Lake Michigan: A Calamitous History of Commercial Fishing, 1870-1925

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Under the Supervision of Dr. David Soll

This thesis presents information on the formation of the Great Lakes, the American Indian Fishermen of the Lake Michigan Basin, the fish species, nets, and boats vital to the commercial fishing industry, and the calamitous causes behind the industry's implosion. This study investigates the catalysts behind the decline of the commercial fishing enterprise on Lake Michigan by utilizing primary sources including but not limited to, government reports, catch quotas, state fish commission reports, and manuscripts. The topic was selected because the history of Lake Michigan commercial fishing from 1870 - 1925 has never been thoroughly researched and put into a single volume for examination.

Therefore, knowing how Lake Michigan's commercial ecological status once was will provide a historical guidepost for not only policymakers but also for the public, to help promote prudent managing measures for not only the fish but the entire Great Lakes ecosystem.

[Signature]
Thesis Adviser (Signature)

6-10-16
Date
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“What of the great lakes? ... And where are the fish?”

Chicago Times, 1881

Plate 1: Great Lakes Region. Treaty waters of 1836 and 1842, marked in Lake Superior. (Cartography by John Hudson)

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1 Margaret Beattie Bogue, Fishing the Great Lakes: An Environmental History, 1783-1933 (Madison: The University of Wisconsin Press, 2000), 332.

Chapter One: Introduction

As industrialization in America rapidly spread, many industries, no longer distracted by the priority of war, across the country established substantial investments in natural resource extraction. Commercial fishing on the Great Lakes was among those industrial investments that boomed in the wake of the Civil War. For some, commercial fishing can invoke closeness to nature that few other pursuits can match; for those of a competitive nature, it may provide an exhilarating challenge when their hard-earned catch is processed for profit. Lake Michigan commercial fishermen engaged the forces of nature with daring, but also with a sense of indifference to endure the physical and mental uncertainties in their struggle to carve out a living.

George Perkins Marsh’s 1864, *Man and Nature* connects “the fate of civilizations with the quality of their environments” and asserts, “that humanity could alter the environment in permanently damaging ways, even to the point of jeopardizing the future of environmentally destructive nations.”

He concludes, “civilizations declined as they destroyed their environments, particularly through deforestation.”

John Burnham, a leading conservationist, claimed the downfall of the bison across the American west was the result of “the advance of civilization.”

However, the vastness of North America led early Americans to believe the natural resources were too immense and dense to extinguish. This was belief was reinforced for decades as huge numbers of fish, game, and raw materials were harvested or extracted and processed for market.

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4 Ibid., 4.
The passenger pigeon extinction and the near eradication of the bison pushed the American psyche toward natural resource conservation. It was not the commercial fishermen who perpetuated the destruction of targeted fish species, per se, but the market forces that encouraged a free-for-all environment not only on Lake Michigan, but on all five Great Lakes. Alarmed conservationists, sought alternatives to mitigate the market forces behind overharvesting. They settled on artificial fish propagation as the prudent alternative solution.

The conservationists first on the scene were science-educated who channeled their attention to addressing the needless waste of natural resources by pressing for efficient use of these resources and scientific evidence leading regulation development. As a movement, conservation rose in opposition to the widespread American myth of “superabundance.” However, that movement was not uniform as noted in Wisconsin’s 1908 report to the state fish commissioners:

During the past year the question of the conservation of our natural resources has come prominently before the minds of the people. Less, perhaps, has been said regarding the conservation of our resources of fish than regarding other matters, although this is one of the most important of our natural resources both as regards food and recreation.

Disappearing old-growth forests, particularly in the western United States, grabbed the nation’s attention. That is not to say fisheries failed to do so, but compared to forests, fish are much harder to see. If the saying, ‘out of sight, out of mind,’ has any existential meaning, it may explain the distraction but cannot excuse the outcome. When Theodore Roosevelt entered the White House in 1901, the country’s focus for

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7 Ibid., 11.
8 Ibid., 12.
conservation was nearsighted when it came to the Great Lakes fisheries. That being said, public awareness for conservation flourished under President Roosevelt’s administration. Particularly when U.S. Chief Forester Gifford Pinchot established a strong, influential voice for forestry ecology, in Roosevelt’s administration.¹¹

When the various state fish commissions began in the early 1870s they appealed to the public because up until that time, the fisheries remained woefully unprotected.¹²

The years 1873 – 1929 were the “Johnny Fish-Seed” years for artificial fish propagation in the United States. The commencing stages of fish propagation were slated to freshen native fish communities reduced by commercial overfishing, introduce fish species familiar to arriving European immigrants but foreign to where they were introduced, feed an increasing population with an inexpensive, vast, protein-rich food source, and provide for recreational sport fishing that was gaining popularity as more Americans gained leisure time away from work.¹³

The work of noteworthy early fish culturists – Seth Green of New York, Nelson W. Clark of Michigan, and Samuel Wilmot of Ontario, Canada - not only confirmed the optimism the U.S. Fish Commission used at the time to then advertise artificial propagation, but also convinced “efficiency-minded”, utilitarian conservationists to prefer their fish-culture methods.¹⁴

¹¹ Stradling, Conservation in the Progressive Era, 7.
The legacy of the artificial fish propagation programs during the “Johnny Fish-Seed Era” is one of optimism and complete faith in “modern, progressive conservation” with the central focus of returning commercial and recreational fish populations to pre-Civil War levels. Fish commissioners, policy makers, commercial fishermen, fish culturists, and conservationists thought of, “fish hatcheries as a politically expedient way of avoiding the more systemic problems plaguing the Great Lakes.” The practice of artificial propagation was the preferred method to revitalize the lake whitefish and lake trout populations starting in the 1870s.

This thesis, *Lake Michigan: A Calamitous History of Commercial Fishing, 1870-1925*, centers on the calamities behind the commercial fishing enterprise on Lake Michigan, focusing on the pre-ecological artificial fish propagation programs as they were chosen to reverse overharvesting effects and in doing so, symbolized one of the first wholehearted attempts to save a set of species (fish) for commercial markets.

The commercial overharvesting of not only lake whitefish but also the other three main commercial species - lake herring, lake trout, and lake sturgeon - continued unabated until the 1920s when science-based research would take the lead in forming regulations. Within the span of about fifty years following the conclusion of the Civil War, commercial fishing on the Great Lakes developed before a backdrop of nationwide resource extraction. This exploitation eventually had no choice but to shrink, as progressive conservation politics became increasingly determined to reverse ecological destruction, while changing the American attitude towards nature and science.

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16 Ibid.
17 Whelan, “A Historical Perspective on the Philosophy behind the Use of Propagated Fish in Fisheries Management,” 308.
A stream of European immigrants provided a large, readily available, low-cost labor supply for the entrepreneurial fishing companies and dealers in the expansive years after 1865. Powerful fish dealers took considerable advantage of their position of power and influence over the lake and its fish resources, dominating fishing operations. The demand from consumers, both along the shoreline and in the more influential markets of New York, Omaha, Chicago, and Boston plus countless smaller municipalities eclipsed any effort to mitigate the industry's unchecked momentum on Lake Michigan for a more sustainable one. The technological means of harvesting fish as the industry grew was leaps and bounds ahead of any branch of fishery science, management or conservation law. Continued net fishing would have a profound effect on the use and attitude towards the Lake Michigan fishery. The concerns of the industry's leaders transcended all other concerns related to Lake Michigan, be they political, technological, scientific, ecological or business.

Rarely do historians describe the development of basic sectors in society like commercial fishing. A great deal has been written on the economic and cultural development of the Great Lakes region, but scholars have only paid scant attention to the history behind the fish and fishermen on Lake Michigan. To include all five of the Great Lakes for this thesis would have been too ambitious.

The states of Wisconsin, Michigan, and the U.S. federal government began investigations beginning in the 1870s on commercial fishing on Lake Michigan, which all pointed to a conclusion of inevitable decline, or total collapse if the continuation of the status quo were to continue. The early government reports can be interpreted as a dark

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18 Bogue, *Fishing the Great Lakes*, 83.
omen for commercial fishing on not only Lake Michigan but also the Great Lakes in general.

This research uses a variety of primary sources, including catch reports, state and federal government records, interviews, and manuscripts from not only the years between and including 1870 – 1925 but also from outside the timeframe to add historical perspective. Three reports from the federal government on the fisheries of Lake Michigan, from 1872, 1885, and 1926 provide detailed information that was used in this research to demonstrate what happened to the industry on Lake Michigan. Those three reports serve as a baseline to track the overall changes in the industry.

The role of the lake whitefish as a preferred commercial fish is confirmed by its long history of economic and cultural significance that led to progressive fisheries management nearing the turn of the twentieth century. Reports detailing the decline of Great Lakes whitefish stocks throughout local fishing grounds around 1870, concerned government officials and conservationists alike, who then established the U.S. Fish Commission in 1871. Spencer F. Baird as first commissioner dispatched assistant commissioner and biologist James W. Milner to the Great Lakes to reconnoiter the status of the fisheries, primarily focusing on lake whitefish.19

Milner trekked the shore of Lake Michigan and its islands, inquiring upon nearly all of the commercial fishing establishments where he collected specifics and discernable patterns as to the current status of the fisheries that account for the Lake Michigan fishery. Milner went on to include the status of previous seasons, the types of nets used and their impact on the numbers of fish, and the opinion of the commercial net-owners as to the consequence legislation carries when protecting the fish or enhancing the

fisherman’s livelihood. Milner was sent by the United States Commission of Fish and Fisheries to survey all five of the Great Lakes fisheries, but he spent most of his time on Lake Michigan. He published his report in 1874, *Report of the Fisheries of the Great Lakes: The Result of Inquiries Prosecuted in 1871 and 1872.*\(^{20}\) Milner’s report adulated about the benefits of artificial propagation, as it could be strategized “to feed Americans of all social classes.”\(^{21}\)

U.S. commissioner Baird’s professional goal of an inclusive fisheries science program was based on scientific-reasoning but the American Fish Culturists’ Association “high-profile” and “collective weight” made certain the association’s core concern, artificial propagation, would take precedence in all federal Great Lakes management programs.\(^{22}\) Commissioner Baird did not want to upset local jurisdiction over the fisheries in the Great Lakes. Therefore, arranged federal jurisdiction to influence, not help, various state managing agencies.\(^{23}\) This arrangement created a casual relationship between state and federal agencies over Great Lakes fisheries management that persisted until the environmental movement in the 1960s changed attitudes.

R. Edward Earll, J. Frank Ellis, and Merwin-Marie Snell spent August, September, October, and November of 1885 canvassing Lake Michigan on the west side south to Chicago and continuing to Frankfort, Michigan. All three were members of the United States Fish Commission sent to describe in detail all noteworthy geographical features of Lake Michigan, the lake’s current commercial and economic importance, and


\(^{21}\) Chiarappa, “Overseeing the Family of Whitefishes,” 166.

\(^{22}\) Ibid., 165.

\(^{23}\) Ibid., 166.
the historical events that led to those financial developments. This 1885 federal report was less concerned with the lake’s natural history and the scientific problems connected with the fisheries than it was with noting the rising importance of the commercial fisheries due to the exponential population growth west of the Mississippi. This rapid population growth required a steady food supply to continue, which encouraged the federal government to find a steady, inexpensive food source. Artificial fish propagation, which consisted of little more than scientific experiments orchestrated by individuals, quickly became a matter of great interest to state governments bordering the Great Lakes. Therefore, this inquiry in 1885 had the additional objective of understanding the full effects of fish propagation or fish culture, as it was otherwise known. Dr. Hugh M. Smith and Merwin-Marie Snell compiled the resulting report, *Review of the Fisheries of the Great Lakes in 1885*, in 1890.24

Dr. Walter Koelz was an associate aquatic biologist with the U.S. Bureau of Fisheries who prepared a government report in 1926, *Fishing Industry of the Great Lakes*, which drew upon statistical, biological, and ecological data. In addition to the fieldwork Dr. Koelz had been conducting since 1919 on “the systematic relationships and natural history of the Lake whitefishes and lake herrings of the Great Lakes,” the bureau planned to link the data with pollution studies.25 The goal of Dr. Koelz was to capture the attention toward the need of “intelligent action to preserve those fisheries.”26 The empirical method and eyewitness accounts Koelz selected proved that “practical

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26 Ibid.
application of ecologically-oriented inquiry” could be successful. In fact, Dr. Koelz’s research widened the perspective used to managing Great Lakes fisheries hence fourth.

Shortly after the release of Dr. Koelz’s report, the U.S. House of Representatives (hereafter titled Great Lakes Fishery Investigations) granted the development of a U.S. Bureau of Fisheries Great Lakes biological research laboratory in 1927, reversing their 1902 decision. This is evidence of a new, national attitude change toward ecological research and away from optimistically relying on artificial fish propagation.

The state of Michigan approved general laws to protect fish and the fisheries on March 21, 1865 that made it unlawful “to put into any of the waters of this State, where fish are taken, any offal, blood, putrid brine, putrid fish, or filth of any description” and those caught committing such acts were to be fined no less than three-hundred dollars or incarceration for thirty days per violation. The state court reserved the right to use both means at their discretion. Michigan also forbade the keeping of lake whitefish spawn, which if caught must be immediately released. The depositing of any vessel ballast, stone, sand, coal cinder, ashes, log slabs, decayed wood, saw dust, or any other filth was unlawful and the driving of any pound net stakes in the lakebed was barred from any Michigan shore within one mile.

Many fishermen discussed the matter of issuing licenses to out-of-state commercial fishermen to help fund the in-state fish propagation programs and/or state game wardens. Since 1865, a statute passed in Michigan that required a license of $50 for each pound net placed in its waters by non-residents. It was the widespread opinion of

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28 Ibid., 178.
30 Ibid.
many Lake Michigan commercial fishermen that they would willingly pay license fees if, and only if, the regulations could be uniformly enforced to preserve the fisheries and young fish populations.  

States bordering Lake Michigan and the federal government were aware of the problems facing the fish in Lake Michigan, decades of harvesting too many young fish, failure to regulate industrial and timber pollution, placing too much faith in artificial fish propagation when armed with only a pre-ecological understanding of fish biology and aquatic science, an incomplete register responsible for tracking and enforcing harvest quotas at all fishing localities, and the widespread implementation of evolving fishing technology all led to an intense escalation of unchecked commercial fishing. Any who had a hand in the commercial fishing industry on Lake Michigan during the “Johnny Fish-Seed Era” failed to understand the delicate symbiotic relationship linking these calamities. There was no tangible, cohesive political will to establish the prudent and collaborative measures to prevent the devastation that came to be.

*Great Lakes Formation*

The Laurentian Great Lakes formed around 20,000 years ago, a byproduct of the retreating Laurentide Ice Sheet that comprised millions of square miles of ice, two miles thick at points. As glaciers from the ice sheet retreated, they gouged the physical geography with their immense weight, thereby creating basins. The land rose and this “crustal tilting” changed the geographic attributes of each of the five glacial lakes. Glacial byproducts called moraines build up ridges along the glacier’s boundaries. Vast

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moraines ring the southern end of the Lake Michigan Basin with some gauged at over a hundred miles long and 500 feet thick.\(^{32}\)

The present framework and opus of the five Great Lakes are the upshots of the final glacial melt, as the basins filled due to a warming climate that began around 3,500-4,000 years ago.\(^{33}\)

The Great Lakes cover 94,250 square miles and hold 5,439 cubic miles of water. They constitute the largest continuous body of freshwater in the world. This expanse stretches from Kingston, Ontario, on the east to Duluth, Minnesota, on the west (approximately 780 miles) and from Gary, Indiana, on Lake Michigan’s southern shore to Nipigon, Ontario, on Lake Superior’s northern shore (approximately 500 miles). The shoreline around the lakes is 10,210 miles long. The Great Lakes are composed of five separately identified lakes, but Lake Michigan is the only lake wholly located within the United States.

The Great Lakes Basin falls into two distinctive northern and southern halves, each with their own fauna and flora. The northern half (Northern Lake Michigan, Lake Huron and Lake Superior) has a colder climate, granite bedrock, thin acidic soils, conifer forests, and rocky lake shorelines. The southern half of these Lakes has mainly deciduous forests intermixed with grasslands and woodlands, making it more suitable for settlement because it also has deeper, more fertile soils, warmer temperatures, and a longer growing season.\(^{34}\)


The enormity of the Great Lakes allows for tide-like behavior called “seiches.” The tides and surf are measured in inches, not feet, but once these “seiches” begin, they have the potential to seesaw for days from one end of the Great Lakes to the other, similar to “water slooshing in a bathtub.”

The largest lake of the Great Lakes, Lake Superior, is also the coldest, with an average depth of 483 feet, with drop-offs to 1,330 feet. Lake Erie has an average depth of 62 feet, the shallowest, which then makes it the warmest Great Lake. The enormous outflow from cold Lake Superior passes through Sault Ste. Marie and into Lake Huron, which then reaches Lake Michigan through the Straits of Mackinac on the northern end.

Lake Michigan is the second largest by volume, with an average depth of 279 feet and a maximum depth of 923 feet, and third largest by surface area, situated at 22,300 square miles. At 307 miles north to south and 118 miles at its widest east to west with a shoreline of 1,659 miles, its water retention rate is roughly a century. This means that a century’s worth of time is required to completely cycle the water of Lake Michigan through the Straits of Mackinac.

The Mackinac Bridge links St. Ignace on Michigan’s Upper Peninsula to Mackinaw City, Michigan, and this bridge is generally considered the dividing line for Lakes Michigan and Huron. On the Lake Michigan side, every inch of water depth variation is equivalent to roughly 390 billion gallons. The straits underneath the

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35 Ashworth, The Late, Great Lakes, 27.
36 Bogue, Fishing the Great Lakes, 4.
37 Ashworth, The Late, Great Lakes, 25.
Mackinac Bridge are deep and wide, permitting uniform-like water flow which results in equal surface elevation between these two lakes.\(^{41}\) However, Lake Michigan is slightly more stunted than its hydrologic twin in surface area.

From the retreating glaciers, new plants and animals colonized and interacted, mostly from the surrounding watersheds connected to Lake Michigan through channels, rivers, and wetlands. The colonizing fish species responded to the various niches by adaptation. One fish family in particular, the \textit{Coregonids}, became very successful at filling these niches.\(^{42}\) This family includes the lake whitefish, lake herring, and chubs.

\textit{Great Lakes American Indian Fishermen}

Over the centuries, Great Lakes American Indians relied on mobility to efficiently exploit the seasonal diversity of available food sources. The Lake Michigan Indian tribes were: the Anishinaabeg (Ottawa, Potawatomi, Ojibwa or Chippewa); the Iroquois; the Huron; the Menominee; and the Winnebago (Ho-Chunk), who all began using fishing nets around 300 to 200 B.C.\(^{43}\) American Indian life and mobility were one and the same. When food had to be stored during the colder months, American Indians dug underground “pit-barns.” Tools, instruments, shelters and other necessities had to be lightweight and easily portable or they were abandoned and re-made when needed in a new location.\(^{44}\)

With such mobility, American Indians could follow the fish during their fall and spring spawning runs. They could stock up on fish for immediate consumption or take the


\(^{42}\) Hudson and Ziegler, “Environment, Culture, and the Great Lakes Fisheries,” 393.


excess catch (which was either dried or smoked for winter storage) and then move on to other seasonal fishing, hunting or harvesting spots for continued sustenance.

An important source of protein, freshwater fish also offer vitamins A and D in the oils and livers but lack carbohydrates. Fall-spawning species are nutritionally of higher quality than the spring fish species because they produce 600 to 800 calories per pound, while the spring species offer 350 to 450 calories.\textsuperscript{45} Nonetheless, they were, and are, an important food source.

