, Records of the U.S. Fish and Wildlife Service, Record Group 22, National Archives at College Park, College Park, MD.

Subject Files, 1968-1969, Commercial Fish Material, Fish Catch Statistics, Department of Natural Resources, Record Group 75-34, Archives of Michigan, Lansing.

Research, reports and government publications

Adlerstein, Sara A., Edward S. Rutherford, John A. Clevenger, James E. Johnson, David F. Clapp and Aaron P. Woldt, "Lake Trout Movements in U.S. Waters of Lake Huron Interpreted from Coded Wire Tag Recoveries in Recreational Fisheries." *Journal of Great Lakes Research* 33 (2007): 186-201, doi: 10.3394/0380-1330(2007)33[186:LTMIUW]2.0.CO;2

Applegate, Vernon C. "Natural History of the Sea Lamprey, Petromyzon marinus, in Michigan." Special Scientific Report – Fisheries, Fish and Wildlife Service, Department of the Interior (Washington, DC, 1950), 2-3. http://name.umdl.umich.edu/2142335.0001.001.

_____. "The Sea Lamprey in the Great Lakes." *The Scientific Monthly*, 72, no. 5 (May, 1951): 275-281. http://0-www.jstor.org.library.unl.edu/stable/20093.

B.A. Bensley. “The Fishes of Georgian Bay.” *Contributions to Canadian Biology*, Sessional Paper No. 39b, Supplement to 47th Annual Report of the Department of Marine and Fisheries, Fisheries Branch (1915): 1-51.

Bence, James R. and Lloyd C. Mohr, eds. *The State of Lake Huron in 2004*.” Special Publication 08-01, ed. Ann Arbor: Great Lakes Fishery Commission, August 2008. Last modified August 4, 2008, http://www.glfc.org/pubs/SpecialPubs/Sp08_1.pdf.

Brege, Dean A. and Niles R. Kevern. *Michigan Commercial Fishing Regulations: A Summary of Public Acts and Conservation Commission Orders, 1865 through 1975*. Michigan Sea Grant Program, MICHU-SG-78-605 (November 1978).

Brenden, Travis O., Mark P. Ebener, and Trent M. Sutton, “Assessing the health of lake whitefish populations in the Laurentian Great Lakes: Foreword.” *Journal of Great Lakes Research* 36 (July 2010): 135-139. doi: 10.1016/j.jglr.2010.01.001.

Bryan, M. B., D. Zalinski, K.B. Filcek, S. Libants, W. Li, K.T. Scribner. “Patterns of invasion and colonization of the sea lamprey (Petromyzon marinus) in North America as revealed by microsatellite genotypes.” *Molecular Ecology* 14, no.12 (October, 2005): 3767-3769, doi: 10.1111/j.1365-294X.2005.02716.x.

Canada, Sessional Papers, 1898.

Collins, John J. “Introduction of Kokanee Salmon (Oncorhynchus nerka) into Lake Huron.” *Journal of the Fisheries Research Board of Canada* 28, no. 12 (1971): 1857-1871.

Creaser, Charles W. “The Lamprey *Petromyzon Marinus* in Michigan.” *Copeia*, 1932, no. 3 (October 7, 1932), 157, http://0-www.jstor.org.library.unl.edu/stable/1436078.

Censuses of Canada. 1665-1871. Statistics of Canada, 4 Ottawa: I.B. Taylor, 1876.

Dahl, Frederick H. “A Surface Tow Net for Collection of Parasitic-Phase Sea lampreys.” *The Progressive Fish-Culturist*. (July 1968), 183-184. doi: 10.1577/1548-8640(1968)30[183:ASTNFC]2.0.CO;2.

Ebener, Mark P., Travis O. Brenden, Greg M. Wright, Michael L. Jones, and Mohamed Faisal. “Spatial and Temporal Distributions of Lake Whitefish Spawning Stocks in Northern Lakes Michigan and Huron, 2003–2008,” *Journal of Great Lakes Research* 36 (July 2010): 38-51. doi: 10.1016/j.jglr.2010.02.002.