The autumn fish provided a more opportune window for preservation due to cold temperatures, so much of the catch could be set aside. On the other hand, the spring fish spawned at a time for immediate dietary relief from a long winter but fish preservation posed a challenge. Sun drying and fire smoking were not entirely effective in keeping the catch fresh in the damp spring and hot summer months.

The fishing conduct of Great Lakes American Indians was limited by their fish processing capacity, population size, temporary and sometimes low-producing seasons, and available winter food storage. There was a progression from hunter to general fisherman to specialized fisherman.\textsuperscript{46} A successful method, and one of the earliest for spearing and gaffing fish was with the use of a weir(s), a barrier across a river or stream designed to redirect the flow, for the fisherman’s benefit.\textsuperscript{47}

Harpoons resembled spears but with the added addition of a hole cut through it for a line to be attached. The head of the harpoon unhitched which permitted the fisherman to play the fish, greatly improving the odds of landing bigger fish. This method largely


\textsuperscript{46} Ibid., 777.

\textsuperscript{47} Ibid., 768.
replaced other fishing techniques by hand in later periods all along the Great Lakes.\textsuperscript{48} It is a logical conclusion to believe that the earliest fishing endeavors by Great Lakes American Indians transferred spear technology from hunting large land mammals to fish. The continued progression of fishing methods was a necessity since the spawning times coincided with a downturn in hunting productivity.

The exact period of spawning and the number of fish taking part may vary considerably from year to year. Aquatic spawning is sensitive to weather conditions, water temperature, bottom conditions, and the natural fluctuation in rival fish and food populations. This is a fragile balance to maintain; for example, lake whitefish spawn when the water temperature is between 32.9° and 33.08° F.\textsuperscript{49}

Spring-spawning freshwater fish are territorial and confined to shallow waters, and the best means to take these fish was with the use of seines.\textsuperscript{50} Seine fishing requires deep nets made from fine-mesh weighted towards the bottom with long handles on each end which can be drawn together by wading, encircling the fish.\textsuperscript{51}

In action, seines are bendable mesh fences moving through the water and are better utilized in four to five feet of water (as deep as an adult could wade) and of abundant length, such as several hundred feet. Seine fishing was undoubtedly a communal effort because it necessitated hands to construct and operate the net and have the energy to clean the fish, gather firewood, build smoking racks, sustain the fires,

\textsuperscript{48} Cleland, "The Inland Shore Fishery of the Northern Great Lakes", 774.
\textsuperscript{49} Ibid., 767.
\textsuperscript{50} Ibid.
\textsuperscript{51} Ibid., 774.
smoke the fish, and store the winter portion all in a short window of time.\textsuperscript{52} The reward could, and most often did, grant large stores of fish.

Birch-bark canoes utilized by the American Indian tribes on and around northern Lake Michigan drew curiosity and admiration from the first European explorers. American Indians used bark from birch trees because it is light, strong, flexible, and waterproof. These characteristics allowed for the bark to be shaped and sewn together. The canoes were ideal for fishing on a lake and traveling because their designs could be altered to address particular needs such as weight capacity, purpose, maneuverability, and draft. Fishing at night by torchlight, the fisherman would stand on the bow using illumination to spot the reflection from the fish’s eyes while holding a harpoon-like spear in one hand at the ready above the shoulder.\textsuperscript{53} This technique was observed by Euro-Americans as late as the 1840s on the waters of Green Bay and Fox River, Wisconsin.\textsuperscript{54}

The necessary means to reach shoals in depths beyond any shore-based fishing method called for new approaches of access. Those were found in repurposing current net designs. This led to the development of the gill net.

An herbaceous plant with jagged leaves covered with stinging hairs called nettles and hemp fibers were spun and twisted together to make fine cord for netting. The gill net formed an underwater screen, causing the fish to become fatally caught in their gills. It was vital to keep the “screen” taut and in order to do so, floats were deployed at the surface and weights at the bottom. Two or three men from a birch bark canoe was the most sensible way of placing and raising gill nets.\textsuperscript{55}

\textsuperscript{52} Cleland, “The Inland Shore Fishery of the Northern Great Lakes”, 779.
\textsuperscript{53} Bogue, Fishing the Great Lakes, 7.
\textsuperscript{54} Jensen, Wooden Boats and Iron Men, 5.
\textsuperscript{55} Bogue, Fishing the Great Lakes, 7.
Lake Michigan Explored and Charted

French explorer Jean Nicolet with his fellow French voyagers started trekking through the Great Lakes region looking for Asia beginning in the early 1600s.⁵⁶ Nicolet paddled a canoe one summer morning west of the Strait of Mackinac assuming he would one day meet the Chinese.⁵⁷ Instead, he discovered the Illinois, Potawatomi, Fox, Menominee, and other tribes inhabiting the Lake Michigan Basin.

The tribes of the Great Lakes region had known about Lake Huron for centuries, but Champlain is noted for “discovering” Lake Huron. Having said that, Champlain is not noted for discovering the entrance into Lake Michigan; instead that man was Étienne Brûlé.⁵⁸

Brûlé pointed at another rather large water opening to the west once as he came across the Straits of Mackinac, and with this news, Champlain sent his young protégé, Jean Nicolet, to investigate. The year was 1634 and Nicolet with seven Hurons paddled a canoe beyond the Straits, anticipating that they would reach China on the other side.⁵⁹ However, his discovery was not China, but was instead the territory of Wisconsin’s Green Bay.

The new explorers from Europe were in awe at the sheer bounty of fish in the spawning grounds and enthusiastically sought to gain local knowledge on how and where to catch the fish. According to one observation, a person could catch fifty lake trout in a day, many of them “weighing half as much as a man.”⁶⁰

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⁵⁷ Ashworth, The Late, Great Lakes, 3.
⁵⁸ Ibid., 35.
⁵⁹ Ibid., 36.
⁶⁰ Dorsey, The Dawn of Conservation Diplomacy, 32.
During British colonization of North America, "common law held that all British subjects had the right to use the public fisheries of the seas and the navigable rivers of the British Isles."\(^{61}\) The fish were public property but "subject to regulation designed to conserve them" for the nation’s use.\(^{62}\) The idea behind aquatic common laws was not new. They spread from Great Britain and into the Great Lakes region, as newly organized territorial and later American state governments appropriated the established fishing common laws from the eastern states and Canadian provinces that bordered the Atlantic Ocean.\(^{63}\)

The newly created United States government crafted a series of decrees to transform the wilderness into a hearty agricultural and commercial enterprise: the Treaty of Paris of 1783 and the Land Ordinance of 1785, as well as the Northwest Ordinance and the U.S. Constitution, both drafted in 1787.\(^{64}\) No diplomatic considerations for the marine life were made during the 1783 treaty talks, and land surveying and settlement soon followed in waves.

In 1783, representatives from Great Britain and the United States drafted a peace treaty in Paris that included a stipulation for drawing acceptable boundaries between the United States and British North America by an established international law: "when nations border bodies of water, the boundary is drawn down the middle" of the body of water in question.\(^{65}\) Therefore, the international boundary cuts through the middle of Lakes Superior, Huron, Erie, and Ontario.

\(^{62}\) Ibid.
\(^{63}\) Ibid.
\(^{64}\) Ibid., 10.
\(^{65}\) Ibid., 11.
American policymakers were anxious to avoid the problems the British faced administering the wilderness and waters of the Great Lakes following the American Revolutionary War. Therefore, they drafted the Northwest Ordinance of 1787 to assure a system of government in these wilderness areas compatible with the state and national governments in the Eastern States, and to also put in place a process of transitioning territories to states.

The Northwest Ordinance created the first organized territory around the Great Lakes. The ordinance required that “not less than three nor more than five” states would be carved from the Northwest Territory.66 The State of Wisconsin was the last state from this ordinance to be created in 1848. Similar to the other four states bordering Lake Michigan, Wisconsin was given a portion of the Great Lakes adjacent to the state’s boundaries by Enabling Acts drawn up by the U.S. Congress.67 Since Lake Michigan rests entirely within the United States, the 10th Amendment to the United States Constitution divided the Lake between Michigan and Wisconsin, with smaller portions going to Indiana and Illinois.

When the American delegates met in Philadelphia in 1787 to discuss how to restructure the national government, they concluded, “the authority to regulate the fisheries were not designated as an enumerated power of Congress.” Therefore, the states saw the designation “as a power reserved for them under the Tenth Amendment.”68 These ordinances remain the basis for regulations for the waters of the Great Lakes. They also created legal obstacles for managing the Great Lakes by a singular governing body.

67 Ibid.
68 Ibid., 12.
The general attitude towards federal control was quite clear in 1893 when the Michigan fish commissioners expressed this attitude in their tenth biennial report:

It [regulation of the fisheries] is a state matter, and the state alone must be looked to for its proper administration. The sooner this becomes generally known and recognized the sooner will people cease chasing this ignis fatuus and direct their undivided attention to the proper authorities to correct the evils complained of, and by placing the duty and responsibility where it naturally and of right belongs, will more surely accomplish the desired results.\textsuperscript{69}

The states bordering Lake Michigan and the remaining Great Lakes created and enforced their own laws because they believed no other governing body was "familiar with the necessities of their states."\textsuperscript{70} State legislators felt that they and they alone could respond aptly to the various needs of their constituents.

Knowing that the fish could be counted on as a stable food source, the settlement by Europeans all along the Great Lakes began with military outposts, farms, and trading posts. Before long, the new settlers took advantage of the fish resource and used the seine as the first method of early commercial fishing by making the nets much larger and more numerous than ever before.\textsuperscript{71}


\textsuperscript{70} Ibid., 181.

\textsuperscript{71} Dorsey, \textit{The Dawn of Conservation Diplomacy}, 33.
Chapter Two: Nets, Boats and Four Commercial Fish

Wisconsin biologist Aldo Leopold succinctly recounted the all too familiar relationship between machines and nature: "The conquest of nature by machines has led to much unnecessary destruction of resources. Our tools improve faster than we do."\(^{72}\)

The commercial fishing tools were, broken down simply, the net, boat, and preservation systems. The strategic implementation of technologies was the key to the rapid rise of the industry and the subsequent erosion of fish stocks in Lake Michigan. The several factors that allowed for the enormous harvests were: the expansion of the gill net steamer fleet equipped with mechanical gill net lifters; the use of many more and finer-mesh nets; a plentiful labor supply; and the increased use of freezing techniques in conjunction with wide-spread transportation. Any technological advancement that failed to pay off in the long run was curbed for a better instrument.

European immigrants were another strong reason for why entrepreneurial fishing companies and dealers expanded rapidly during the growth years of the 1870s and 1880s.

**Nets**

Selecting the proper gear for the method of fishing to be done rested on three, maybe four ground rules: fish species, value of the fish species, water depth, and the characteristics of the seabed [only if the gear was to collaborate with the bottom].\(^{73}\)

The nets were raised before winter to begin a month(s)-long maintenance routine, since the net fibers were most likely worn or frayed. If the nets were left sitting wet in a


box they would rot in no more than three days, and the floating corks lasted about two to three months until replacement.\textsuperscript{74}

To accomplish the seasonal net maintenance, they were dipped in vats of hot tar and dried.\textsuperscript{75} A way to preserve the nets included dipping them in a mixture of boiling water, salt, creosote, and dyes, a process known as “scalding.” The wood floats, or corks, were also dipped in this mixture. Tanning dye based from hemlock bark was used as a way to camouflage the nets.\textsuperscript{76}

The last step included drying reels. These drying reels were cubical wooden frames about ten feet long and five or six feet wide with a central axis resting on two wooden upright supports. One drying reel could attend to eight-gill nets in “thirty-five to forty-five minutes” or “about ninety complete revolutions.”\textsuperscript{77}

![Plate 2: A net yard with gill nets on drying reel racks.\textsuperscript{78}](image)

From a commercial standpoint, fishing with seines was the least complicated and expensive method even when they ranged in length to over one thousand feet. As seine net harvests diminished, the fishermen who operated near shore then turned to the pound

\textsuperscript{74} Jensen, \textit{Wooden Boats and Iron Men}, 48.
\textsuperscript{75} Ibid., 43.
\textsuperscript{76} Ibid., 47.
\textsuperscript{77} Smith, \textit{Review of the Fisheries of the Great Lakes in 1885}, 74.
\textsuperscript{78} Chiarappa, “Great Lakes Commercial Fishing Architecture,” 226.
net.79 When the Scottish-designed pound nets arrived on the scene in the 1830s, they were constructed from cotton and needed a preservative element in the fibers.

Pound nets were complex and remained more expensive because they included a leader, a tunnel, and a pot. The leader net is set at a right angle to the shore and juts outward from the “pot” and guides the fish into the trap. Pound nets were dropped just before May and were left submerged until mid-June. They were then reset in late October to coincide with the whitefish and herring spawning runs.80

![Plate 3: Pound net in Green Bay, Wisconsin](image)

When a fish encounters a pound-net, it first encounters the lead net (7 to 14 inch diameter mesh), and then moves into a deeper part of the net called the “heart” (6 to 11 inch diameter mesh). Then the fish swims through a funnel (4 inch mesh) and into the pot, sometimes called a bowl or crib.82 The pot covers an area of thirty to forty square feet and at average depths of thirty feet.83

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83 Ibid., 41.
Two or three days were often required to place a pound-net. The ideal plan would require one day to drive the stakes or "spiles" into the bottom and the second to set the nets and pulleys. The net stayed clasped in place by this rope and pulley system.\textsuperscript{84}

Plate 4: Raising the "pot" of a pound net.\textsuperscript{85}

When tending a pound net, several fishermen would depart at daybreak and empty the pot by maneuvering their boat to just outside the net to release the line connected to the tunnel. Then the net pulleys connected to the stakes had to be unlocked in order to raise the corners of the pot.\textsuperscript{86} Next, the side of the net was temporarily lowered to allow the boat to be positioned just above the pot. After this, the harvesting began with scoop nets because the fish will rush and bunch in the corners.\textsuperscript{87} During the peak of the season, these nets were visited twice daily.

Scandinavian immigrants in particular filled the ranks of the pound net fishing industry, but instead of owning their operations they often worked for wages. For

\textsuperscript{84} Jensen, \textit{Wooden Boats and Iron Men}, 42.
\textsuperscript{85} Smith, \textit{Review of the Fisheries of the Great Lakes in 1885}, plate xxx.
\textsuperscript{86} Jensen, \textit{Wooden Boats and Iron Men}, 41.
\textsuperscript{87} Ibid.
example: A. Booth and Company paid thirty dollars per month to those who worked at
their pound net fisheries in Little Bay de Noc, Michigan in the late 1880s.\(^8\)

Around 1845, Lake Michigan was the first locale where gill nets, called “float and
stone nets”, were placed.\(^9\) The simply designed gill net was quite fatal once dropped
over the side because fish would soon swim into it, getting their gills caught.

As fish species altered their depths and locations during the year, gill net
fishermen altered their equipment. The gill net is a large wall of netting better suited for
deep water, similar to a tennis net. It could be set at just above the seabed or from the
surface to mid-water, but was used quite extensively in deep water.\(^0\)

The rigging of gill nets varied widely but one arrangement became common once
some kinks were ironed out from earlier models: the top of the net was connected to a
float or cork line and the bottom line was secured to lead weights.\(^1\) The use of both the
floats and weights kept the net taut and extended regardless of depth. Therefore, gill nets
could be set in a straight line or in curved formations if the surface conditions were gentle
enough. That being said, gill nets were often placed in straight lines at right angles to the
current depths from around 30 to 420 feet, and from twenty-five to thirty miles away
from shore. The depth in the vertical water column at which the gill net was set was
determined by the habits of the targeted fish species.\(^2\)

For many gill-net fishermen, success was a simple principle: more nets in the
water increased the odds of economic success. This resulted in “gangs” of strung together

\(^8\) Michael J. Chiarappa, “Great Lakes Commercial Fishing Architecture: The Endurance and
Transformation of a Region’s Landscape/Waterscape,” Perspectives in Vernacular Architecture 10 (2005),
221.
\(^9\) Jensen, Wooden Boats and Iron Men, 45.
\(^0\) Bogue, Fishing the Great Lakes, 39.
\(^1\) Jensen, Wooden Boats and Iron Men, 45.
\(^2\) Smith, Review of the Fisheries of the Great Lakes in 1885, 73.
gill nets. Some gill net gangs reached four to eight miles. The distance of the gang was set by the fisherman’s discretion.⁹³

![Fig 1](image)

![Fig 2](image)

Plate 5: Two types of gill net rigs.⁹⁴

By the mid-1920s, three size varieties of gill nets were in use by the Great Lakes fishermen: large for whitefish and trout; medium for herring, chubs, perch, etc.; and small for bait. All three varieties were set in deeper waters, sometimes at depths to six hundred fifty feet, but most averaging six hundred feet. At the discretion of the fishermen, these nets could be placed end to end, forming net “gangs” capable of reaching four to eight miles. Within one to six days these gangs were lifted depending on water temperature and surface conditions. The fish were being captured from the surface to within five feet off the bottom. The gill net fishermen nearly had the whole water column covered by their nets.⁹⁵

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⁹⁴ Smith, Review of the Fisheries of the Great Lakes in 1885, plate xix.
Boats

Fishing experiences from Scandinavia were preserved in the construction principles for the Great Lakes commercial fishing vessels.\(^6\) Although any Viking ship’s construction could be tweaked for certain intentions, they generally were slender, high-bowed, flexible boats with symmetrical ends, creating the ability to reverse direction in a few feet of water with their shallow draft without the need to turn around. The Scandinavian immigrants brought shipbuilding ideas, such as “clinking.” The brilliance behind the Viking vessels was their boat building method called “clinker” or “lap-strake” or “clinking,” a process where the edges of wood planks for the hull were slightly overlapped and then joined with small clincher nails.\(^7\)

![Plate 6: Huron boat.\(^8\)](image)

Around 1850, the common commercial fishing vessels seen on Lake Michigan were: the “Huron”, the “Mackinaw”, the “Norwegian”, “pound-boat”, and the streamer.\(^9\)

The wooden frames and keels for most of these craft were from locally harvested white oaks and white pines.

The “Huron” boat had ample storage for net boxes, fish barrels, and fish and “was more or less a schooner-rigged sailboat” with the better-built models faster than Mackinaw boats.\textsuperscript{100} Huron boats were fitted with a square stern, with the rudder hung outside, and a length overall between thirty and forty feet. In the communities where Huron boats were favored, the fishing was done further away from shallower waters even though the Huron boats were less maneuverable\textsuperscript{101}.

Milner observed that, “An inquiry into the history of loss of life and accidents among the fishermen of Lake Michigan indicates that these boats had suffered the most, partly, no doubt, because of their longer runs out from shore.”\textsuperscript{102} The poor safety record can also be attributed to the boat design because it reduced the sheer, which means a reduction in hull buoyancy (volume), forward and aft.

But the Huron’s poor safety record did not faze the fishermen. Milner went on in his report to note, “[It] is the boat in most general favor where the large gill-net rigs are employed.”\textsuperscript{103} These boats were used anywhere large gill nets were present but concentrated nowhere higher than on Lake Michigan.\textsuperscript{104}

Many fishermen working gill nets near shore preferred the “Mackinaw boat.” Made from local white cedar or pine, the hulls were commonly clinker-built, double-ended schooners altered from their originating prototype to best suit the regions where they were utilized for commercial fishing.\textsuperscript{105} Writing on the Mackinaw boat, Milner said:

\[... \text{She is comparatively dry, and her sharp stern prevents the shipment of water aft when running with the sea. They have been longer and more extensively used on the upper lakes than any other boat, and with less loss of life or accident. The objection to the more}\]

\textsuperscript{100} Jensen, \textit{Wooden Boats and Iron Men}, 26.
\textsuperscript{102} Ibid.
The general use of the mackinaw is that her narrowness aft affords too little room for storage. They are employed entirely with the light-rig gill-net stocks, and are usually from 22 to 26 feet in length. Lake Superior, the northern half of Lake Michigan, and a large portion of Lake Huron are the regions where they are in general use.\textsuperscript{106}

The “Norwegian” boats, noted for their stability and dryness, were used in a number of places, especially where sudden and violent storms were common, such as St. Joseph, Michigan on Lake Michigan. Resembling the fishing vessels of Scandinavia, they were used exclusively by Norwegian and Swedish immigrants, sometimes crewed by six men but often three to five.\textsuperscript{107} This cumbersome-looking vessel was a sharp-stern keelboat, with strong sheer, one mast with usually three sails, hollowed floors near the keel (which is a common feature in Scandinavian fishing vessels), and a more or less a concave water line forward and aft.\textsuperscript{108}

Milner shrewdly observed the “Norwegian” as:

\begin{quote}
... a huge, unwieldy thing, with flaring bows, great sheer, high sides, and is sloop-rigged. She is absolutely dry in all weathers, and though perfectly safe, and with ample room, she is only used by the Scandinavian fishermen, most other fishermen objecting to her slowness and the great labor of rowing in time of a calm. These boats are in use but in very few localities. They are from thirty-five to forty feet in length.\textsuperscript{109}
\end{quote}

The pound net fisheries are unique in that two boats are required in order to operate the fishery smoothly. The “pound” boats were lengthy at about forty-feet, open, and flat-bottomed with a sharp bow and wide, square stern with two tall, tapering masts, a foresail and mainsail, each with a boom as a rule.\textsuperscript{110}

They were fast before the wind and spacious with a simple piece of board as the rudder that was set into a slot. The reason behind this rudder design was to obtain as

\begin{footnotes}
\end{footnotes}
much force as possible with a small amount of rudder immersion.\textsuperscript{111} However, they were unable to sail well in high seas due to their flat bottom and shallow draft.\textsuperscript{112}

![Typical pound net boat](image)

Plate 7: Typical pound net boat.\textsuperscript{113}

Pound net boats were primarily used for delivering fish from the pound-nets to the warehouses and freezing houses dotted along the Lake Michigan shoreline.\textsuperscript{114} Between the two thwarts, one forward and one aft, is the space where the catch is thrown when raised from the pound-nets. For this, it is necessary to have a wide boat for stability when lifting the fish and water-soaked nets.\textsuperscript{115}

Located at Waukegan, Illinois, the pound-net boats had no sails or washboards because the boats were either rowed or towed via pulleys by horses from shore in order to reach the stationed pound-nets offshore. Surprisingly, some pound-nets were placed seven miles from shore and to reach them required one man to steer the boat and two to three to guide the horse in a tight circle around a sheltered, vertical drive axle. With a

\textsuperscript{111} Smith, \textit{Review of the Fisheries of the Great Lakes in 1885}, 27.
\textsuperscript{112} Ibid.
\textsuperscript{113} Smith, \textit{Review of the Fisheries of the Great Lakes in 1885}, plate vi.
\textsuperscript{115} Smith, \textit{Review of the Fisheries of the Great Lakes in 1885}, 27.
series of pulleys assisting the horse(s), the towrope would not drag on the ground or get stuck in the pulleys, but be coiled neatly on a nearby spindle.\textsuperscript{116}

The second boat needed in the pound-net fishery was the "stake-boat" or "pile-driver" boat that drove and removed stakes for each pound net at the start and end of each fishing season. Sturdiness and viability were the principles behind the crude and inexpensive construction of this boat.\textsuperscript{117}

![Plate 8: Image of Stake-Driver boat.\textsuperscript{118}](image)

Of course variation in designs were centered on location, but they generally followed a flat-bottomed, wide-beamed sailable dinghy design measuring between twenty-five to thirty feet and six to eight feet wide with a large centerboard and a single sail. To lift or raise the stakes required machinery at the bow for guiding the stake-driver and at the stern a windlass (winch).\textsuperscript{119}

"Driving stakes is considered the hardest work connected with the pound fishery," noted Ludwig Kumlien.\textsuperscript{120} Operating this twenty-five foot upright tower or "derrick" (crane) pile driver required four to five men to pull on a rope laced through an eyehook at

\textsuperscript{117} Ibid., 29.
\textsuperscript{118} Ibid., plate ix.
\textsuperscript{120} Bogue, \textit{Fishing the Great Lakes}, 94.
the top of the tower to lift a hammer. At the proper moment, the men released the hammer; the impact could drive a stake six to seven feet into the lakebed.\textsuperscript{121}

When the twentieth century began, the utilization of the common steam tug on Lake Michigan made the water crowded with steam tugs. Commercial fishermen began increasing the use of steam powered fishing “steamers” or “tugs” which revolutionized the industry. The “pound steamers” or “pound tugs” transported the catch from the pound nets to fish processing facilities on the shore for assortment, inspection, and storage. Other steam-powered boats fished with large gangs of gill nets and called their boats “gill net steamers” or “gill tugs.” The steam-powered boats for gill net fishing installed rollers on the bows to haul in the nets that were then immediately stored below.\textsuperscript{122}

![Gill net fishing tug](image)

Plate 9: Gill net fishing tug.\textsuperscript{123}

The steam engine was located amidships, covered by a deckhouse, and the fish were often stored forward of the engine room. Typically, fishing steamers/tugs provided pens and iceboxes for additional fish storage that dwarfed the sail-powered fishing boats.\textsuperscript{124}

\begin{enumerate}
\item \textsuperscript{121} Jensen, \textit{Wooden Boats and Iron Men}, 42.
\item \textsuperscript{122} Smith, \textit{Review of the Fisheries of the Great Lakes in 1885}, 19.
\item \textsuperscript{123} Ibid., plate 1.
\item \textsuperscript{124} Ibid., 20.
\end{enumerate}
Milner noted the comparisons between sail-powered and steam-powered tugs he witnessed on Lake Michigan in the early 1870s:

Steam tugs usually carry from 250 to 400 nets, disposed in gangs of about 40 nets each. They are set from the stern of the boat while it steams slowly along, and are taken in over the bows, where rollers are arranged to lessen the hardships.\textsuperscript{126}

At harbors from Kenosha, Wisconsin, to Sheboygan, Wisconsin, gill net steamers or tugs landed daily in order to ship the daily catch fresh on rail, in ice boxes to dealers in Chicago, Illinois.

Noting the changes in the Great Lakes fisheries in 1882, Charles W. Smiley of the American Fisheries Society penned the following about the evolution of fishing technology from 1871-1879: “The apparatus for capture has increased in effectiveness enormously, probably by 500 percent. The increased effectiveness was produced by the introduction of finer meshes in nets, the addition of steam-powered tugs, the increase of pounds, and very great increase in the number of gill nets in use. The number of fishermen also increased.”\textsuperscript{127}

\textsuperscript{125} Smith, \textit{Review of the Fisheries of the Great Lakes in 1885}, plate II.
\textsuperscript{126} Jensen, \textit{Wooden Boats and Iron Men}, 27.
Four Commercial Fish

There were four fish species specifically targeted for commercial harvesting due to their appeal to the consumer: lake herring (cisco), lake sturgeon, lake trout, and lake whitefish.

Plate 11: Lake Herring.\textsuperscript{128}

**Features:** Silvery with pink to purple iridescence; similar to a bloater chub with more gill rakers.

**Size:** Eleven to fifteen inches long; weighs six ounces to two pounds.

**Adult Diet:** Mainly zooplankton; *Mysis relicta, Diporeia* species.

**Spawns:** Gathers in large schools to spawn in late November and early December.

**Common Names:** Cisco, tullibee, freshwater herring.\textsuperscript{129}

Lake herring are the small, slender cousin of the lake whitefish. When available, they can constitute a large portion of the diet for many larger fish. The herring are by nature active fish when it comes to searching for food.\textsuperscript{130} They move continuously in circles ranging from shallow to deeper water during the peak of summer, feeding on plankton, insect larvae, and fish eggs.\textsuperscript{131}

The water temperature plays a major role in spawning once it drops to 39\textdegree{} F. Off the shores of Green Bay, Wisconsin, lake herring congregate in shallow water of around

\textsuperscript{128} Smith, *Review of the Fisheries of the Great Lakes in 1885*, plate xiii.

\textsuperscript{129} Jensen, *Wooden Boats and Iron Men*, 76.

\textsuperscript{130} Ibid., 75.

\textsuperscript{131} Ibid.
thirty to forty feet in late fall. The spawning takes place near the surface. The males arrive a few days before the females but once they meet, the spawning begins. The eggs will hatch in late spring and the hatchlings will reach maturity in two to three years.\textsuperscript{132}

![Plate 12: Lake Sturgeon.\textsuperscript{133}]

**Features:** Sleek body shape with rows of bony plates along its sides with a greenish-grey coloring. Pointy nose with two pairs of whisker-like tactile organs called barbells dangle near the mouth.

**Size:** Can reach 6 feet, some closer to 7.5 feet, and weigh 200 pounds or more. Males can live up to 55 years and females can reach 150 years.

**Adult Diet:** Insect larvae, crayfish, snails, clams, worms, leeches, and other small organisms because they lack teeth.\textsuperscript{134}

**Spawns:** Fishermen agree that the spawning occurs during mid-April to early-June when they travel upstream in rivers to their ancient spawning grounds. Their spawning is dependent on water temperature.\textsuperscript{135}

Lake sturgeons are patrons of shallow waters, often thirty feet or shallower, making them easy prey for fishermen. The claims from numerous commercial fishermen notwithstanding, lake whitefish eggs were not a part of the sturgeon’s preferred diet.\textsuperscript{136} Fish eggs and other edible material simply got caught up in the whirlwind of water sucked into the sturgeon’s mouth. Sturgeons were never the great destroyers of lake whitefish.

\textsuperscript{132} Jensen, *Wooden Boats and Iron Men*, 76.

\textsuperscript{133} Smith, *Review of the Fisheries of the Great Lakes in 1885*, plate xli.


\textsuperscript{136} Bogue, *Fishing the Great Lakes*, 159.
Sturgeons instinctively know their ancient spawning grounds, but human
development and dams have spoiled their spawning waters. The dams prevent the
sturgeons’ access to their spawning grounds upstream in tributary rivers, so they resort to
rocky areas along the shores with sandy or hard clay bottoms, between two to fifteen feet
deep.\textsuperscript{137}

Spawning sturgeons prefer clean, gravel shoals and stream rapids from April to
June, in ideal water temperatures of 55 to 64\degree F. The females reach sexual maturity
between fourteen and thirty-three years and the males need eight to twelve years but
twenty-two years may be required for some. The females spawn once every three to
seven years and the males spawn once every one to four years. Once the eggs are ready to
hatch, the production is somewhere between 4,000 to 7,000 eggs per pound of fish.\textsuperscript{138}
Therefore, around ten to twenty percent of adults in each population are ready to spawn
during each season.\textsuperscript{139} This means that lake sturgeon could not by biology alone
withstand the intensive onslaught they endured from commercial fishermen, whether for
marketable purposes or for sport.

Plate 13: Lake Trout.\textsuperscript{140}

\textsuperscript{137} Bogue, Fishing the Great Lakes, 159.
\textsuperscript{138} Fishing: Lake Sturgeon, \textit{Acipenser fulvescens} (accessed December 3, 2015); available from
\url{http://www.michigan.gov/dnr/0,4570,7-153-10364_18958-131946--,00.html}.
\textsuperscript{139} Lake Sturgeon Biology and Population History in the Great Lakes, (accessed December 3, 2015);
available from \url{http://www.fws.gov/midwest/sturgeon/biology.htm}.
\textsuperscript{140} Smith, Review of the Fisheries of the Great Lakes in 1883, plate xii.
**Features:** Generally light green or gray in color with light spots on a darker background, irregular wavy markings on back and dorsal fin. Deeply forked caudal fin.

**Size:** Average weight in Great Lakes is six to twelve pounds, but may exceed sixty pounds; approximately twenty-three to twenty-nine inches long.

**Adult Diet:** Chubs, lake herring, stickelbacks, alewives, smelt, sculpins, macroinvertebrates.

**Spawns:** Fall, over open water rocky shoals

**Common Names:** Laker, toge, grey trout.\(^{141}\)

Before commercial fishing, lake trout traversed the Great Lakes in a bursting exhibition of numbers that claimed “a variety of habitats from rivers to the deepest waters and they varied in shape, color, and fat content.”\(^ {142}\) They have an unquenchable appetite, eating both large and small fish, such as whitefish and herring. Commonly, fish are communal and travel in schools but, out of these four species, lake trout are the most independent. They hunt and feed independently, and are regulars to deep water.\(^ {143}\) Lake trout live long lives but do not reach sexual maturity until six to eight years of age.\(^ {144}\)

Lake trout prefer the shallows up and down the shoreline at the close of September and into October to single out areas of clay, honeycombed rocks, and reefs at depths from very shallow to hundreds of feet to begin spawning. At some time in January until early February the recently spawned eggs hatch. The reefs off Sheboygan and Milwaukee have long been spawning grounds for native lake trout.\(^ {145}\) Beginning around 1955 many viewed lake trout as a rare species but it was one of the most abundant species in Lake Michigan circa late 1800s.

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\(^{141}\) Jensen, *Wooden Boats and Iron Men*, 73.


\(^{143}\) Jensen, *Wooden Boats and Iron Men*, 73.

\(^{144}\) Ibid.

\(^{145}\) Ibid., 74.
Plate 14: Lake Whitefish.\textsuperscript{146}

**Features:** Silvery color with green-brownish back. Clear or lightly pigmented fins. Heavy amount of slime over the scales.

**Size:** Average weight in the Great Lakes, two to four pounds; length is eighteen to twenty inches.

**Adult Diet:** *Diporeia*, small fish, and fish eggs.

**Spawns:** November and December over rocky shoals.

**Common Names:** Whitefish, sault fish, gizzard fish, *grande coregone*, and *attikumai* (Chippewa).\textsuperscript{147}

Lake whitefish are bottom feeders that enjoy the taste of crustaceans, mollusks, and certain kinds of insect larvae.\textsuperscript{148} According to Milner’s observations, they lack teeth adequate enough to consume other fish or aquatic vegetation. However, when required by the lack of a preferred food supply, they will eat smaller fish.\textsuperscript{149}

They live in large, slow moving groups, staying generally in one area, but move toward the coast twice a year. During summer, there is a small window where they arrive to enjoy more oxygenated water. Spawning would typically start in late October, and they would approach the shoreline a second time, and stay around until mid-December in six to sixty feet of water over gravel or honeycombed rocks.\textsuperscript{150}

\textsuperscript{146} Smith, *Review of the Fisheries of the Great Lakes in 1885*, plate xx.

\textsuperscript{147} Jensen, *Wooden Boats and Iron Men*, 70.

\textsuperscript{148} Bogue, *Fishing the Great Lakes*, 152.

\textsuperscript{149} Ibid., 151.

\textsuperscript{150} Jensen, *Wooden Boats and Iron Men*, 71.
At the time lake trout rose in importance, lake whitefish numbers were caught in a downward spiral. Federal statistics for Lake Michigan in 1880 indicated a harvest over 12,000,000 pounds but by 1922 the harvest fell to 1,500,000 pounds.\textsuperscript{151}

\textsuperscript{151} Jensen, \textit{Wooden Boats and Iron Men}, 72.
Chapter Three: The Upswing of Optimism, 1870 – 1899

In a Milwaukee Sentinel article dated July 17, 1862, the pound net fishing operations of John Luck off Whitefish Bay, Wisconsin, were recorded. After minutes of “inextricable twisting of ropes, ducking of heads and, in our case, a continual chorus of nautical phrases, in which all joined and above which the horse laugh could be heard loud and distinct” and upon the vessels’ return, the fishing “parties always come to shore with selected strings of fish for which a mere nominal fee is charged.”\(^\text{152}\) The zenith of this local fishery came twenty years later, when the Whitefish Bay Resort requested three hundred to six hundred pounds of fish per week for the guests.\(^\text{153}\)

William Davis of Detroit patented a freezing appliance for fish around 1868. The result was that nearly each important lakefront town or harbor established freezers of varying capacities. Davis’s device was not well-received upon introduction but since the only preserving alternative was salting, which inevitably reduced value, fish dealers and wholesalers began favoring this new method once it was determined that a fish could be preserved frozen for any amount of time.\(^\text{154}\) Later on, productive or lucrative pound or gill net fisheries often had corresponding freezing houses established nearby.

Commercial fisherman John O’Neil had the fish tug, *Kittie Gaylord*, constructed in 1870 at Fort Howard, Wisconsin, for use on Green Bay. For the time, this fish tug’s dimensions were unprecedented, and it was not long after that more fishermen were ordering fish tugs similar to John O’Neil’s. The *Kittie Gaylord* was forty-one feet in length supported by a ten and a half foot long beam displacing 13 gross tons (volume of

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\(^\text{153}\) Fehring, *Chronicles of Whitefish Bay*, 23.

all enclosed spaces) and 8 net tons (volume of all cargo spaces of the ship that indicates each vessel’s earning volume) propelled by a high-pressure steam engine.\textsuperscript{155} The pressure these steam-powered vessels could exert on any fish stock was tremendous.

In 1872, only a few gillnet steamers were in use with heavy gill netting rigs. Introduced on Lake Michigan near Green Bay in 1869, the \textit{Pottawatomie} was one of the first of these ships launched.\textsuperscript{156} It would be only a small matter of time until the employment of steamers for commercial fishing led to a dramatic increase in harvesting intensity from the mid-1870s through the 1880s. The most extensive fleet of gill net steamers/tugs on any Great Lake was concentrated on Lake Michigan during the expansive years. The fleet grew to thirty vessels by 1880, up from five vessels just seven years earlier. In 1885, there were eighty-two but by 1890, the number was down to forty-eight.\textsuperscript{157}

The implementation of newer fishing technology helped the fishermen stay competitive and major fish dealers to strategize and consolidate. They could quite literally comb the waters like we comb our hair or mow the yard. The investment in commercial fishing on Lake Michigan in 1871 was:

\begin{table}[h]
\centering
\begin{tabular}{|l|c|}
\hline
281 pound-nets, avg. value $500 & $140,500.00 \\
102 gill nets, “heavy-rigs,” avg. value $725 & $73,950.00 \\
348 gill-nets, “light-rigs,” avg. value $225 & $78,300.00 \\
96 boats, avg. value $500 & $49,000.00 \\
348 Mackinaw boats, avg. value $100 & $34,800.00 \\
143 pound-net boats, avg. value $50 & $7,150.00 \\
100 anchor-boats, avg. value $25 & $2,500.00 \\
4 steam fishing-boats, avg. value $1800 & $7,200.00 \\
1 schooner & $3,000.00 \\
500 shanties, avg. value $50 & $25,000.00 \\
100 ice-houses, avg. value $100 & $10,000.00 \\
Total of fishing investment & $431,400.00 \\
\hline
\end{tabular}
\caption{Table 1: Investment in Commercial Fishing, 1871\textsuperscript{158}}
\end{table}

\textsuperscript{155} Jensen, \textit{Wooden Boats and Iron Men}, 27.
\textsuperscript{156} Bogue, \textit{Fishing the Great Lakes}, 41.
\textsuperscript{157} Ibid., 49.
The Chicago fish dealers enjoyed a steadily increasing supply because the lake was being fished over and over in the same localities. There was no let up. Wherever expanding lines of railroad could link up with ports, a new fishing operation would begin.