Eshenroder, Randy L. “Comment: Mitochondrial DNA Analysis Indicates Sea Lampreys are Indigenous to Lake Ontario,” *Transactions of the American Fisheries Society*, 138, no. 5 (September 2009): 1178-1189, doi: 10.1577/T08-035.1.

Eshenroder, Randy L. and Kathryn L. Amatangelo. “Reassessment of the Lake Trout Population Collapse in Lake Michigan During the 1940s.” technical report 65. Ann Arbor: Great Lakes Fishery Commission, December 2002. Last modified February 2, 2003, http://www.glfc.org/pubs/TechReports/Tr65.pdf.

Eshenroder, Randy, L. N. Robert Payne, James E. Johnson, Charles Bowen II, and Mark P. Ebener. “Lake Trout Rehabilitation in Lake Huron.” *Journal of Great Lakes Research* 21, supp. 1 (1995), 108-127, doi:10.3394/0380-1330(2008)34[287:PTTROL].

Fodale, Michael F., Roger A. Bergstedt, Douglas W. Cuddy, Jean V. Adams, and Dimitri A. Stolyarenko. “Planning and Executing a Lampricide Treatment of the St. Marys River Using Georeferenced Data.” supplement 1, *Journal of Great Lakes Research* 29 (2003): 711-714. doi:10.1016/S0380-1330(03)70525-5.

Hogman, Walter J. “The Relative Efficiency of Nylon Gill Nets After Transition From Cotton Nets in a Multispecies Fishery.” Transactions of the American Fisheries Society 102, no. 4 (October 1973) 778-785. doi: 10.1577/1548-8659(1973)102<778:TREONG>2.0.CO;2.

Huntsman, A.G. “Prospects for More Fish.” reprint Milwaukee: Howard K. Balch Co, 1944.

Jones, Frank W. “The Age, Growth, and Bathymetric Distribution of Reighard's Chub, Leucichthys Reighardi Koelz, in Lake Michigan.” *Transactions of the American Fisheries Society* 72 (1943): 108-135, doi: 10.1577/1548-8659(1942)72[108:TAGABD]2.0.CO;2.

Jordan, David Starr. “The Fresh-Water Lampreys of the Eastern United States,” *Copiea* no. 64 (December 31, 1918): 93, http://0-www.jstor.org.library.unl.edu/stable/1437181.

Kitchell, James F., Sean P. Cox, Chris J. Harvey, Timothy B. Johnson, Doran M. Mason, Kurt K. Schoen, Kerim Aydin, Charles Bronte, Mark Ebener and Michael Hansen, et al. “Sustainability of the Lake Superior Fish Community: Interactions in a Food Web Context.” *Ecosystems* 3, no. 6 (November-December 2000): 545-560, DOI: 10.1007/s100210000048.

Koelz, Walter. “Coregonid Fishes of the Great Lakes.” *Bulletin of the Bureau of Fisheries,* 43 Washington: US Government Printing Office, 1929.

Lavis, Dennis S., Andrew Hallett, Ellie M. Koon, and Tom C. McAuley. “History of and Advances in Barriers as an Alternative Method to Suppress Sea Lampreys in the Great Lakes.” supplement 1, *Journal of Great Lakes Research* 29 (2003): 362-372. doi:10.1016/S0380-1330(03)70500-0.

Mallatt, Jon. “Effects of TFM and Bayer 73 on Gill Ultrastructure of Sea Lamprey Ammocoetes and Rainbow Trout Fry.” Project Completion Report. Ann Arbor: Great Lakes Fishery Commission, May 20, 1987. Last modified May 27, 2003, http://www.glfc.org/research/reports/MallattTFM.pdf.