Even in 1871 Milner statistically noted the evidence of decline. The shipments of salted fish from the port at Two Rivers, Wisconsin decreased from 6,351 packages in 1867 to 2,811 in 1870. This was a fifty percent decrease in four years.\textsuperscript{159} Perhaps the best evidence of fishery decline rests on the fact that fewer nets with greater success were placed before 1871. Three times as many nets were used to achieve a similar sized harvest in 1871. Fifty-gill nets were usually required to fill a half-barrel but in 1871 it took eighty to ninety gill nets to fill that same half-barrel.\textsuperscript{160} Lake whitefish were caught at smaller sizes than previously.

According to the oldest fishermen Milner interviewed, who had nearly three decades of experience on the lake, the decline coincided with the start of the Civil War. They asserted that the fish were abundant running near the shore and that large harvests were made with the seine. In 1858, thirty-three gill net watercraft operated out of the harbor at Milwaukee, Wisconsin, but by 1871 the number of vessels fell to fourteen. At Whitefish Bay, Door County, Wisconsin, a once extensive fishing ground had only a few pound nets operating in 1871.\textsuperscript{161}

\textsuperscript{160} Ibid.
\textsuperscript{161} Ibid., 16.
The increasing use of gill nets from 1870 - 1879 led the Michigan Board of Fish Commissioners to conclude the “entire fishing grounds of Wisconsin” were nearly depleted and by 1880 over sixty percent of the grounds were deserted.162

Gill nets did destroy significant sums of fish without ever having to be hauled aboard. During storms the fishermen were delayed in hauling in the nets and during this lull the knots holding the net to the floats would weaken and eventually fail. In the summer months, not more than three days were necessary for the stranded fish to become putrid in the nets. This caused other fish to vacate the area until the putrid fish were removed or left to completely rot. When the gill net floats sank, whole nets or entire gangs were sunk. Sometimes these lost nets or gangs were later raised, full of fish skeletons. One net lost was insignificant but when entire gangs were lost every year from storms, the situation started to become an ongoing snowball effect of wasteful fishing practices.

A decline occurred between 1871/72 and 1879 in trade of fish-based products out of Milwaukee, Wisconsin. A fish house reported a drop in half barrels from fourteen thousand to two thousand fifty-eight half barrels sold. A different fish house reported eight thousand half barrels in 1871 and seven thousand half barrels in 1872, but only one thousand nine hundred eight in 1879. Even though trade fell at Milwaukee and other places, the loss was offset by the transactions in Chicago. In 1872, Milner reported the transactions in Chicago at 7,461,102 pounds, and in 1879 Ludwig Kumlien with the United States Fish Commission reported 17,247,570 pounds worth of transactions.163

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162 State of Michigan. Sixth Biennial Report of the State Board of Fish Commissioners for 1883-84, Lansing, 1885, 10.
The Wisconsin Fish Commissioners concluded their 1875 report by saying, "The number and variety of nets used for fishing are appalling, and their destructive character, supplemented by the spear, are rapidly exterminating the whitefish and salmon-trout in Lake Michigan, Green Bay, and in many of the larger inland lakes."\(^{164}\)

The numbers of fishing apparatuses from 1871 to 1879 increased as shown in the table below:

<table>
<thead>
<tr>
<th></th>
<th>1871</th>
<th>1879</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pound nets</td>
<td>281</td>
<td>476</td>
</tr>
<tr>
<td>Gill nets</td>
<td>450</td>
<td>24,599</td>
</tr>
<tr>
<td>Sailboats</td>
<td>689</td>
<td>612</td>
</tr>
<tr>
<td>Steam tugs</td>
<td>04</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 2: Quantity of Fishing Apparatuses, 1871 & 1879.\(^{165}\)

In order to increase fish numbers and ensure a healthy continuation of the industry, various legislative and ecological requirements were necessary for each fishery in Lake Michigan. Milner noted this in his report, but this legislative suggestion, like others, was largely ignored or half-heartedly enacted.\(^{166}\)

When the fisherman understands the true intent and objects of regulation, as well as the benefits to be derived from it by him, his principal objection to that part of it which bears directly upon his interests will be removed: because he will see that any temporary inconvenience he may suffer in the loss of tackle and present profits, is more than made good to him by the permanent improvement in the number and size of fish available.\(^{167}\)

If the regulations were properly administered, then not only the fishermen but also the region would benefit from a well-maintained, inexpensive, and nutritious food source. The frame of mind the early state regulators instilled in the public resonated for generations. The widespread opinion was one of support for "adequate and suitable laws" to protect and maintain the lake whitefish populations. The intent behind the protective

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\(^{165}\) Ibid.


\(^{167}\) State of Michigan, Sixth Biennial Report of the State Board of Fish Commissioners for 1883-84, Lansing, 1885, 12.
laws for the individual commercial fisherman was clear on paper but ambiguous out on the water: "No laws should be passed which should rob the fisherman of the right to follow his calling within legitimate means." Therefore, it was not long before state fish commissioners began hearing solicitations for a game warden system in conjunction with a large-scale artificial fish propagation program to replenish all inland waters as well as the Great Lakes with commercially and recreationally important species.

*Smorgasbord of Unregulated Fishing Practices*

A description of the numerous Lake Michigan local fishing scenes in 1871 is valuable for showing the necessity of legislation designed for the different fisheries. Ironically, the regulations that were enacted were confusing to not only the fishermen but to those tasked with enforcing them as well.

At South Chicago, ten pound nets covered roughly eleven miles of coast. Here, unlike other pound net fishermen, anglers sought every variety of fish to sell to peddlers, except the dogfish, *Amia calva Lin*. Moving north along the shore, Chicago did not place nets for quite some time due to the filth originating out of the Chicago River. From Lake Forest, Illinois, through Waukegan, Illinois, to the border with Wisconsin were twenty-seven pound nets taking little else other than whitefish.¹⁶⁹

In Illinois, no commercial fishing was done outside of pound nets, as gill netting was seen as too hazardous to both life and material investments. The use of gill nets was to be used concurrently with shorelines with quality boat harbors or at least, favorable lee

shores. The large numbers of deserted fishing shanties were the only evidence of earnest efforts of gill netting and its inevitable impracticability.\textsuperscript{170}

Around thirty boats using “large gill net rigs” dropped nets a mile or more in length from Kenosha, Wisconsin to Sheboygan, Wisconsin. This was achieved by storing five to six gangs of nets and in each gang were twenty to thirty individual gill nets. With a crew of five men, steamers sailed eight to twenty miles from shore, their direction dictated by the range and migration of lake whitefish and lake trout.\textsuperscript{171} These nets also caught a lot of burbot, a.k.a. “lawyers”, which were thrown away almost instinctively except where local demand had an appetite for them. But in Chicago and Milwaukee, fish peddlers and fish stands had little trouble finding customers with an experienced palate for the livers of “lawyers.” \textsuperscript{172}

At Two Rivers, Wisconsin, and extending to the islands off of Door County and into Green Bay, mackinaw boats placed lighter gill net rigs. The net mesh netting was five inches from knot to knot and placed by a crew of two to three usually seven or eight miles from shore and often in net gangs of three to four at anywhere between eight and twenty nets per gang.\textsuperscript{173}

The pound net fishery at the head of Green Bay and reaching north to Peshtigo and Marinette, Wisconsin, took little more than herring. The western shore of Green Bay was the breadbasket of the pound net fishery for Lake Michigan. The season of 1871-'72 saw ninety pound nets established.\textsuperscript{174}

\textsuperscript{170} Ibid.
\textsuperscript{172} Ibid.
\textsuperscript{173} Ibid.
\textsuperscript{174} Ibid., 10.
The shoreline from Seul Choix Point, Michigan, across the Straits of Mackinaw and southward to Leland, Michigan, encompassed many successful pound nets. However, pound net fisheries proved to be a failure and were subsequently abandoned at any point south of Leland, Michigan. The stretch between Manistee, Michigan to Saint Joseph, Michigan, witnessed the larger gill net rigs operating seven to ten miles off shore. Since there was no spawning at Saint Joseph or anywhere southward, the fishing ceased during the late fall.  

After the surface froze from winter in Green Bay to a safe thickness, about four inches minimum safely for an adult male, the commercial fishing resumed to a limited extent. Holes were cut with chisels and baited hooks were lowered to locate lake trout or other fishes. If unsuccessful, more holes were drilled. A fisherman could take twenty-five to seventy-five fish a day, weighing from one hundred to three hundred fifty pounds that were then hauled away on a sled at night. The gill nets were set beneath the ice by sliding a line along from one hole to another. During the winter of 1870, a pound net was allowed to freeze into place with a shanty built over the crib or pot to prevent freezing, which would then allow the catch to be lifted daily without inconvenience.

The first report by the state of Michigan on the condition of the states’ fisheries in 1874 shows that political leaders knew the end result from reckless fishing practices: “waters once abounding with fish can become barren by excessive, or ill-timed, or barbarous fishing, or all together, is too obviously, painfully true.” According to Milner, the only tangible way to restore the lost fish stocks from wasteful fishing.

176 Ibid.
practices and pollution was artificial propagation.\textsuperscript{179} He placed a tremendous amount of confidence in those fish culturists who claimed their art could save the whitefish, which had become known as, and remained for quite some time, the indispensable fish in the fisheries.\textsuperscript{180} The fish commissioners from the state of Michigan in 1874 believed that the natural laws of fish reproduction would not generate enough spawn to maintain a steady supply of inexpensive fish foods.\textsuperscript{181}

The seventh biennial fish report from the state of Michigan published in 1887 concluded that the industrial fisheries “are being steadily ruined” and can only be saved by two strategies: conventional regulations and artificial propagation.\textsuperscript{182} It was prudent to protect the young commercial fish species until they were mature and ready for market: otherwise, all of the artificial propagation work would be fruitless. In other words, the artificial fish propagation programs and lawful natural resource management were “mutually dependent conditions.”\textsuperscript{183}

\textit{Artificial Fish Propagation, 1870 – 1899}

Artificial propagation was in fact “an industrial art, requiring labor, and practice and skill to produce” the desired outcomes, since the exercise requires the obtaining of both the male and female fish without injury.\textsuperscript{184} In scientific terms, artificial fish propagation necessitates the studying of water quality and fish biology, or in other words, “a complete knowledge of one and all of those essentials that antedate birth,

\begin{itemize}
  \item \textsuperscript{179} Milner, \textit{Report of the Fisheries of the Great Lakes}, 24.
  \item \textsuperscript{180} Milner, \textit{Report of the Fisheries of the Great Lakes}, 25.
  \item \textsuperscript{181} State of Michigan, \textit{First Report of the State Commissioners and Superintendent on State Fisheries, for 1873-4}, Lansing, 1874, 7.
  \item \textsuperscript{182} State of Michigan, \textit{Seventh Biennial Report of the State Board of Fish Commissioners from Dec. 1, 1884, to Dec. 1, 1886}, by Dr. Joel C. Parker, John H. Bissell, Herschel Whitaker, Walter D. Marks, vol. 7, Lansing, 1887, 7.
  \item \textsuperscript{183} Ibid., 102.
  \item \textsuperscript{184} State of Michigan, \textit{First Report of the State Commissioners and Superintendent on State Fisheries, for 1873-4}, Lansing, 1874, 16.
\end{itemize}
development, and the reproduction of valuable animal life.”\textsuperscript{185} This industrial art was strengthened not by brawn or muscle, as was often the case when working the nets, but by knowledge and intelligence in order to ascertain the correct methods and processes to develop a “seamless garment of perfection.”\textsuperscript{186}

The pipe dream artificial fish propagation could generate in the minds of those connected to the fishing industry, commercial or recreational, was itself a product of wild assumptions. They believed it was sure to alleviate any calamity from fish harvesting advancements, pollution, and ineffective or unenforced regulations on Lake Michigan, the other four great lakes, and all inland lakes and streams in the region.

This belief was buoyed by the fact that a spawning fish carries huge amounts of eggs, which influenced greatly the assumptions of the fish culturists. To many, artificially spawning fish in a laboratory setting was little more than a numbers game. They saw the restoration of the waters as a simple task of gathering, impregnating, and hatching all of the fish eggs of the desired species. This widespread pre-ecological understanding of aquatics lead many to assume that at the moment the fry were released into the wild, all the superfluous practices in the past would be absolved, and within a few years the waters would brim with valuable species.\textsuperscript{187} There were field notes of concern regarding high percentages of loss of released fish in the wild at this time, but noted fish culturists passed this off as a small concern that would be remedied in the near future.

\textsuperscript{185} Ibid., 16. 
Listed below are the numbers of lake whitefish artificially propagated and relocated into Lake Michigan by the U.S. Fish Commission. These numbers do not include the fish propagated and relocated by individual states. The sheer numbers speak for the depth of optimism many held for the artificial fish programs at the federal level. The Great Lakes, many believed, were the domain of the United States, and the continuation of the lake whitefish was no trivial matter but one of national importance.\(^{188}\)

<table>
<thead>
<tr>
<th>Year</th>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1875-'76</td>
<td>130,000</td>
</tr>
<tr>
<td>1880-'81</td>
<td>5,000,000</td>
</tr>
<tr>
<td>1881-'82</td>
<td>7,500,000</td>
</tr>
<tr>
<td>1882-'83</td>
<td>11,000,000</td>
</tr>
<tr>
<td>1883-'84</td>
<td>20,000,000</td>
</tr>
<tr>
<td>1884-'85</td>
<td>25,060,000</td>
</tr>
<tr>
<td>Total</td>
<td>68,690,000</td>
</tr>
</tbody>
</table>

Table 3: Lake Whitefish Fry Deposited, Lake Michigan, 1875 – 1885.\(^{189}\)

A whitefish fry reaches maturity if it is given the mandatory four to six years to develop naturally.\(^{190}\) Expanding from the laboratory trials of early fish culturists N.W. Clark, Seth Green, and Mr. Wilmot from Ontario in dealing with lake whitefish, the fish commissioners from the state of Michigan believed that all of the waters of their state could be restocked fully or nearly so with whitefish “if proper means are used.”\(^{191}\) In the spring of 1877 Michigan deposited 1,520,000 whitefish fry into Lake Michigan.\(^{192}\) In the

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mid-1870s, the state of Wisconsin donated to the city of Milwaukee, a large room in the water works building with the intent to artificially hatch tens of millions of fish.\textsuperscript{193}

In 1878, fish culturist Oren M. Chase developed a bell-shaped glass jar with a one to one-half gallon capacity with water flowing upwards from a glass tube at the bottom, creating a gradual but constant current for the fish eggs. This was necessary in order to prevent the eggs from adhering to each other during the propagation stages.\textsuperscript{194} As the water flowed the healthy eggs were separated. This made it possible to simultaneously oversee a multitude of jars to produce an adequate amount of young fry at an affordable cost, in order to replenish the Great Lakes.

With a similar amount of effort, hundreds of millions of eggs could be hatched as opposed to just thousands before the invention of the Chase Automatic Jar. The only obstacle to the distribution of this jar pertained to expenditure, and the only obstacle to ensuring the expenditures were justified had to do with acquiring the wild fish eggs.\textsuperscript{195} One hundred and thirty bushels were required to fill the 1,029 jars at the Detroit hatchery with lake whitefish eggs.\textsuperscript{196} After fertilization, the required time the eggs needed to incubate was four months with minimal labor.\textsuperscript{197}

In the early 1880s, the Michigan fish board reported that their propagation capacity could restock “all suitable inland lakes and more than [make] good the supply in

\textsuperscript{195} State of Michigan, Tenth Biennial Report of the State Board of Fish Commissioners, 7.
\textsuperscript{196} Ibid., 8.
\textsuperscript{197} Ibid.
the Great Lakes" if a small expenditure increase was permitted.\textsuperscript{198} The Michigan board furthermore wished to include a broad scientific study on the program’s results and survey new bodies of water for the purpose of concluding whether or not their temperature, depth, and food supply was biologically appropriate to be stocked with valuable fish species, according to the fish market.\textsuperscript{199}

The board claimed their facilities, if funding was increased, could develop and distribute no fewer than 200,000,000 whitefish annually. In 1883 the cost to raise and plant 1,000 lake whitefish and lake trout was $1.85 with a $15,000 biennial budget. The board argued, the cost to raise and plant 1,000 fish would be reduced to less than $.10 if the biennial budget was doubled. The budget increase was granted, and the board used around $11,000 of the $30,000 for new hatching stations that raised efficiency and capacity to new heights. The new updated propagation program operated on an annual budget of $10,000 or less for maintenance.\textsuperscript{200}

Transporting the fish from the hatcheries required a suitably designed railway car that could securely facilitate the delicate operation without loss to the eggs or fry. In 1883 no adequately designed car existed. A new car would have to be developed and would cost between $1500 and $1800.\textsuperscript{201} The fish plantings that year were carried out using ten-gallon tin cans with capacities ranging from 20,000 to 35,000 fry depending on the estimated time of travel which often spanned from three days to a few hours.\textsuperscript{202} If an even and cold temperature is maintained during travel, the percentage of loss is reduced, so it

\begin{footnotesize}
\textsuperscript{199} State of Michigan. \textit{Fifth Biennial Report of the State Board of the Fish Commissioners for 1881-82}, 5.
\textsuperscript{200} Ibid., 4.
\textsuperscript{201} Ibid., 5.
\end{footnotesize}
was not uncommon for the tin cans to have ice dropped inside. Different rail companies who also waived the passenger fees for the attendants hauled the rail car used during these plantings for free for these six weeks that were needed to disperse the fry.\textsuperscript{203} The savings accrued from free rail service each year added up to hundreds of dollars.\textsuperscript{204} The lake whitefish plantings from Michigan into Lake Michigan was 10,500,000 in 1883 and 15,800,000 in 1884.\textsuperscript{205}

In 1885, the total capacity with 520 “Chase” jars was 69,680,000 eggs between the two lake whitefish hatching operations at Detroit and Petoskey, Michigan. A loss of ten to fifteen percent was recorded following the first round of hatching. The optimism for fishery science surfaced in state reports. Michigan’s seventh report to the fish commissioners said the Chase Automatic Jar “is more natural than nature.”\textsuperscript{206}

A Michigan statistical agent from the Board of Fish Commissioners recorded “intelligent” testimonies in 1886 from many fishermen on the east shore of Lake Michigan and Green Bay. Agent Lyman A. Brant heard success stories about the artificial propagation programs to restore small fish the fishermen observed the previous year.\textsuperscript{207} However, state fish boards, like Michigan’s, publicly stated that they did not know “what fish-culture can do for the State” as it was “not generally understood” that same year.\textsuperscript{208} The plan by propagation supporters was to “restore the fisheries at two or three average places.” Then the restoration could be increased exponentially, as there would be little

\textsuperscript{203} Ibid.
\textsuperscript{204} State of Michigan. \textit{Seventh Biennial Report of the State Board of Fish Commissioners from Dec. 1, 1884, to Dec. 1, 1886}, 79.
\textsuperscript{205} State of Michigan. \textit{Sixth Biennial Report of the State Board of Fish Commissioners for 1883-84}, 15.
\textsuperscript{207} Ibid., 23.
\textsuperscript{208} Ibid., 101.
public doubt to the outcome regarding artificial fish propagation programs. 209 These supporters continued to argue that the programs were not being conducted on an “adequate scale” despite the fact 50,000,000 lake whitefish were hatched annually. It was the goal to increase the output between 900,000,000 to 1,200,000,000 whitefish fry. 210

The original propagation experiments were born from curiosity and scientific interest, but had since taken a serious note because this science grabbed the attention and funding from multiple states as well as the federal government. The state of Michigan as of 1893 alone planted almost 750,000,000 whitefish since 1874, half of which were planted between 1888-1892. 211

By 1892, the avenues to harvest increased in efficiency and fishermen remained eager to profit from what dropped out of their nets, no matter the size. On any given day during the season, thousands of miles of nets were in place, preventing planted lake whitefish and other fry from reaching maturity. Yet, the commercial fishermen were impressed with the propagation results as evidenced by increasing amounts of testimony, which a few years earlier was reserved for only denouncing or “poking fun” at the scientific fish propagation experiments. 212

The residence of young fish throughout the year, their diet during their life cycle, tenure over their natural spawning beds following the hatch, and a myriad of other questions were being asked by Michigan fish commissioners in the early 1890s to deduce

209 Ibid., 102.
210 State of Michigan, Seventh Biennial Report of the State Board of Fish Commissioners from Dec. 1, 1884, 102.
211 State of Michigan, Tenth Biennial Report of the State Board of Fish Commissioners from Oct. 1, 1890, to Dec. 1, 1892, 8.
212 Ibid., 11.
the practicality of fish propagation.²¹³ The answers swam in the depths, and through scientific investigations under the guidance of state fish boards, skilled scientists were dispatched to find practical answers in order to generate practical results.²¹⁴ Twenty years later, on the eve of World War I, the sentiment toward fish culture, otherwise known as artificial propagation was still considered "a sure guarantee" for restocking any and all waters year to year, thereby creating "a food factor for all classes."²¹⁵

Three Presages to Calamity

The exact season or even year the first time commercial fishing occurred on Lake Michigan remains a mystery, but due to the proximity of good shoreline markets and access to many more by rail, Lake Michigan had been fished to the limit since settlement. Lake Michigan yielded more harvested lake trout than all the other Great Lakes combined. At the start, lake whitefish was the principal species but soon fell to the lake herring in 1870 and lake trout after 1880. Yet, the lake trout were unimportant as long as the whitefish remained bountiful.²¹⁶

By the fall of 1884 the Michigan commissioners distributed a letter requesting general information from the fishermen or those familiar with the fisheries because of a lack of funding to dispatch an agent to the various spots. The letters were mailed with an enclosed pre-stamped return envelope. There were four points of interest the commissioners sought guidance on:

²¹⁶ Koetz, Fishing Industry of the Great Lakes, 564.
1. Whether the average size of the fish caught was increasing or decreasing.
2. Whether the general product in pounds increased or decreased.
3. The same as to the extent of ground fished.
4. Whether more or fewer men, boats, and nets were employed than formerly.  

It was not until the mid-1880s when lake sturgeon and other fish, such as the yellow perch, found a stable demand in the market. A statistical agent with the Michigan Board of Fish Commissioners remarked in 1885, “In the immediate vicinity of large towns around the entire lake coast the common yellow perch (perca Americana) is caught in large quantities. This is especially true of Lake St. Clair and the southerly end of Lake Michigan.”

The number of persons, vessels, quantity and value of fishing apparatuses, fish products, and capital invested increased dramatically on Lake Michigan over the course of 5 years. In the late 1800s there were freezer houses in the state of Michigan at Escanaba, Fairport, Sturgeon Bay, Petoskey, and Traverse City. The table below shows the particulars behind the increase between 1880 and 1885.

<table>
<thead>
<tr>
<th></th>
<th>1880</th>
<th>1885</th>
<th>Value, 1880</th>
<th>Value, 1885</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons employed</td>
<td>1,578</td>
<td>3,378</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steamers</td>
<td>30</td>
<td>82</td>
<td>$63,400</td>
<td>$267,600</td>
</tr>
<tr>
<td>Fishing</td>
<td></td>
<td>70</td>
<td></td>
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217 State of Michigan. Sixth Biennial Report of the State Board of Fish Commissioners for 1883-84, 8.
218 Bogue, Fishing the Great Lakes, 168.
219 Chiarappa, “Great Lakes Commercial Fishing Architecture,” 222.
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Table 4: Increase in persons, vessels, fishing apparatuses, fish products, and capital invested, 1880 – 1885.

The Beaver Islands and Green Bay of Wisconsin maintained the most important fisheries in 1885 where no fifty miles of stretch was absent of one pound net. If a pound net fisherman wanted to catch whitefish in 1885 he had to drop the nets near the Beaver Islands or along the northern shores. For years the heart of the pound net fishery rested off Green Bay, Wisconsin, but the southern half of the bay saw a dramatic fall in whitefish, causing the fishermen to target herring and other species. Data from numerous state fish reports conclude that the then current methods of fishing were the “most disastrous” obstacle to the appropriate maintenance of the fisheries.

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221 Ibid., 14, 16.
223 Ibid., 16.
224 Ibid., 73.
First Presage: Nets and Small Fish

Any fisherman with one degree of common sense would know that the practice of taking small fish by any net design at a higher rate than what any reproductive measure, be they natural or artificial, can for any given year would cause a population decrease. One central cause of the decline was the capturing of large numbers of small fish by pound nets. Fishermen in each locality agreed that this behavior was a potent factor in the rapidly decreasing yield of lake whitefish and pickerel. The capture of half-grown, immature fish was considered less legitimate, but when considering that the total number of mature fish in the early 1870s would be no greater than the demand, fishermen had an incentive to sell what fish they could, even smaller fish.

In 1880 Great Lakes fish cost four cents per pound. Three years later that same pound cost five to six cents as the lowest price but the average cost stayed between twelve and fifteen cents.

Harvests procured from the pound nets during spring and summer in 1871 along the western shoreline of Lake Michigan were estimated to contain from one-twentieth to one-sixth of small fish. When these fish were prepared for salting, on average a fish weighed less than eight ounces. The alternative was to discard them. A considerable number of commercial fishermen did because the small fish were not large enough to be suitable for market. Milner observed the danger in pound net fishing, as “entirely wrong and destructive to the fishing interests.”

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227 State of Michigan. Sixth Biennial Report of the State Board of Fish Commissioners for 1883-84, 8.
229 Ibid.
season diminished those species by perhaps a hundred to one because every premature fish was prevented from spawning.

Gill net fishermen and some regulating bodies suggested fully prohibiting the use of pound nets because it was believed to be the simplest and most effective way of addressing the loss of small fish. The problem with this solution was its failure to protect pound net fishermen from financial ruin because the equipment for pound net fishing is woefully useless for any other purpose. Plus, the reduction of nets in the water meant a reduction in fish products, which would have had a noticeable negative impact on the market. The idea of removing the smaller fish by hand out of the pound net “pot” was suggested repeatedly. Milner noted such an idea was shortsighted, not only due to low probability of enforcement, but also because whitefish are too delicate for repeated handling.\footnote{Milner, \textit{Report of the Fisheries of the Great Lakes}, 21.} A law limiting the number of pound nets per mile was a favorable piece of legislation that was repeatedly proposed but failed to materialize. As was reducing the length of the pound net leaders, which at the time was obstructing the movement of the fish and limited the rights of other fishermen as the fish’s freedom of movement was prohibited.\footnote{Ibid., 23.}

The reason behind why the gill net is not responsible in the taking of small fish is simple: the nets were set too deep. The shallowest employed depth for a gill net when Milner made his report was twelve or fifteen fathoms.\footnote{Ibid., 18.}

The ecological destruction of small fish from small mesh-diameter pound nets was immense. G.A. Sheley from the U.S. Fishery Commission visited fishing camps on Lake Michigan in 1884 to note the knot-to-knot diameter of mesh nets in the pound net
fisheries. He noted a mesh size range from 3½ inches to 1½ inches. As of 1884, gill net fishermen were catching a few fish per day where they formerly caught hundreds. Just a few years earlier, in 1878 at Washington Island, Wisconsin, over five thousand barrels, equal to seven million-five hundred thousand young whitefish, were thrown away for being too small to market.

When Sheley asked the fishermen what would have they liked to see happen, the response was a collective “net fishing (at least the pound nets) should be discontinued during the month of November” because they were used “on both sides of the shoals” [sand or gravel banks/bars] while the fish spawned.

Sheley thought that a vessel should inspect the nets for legal mesh size and remove any nets during the month of November if they were dropped near any spawning grounds. Testimony from Laflin and Co., wholesale dealers in oysters and fish, described a dire situation at Saint Joseph, Michigan regarding the size of lake whitefish being caught in April 1884:

A fisherman tells us that three years ago large quantities of young whitefish were put in the water there. This spring the same whitefish are being taken out by the tons. The fish are small, only half grown, and will not endure warm weather long after being taken; they are about 8 or 9 inches in length. If they were allowed to grow another year they would increase in quantity and the same fish be a No. 1 fish. The reckless waste of the fish is due to the men fishing there with small mesh gill-nets. We are told some of the meshes are only 3½ inches. If there was a national law preventing the using of any gill-nets less than 4¾ or 4 7/8 inches mesh, these small fish would escape and mature into good solid fish. The majority of regular fishermen around the lakes favor stringent laws preventing the taking of small fish, but take no steps, as they don’t want to incur the ill-will of their neighbors who use small nets.

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235 Sheley, Destruction of Fish Caused by Nets of Small Mesh in Lake Michigan, 353.
236 Ibid.
In a separate testimony dated May 7, 1884 Laflin & Co. went on to say,

In many cases fishermen go 20 to 30 miles away to fish and bring their fish with steam-tugs to shipping points...To limit size of meshes of both pound and gill-nets for next season would work no hardship on fishermen, as they renew their scines [nets] each spring. The fish are literally caught out in Lake Michigan, and where there ought to be a large source of food supply to a rapidly filling country, it is being foolishly wasted by a few men to make a living for the time being, who do not intend to stay in the business permanently. A law ought also to be enacted regulating the depth of water in which fishing should be done during the spawning season, and there should not be the reckless waste of trout there is each fall. They are caught all around the lake in such quantities that many are valueless and cannot be sold for food. In Green Bay and at Ahnapee, Wisconsin and in fact all along the western shore of Lake Michigan, trout are caught by the ton and thrown away, because the demand falls off when the catch increases. They are not fit to salt...One-fishermen, when told he was doing wrong in fishing out such small fish, laughingly remarked that the United States were going to put 10,000,000 more in at Saint Joseph this year for their benefit.238

**Second Presage: Lake Sturgeon – The Hapless Fish**

Commenting on the lake sturgeon fishing in 1884, H.C. Hovey from the *Scientific American* observed that when sturgeon were abundant in May, the market was already inundated with more delectable choices of Great Lakes fish.239 The market for sturgeon was opened when fish packers in New York City began freezing dressed sturgeons with a patented method that froze the fish solid. This technological improvement meant fish could be stored for months until needed in the market. For example, a fish warehouse in Salem, New Jersey, could freeze one hundred twenty-five dressed sturgeons weighing an average of eighty-five pounds “every seven hours.”240

Prior to the 1860s, commercial fishermen considered lake sturgeon terrible nuisances because they ripped and sank their nets after being entangled. Sturgeon were wounded for sport and thrown back in the water with the intention to dissuade other sturgeon from swimming into other, more important commercial fishing areas. The

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240 Hovey, *The Sturgeon Fishery*, 346.
sturgeons that were caught “trespassing” were killed and stacked like cordwood in the shape of pyramids and set ablaze on beaches. Sturgeons were burned as fuel in marine boilers, fed to pigs, and turned into fertilizer or were left to rot for scavenging wildlife.²⁴¹

The techniques to catch lake sturgeons included any sort of net and gaff hooks attached to batons swung from small boats. The gaff hooks were preferred when the sturgeons were “rolling” over their spawning grounds.²⁴² Observers have witnessed the rolling, splashing, leaping movements of these big fish at spawning time. When these ancient fish were caught with gill nets, the gap knot to knot was a foot wide and each net was about twelve hundred feet long.²⁴³

Lake sturgeon flesh is coarse and oily and several cooking methods existed but there were two methods that at the time held the most promise of being delicious: pan-fried and boiled. Some pickled the flesh after boiling, mostly Scandinavians, who considered pickled sturgeon “excellent.”²⁴⁴ Smoking the flesh was the standard practice to reach market. After one night hanging over a slow-burning fire of hardwoods, the strips of smoked sturgeon flesh were then shipped to any consumer nationwide thanks to the expanding railroad network. Caviar enjoyed a higher demand in Russia and Europe but was being prepared in the United States as an important feature of the Lake Michigan commercial fishing industry, as its consumption was higher in states to the west and south of the Great Lakes. The states in the South enjoyed the best hard caviar, which in early spring, was “said to be fifteen to twenty cents per pound.”²⁴⁵

²⁴¹ Bogue, Fishing the Great Lakes, 158.
²⁴² Bogue, Fishing the Great Lakes, 161.
²⁴³ Hovey, The Sturgeon Fishery, 346.
²⁴⁴ Ibid., 347.
²⁴⁵ Ibid.
U.S. Commissioner of Fisheries, Hugh Smith, recalled the history of the lake sturgeon in his official report, “Passing of the Sturgeon,” as “one of the most distressing in the whole history of the American fisheries.” Sentiment expressed by a commercial fisherman on Lake Erie in 1894 about why they harvested lake sturgeon was shared throughout the Great Lakes: “A sturgeon is like a hog in a hen roost. They go around and suck up all the spawn there is. . . . You take a sturgeon weighing 50 lbs., what a lot of spawn he is going to lick up in 24 hours.”

Commissioner Smith added a fitting reminder for his American brethren about the nature of mankind: that we are “witnesses to the cruelty, stupidity, and profligacy of man.”

_T h i r d  P r e s a g e :  A l f r e d  B o o t h  —  T h e  D e v i o u s  F i s h  D e a l e r_

In April of 1886, in Chicago, experienced commercial fisherman and powerful fish dealer, Alfred Booth, argued at length in front of the American Fisheries Society about the core duties of the state and national fishery authorities. To A. Booth, they were to increase the number of artificially hatched young whitefish in addition to remedying the decay of fish populations found across the Great Lakes. When that was achieved, then there would be no need for the budget to regulate the industry.

The business acumen of A. Booth Packing Company greatly affected the fish resource because the company created their business motto around major fish production for Lakes Michigan and Superior. There was a clear drive of the company to control every step in the Lake Michigan fisheries: harvesting, processing, and marketing.

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246 Bogue, _Fishing the Great Lakes_, 157.
247 Ibid., 161. Smith said this because within his own generation, sturgeons had been pulled out of the Potomac River and discarded.
In 1850, as legend has it, English-born Alfred Booth, at twenty-four, began by buying fish from Lake Michigan fishermen and distributing them through the streets of Chicago. His timing could not have been better because the economic stimulus of the Civil War enabled him to earn $8,000.00 to $10,000.00 in 1862 and $100,000 to $250,000 in sales nine years later. 249

By 1870, fleets of fishing steamers or tugs owned by the A. Booth Packing Company started sweeping northern Lake Michigan. The company arranged a biweekly schedule for two or three vessels to return to Chicago for unloading. The company owned a ninety-foot tug that collected fish at Manistique, Michigan, St. Martin Island, and Washington Island before returning to Chicago biweekly. 250

This company, a sweeping titan, established a strategic business plan where the company would fish commercially of its own accord, buy at will any and all catches from other fishermen, sort and process the daily catch at their leisure by owning the fish processing facilities, and market the fish products well into the twentieth century. 251 In 1880, a freezer facility was constructed by A. Booth Packing Company in Escanaba, Michigan, a first for the company, before more were built. Distribution of fish, fresh or frozen, from Escanaba surpassed one million pounds in 1884. 252 Large fish firms such as A. Booth and Company coordinated their shipping with rail systems linked to Chicago primarily in order to control the movement of Lake Michigan fish into the North American market.

249 Jensen, Wooden Boats and Iron Men, 14.
250 Jensen, Wooden Boats and Iron Men, 14.
251 Bogue, Fishing the Great Lakes, 275.
252 Ibid., 62.
In order to operate like clockwork on crowded waters, the wholesale dealers carved out competition amongst themselves through lake-by-lake jurisdictions. By 1893, three large clusters of dealers controlled the harvesting and marketing of the majority of the catch from the Great Lakes. The dealers in Cleveland and Sandusky monopolized western Lake Erie. In Buffalo, dealers cornered parts of eastern Lake Erie, Lakes Huron and Ontario. From Chicago, A. Booth Packing Company controlled most of Lakes Michigan and Superior.  

Alfred Booth, president and CEO of A. Booth Packing Company, astutely summed up the industry’s attitude in 1885:

It did not take long for capital to see the rewards which might be gained by reaping the fields which nature had so abundantly supplied with a crop [Great Lakes fish] that cost nothing for the sowing or raising, and but little for the reaping.  

The ethos expressed by the A. Booth Packing Company was capital-intensive, buoyed by the immigrant wage-labor system. A. Booth and Company benefitted twofold from its financial dominance and its cumulative territorial claims with pound nets, warehouses, docks, freezing houses, and fleets.

It was Booth’s personal goal to consolidate and dominate the entire fishing industry of the Great Lakes by controlling the majority of the fish dealers. That became a reality in the wake of the 1893 depression, which allowed Booth to arrange a merger designed to consolidate the vital fisheries of the Great Lakes.

By an Illinois corporate anti-trust law, on July, 20, 1898, A. Booth Packing Company was changed into A. Booth and Company, commonly referred to as the “fish trust” after the A. Booth Packing Company gathered multiple failed fish dealerships.

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253 Bogue, Fishing the Great Lakes, 56.
254 Ibid., 44.
255 Ibid., 58.
following the 1893 depression. The Booth interests argued the merger would eliminate wasteful competition, steady the market, and assist in the preservation of small, immature fish species. The corporation also claimed the merger made sound business and conservation sense, as it was valued at $5,500,000 that year.

After 1899, A. Booth and Company gained a fierce reputation for intimidation, law breaking, and fleecing fishermen. Alfred Booth’s monopoly or near monopoly of fish marketing provided him with the ideal opportunity to set the market price straight from the fishermen’s nets. Yet, Booth’s business acumen could not entirely shield his company from the month long Panic of 1907. In 1909, a year after declaring bankruptcy, A. Booth and Company was renamed the Booth Fisheries Company.

Booth’s company initiated manufacturing unique fish products after World War I such as “fish cakes ready to fry, boneless herring, finnan haddie, fish flakes and smoked fish of all kinds.” His Chicago-based operation would later morph into ten retail stores in major American and Canadian cities, because nearly $6,000,000 of the company’s $23,000,000 of capital assets were allocated for distribution in the mid-1920s. Booth Fisheries Company peaked leading up to World War I, but had to declare another bankruptcy, a tragic but all too common affect from the Great Depression and never quite regained its previous influence.