McCullough, A.B. "Commercial Fishing on the Great Lakes: Resource Management and Technological Efficiency." Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine 11, no. 1 (1987): 14. http://id.erudit.org/iderudit/800242ar

McLaughlin, Robert L., Andrew Hallett, Thomas C. Pratt, Lisa M. O'Connor, and D. Gordon McDonald. "Research to Guide Use of Barriers, Traps, and Fishways to Control Sea Lamprey." special issue 2, *Journal of Great Lakes Research* 33 (2007): 7-19. doi: 10.3394/0380-1330(2007)33[7:RTGUOB]2.0.CO;2.

McKernan, Donald L. and J.L. McHugh, "Bureau of Commercial Fisheries." *AIBS Bulletin* 13, no. 5, (Marine Biology, Oct., 1963): 31-33. http://www.jstor.org/stable/1292954.

McNickle, Gordon G., Michael D. Rennie, and W. Gary Sprules. "Changes in Benthic Invertebrate Communities of South Bay, Lake Huron Following Invasion by Zebra Mussels (Dreissena polymorpha), and Potential Effects on Lake Whitefish (Coregonus clupeaformis) Diet and Growth." *Journal of Great Lakes Research* 32 (2006): 180-193. doi: 10.3394/0380-1330(2006)32[180:CIBICO]2.0.CO;2

Michigan, *Public Acts of the Legislature of the State of Michigan Passed at the Regular Session of 1909*. Lansing: Wyncoop Hallenbeck Crawford, 1909.

Mills, Edward L., Joseph H. Leach, James T. Carlton, and Carol L. Secor. "Exotic Species in the Great Lakes: A History of Biotic Crises and Anthropogenic Introductions." Ann Arbor: Great lakes Fishery Commission, August 1991. Last modified February 20 2003. http://www.glfc.org/research/reports/Mills.pdf.

Nalepa, Thomas F., David L. Fanslow, and Gretchen Messick, "Characteristics and potential causes of declining Diporeia spp. populations in southern Lake Michigan and Saginaw Bay, Lake Huron," in *Proceedings of a workshop on the dynamics of lake whitefish (Coregonus clupeaformis) and the amphipod Diporeia spp. in the Great Lakes*. technical report 66, ed. Lloyd C. Mohr and Thomas F. Nalepa. Ann Arbor: Great Lakes Fishery Commission, March 2005. Last modified June 1, 2005. http://www.glerl.noaa.gov/pubs/fulltext/2005/20050007.pdf.

O. Brenden, Travis Mark P. Ebener, Trent M. Sutton, Michael L. Jones, Michael T. Arts, Timothy B. Johnson, Marten A. Koops, Gregory M. Wright, and Mohamed Faisal. "Assessing the Health of Lake Whitefish Populations in the Laurentian Great Lakes: Lessons Learned and Research Recommendations." Journal of Great Lakes Research 36 (July 2010): 135, doi: 10.1016/j.jglr.2010.02.006.

Organ, William L., Gary L. Towns, Mark O. Walter, R. Bruce Pelletier and Dennis A. Riege. "Past and Presently Known Spawning Grounds of Fishes in the Michigan Coastal Waters of the Great Lakes." TR 79-1, (Ann Arbor: Michigan Department of Natural Resources, 1979). http://name.umdl.umich.edu/4994292.0079.001.

Polis, Gary A., Wendy B. Anderson, and Robert D. Holt, "Toward an Integration of Landscape and Food Web Ecology: The Dynamics of Spatially Subsidized Food Webs," *Annual Review of Ecology and Systematics*, 28, (1997): 289-316.

Purvis, Harold A. "Variations in Growth, Age at Transformation, and sex ratio of sea lampreys reestablished in chemically treated tributaries of the upper Great Lakes." technical report 35. Ann Arbor: Great Lakes Fishery Commission, May 1979.

Report of the Bureau of Commercial Fisheries for the Calendar Year 1961. United States Department of the Interior. Washington DC: Government Printing Office, 1963.