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256 Ibid., 72.
257 Ibid., 73.
258 Bogue, Fishing the Great Lakes, 265.
259 Ibid.
260 Bogue, Fishing the Great Lakes, 275.
261 Ibid.
Chapter Four: The Optimism Fades with the Fish, 1900-1925

Rowboats and sailboats were abandoned as primary fishing vessels in the early part of the twentieth century but stayed near the shore or harbors, as they tended to the pound net fisheries or where shallow gill nets were set. The steamers or tugs specifically constructed for commercial fishing, fitted with oil-burning steam engines, were often the largest constructed with a range of over one hundred miles.\textsuperscript{262} The gill nets were the main apparatus dropped by steamers or tugs at this time, because since 1900 the tugs had been equipped with mechanical net lifters. There were two types of lifters but only one was widely used, because it utilized a revolving drum with two rows of rubber-tipped teeth that came together, and then separated as the drum continued to revolve. The speed of the drum's revolution was controllable, allowing the men handling the nets and fish to determine its pace.\textsuperscript{263}

Once wasteful fishing methods and pollution hammered the lake whitefish and lake sturgeon stocks, lake trout were then chiefly caught in deeper water with hooks. This continued haphazardly until around 1900 when the then antiquated techniques were replaced by commercial setlines. Setlines previously used for catching sturgeon off Milwaukee, Wisconsin were then set in great numbers to harvest lake trout. The hooks, ordinarily two thousand five hundred to three thousand to a gang, were fastened at different intervals by a fine line.\textsuperscript{264} The length of a setline was determined by the number of hooks to be used. It was not uncommon for a line to stretch several miles because thousands of hooks were thrown overboard. The effectiveness of this tactic when used properly tied with its inexpensive operating costs explain its popularity until 1917. That

\begin{footnotes}
\item[263] Ibid.
\item[264] Ibid.
\end{footnotes}
was when hook steamers ventured into Lakes Huron and Superior when the supply of trout dwindled in Lake Michigan.\textsuperscript{265}

The escalation in native “rough” fish was the result of long-term, ill-advised commercial fishing practices that caused further ecological imbalances amongst predator and prey populations.\textsuperscript{266} The title “rough” fish had an ambiguous meaning, but to the fishermen, it meant those species that were not as economically viable as the “big four” because many more were needed to make a livable income as a commercial fisherman. To other commercial fishermen the term simply referred to specific fish like the perch, bowfin (a.k.a dogfish), carp, chubs, sheepshead, bullhead, and suckers.\textsuperscript{267} No matter from which angle rough fish were considered, one thing was for sure: they provided a cheaper, wholesome food for many American families when they could no longer afford the more delectable commercial fish species. “Rough” fish numbers can increase in slightly murkier waters because they are capable of surviving in low oxygenated waters, or with no oxygen in the water for long periods of time.\textsuperscript{268}

The first reported harvests of chubs were in 1869 out of Grand Traverse Bay, Michigan. Just like the lake whitefish, the chubs were salted and sold cheaply as a local fresh fish in limited quantities to wholesale grocers.\textsuperscript{269} Around 1885 many fishermen adopted chub fishing, as smoked fish products became incredibly popular. Six years later chubs were being caught from Sheboygan, Wisconsin to St. Joseph, Michigan, and for a window of time, the supply surpassed demand. During the 1890s there was a sharp decline in fish so the mesh on gill nets were enlarged. By 1900 commercial chub fishing

\textsuperscript{265} Koelz, *Fishing Industry of the Great Lakes*, 563.
\textsuperscript{266} Bogue, *Fishing the Great Lakes*, 166.
\textsuperscript{267} Ibid.
\textsuperscript{268} Bogue, *Fishing the Great Lakes*, 169.
\textsuperscript{269} Koelz, *Fishing Industry of the Great Lakes*, 565.
became an industry at most ports on Lake Michigan, but by 1910 the chub fishery declined in alarming numbers. The decline was drastic enough to where Wisconsin registered vessels and reduced the mesh diameter to 2 ½ inches. \(^{270}\)

At the turn of the twentieth century the widespread appetite for fish far exceeded supply. \(^{271}\) For the Great Lakes, total market production for the “big four” commercial fish dropped from seventy-four percent in 1880 to sixty-nine percent in 1899 and hit a low of sixty-three percent in 1903. \(^{272}\)

The nonpartisan, Wisconsin Board of Fish Commissioners was a vital component of the state government. The focus of these commissioners centered on “practical results for the money expended” and this attitude led the commissioners to conclude in 1908 that, “the work of the Commission is second to that of no other state fish commission in extent and practical results.” \(^{273}\) This conclusion was buoyed by the five updated hatcheries, one hatching station and 900 acres of property administered by Wisconsin.

There were some years the fish reports from the state of Michigan were virtually silent on the propagation programs for the Great Lakes, and gave preferential treatment to the inland lakes due to the rising popularity of recreational fishing. This was not from malicious intent from the state board of fish commissioners, but from the board’s decision to cease the Great Lakes propagation programs in 1897. \(^{274}\) It was also the intent

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\(^{272}\) Bogue, *Fishing the Great Lakes*, 169.

\(^{273}\) State of Wisconsin. *Biennial Report of the Commissioners of Fisheries of Wisconsin for the Years 1907 and 1908*, 34.

of the Michigan board to not overstep the federal government's effort to maintain the
supply of commercial fish for the Great Lakes.

The nine census years highlight the abundance in pounds and what happened to
the fish stocks from 1880 to 1922.

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</tr>
<tr>
<td>Perch</td>
<td>3,313,000</td>
<td>3,256,000</td>
<td>2,362,000</td>
<td>1,244,000</td>
</tr>
<tr>
<td>Suckers</td>
<td>2,917,000</td>
<td>2,510,000</td>
<td>2,118,000</td>
<td>1,519,000</td>
</tr>
</tbody>
</table>

Table 5: Nine Selected Census Years Showing Harvested Fish Poundage.

Observations include the following: lake trout were the principal species in 1922;
sturgeon met their demise after 1890; the whitefish and trout were supplanted by the
herring/chub fishery; and a slight bump in whitefish numbers from 1908 to 1922. The
fishermen spent years needlessly destroying sturgeon and immature lake trout and
whitefish when they were taken because there was no market because the trout and
whitefish were too small and light for market. Government at all levels failed to check the
wanton destruction of the American fisheries.

**Small Nets and Immature Fish**

The observation of small-mesh gill nets continued into the twentieth century to
harvest chub and herring and in doing so removed from Lake Michigan "a great many

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small lake trout weighing about one-fourth of a pound each.\textsuperscript{276} As of 1902, a number of fishermen abandoning small-mesh gill nets in not only Green Bay but also Lake Michigan were visible enough to be officially observed after realizing the crippling effect of their nets.\textsuperscript{277}

Yet, there were calls for alarm as rising numbers of commercial fishermen called foul on the use of small-mesh nets for lake whitefish and lake trout. As of 1907, no new law to restrict the use of small-mesh nets was enacted in ten years even though “the fishermen have increased their investments in nets, boats, and other appliances, taken advantage of vast improvements in apparatus and transportation; …and pursued the fish so persistently and with so little regard to the future, that, notwithstanding the efforts of the fish commissions of the state and nation, the catch of the better classes of commercial fishes is not increasing in pounds as it should.”\textsuperscript{278}

The status of the Great Lakes fisheries in 1907 stood in detriment as widespread use of small-mesh nets, particularly in Lake Michigan continued. The result from using small-nets was all too common; “hundreds of tons of small, immature whitefish and lake trout weighing from one-fourth to one and one-half pounds each” were caught each season before they could mature.\textsuperscript{279} This practice negated and undermined the basic principles of why state and federal fish commissions optimistically adopted the artificial fish propagation programs. Leaving the small fish to swim freely through the nets until natural maturity would create two positives: a larger fish means an increased weight,

\textsuperscript{277} Ibid.
\textsuperscript{279} Ibid., 24.
which in turn makes for a higher profit. The price of these small fish per pound was two
cents in 1907 and at two hundred thousand pounds, the profit would be $4,000.00. If a
three-year moratorium on small fish harvesting was enforced, that would multiply the
profits by nine for a total of $36,000.00 (800 percent gain).\footnote{State of Wisconsin. Biennial Report of the Commissioners of Fisheries of Wisconsin for the Years 1905 and 1906, 24.}

The solution to the small-mesh nets could have been found in developing prudent
laws with tangible intent of enforcement. Even the Commercial Fishermen’s Association
pushed for laws that restricted nets with mesh diameters of three inches or less at the
December 1906 meeting in Milwaukee.\footnote{Ibid., 25.} There were numerous ranks of commercial
fishermen willing to “foster the immature fish.”\footnote{Ibid.} However, there were substantial
numbers of fishermen of a different sort who wanted to turn large profits. There was one
behavior that all fishermen appreciated and praised, the service from the “Fish
Commission in planting lake trout and whitefish fry in the Great Lakes,” for which the
commercial fishermen owed their livelihoods.\footnote{Ibid., 26}

The proliferation of small-mesh nets experienced its first setback in 1908 when
Wisconsin forbade nets “with meshes less than four inches” in its Great Lakes and inland
waters.\footnote{Ibid.}

\textit{Wisconsin Artificial Fish Propagation, 1900-1910}

The avenue the Wisconsin Fish Commission traveled “in order to obtain a suitable
supply of the spawn” began on October 16, 1899 when Wisconsin passed law Ch. 311,
Mar., 1899. This law authorized “the Commission to take fish at all seasons from the
outlying waters for stocking other waters or for the purpose of securing eggs for artificial propagation, and to dispose of said fish in such manner as they deem for the best interest of the state."\textsuperscript{285} Such concern for the spawn supply placed fish agents or commission employees on the vessels "to strip and melt the spawn as soon as the nets were raised."\textsuperscript{286}

Prudence may have been on the commission’s side, but the weather was not. The autumn of 1899 was unexpectedly warm, making egg collecting particularly difficult until the 15\textsuperscript{th} of November, when the first impressionable cold front guided the fish near shore. From then it took two weeks to collect the earmarked amount of eggs. Usually, the whole affair would be completed by the 10\textsuperscript{th} of November.\textsuperscript{287}

This arrangement guided the Wisconsin commission to establish contracts with “responsible” commercial fishermen in possession of nets, boats, and the necessary gear to fish on a wide cope during the breeding season.\textsuperscript{288} In 1900, 40,000,000 procured whitefish eggs were redistributed to Lakes Superior and Michigan to be placed in suspected spawning areas, and the commission considered this tactic practical as well as “… to be for the best interests of the state.”\textsuperscript{289}

The work of the Wisconsin commission from January to June 1899 centered around gathering fish ova, hatching, and planting fish fry or larger throughout the state.\textsuperscript{290} In March, about 5,000,000 lake trout eggs were transferred from the Bayfield Hatchery to the Oshkosh Station and the hatched fry were then later planted in Green Bay and across

\textsuperscript{286} Ibid.
\textsuperscript{287} Ibid., 30.
\textsuperscript{288} Ibid., 6.
\textsuperscript{289} Ibid., 7.
\textsuperscript{290} Ibid., 11.
Lake Michigan.\textsuperscript{291} For the remaining six months of 1899 the central focus continued to be collecting trout eggs. Within this biannual window, Wisconsin collected 30,372,000 lake trout ova. However, this collection and others were hit with high rates of infertility and the goal of 35,000,000 lake trout ova was unachieved.\textsuperscript{292}

Two factors that often further exacerbated the fish supply situation were unexpected warm weather that then delayed the arrival of spawning fish, and the employment of the inexperienced to handle the fragile fish eggs during artificial propagation and the delicate delivery of the fry.

The first six months of 1900 confirmed that the Oshkosh Station proved “to be of great importance to the state” as the station placed around 8,000,000 lake trout fry in Green Bay and throughout Lake Michigan waters administered by Wisconsin.\textsuperscript{293} By New Years Eve, the Oshkosh hatchery inventoried 40,000,000 lake whitefish eggs and 11,600,000 lake trout eggs. The Bayfield hatchery had 22,400,000 lake trout eggs and 10,400,000 lake whitefish eggs.\textsuperscript{294} The ova from the inventory were gathered from Lake Michigan off Door County, Wisconsin from contracts with commercial fishermen Albert Kalmbach of Sturgeon Bay and F. Koehn, Sr. from the Fish Co. of Sheboygan.\textsuperscript{295}

The state fish railcar, adjusted to transport spawn, fry, and larger fish while conducting mobile artificial propagation experiments, traveled 13,064 miles in 1901 and 3,617 more the following year.\textsuperscript{296}

\textsuperscript{291} State of Wisconsin. \textit{Biennial Report of the Commissioners of Fisheries of Wisconsin for the Years 1899 and 1900}, 12.
\textsuperscript{292} Ibid., 15.
\textsuperscript{293} Ibid., 24.
\textsuperscript{294} Ibid., 30.
\textsuperscript{295} Ibid., 29.
\textsuperscript{296} State of Wisconsin. \textit{Biennial Report of the Commissioners of Fisheries of Wisconsin for the Years 1901 and 1902}, 11.
In light of the annual November commercial fishing moratorium, it was suggested to include a June moratorium as well, "to increase the supply of fish in the lakes," in addition to offering fish culturists a second window of time to collect spawn.\textsuperscript{297} The Wisconsin commissioners stressed the high percentages of lost eggs and fry reproduced naturally, whereas a "fish culturist is able to save and hatch from fifty to ninety percent of the eggs" and be able to release "a corresponding number of young fish" for later use as observed in 1902.\textsuperscript{298}

When the Bayfield hatchery was established in 1897, an effort to plant "large numbers of Lake Superior trout in Lake Michigan" began. Results were seen in less than six years and stood as a testament to the optimism that perpetuated the propagation programs because the harvest quota in 1901 and 1902 from Lake Michigan recorded "a considerable number of red-meated trout" which is in-fact indigenous to Lake Superior.\textsuperscript{299}

As the demand for delectable freshwater fish from the Great Lakes escalated, it was becoming painfully apparent to the commercial fishermen, fish culturists, and fish dealers in 1902 that the demand "is impossible to meet."\textsuperscript{300} This was the opinion from Wisconsin fish commissioners even when thirteen species of fish fry were deposited for a total of 269,078,700 for 1901 and 1902.\textsuperscript{301} Lake trout and lake whitefish deposits accounted for fifty-two percent out of that total; but the total lake whitefish deposit

\textsuperscript{297} Ibid., 25.
\textsuperscript{298} Ibid.
\textsuperscript{299} Ibid., 26.
\textsuperscript{300} Ibid., 27.
\textsuperscript{301} State of Wisconsin. \textit{Biennial Report of the Commissioners of Fisheries of Wisconsin for the Years 1901 and 1902}, 100.
(102,270,000) for those two years was just larger than two-and-a-half times than the lake trout deposit (37,857,000).  

By the end of 1904, the Bayfield Hatchery had 16,000,000 lake trout eggs, half of which were collected from Lake Michigan. The U.S. Bureau of Fisheries contributed 10,000,000 lake whitefish eggs to the hatchery near the same time. The Oshkosh Hatchery had an egg inventory of 18,000,000 trout and whitefish eggs. From Lake Michigan 8,000,000 lake trout eggs were gathered and Frank Suthers on the Canadian side of the Detroit River delivered 10,000,000 lake whitefish eggs to the Oshkosh hatchery.

As of 1905, the lake trout was the “most important” Great Lakes fish as harvest quotas recorded higher ratios of lake trout. The lake trout fisheries in Wisconsin appeared “to be holding their own in amount and value of their products” according to the state fish commission.

36,630,000 lake trout fry were planted cumulatively by the state of Wisconsin for the years 1903 and 1904 in Wisconsin waters. Twenty-five percent of that total (9,270,000) was deposited into Lake Michigan in no less than six separate locations for both years. Lake whitefish fry were also planted at these locations at even higher rates but at fewer locations. A cumulative total of 57,875,000 whitefish fry were deposited by

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302 Ibid.
304 Ibid., 25.
Wisconsin in the years 1903 and 1904 with fifty-eight percent (33,800,000) deposited in Lake Michigan.  

The overall fry planted by Wisconsin during 1905 and 1906 was the most generous to date. The state received from the U.S. Bureau of Fisheries 10,000,000 lake whitefish eggs in 1905, and received 19,360,000 whitefish eggs with 7,004,000 lake trout eggs the following year. The lake trout fry planted in 1905 and 1906 in Lake Michigan by Wisconsin cumulatively totaled 9,301,000 or twenty-seven percent of the grand total fry produced and planted by Wisconsin. The lake whitefish fry planted was 31,322,000 or forty-five percent of the biennial grand total.

By 1906, the Lake Michigan commercial catch was average but the prices skyrocketed, making that "year the best year the fishermen on these waters ever had."

As a state fish commission, Wisconsin commissioners "hoped that the states bordering Lake Michigan will, as promptly as possible, cede to the federal government the right to regulate the fisheries of that lake on the same principles as it does those of the other Great Lakes." It is quite evident that Great Lake states were interested in widening cooperation with the U.S. Bureau of Fisheries as progressive politics swept across the nation like a brush fire. This new political attitude went opposite of the established tradition between states and the federal government over regulating the Great Lakes through the tenth amendment.

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306 Ibid., 73.
308 Ibid., 21.
309 Ibid., 64, 106, 110.
310 Ibid., 23.
The attendees of the Fourth International Fisheries Congress, the biggest congress to date, met in Washington, D.C. in 1908 to discuss artificial fish propagation, because the public's interest in fish hatching was rapidly increasing. No issue was more discussed or fretted about than replenishing and retaining lake whitefish all across the Great Lakes.\(^{312}\) The academic and field biologists or "experts," as they were commonly titled, unanimously "agreed that the best legislation for the development of the whitefish industry would be that which permitted fishing during the spawning season, provided, the states made arrangements by which all of the whitefish thus caught should be spawned, the eggs hatched, and the fry planted in the lakes.\(^{313}\) This strategy walked a fine line because fishing the same spawning fish with a different intent, no matter how slight, would be calamitous to the Great Lakes fishing interests. The International Fisheries Congress wanted to address the replenishing of the lake trout fisheries in the same fashion.\(^{314}\)

Dr. Paul Reighard communicated his research, which determined that planting 30,000 fish fry per square mile over lake whitefish grounds would maintain the stocks but even planting 10,000 could achieve a stabilizing effect on a fish population. Otherwise, any planting number below 10,000 would fail to achieve any goals.\(^{315}\) Dr. Reighard cited a recent field example off Manistee, Michigan when ninety square miles where planted with 90,000 fry per square miles, for a total of 8,100,000 fry. The following harvest was


\(^{313}\) Ibid., 11.

\(^{314}\) Ibid.

noted to be “a very great increase.” By using Dr. Reighard’s approach, if each square mile in every lake whitefish ground across Lake Michigan was planted with 30,000 fry, no fewer than 40,000,000 healthy fry would be required every year to replenish and maintain the fisheries.

Wisconsin fish commissioners on the other hand were expected to offer no “fundamental changes” to the existing fishery laws, for they thought it “wiser that Wisconsin, with the other states bordering Lake Michigan, should entrust the regulation of these fisheries to the federal government.” The spirit behind these sagacious regulations can be boiled down to two concluding sentences in the 1908 Commissioner’s Report:

An intelligent, uniform, and vigorously enforced policy is necessary, which will lead to the maximum protection of the interests, both of the fishermen and of the public. The preservation and increase of the commercial fisheries will depend in large part on wise legislation, and also, in great measure, upon the hatching and planting of enormous numbers of fry.

The railcar used to distribute fry “handled fifty-two car loads of fish” across 21,845 Wisconsin miles in 1908. Aside from the standard fish varieties addressed in Wisconsin hatcheries, the state also received 14,500,000 lake trout eggs and 40,000,000 lake whitefish eggs from the U.S. Bureau of Fisheries to be later planted throughout Wisconsin waters.

In contrast to the scientific progress over twenty-five years regarding fish propagation programs and academically studying “the life history of the commercial and

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316 State of Wisconsin. Biennial Report of the Commissioners of Fisheries of Wisconsin for the Years 1909 and 1910, 4
317 Ibid.
319 Ibid., 15.
320 Ibid., 23.
321 Ibid., 7.
game fishes” of the Great Lakes, Wisconsin fish commissioners reported, “...comparatively little is known of the natural food of the young fish we plant and of the conditions under which they thrive.” Furthermore, depositing fry with the utmost consideration was done with “no accurate knowledge” as of 1908, and commissioners still knew nothing about the food, temperature, etc. that fish concern themselves with in their life cycle. Therefore, it is not surprising that with a pre-ecological understanding of fish and aquatics, significant numbers of planted fish were lost every year for decades.

Admitting, and then setting aside their pre-ecological understanding, Wisconsin commissioners secured $30,000.00 of state funding for two additional hatcheries in 1907 even though the operational costs for the two new hatcheries were absent in that year’s budget.324

The 1909 Wisconsin hatching season had 40,000,000 lake trout eggs after 15,000,000 were replanted over the spawning beds in addition to the 25,000,000 eggs sent to hatcheries.325 The Wisconsin legislature passed a law that permitted lake trout fishermen under permit to fish for 15 days during the fish’s spawning season. Under this permit the fishermen had to abide by the following: catch and spawn the fish, fertilize the eggs, and pay all the associated expenses. The eggs not needed for the hatchery inventories were released over spawning beds and much bigger reefs. This law was passed by the State of Michigan circa 1910.326

323 Ibid., 31.
324 Ibid., 32.
In 1910, 27,400,000 lake trout eggs were inventoried by the Wisconsin hatcheries, an inventory surpassed only once since the state commissions began.\(^{327}\) The desire for the U.S. government to administer Lake Michigan continued on, as the designation of the Great Lakes moved away from regional importance to not only national but international importance.

By 1910, forty-nine fish hatcheries were in operation across twenty-six states, all utilizing four railcars designed for hauling fish and fish eggs.\(^{328}\)

*Lake Michigan and World War One*

The U.S. Bureau of Fisheries supported work by “scientific observers” between 1913 and 1915 that an acre of water could produce as much if not more food than an acre of land.\(^{329}\) Professor Dyche, a former curator of mammals, birds, and fishes at the University of Kansas, calculated that each Michigan family would generate an annual revenue of $19,092,000 for Michigan fisheries if they consumed fish twice a week.\(^{330}\)

During the war, the Canadian and American governments encouraged the public to consume larger quantities of fish to ease pressure on livestock. Each government printed and distributed information for homemakers about fish cuisine. The United States Food Administration printed patriotic posters picturing multiple fish with the quotation: “Save the Products Of the Land – Eat More Fish– They Feed Themselves.”\(^{331}\) The public responded by rapidly eating more carp and other rough fish in the span of five months. Beforehand, there was practically no market for carp in Wisconsin. Governor Emanuel L.

\(^{327}\) Ibid., 3.
\(^{328}\) Ibid., 13.
\(^{330}\) Ibid., 14.
\(^{331}\) Bogue, *Fishing the Great Lakes*, 276.
Phillip suggested that all municipalities sell these wartime rough fish at cost and most followed his suggestion. Contracts with Wisconsin based fishermen were made that fixed the price at two-and-a-half cents per pound. The retail price was determined by transportation cost but rarely rose above five cents for the same pound of fish.\textsuperscript{332} When the United States entered World War I in 1917, fifty percent more gill nets and around ninety percent more trap nets were placed to reach quotas barely equal to 1908 and still less than 1890 and 1899.\textsuperscript{333}

The practice of direct price discrimination was commonplace for fish dealers, large or small, in order for the seller to raise profit before the fish spoiled. For example, lake trout catches that passed through Chicago before reaching the smaller markets in Wisconsin or Michigan, where sold for about fourteen cents per pound, then the Chicago based fish dealers would ship the remaining frozen lake trout to Wisconsin and charge roughly twenty cents per pound.\textsuperscript{334} It was an unscrupulous time and one where fish dealers took advantage because there was no outside regulation significant enough to mandate different business practices.

During this time Wisconsin was not distributing the whitefish fry that would have aided the commercial fishing industry in the area. Instead, when the eggs were hatched and the fry were ready to be planted, the U.S. Bureau of Fisheries obtained them for the war effort. At the time, the law permitted the federal government to take lake trout and whitefish fry and store them for future use but what likely ended in their terminal


\textsuperscript{333} Koelz, Fishing Industry of the Great Lakes, 609.

inactivity when the fry could have been put to better use for the state as a commercial entity.\textsuperscript{335}

Men who had worked for the state fish commissions left for military service and the commissions found it difficult to hire suitable men as replacements. Without finding the proper candidates, the Wisconsin commission resorted to using messenger services to deliver the recently hatched fry into selected bodies of water.\textsuperscript{336}

The various railroads that hauled the converted Pullman cars to suit the fish commission’s needs were issued a new ruling by the federal government during the war. The ruling broke tradition; there would be a charge of thirty cents per mile with an additional cent for each commission employee or attendant. That may not seem like much but when two-thirds of the fry are transported by rail to their dumping site, it was a major financial blow to the propagation programs. Where before it cost forty dollars to travel one thousand miles, with the new ruling the same distance would cost three hundred dollars.\textsuperscript{337}

\textit{Regulatory Approach, 1920 – 1925}

The most important herring fishery was at Green Bay during the 1920s, where gill and pound nets caught them, in the fall. The price paid was so low (not more than one to three cents per pound) that the only way to make any profit was to take lake herring in enormous numbers.\textsuperscript{338}

The pound net mesh was still made from coarse cotton netting, but by the 1920s they were designed to prevent “gilling” of the fish by shrinking the mesh in the “heart” of

\textsuperscript{336} Ibid., 43.
\textsuperscript{337} Ibid., 42.
\textsuperscript{338} Koelz, Fishing Industry of the Great Lakes, 566.
the net to five inches, the "pot" to four inches, three inches on the outer side or back of
the pot, and four inches on the bottom and remaining three sides. The pot was located at
depths of twenty-five to eighty feet. The introduction of the trap net (an upgraded pound
net) was better because the lead net was stationed by weights with corks. No longer were
stakes and anchors used to fix the heart and pot of the net. Furthermore, the pot and heart
were entirely enclosed like a basket.\textsuperscript{339} Without the need for stakes, there no longer was a
need for a pile-driver boat and the extra capital to procure the vessel and the required
accessories.

The fishing regulations for pound and trap nets in 1922 are listed below:

<table>
<thead>
<tr>
<th>State</th>
<th>Mesh Size (knot to knot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>4 1/2 inches or more for the pot (trout and whitefish)</td>
</tr>
<tr>
<td></td>
<td>2 1/2 inches or less for other species</td>
</tr>
<tr>
<td>Indiana</td>
<td>2 inches or more for the back, 2 1/4 inches or more or the remaining sides</td>
</tr>
<tr>
<td>Michigan</td>
<td>2 inches or less for back of net at no less than 15 feet below the surface, 3 1/4 inches or more on the bottom and sides or if the mesh of the pot does not measure less than 4 inches (trout and whitefish) For other fish, a back of 2 inches or less; sides and bottoms no less than 2 1/4 inches For herring, 2 inches or more throughout only between October 1 and June 15</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>2 inches or less (trout and whitefish)</td>
</tr>
</tbody>
</table>

Table 6: 1922 Fishing Regulations for Pound and Trap Nets.\textsuperscript{340}

The summer of 1920 was the last for many commercial chub fishing enterprises at
numerous ports. The trout fishermen were at odds with the chub fishermen because too
many young lake trout were killed in the chub gill nets. Further adding to the plight of the
commercial chub fishermen was the absence of protective measures. No efforts at
artificial propagation were made on their behalf.\textsuperscript{341}

Beginning in the 1920s and continuing into the 1930s, fish commissioners from
Great Lake states concluded more hatcheries were needed to bring selected fish species,

\textsuperscript{339} Ibid., 557.
\textsuperscript{340} Ibid., 569.
\textsuperscript{341} Koelz, \textit{Fishing Industry of the Great Lakes}, 566.
whether for commercial or recreational purposes, to a healthy population level for every season. The approach to use hatcheries to quench the thirst of dehydrated fisheries was not new, but what was at this time was the changed policy to produce fish fingerling as opposed to fish fry.  

An experiment on July 4th and 16th, 1921 on Lake Ontario concluded that a difference of ¼ inch in mesh diameter could double a catch. Two kinds of linen gill nets equal in quality and thickness, manner of suspension, length and fish targeted were equal or practically equal. The ¼ inch difference allowed for precise targeting of not only size but species of fish. But the various laws from fishery to fishery, company to company, and state to state regulating net mesh diameter failed to coordinate on a large enough scale which proved that coordination (a) could not be done in a way to make commercial fishing profitable yet sustainable, and (b) even basic coordination could not be done. There were no laws limiting the number of nets that could be set or the quantity of fish taken.

The fishing regulations for gill net mesh size per state in 1922 were as follows:

<table>
<thead>
<tr>
<th>State</th>
<th>Mesh Size (knot to knot)</th>
<th>State</th>
<th>Mesh Size (knot to knot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wis.</td>
<td>4 inches (trout and whitefish)</td>
<td>Illinois</td>
<td>4 ½ inches or more (trout and whitefish)</td>
</tr>
<tr>
<td></td>
<td>2 ¾ inches or less (chubs)</td>
<td>2 ½ inches or more (chubs)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 ½ inches or more (other fish)</td>
<td>2 ½ inches or more (other fish)</td>
<td></td>
</tr>
<tr>
<td>Ind.</td>
<td>4 inches (trout and whitefish)</td>
<td>Mich.</td>
<td>4 ½ inches or more (trout and whitefish)</td>
</tr>
<tr>
<td></td>
<td>2 ½ inches or more (chubs)</td>
<td>2 ½ inches or more (chubs)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 ¼ inches or more (other fish)</td>
<td>2 ¼ inches (other fish)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(other fish)</td>
<td>2 ½ inches, Nov. 1 and Dec. 15th (herring)</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: 1922 Fishing Regulations for Gill Net Mesh Diameter for Wisconsin, Illinois, Indiana, and Michigan.

Artificial hatching programs were more active in the post-World War I years for the new important commercial species in 1922: lake trout, chubs, herring, lake whitefish,

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343 Koelz, Fishing Industry of the Great Lakes, 611.
344 Koelz, Fishing Industry of the Great Lakes, 568.
suckers, and yellow perch. Species once ignored were being propagated with no criteria to gauge the effect of this program in the Great Lakes, because none existed.\textsuperscript{345}

Most of the fish harvested in 1922 were sold fresh and shipped in wooden boxes packed with ice containing one hundred to one hundred fifty pounds of fresh fish. The fish were sorted and packed by one or two men who did nothing else during the workday. The boxes were shipped according to the weigh-in instructions of a manager because the express companies required appropriate ice packing, while they charged one-fourth the weight of the fish for the ice.\textsuperscript{346} Every fish was dressed immediately when brought to shore, or if there was space on the steamers, they were dressed on the water.

Lake sturgeons were practically exterminated by 1922 in Lake Michigan. Sturgeon had a marketable value in 1880 as almost 4,000,000 pounds were lifted out of the water. A decade later the poundage dropped to less than 1,000,000 and continued to fall. Wisconsin was the only state that established a closed season for sturgeon fishing in 1915. The other Lake Michigan states continued to allow fishermen to take sturgeon at their discretion. In certain non-Wisconsin waters on Lake Michigan, a minimum size limit did not exist, and artificial propagation programs for lake sturgeon were discontinued.\textsuperscript{347}

Marketing creativity and distribution ingenuity leading into the twentieth century were notable causes affecting fish populations. Marketing tactics were focused on improving the quality of the product, while distribution improved freezing and storage methods with the goal of offering a superior, cost effective product over a long distance. Robert Kolbe, a mechanical engineer by trade, developed a brine-based freezing process

\textsuperscript{345} Ibid., 613.
\textsuperscript{346} Ibid., 560.
\textsuperscript{347} Ibid., 567.
in 1925, allowing the fish to retain “better color and firmer flesh,” greatly increasing their marketability. Soon afterward, filleting the fish before departure to the markets began, as it saved costs on freezing and transportation, and lowered the spoilage ratio.\textsuperscript{348}

The U.S. Bureau of Fisheries reported in 1925 that the states of Michigan and Illinois did not permit mesh nets with a diameter smaller than 4 ½ inches for lake trout and whitefish. The state of Michigan determined a mesh of 2 ¾ inches was suitable for chubs but other states went smaller: 2 ½ inches. Wisconsin law said nothing larger than 2 ¾ inches was permitted.\textsuperscript{349} Wisconsin had special laws for Green Bay effective January 1, 1925 which differed from the other states in that the smallest mesh allowed was 2 3/8 inches, but 2 1/8 inch mesh nets were allowed to catch herring from December 1st until the ice-out.\textsuperscript{350} Ironically, with the noted concerns about killing small fish from Milner in 1872, Wisconsin, Indiana and Michigan permitted nets to be used to catch bait for lake trout.

When Dr. Walter Koelz, an aquatic biologist, published his report in 1926, regulations were found everywhere regulating commercial fishing: mesh net diameter, minimum fish length, closing dates for certain species, and artificial propagation. However, few beyond commercial fishermen could appreciate the variations in the character of each law on the same lake. To many in the public, the commercial fishing regulations were all too confusing, and unfortunately there were no other tangible avenues of regulation. Furthermore, the enactment of protective laws and their field applications could not keep pace with the progressive, technological curve behind locating, harvesting, preserving, and distributing fish-based products.

\textsuperscript{348} Bogue, \textit{Fishing the Great Lakes}, 274.
\textsuperscript{349} Koelz, \textit{Fishing Industry of the Great Lakes}, 569.
\textsuperscript{350} Ibid.
When it came to size limits in 1925 for individual fish, the regulations were frustrating to say the least. Indiana did not limit the size of any Great Lakes fish species taken with exception of the walleyed pike or northern pike; it could not be less than twelve inches. For the other states:

<table>
<thead>
<tr>
<th>Illinois (Inches)</th>
<th>Minimum size (inches)</th>
<th>Indiana</th>
<th>Minimum Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake trout</td>
<td>1 ¼ pounds (dressed)</td>
<td>Walleyed or Northern pike</td>
<td>12 or more inches</td>
</tr>
<tr>
<td>Lake whitefish</td>
<td>1 ¼ pounds (dressed)</td>
<td>All other species</td>
<td>No limit</td>
</tr>
<tr>
<td>Buffalo fish</td>
<td>15 inches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bullheads</td>
<td>8 inches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White bass</td>
<td>10 inches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perch</td>
<td>7 inches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catfish</td>
<td>13 inches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern pike</td>
<td>0 (restricted)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walleyed pike</td>
<td>0 (restricted)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Michigan (Inches)</th>
<th>Minimum size</th>
<th>Wisconsin</th>
<th>Minimum Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake trout</td>
<td>1 ½ pounds (round)</td>
<td>Lake trout</td>
<td>12 inches</td>
</tr>
<tr>
<td>Lake whitefish</td>
<td>1 ¼ pounds (dressed)</td>
<td>Lake whitefish</td>
<td>13 inches</td>
</tr>
<tr>
<td></td>
<td>2 pounds round</td>
<td>Suckers</td>
<td>12 inches</td>
</tr>
<tr>
<td></td>
<td>1 pound, 10 ounces (dressed)</td>
<td>Perch</td>
<td>7 inches</td>
</tr>
<tr>
<td>Lake sturgeon</td>
<td>20 pounds (round)</td>
<td>Walleyed pike</td>
<td>16 inches</td>
</tr>
<tr>
<td>Suckers</td>
<td>1 pound (round)</td>
<td>Catfish</td>
<td>20 inches</td>
</tr>
<tr>
<td>Walleyed pike</td>
<td>1 ½ pounds (round)</td>
<td>Buffalo fish</td>
<td>18 inches</td>
</tr>
<tr>
<td>Northern pike</td>
<td>2 pounds (round)</td>
<td>Other fish</td>
<td>8 inches</td>
</tr>
<tr>
<td>Catfish</td>
<td>2 pounds (round)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bullheads</td>
<td>8 ounces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perch</td>
<td>9 inches</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8: 1925 Size Limits, Great Lakes Species.  

Wisconsin and Michigan permitted net fishing during a closed season if, and only if, the spawn or premature fish caught “be saved, impregnated, and delivered to the proper authorities.” As for closed fishing seasons in 1925, Indiana was the only Lake Michigan state that had no closed season. For the other Lake Michigan states, the closed seasons were:

<table>
<thead>
<tr>
<th>Illinois</th>
<th>Dates</th>
<th>Indiana</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake trout</td>
<td>November 1 – December 1</td>
<td>All species</td>
<td>No closed season</td>
</tr>
<tr>
<td>Lake whitefish</td>
<td>November 1 – December 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Michigan</th>
<th>Dates</th>
<th>Wisconsin</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake trout</td>
<td>October 10 – November 4</td>
<td>Northern pike</td>
<td>March 10 – May 1</td>
</tr>
<tr>
<td>Lake whitefish</td>
<td>November 20 – December 15</td>
<td>Walleyed pike</td>
<td>March 10 – May 1</td>
</tr>
</tbody>
</table>

351 Koelz, Fishing Industry of the Great Lakes, 569.
352 Ibid., 570.
Dr. Koelz noted no later than 1925 that people outside of fishing, commercial or recreational, believed that all a fish needed to survive was water, only water. This perception carried over into the artificial propagation programs, as many believed that the immense numbers of eggs being released would offset any challenges created by overfishing. If a billion eggs were released, then, “one argues, that immense number cannot fail to affect the fish supply advantageously.” Fishermen knew more in regards to aquatic behavior but not enough to keep the “big four” commercial fish at sustainable levels or enough to delay decline among multiple species.

Basic fish behavior eluded those responsible for fish propagation. For example, fish culturists could not definitively determine as of 1925 whether reported fish increases were due to their propagation program or to natural occurrence. The fry were still dumped into inhospitable waters when not thrown in randomly along the shoreline. It is not surprising government reports indicated the spreading of skeptical attitudes from fish-culturists toward the once coveted artificial propagation programs.

Concluding his report in 1925, aquatic biologist Walter Koelz highlighted the need for common-sense action in order to control the wayward fishing practices on the Great Lakes. He offered three recommendations the industry needed in order to operate in an intelligent, wise, and controlled manner:

a. “In the light of the knowledge” granted from studying all fish of the Great Lakes, the regulations would then aptly follow in order to conserve the fisheries. By this time it was proven

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354 Ibid., 612.
355 Ibid., 614.
that no one law would work uniformly for all five lakes. Any laws found agreeable were to transcend political boundaries. Furthermore, state divisions of authority over the fisheries should yield to a "definite and responsible character, international in character" to take control in regulating the Great Lakes fisheries.

b. Restore closed seasons for spawning fish wherever necessary. No spawn should be collected if aquatic investigations or experiments prove the propagation programs failed to reach the desired goals.

c. Continuation in investigating life histories of important commercial fish and other aquatic species. Statistics must to be collected annually on the condition of each fishery.356

The attitudes were changing but the established influence artificial propagation instilled among early conservationists remained strong. Dr. Koelz called out conservationists of the Great Lakes area as those "still influenced by the exuberant optimism of the pioneer fish-culturists, who, inspired by the novel achievement of being able to hatch countless fry, entertained rosy visions of the possibilities of the new-found art."357 This illusion remained even though field workers and fish culturists knew immense percentages of newly released fish fry died before they reached the one-inch mark and many more failed to reach two-inches in length.358 No one was truly qualified to select the best or ideal locations to plant fish hatchlings.

Pollution

It was in the 1890s that progressivism began to strengthen and express an interest in enhancing the daily life of Americans at a local, state, and federal level to resolve the polluting woes all too familiar in industrial and urban circles.359

Timber pollution impacted not only Lake Michigan but also the rivers and streams leading into and out of the lake. Migrating fish communities native to Lake Michigan

357 Ibid., 614.
358 Ibid., 615.
359 Stradling, Conservation in the Progressive Era, 8.
needed the rivers to be clean and free flowing so they could feed and/or spawn.\textsuperscript{360} The old-growth forests largely made up of white pine that once surrounded Lake Michigan were deforested from the end of the Civil War to the early twentieth century. A log drive was the technique of drifting sawn tree trunks downstream from sawmills, which if left alone would run aground on sandbars or jam at riverbeds or in rapids. The sawdust that escaped the confines of the mills covered the feeding and spawning grounds, negatively affecting the profitability at each location where this practice went unchecked. These log drives, before they reached their destination, tore up thousands of miles of spawning beds and devastated local river/stream fish populations that were an important food source for migrating fish from Lake Michigan.