Report of the Bureau of Commercial Fisheries for the Calendar Year 1962, United States Department of the Interior. Washington DC: Government Printing Office, 1964.

Report and Review of the Dominion Fishery Commission on the Fisheries of the Province of Ontario, 1893. Ottawa: S.E. Dawson, 1894.

Report of the Joint Commission Relative to the Preservation of Fisheries in Waters Contiguous to Canada and the United States. Ottawa: S.E. Dawson, 1897.

Research and Management Priorities for Aquatic Invasive Species in the Great Lakes. International Association for Great Lakes Research, 2002. http://www.iaglr.org/scipolicy/ais/index.php.

Riley, Stephen C., Edward F. Roseman, S. Jerrine Nichols, Timothy P. O'Brien, Courtney S. Kiley, and Jeffrey S. Schaeffer. "Deepwater Demersal Fish Community Collapse in Lake Huron." *Transactions of the American Fisheries Society* 137 (2008): 1879-1890, DOI: 10.1577/T07-141.1.

Scott, W.B. and E.J. Crossman. *Freshwater Fishes of Canada*. Ottawa: Fisheries Research Board of Canada, 1973.

Schaefer, Wayne F., Richard A. Heckmanna and William A. Swenson. "Postspawning Mortality of Rainbow Smelt in Western Lake Superior." *Journal of Great Lakes Research* 7, no. 1, (1981): 37-41.

Shetter, David. "A Brief History of the Sea Lamprey Problem in Michigan Waters," *Transactions of the American Fisheries Society* 76, no. 1 (January 1949): 160-176, doi: 10.1577/1548-8659(1946)76[160:ABHOTS]2.0.CO;2.

Smith B.R. and J.J. Tibbles, "Sea Lamprey (Petromyzon Marinus) in Lakes Huron, Michigan, and Superior: History of Invasion and Control, 1936-78," *Canadian Journal of Fisheries and Aquatic Sciences* 37 (November 1980): 1780-1801.

Smith, Hugh M. and Merwin-Marie Snell. *Review of the Fisheries of the Great Lakes in 1885*. Washington: Government Printing Office, 1890.

Smith, Oliver H. and John Van Oosten. "Tagging experiments with lake trout, whitefish, and other species of fish from Lake Michigan." *Transactions of the American Fisheries Society* 69, no. 1 (January 1940): 63-84. doi: 10.1577/1548-8659(1939)69[63:TEWLTW]2.0.CO;2.

Stagg, Ronald *The Golden Dream: A History of the St. Lawrence Seaway*. Toronto: Dundurn Press, 2010.

Styran, Roberta M. and Robert R. Taylor. *The Great Swivel Link: Canada's Welland Canal*. Toronto: Champlain Society, 2001.

Toner, G.C. "Annotated List of Fishes of Georgian Bay." *Copeia* 1933, no. 3 (1933): 133, http://0-www.jstor.org.library.unl.edu/stable/1436239.

Van Oosten, John. "The Dispersal of Smelt, Osmerus Mordax (Mitchill), in the Great Lakes Region." *Transactions of the American Fisheries* 66, no. 1 (January, 1937): 160-171. doi: 10.1577/1548-8659(1936)66[160:TDOSOM]2.0.CO;2

_____. "Maximum size and age of whitefish." *The Fisherman* 14, no. 8 (1946): 17-18.

_____. "Mortality of Smelt, Osmerus Mordax (Mitchill), in Lakes Huron and Michigan During the fall and Winter of 1942-1943." *Transactions of the American Fisheries Society* 74, no. 1 (January 1947): 310-337. doi: 10.1577/1548-8659(1944)74[310:MOSOMM]2.0.CO;2.

Waldman John R., Cheryl Grunwald, Nirmal K. Roy, and Isaac I. Wirgin "Mitochondrial DNA Analysis Indicates Sea Lampreys Are Indigenous to Lake Ontario." *Transactions of the American Fisheries Society*, 133, no. 4 (July 2004): 950-960, doi: 10.1577/T03-104.1.

Waldman John R., Robert Daniels, Michael Hickerson, and Isaac Wirgin. "Mitochondrial DNA Analysis Indicates Sea Lampreys Are Indigenous to Lake Ontario: Response to Comment." *Transactions of the American Fisheries Society* 133, no. 5 (September 2009): 1190-1197, doi: 10.1577/T08-035R.1.

Westerman, Fred A. "The Deep Water Trap Net and its Relation to the Great Lakes Fisheries." Transactions of the American Fisheries Society 62 (1932): 64-71. doi: 10.1577/1548-8659(1932)62[64:TDWTNA]2.0.CO;2.

Wolfe, Mathew D., Victor J. Santucci Jr., Lisa M. Einfalt, and David H. Wahl. "Effects of Common Carp on Reproduction, Growth, and Survival of Largemouth Bass and Bluegills." *Transactions of the American Fisheries Society* 138 (2009): 975-983, DOI: 10.1577/T08-115.1.

Young, R.J., G.C. Christie, R.B. McDonald, D.W. Cuddy, T.J. Morse, and N.R. Payne. "Effects of habitat change in the St. Marys River and northern Lake Huron on sea lamprey." *Canadian Journal of Fisheries and Aquatic Sciences*, 53, suppl. 1 (1996): 99-104. doi:10.1139/cjfas-53-S1-99

Other primary source materials

Champlain, Samuel de, *The Works of Samuel de Champlain*. ed. H.P. Biggar. Toronto: Champlain Society, 1936.

The Fisherman. v. 1-35.

Kellog, Louise Phelps ed., *Early Narratives of the Northwest*. New York: Charles Scribner's Sons, 1917.

Le Clercq, Chrestien. *First Establishment of the Faith in New France*. ed. John Gilmary Shea. New York: John G. Shea, 1881.

Thwaites, Reuben Gold, ed. *Jesuit Relations and Allied Documents*. Cleveland: Burrows Brothers, 1901.

Monographs and journal articles

American Society of International Law. "The Boundary-Fisheries Treaty." The American Journal of International Law vol. 2, 3 (July 1908): 638. http://www.jstor.org/stable/2186341

Andreas, Alfred Theodore. *History of Chicago*. 1884; repr., New York: Arno Press, 1975.

Angus, James T. *A Respectable Ditch: A History of the Trent-Severn Waterway, 1833-1920*. Kingston: McGill-Queen's University Press, 1988.

Ashworth, William. *The Late Great Lakes: An Environmental History*. New York: Alfred A. Knopf, 1986.

Barry, James P. *American Power Boats: The Great Lakes Golden Years*. St. Paul: MBI Publishing, 2003.

Bogue, Margaret Beattie. *Fishing the Great Lakes*. Madison: University of Wisconsin Press, 2000.

Buffalohead, Priscilla K. “Farmers Warriors Traders: A fresh Look at Ojibway Women.” *Minnesota History* 48, no. 6 (Summer 1983): 236-244.

Bukowczyk, John J. et al., *Permeable Border: The Great Lakes Basin as Transnational Region, 1650-1990*. Pittsburgh: University of Pittsburgh Press, 2005.

Caldwell, Lynton K. ed. *Perspectives on Ecosystem Management for the Great Lakes*. Albany: State University of New York Press, 1988.

Callicott, J. Baird and Michael P. Nelson. *American Indian Environmental Ethics: An Ojibwa Case Study*. New Jersey: Upper Saddle River, 2004.

Campbell, Claire Elizabeth. *Shaped by the west wind: nature and history in Georgian Bay*. Vancouver: UBC Press, 2005.

Careless, J.M.. *Ontario: A Celebration of Our Heritage*. vol. 2 Mississauga, Ontario: Heritage, 1992.

Carson, Rachel. *Silent Spring*. Boston: Houghton Mifflin, 1962.

Cayer, Samuel. “Lakes & ladders.” *Canadian Geographic*, 116, no. 4 (July/August 1996), 32-47.