Waterlogged timber that sank following a log drive later rolled into commercial nets, causing them to sink with the help from underwater currents. At the mouths of rivers leading into Lake Michigan, sawdust and timber coagulated to form sand bars that blocked the fish from feeding and spawning. It happened to a significant degree in the Menominee River at the border between Wisconsin and the upper peninsula of Michigan.\textsuperscript{361}

The official position authored by Koelz about pollution was that it “may be deleterious to this food supply.”\textsuperscript{362} It is true that the impact from timber, chemical, and fish offal pollution was not confirmed by scientific evidence, but the enormous amount of testimony from fishermen was more than enough eyewitness evidence to trigger alarms.

\textsuperscript{360} Whelan, “A Historical Perspective on the Philosophy behind the Use of Propagated Fish in Fisheries Management: Michigan’s 130-Year Experience,” 308.
\textsuperscript{361} Milner, Report of the Fisheries of the Great Lakes, 19.
\textsuperscript{362} Koelz, Fishing Industry of the Great Lakes, 610.
The steamship traffic passing between Lakes Superior and Huron surpassed that of the Panama Canal in dumping thousands of tons of coal ash every year.\textsuperscript{363}

There were laws forbidding the improper expulsion of fish offal but these were also swept aside as the fishermen constantly witnessed blatant, unchecked pollution from more ghastly and harmful sources. The fishermen threw offal overboard in large quantities, even though observations and common sense pointed to different codes of conduct.

\textit{The Invaders}

There were other culprits behind the Lake Michigan fishery collapse, including one that not many anticipated. The invasive carp, smelt, sea lamprey and alewife found their way into Lake Michigan. By the early 1900s, certain sea-born creatures invaded the pristine Great Lakes through man-made shipping canals linking all five Great Lakes to the Atlantic Ocean. With the opening of the Erie Canal and the Welland Canal, these invaders eventually infiltrated all of the Great Lakes.

In the 1870s, fish culturists were looking for ways to increase the commercial value of the fisheries and introduced two species that became abundant in the twentieth century: the German carp and the alewife. Carp soon found themselves making new homes in Lake Michigan, Lake St. Clair, and Lake Huron. For a time, carp enthusiasm enjoyed a high running streak. In 1888, amateur fish culturist Seth Green wrote a small book in which he advocated that farmers raise carp. He provided instructions on the construction of carp ponds. The book contained no cautions or criticism of the species.\textsuperscript{364}

\begin{footnotesize}
\begin{itemize}
\item[363] Ibid.
\end{itemize}
\end{footnotesize}
Approaching the end of the 1800s, the U.S. Commission of Fish and Fisheries deliberately introduced the common carp (*Cyprinus carpio*) into North America, raising them in ponds as a food fish. In 1893, a reported 631,000 pounds were shipped to markets, and this number increased to over 9 million pounds by 1908.\(^{365}\)

Other fish culturists and the public were quick to condemn the common carp introduction in the 1890s because they did not taste good, or at least not as good when compared to the much beloved lake trout or whitefish. Plus, they became nothing more than a nuisance once introduced into streams and rivers because they uprooted vegetation, which led to soil erosion, muddy waters, and the elimination of vegetation that was necessary for protection from bigger fish.\(^{366}\) Furthermore, since they were omnivores, they ate frogs, insects, spawn of other fish, and the vegetation that grew on the bottom of shallow waters. Fishermen disdained these fish because they ate the spawn and fry of commercial fish species.\(^{367}\)

Alewives (*Alosa psuedoharengus*) are native to the Atlantic Coast. In 1873 the alewives were well established in Lake Ontario, but were found in Lake Erie by the 1930s and Lake Michigan in 1949.\(^{368}\) By the winter of 1956 and ‘57, commercial fishermen in the southern part of Lake Michigan were finding large numbers of alewives in their nets because they moved in large, dense schools. After the sea lampreys eliminated most of the large predator fish in Lake Michigan, the population of alewives exploded throughout the lake.\(^{369}\) Due to their fertility and the need to feed, they competed

\(^{365}\) Ibid.
\(^{366}\) Ibid.
\(^{367}\) Ibid., 86.
\(^{369}\) Ibid.
with young whitefish, herring, chubs, and perch for plankton and other small fish. Due to these new environmental changes, the stress of the native fish species was compounded.

The sea lamprey (*Petromyzon marinus*), is an ancient, hideous predator that feeds on the blood and fluid of large fish. By 1934, the sea lampreys found their way through the Straits of Mackinac into Lake Michigan, where they exploded in numbers. They not only threatened the lake trout, whitefish, herring, and sturgeon, but also in ten years carried out damage no one could have predicted. By the time 1946 arrived, the lake trout were nearly wiped out from the sea lampreys. The lake trout harvest was only 5,500,000 pounds, and the 1953 harvest maxed out at 402 pounds.\(^{370}\)

These unsightly creatures are aggressive parasites where the adults feed on large fish in a manner similar to the way a tick attaches itself on a human. Lampreys attach themselves to their prey by means of a disk-shaped mouth that is full of sharp teeth. The rasp-like tongue of the lamprey creates an opening through the fish’s flesh and then releases an anticoagulant in its saliva, thereby keeping the wound open as long as the lamprey stays attached.\(^{371}\) The fish that do succumb to the lamprey die from loss of fluid or from a secondary infection related to the open wound. This can take weeks until the fish rolls over and dies, falling to the bottom.

The rainbow smelt (*Osmerus mordax*), a descendant from a stock of smelt from Green Lake, Maine, found its way into Lake Michigan in 1923 near Frankfort, Michigan. They were in Wisconsin waters by 1928 when a few were caught in nets near Little Sturgeon Bay, Door County, Wisconsin.

\(^{370}\) Ibid., 82.
\(^{371}\) Ibid., 81.
Koelz considered this non-native introduction deplorable, since their presence would not serve any useful purpose. In 1922 there were challenges in securing a market for smelt. That was surprising since smelt was and remains one of the most palatable fish species from the Great Lakes region.\textsuperscript{372} If there had been a market in 1922 then the net mesh for smelt would have been so small that it would have devastated small fish of all species. Koelz summed up the attitude of not only the federal government but of the local fishermen:

\begin{quote}
We have already accumulated so much experience from the introduction of foreign species of vertebrates that it would seem unnecessary to caution against a continuation of the practice, and it is to be hoped that no organization will in the future assume the responsibility of the importation of any uncontrollable non-indigenous animal.\textsuperscript{373}
\end{quote}

\textsuperscript{372} Koelz, \textit{Fishing Industry of the Great Lakes}, 568.
\textsuperscript{373} Ibid.
Chapter Five: Conclusion

The observations from the early settlers created erroneous and gargantuan visions of infinite supplies of fish in the Great Lakes. When Euro-American settlement spread to the shores of the Great Lakes, seventeenth and eighteenth century legislators from the east coast devised a series of precedents "designed to preserve the fish, or, in order to facilitate a sustainable yield." 374 Instead, these precedents set Lake Michigan on a cataclysmic course because they made the fish, unlike farmlands, common property. The consequences for the "big four" fish remained unclear for at least half a century of commercial fishing.

Fishing commercially was a less stable venture than farming, with its dependence on the wind and surface conditions, frequent injury, loss of life or property, and the need to move from location to location because of fish migrations. Market preferences influenced by taste impacted what fish species were sought and captured. The legislative concerns of the commercial fishermen and public were one and the same: "...policy is best for both [fishermen and public] which will secure the maximum permanent supply of food fish." 375 The only avenue the states traveled to reach their regulatory objectives lacked a cohesive, unified governing body for each of the five Great Lakes. Needless to say, these "model" regulatory objectives were coveted but rarely attained by state fish commissions.

A combination of cultural optimism, consumer demand, technology, and economic competition contributed to what is known as the "fishermen's dilemma." As

374 Bogue, Fishing the Great Lakes, 14.
further explained by the historian Arthur McEvoy, "Every harvester knows that when he or she leaves a fish in the water, someone else will get it, and the profit, instead."\textsuperscript{376}

The fishermen communicated dissatisfaction with pollution in early reports to state fish commissioners and the U.S. Fish Commission, regarding scarred spawning beds from wayward timber logs, and the marketing of small fish. Another source of anxiety for the fishermen was the manic proliferation of industry in the Great Lakes region that clouded the "appropriate environmental remedies" or any other tangible form of political will until progressive politics arrived on the scene.\textsuperscript{377}

The commercial "big four" fish species - lake whitefish, lake trout, lake herring (cisco), and lake sturgeon - collapsed at varying times, but all due to an industry that ignored its own transgressions, scientifically naive legislators overseeing natural resource management, an experimental understanding of lake ecology, and overly optimistic projections of artificial fish propagation. The commercial fishing industry and governments at various levels gambled that nature and aquatic science would outpace the effects of overfishing, pollution, nonnative fish introductions, and ill-advised regulations. The gamble failed to pay. Always at the bow causing calamities, was and continues to be, human behavior, and throughout the late nineteenth century and well into the twentieth century, human behavior decimated the native fish stocks of the Great Lakes. The regulations intended to prevent the loss of the fisheries that supported a significant regional industry failed to adequately account for the conduct and technology employed on the water until World War One concluded.

\textsuperscript{376} Dorsey, \textit{The Dawn of Conservation Diplomacy}, 13.
\textsuperscript{377} Chiarappa, "Overseeing the Family of Whitefishes," 169.
The Lake Michigan commercial fishermen were quite attentive to the fish decline, as it provided them with concern, but the reason why the net-fishing status quo remained was because most fishermen opposed regulation that would in fact constrict their profits. They argued that equal regulation was impossible and the fish belonged to the public.\textsuperscript{378} State regulators from the 1870s through World War I had no earnest inclination to disrupt the fisherman's avenue to earning a livelihood. The attitude was, "Don't spoil profits, don't eliminate jobs, and don't hurt family income."\textsuperscript{379} However, when talk of regulation surfaced, the fishermen were always quick to sneer that the experts' "advice was impractical and uninformed."\textsuperscript{380} Therefore, when the fishing industry was taking flak for overfishing from the federal government or the conservation community, the commercial fishermen exercised their political and industrial muscle time and time again. A. Booth himself served on numerous business related commissions and committees.\textsuperscript{381} It is quite evident that the work from various state fish commissions exerted little, if any, regulatory restraint on the actions of commercial fishermen.

Lake ecology did not mean much of anything when biologist James W. Milner traveled the entire shoreline of Lake Michigan in 1871, visiting fisheries and recording harvest statistics and testimonies. At that time the main concern for the lake's ecology revolved around the three main points represented in Milner's report: fish harvesting, fish processing, and fish marketing. The only progress made in any branch of ecology was connected to the artificial fish propagation programs because of the optimism and

\textsuperscript{378} Bogue, Fishing the Great Lakes, 335.
\textsuperscript{379} Bogue, Fishing the Great Lakes, 334.
\textsuperscript{380} Ibid.
\textsuperscript{381} Bogue, Fishing the Great Lakes, 60.
funding surrounding these programs, rather than applying funds to widening fishery science or aquatic ecology.

By 1890, fish culturists and biologists accepted that “artificial propagation was having no discernible effect in reversing the diminishment” of any of the commercial “big four” species because these programs were an amplifier, not an outright remedy.\textsuperscript{382}

Towards the end of the war, the eight Great Lake state governments folded their fish commissions into new departments of natural resources / conservation as each further integrated their fishery management with the federal government. This new logistical and organizational arrangement sprang from many years of Great Lake states failing to prudently observe commercial fishing behavior and establish a reasonable regulatory system.\textsuperscript{383}

Aquatic ecology in the early 1920s turned a new leaf as it emphasized biological life histories designed to reveal the rate of growth, age of maturity, spawning, food, feeding habits, patterns of migration, symbiotic relationship between predator and prey, and “other elements related to reducing fish numbers.”\textsuperscript{384}

In 1923, the Bureau of Fisheries prioritized three key principles for biological inquiries: the study of the biology of fishes, crustaceans, and mollusks, “their life histories and ecological relationships.”\textsuperscript{385} During a conference sponsored by the United States Bureau of Fisheries in January of 1927 on the tasks of future regulations, Elmer Higgins of the Division of Scientific Inquiry in the Bureau of Fisheries publicly spoke his

\textsuperscript{382} Chiarappa, “Overseeing the Family of Whitefishes,” 171.
\textsuperscript{383} Ibid., 180.
\textsuperscript{384} Bogue, \textit{Fishing the Great Lakes}, 301.
\textsuperscript{385} Ibid.
opinion: "to return to the faith of our fathers." It was the aim of Mr. Higgins and many
in the Bureau to sort out how much the oceans and inland waters had diminished in
robustness and why. Afterward, the Bureau would suggest ways to mitigate "the evil." This was another suggestion for common sense regulation, but the same problem that
plagued previous regulators remained: too few knew what mitigating "the evil" meant
when the time came for funneling that into tangible legislative action on the water.

As of 1929, twenty-five hatcheries were operating in Wisconsin, artificially
producing over 300,000,000 fish for the state's waters. The eggs were still collected by
commercial fishermen by permit during the spawning season for two species only: lake
herring and lake trout. There were three hatcheries dedicated to commercial fish
species in 1930 located in Sheboygan, Sturgeon Bay, and Bayfield, Wisconsin that
transported the majority of their fish to Lake Michigan, especially lake trout.

The last cooperative endeavor by Michigan and the U.S. Great Lakes Fishery
Investigations (G.L.F.I.), under the guidance of G.L.F.I.'s John Van Oosten, from the late
1920s to the early 1930s involved gauging the repercussions of deep trap nets on lake
whitefish populations in Lakes Michigan and Huron. Van Oosten's team concluded
that the deep trap nets, commonly used at fifty feet but sometimes set at one hundred to
one hundred sixty feet, "harvested whitefish in unprecedented numbers in areas that
naturally served as sanctuaries from the fishing pressure of pound nets and gill nets."

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386 Bogue, Fishing the Great Lakes, 305.
387 Ibid.
Years ending June 30, 1929, and June 30, 1930, by William Mauhle, O.C. Lemke, A.W. Ickes, E.M.
389 Ibid., 62.
390 Ibid., 73.
391 Chiarappa, "Overseeing the Family of Whitefishes," 178.
392 Ibid., 179.
By 1935, Michigan and Wisconsin eliminated the use of deep trap nets in lake whitefish fisheries in Lakes Michigan and Superior but not Huron unless at a minimum of eighty feet. Van Oosten and the G.L.F.I. accomplished this by straightforwardly bridging research, official conferences, and years of fieldwork to convince fishery stakeholders that there was a new option of fishery management.  

The core concept behind fishing for sport had a revival in the 1930s across the U.S. Unfortunately, the revival was not based on recreation. The Great Depression put significant strains on the family dining table, and fishing as an individual or as a family was a far cheaper way to feed the family daily. The rapid rise of angling created a bias in favor of propagating “fingerling-sized native or naturalized species with sporting qualities.” The focus on propagation shifted from the lake whitefish and lake trout to inland fish species such as brook trout, brown trout, rainbow trout, steelhead trout, bluegills, the largemouth bass, and later, the muskellunge and walleye.

A pivotal policy shift within the Michigan Department of Conservation occurred in the 1930s, when the management for the Great Lakes commercial fishery administered by the state was reduced intentionally to support the growing practice of sport fishing. The energy behind fishery management in Michigan during the 1930s encouraged fisheries for the sportsmen, but in realistic terms, made angling easier for the individual who, for whatever reason needed to put protein on the table in light of the Great Depression.

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394 Whelan, “A Historical Perspective on the Philosophy behind the Use of Propagated Fish in Fisheries Management: Michigan’s 130-Year Experience,” 310.
395 Ibid.
In the wake of World War II, Michigan and Wisconsin tenaciously pushed for leisure and sport fishing on the Great Lakes because the appeal to wind down from war was too great to resist, and those in charge of fisheries across the U.S. adjusted. In 1965, Michigan’s new fisheries chief, Howard Tanner, stated where the divide between commercial and sport fishing rested. It is this sentiment that continues today throughout all Lake Michigan states, “management goals must be shifted toward recreational fishing opportunities rather than commercial fishing, with commercial fishing playing a useful and productive secondary role.”

Lake Michigan once contained one of the most abundant freshwater fish populations in the world. In the end, policy makers at all levels tasked with forming tangible ideas for fish conservation and pollution control found their directives hamstrung by: aggressive commercial fishing and industrial enterprises; a widespread pre-ecological understanding; insufficient scientific funding for research; political disagreements over state boundaries; resistance from the commercial fishermen themselves; and an American public jaded about fishery science and the nation’s seemingly limitless natural resources.

All agencies managing or assisting Great Lakes fisheries in the future will rely on hatcheries, sport and commercial fishermen but to what degree is a matter of how well local fish populations are self-sustaining. When the time comes to manage any natural resources, actions based on prudence, wisdom, reason, and shrewdness are best.

Det er håp så lenge snøret er i vannet.
There is hope as long as your fishing line is in the water.

-Norwegian Proverb

Bibliography

Primary Sources


State of Michigan. *Sixth Biennial Report of the State Board of Fish Commissioners for 1883-84*, vol. 6, by Joel C. Parker, John H. Bissell, Herschel Whitaker, Lansing, 1885.


**Secondary Sources**


APPENDICES

Appendix A:

**SCIENTIFIC NAMES OF GREAT LAKES FISHES**

Listed below are the scientific names of the species of fish mentioned in the research:

- Alewife: Alosa pseudoharengus
- Bluegill: Lepomis macrochirus
- Brook trout: Salvelinus fontinalis
- Brown trout: Salmo trutta
- Burbot: Lota lota
- Carp: Cyprinus carpio
- Chubs: Leucichthys (species)
- Dogfish: Amia calva Lin
- Lake herring (cisco): Coregonus artedi
- Lake sturgeon: Acipenser fulvescens
- Lake trout: Salvelinus namaycush
- Lake whitefish: Coregonus clupeaformis
- Largemouth bass: Micropterus salmoides
- Muskellunge: Esox masquinongy
- Spotted burbot: Lota maculosa
- Rainbow smelt: Osmerus mordax
- Rainbow trout: Oncorhynchus mykiss
- Sea lamprey: Petromyzon marinus
- Suckers:
  - Longnose: Catostomus catostomus
  - Shorthead redhorse: Moxostoma macrolepidotum
  - White: Catostomus commersonii
  - Walleye: Sander vitreus
  - Yellow perch: Perca flavescens

Appendix B:

**CONVERSIONS**

- 1 Fathom = 6 Feet (approx. 1.8 meters)
- 1 Nautical Mile = 1.15 Miles (6,076 feet)
- 1 Kilometer = 0.62 Mile
- 1 Nautical Knot = 1.15 MPH
Appendix C:

NAUTICAL TERMS

Aft
Near the stern of the boat / vessel

Beam
Greatest width of the boat / vessel

Bow
Forward part of the boat

Draft
Depth of water a boat draws

Fathom
Six feet

Fixed Gear
Stationary fishing equipment (traps, long lines, pots)

Fore
Near the bow the of the boat / vessel

Hull
Main body of boat / vessel

Keel
Centerline (backbone) of a boat / vessel running fore and aft

Knot
Measure of speed equal to one nautical mile (6,076 ft.) per hour

Latitude
Distance measured in degrees from 0° (equator) to 90° (north or south)

Lee
Side sheltered from the wind

Leeward
Direction away from the wind (opposite of windward)

Longitude
Distance measured in degrees from 0° (prime meridian, Greenwich, England) to +180° eastward and -180° (westward)

Nautical Mile
6,076 feet or one minute of latitude, ~1/8 further than a statute mile of 5280 feet

Port
Left side of boat / vessel looking fore. A harbor

Rudder
Vertical plate or board for steering a boat / vessel

Starboard
Right side of a boat / vessel looking fore

Stern
Rearmost part of the boat / vessel

Streaming the net
Towing a net at the surface while the boat / vessel positions itself to set the net

Windward
Toward the direction the wind is coming