Chapelle, Howard Irving. *American small sailing craft, their design, development, and construction*. New York: W.W. Norton, 1951.

“Chat of the Craft.” *Mixer and Server* 14, no. 1 (January 15, 1905): 16.

Chiarappa, Michael J. and Kristin M. Szylvian. *Fish for All: An Oral History of Multiple Claims and Divided Sentiment on Lake Michigan*. East Lansing: Michigan State University Press, 2003.

Fuiman, Lee A. and Robert G. Werner. *Fishery Science: The unique contributions of early life stages*. Osney Mead, Oxford: Blackwell Science, 2002.

Hunt, Harry E. “How the Great Lakes Became "High Seas," and Their Status Viewed from the Standpoint of International Law.” *The American Journal of International Law* vol. 4, 2 (April 1910): 285-313. http://0-www.jstor.org.library.unl.edu/stable/2186615.

Daniel, Pete. “A Rogue Bureaucracy: The USDA Fire Ant Campaign of the Late 1950s.” *Agricultural History* 64, no. 2 (Spring 1990): 99-114. http://www.jstor.org/stable/3743800.

Dickason, Olive Patricia. *A Concise History of Canada’s First Nations*. New York: Oxford University Press, 2006.

Dempsey, Dave. *Ruin & Recovery: Michigan's Rise as a Conservation Leader*. Ann Arbor: University of Michigan Press, 2001.

Devens, Carol Green. "Anishnabek Childhood: Nineteenth and Early Twentieth Centuries." *Michigan Historical Review* 20, 02 (1994): 184-197. http://0-www.jstor.org.library.unl.edu/stable/20173464.

Doherty, Robert. *Disputed Waters: Native Americans and the Great Lakes Fishery*. Lexington: University Press of Kentucky, 1990.

Dunbar, Willis F. and George S. May. *Michigan: A History of the Wolverine State*. 3rd rev. ed. Grand Rapids: William B. Eerdmans, 1995.

Dutcher, Peter "Submarine Nets Defended by Fisherman," *The Fisherman*, vol. 2, 3 (1933).

Dymond, John Richardson, ed., Fish and wildlife; a memorial to W.J.K. Harkness. Toronto: Longmans Canada, 1964.

_____. "A History of Ichthyology in Canada." *Copeia* 1964, no. 1 (March 26, 1964): 2-33. http://0-www.jstor.org.library.unl.edu/stable/1440829.

Edmunds, R. David, Frederick E. Hoxie, and Neal Salisbury. *The People: A History of Native America*. 1. Boston: Houghton Mifflin, 2007.

Farber, Daniel A. "Risk Regulation in Perspective: Reserve Mining Revisited." *Environmental Law* 21 (1991): 1321-1357. HeinOnline.

Fuiman, Lee A. and Robert G. Werner, eds. *Fishery Science: The Unique Contributions of Early Life Stages*. Oxford: Blackwell Science Ltd., 2002.

"February 29th A National Fish Day." *Canadian Fisherman*, 3 (1916), 70.

Fox, William Sherwood. *The Bruce Beckons: the Story of Lake Huron's Great Peninsula*. 1952; repr., Toronto: University of Toronto Press, 1958.

Fuiman, Lee A. and Robert G. Werner. Fishery Science: The Unique Contributions of Early Life Stages. Oxford: Blackwell Science Ltd., 2002.

Gottlieb, Robert. *Forcing the Spring: The Transformation of the American Environmental Movement*. Washington: Island Press, 2005.

Grady, Wayne. *The Great Lakes: The Natural History of a Changing Region*. Vancouver: Douglas and McIntyre, 2007.

Greene, Francis B. *History of Boothbay, Southport and Boothbay Harbor, Maine 1623-1905*. Portland, ME, Loring, Short & Harmon, 1906.

Garrett Hardin. “Extensions of “The Tragedy of the Commons.”” Science 280, no. 5364 (May, 1998): 682-683.

_____. “The Tragedy of the Commons.” Science 162, no. 3859 (December 13, 1968): 1243-1248.

Harkin, Michael E. and David Rich Lewis, eds. *Native Americans and the Environment: Perspectives on the Ecological Indian*. Lincoln: University of Nebraska Press, 2007.

Harris, Edward. *Our Great Lake Fisheries: A Vanishing Heritage*. Toronto: William Briggs, 1905.

_____. *Recollections of Long Point*. Toronto: Warwick Bro’s & Rutter, 1918.

Haynes, Frederick E. “The Reciprocity Treaty with Canada of 1854.” Publications of the American Economic Association, vol. 7, 6 (November, 1892): 7-70. http://0-www.jstor.org.library.unl.edu/stable/2485728

Holli, Melvin G. “The Founding of Detroit by Cadillac.” *Michigan Historical Review*. 27, no. 1, Detroit 300 (Spring, 2001): 129-136. http://0-www.jstor.org.library.unl.edu/stable/20173898

Hubbs, Carl L. and Karl F. Lagler. *Fishes of the Great Lakes Region*. rev. ed. Ann Arbor: University of Michigan Press, 2004.

Hutchins, Michael, Arthur V. Evans, Jerome A. Jackson, Devra G. Kleiman, James B. Murphy, Dennis A. Thoney, et al., eds., *Grzimek's Animal Life Encyclopedia* 2nd ed. Detroit: Gale, 2003.

Huntsman, A.G. “Fisheries Research in Canada.” *Science* 98, no. 2536 (August 6, 1943): 117-122. http://0-www.jstor.org.library.unl.edu/stable/1671385.

Benjamin Kline. *First Along the River: A Brief History of the U.S. Environmental Movement*. Lanham: Acada Books, 2000.

Jensen, Trygvie. *Wooden Boats and Iron Men: History of Commercial Fishing in Northern Lake Michigan &Door County, 1850-2005*. De Pere: Paisa (Alt) Publishing, 2007.

Keir, R. Malcolm. “Fisheries an Example of the Attitude toward Resources.” *Bulletin of the American Geographical Society*, 44, No. 8 (1912): 589, http://www.jstor.org/stable/200102.

Knight, William. “Samuel Wilmot, Fish Culture, and Recreational Fisheries in late 19th century Ontario." *Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine* 30, no.1 (2007): 75-90. http://www.erudit.org/revue/scientia/2007/v30/n1/800527ar.pdf.

Konrad, Victor and Heather N. Nicol. *Beyond Walls: Re-inventing the Canada-United States Borderlands*. Burlington: Ashgate Publishing, 2008.

Krech III, Shepard. *The Ecological Indian: Myth and History*. New York: W.W. Norton, 1999.

Kuchenberg, Tom and Jim Legault. *Reflections in a tarnished mirror: the use and abuse of the Great Lakes*. Sturgeon Bay, Wis.: Golden Glow, 1978.

Law, John Wesley and Deloris A. Law, *Home was Alpena*. Alpena: Village Press, 1975.

Macauley, David. *Minding Nature: The Philosophers of Ecology*. New York: The Guilford Press, 1996.

Mayden, Richard L., ed. *Systematics, Historical Ecology, and North American Freshwater Fishes*. Standford: Stanford University Press, 1992.

McEvoy, Arthur F. *The Fisherman's Problem: Ecology and law in the California Fisheries, 1850-1980*. Cambridge: Cambridge University Press, 1986.

McCullough, A.B. *The Commercial Fishery of the Canadian Great Lakes*. Hull, Quebec: Minister of Supply and Services, 1989.

McGhee, Robert. “Contact between Native North Americans and the Medieval Norse: A Review of the Evidence.” American Antiquity 49, no. 1 (January 1984):4-26. http://0-www.jstor.org.library.unl.edu/stable/280509

Nelson, Melissa. “Ravens, Storms, and the Ecological Indian at the National Museum of the American Indian.” *Wicazo Sa Review*, 21, no.2 (2006): 41-60. DOI: 10.1353/wic.2006.0021.

Officer, Lawrence H. and Lawrence B. Smith, “The Canadian-American Reciprocity Treaty of 1855 to 1866,” *The Journal of Economic History*, vol. 28, 4 (December 1968): 598-623. http://0-www.jstor.org.library.unl.edu/stable/2115515.

Pflug, Melissa A. “Politics of Great Lakes Indian Religion,” *Michigan Historical Review*, 18, no. 2 (Fall 1992): 23-24. http://0-www.jstor.org.library.unl.edu/stable/20173344.

Rector, William G. “From Woods to Sawmill: Transportation Problems in Logging.” *Agricultural History*, vol. 23, 4 (October 1949): 239-244. http://0-www.jstor.org.library.unl.edu/stable/3740583.

Russell, Edmund. *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring*. Cambridge: Cambridge University Press, 2001.

Santer, Richard A. *Michigan: Heart of the Great Lakes*. Dubuque: Kendall Hunt Publishing, 1977.

Shabecoff, Philip. *A Fierce Green Fire*. Washington: Island Press, 2003.

Shelton, Napier *Huron: The Seasons of a Great Lake*. Detroit: Wayne State University Press, 1999.

Sioui, Georges E. *Huron-Wendat: The Heritage of the Circle*. trans. Jane Brierley, rev. ed. Vancouver: UBC Press, 1999.

Smith, Gerald R. *Guide to Great Lakes Fishes*. Ann Arbor: University of Michigan Press, 2010.

Sproule-Jones, Mark. *Restoration of the Great Lakes: Promises, Practices, Performances*. East Lansing: Michigan State University Press, 2002.

Stagg, Ronald. *The Golden Dream: A History of the St. Lawrence Seaway*. Toronto: Dundurn Press, 2010.

Standen, Anthony. "DDT: It will not rid the world of insect pests but it is still a wonder bug killer." *Life* (July 8, 1946), 47-54.

Stroud, Richard H. ed. *National Leaders of American Conservation*. Washington DC: National Resources Council of America, 1985.

Styran, Roberta M. and Robert R. Taylor, eds. *The Great Swivel Link: Canada's Welland Canal*, Toronto: Champlain Society, 2001.

Szylvian, Kristin M. "Transforming Lake Michigan into the 'World's Greatest Fishing Hole': The EnvironmentalPolitics of Michigan's Great Lakes Sport Fishing, 1965-1985." *Environmental History*, 9, no. 1 (January, 2004), 102-127.

Trigger, Bruce. *The children of Aataentsic: a history of the Huron People to 1660*. rev. ed. Montreal and Kingston: McGill-Queens University Press, 1987.

Turner, Frederick Jackson. "The Frontier in American History." Reprint of the 1893 essay. New York: Henry Holt, 1920.

Oosten, John Van. "Michigan's Commercial Fisheries of the Great Lakes." *Michigan History Magazine* 22, no.1 (1938): 3-40.

Waszak, Martha, ed. *State of the Great Lakes: 1998 Annual Report*. 1999.

Werner, Robert G. *Freshwater Fishes of the Northeastern United States, A Field Guide.* Syracuse: Syracuse University Press, 2004.

Westerman, Fred A. "Changes in Michigan Laws." *The Fisherman* 2, no. 9 (1933): 6.

Taylor, William W. and C. Paola Ferreri, eds. *Great Lakes Fisheries Policy and Management: A Binational Perspective*. East Lansing: Michigan State University Press, 1999.

Western Historical Company. *History of St. Clair County, Michigan*. Chicago: A.T. Andreas, 1883.

Worster, Donald. *Nature's Economy: A History of Ecological Ideas*. 2nd ed. New York: Cambridge University Press, 1994. First Published 1977 by Sierra Club Books.