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The Swift Water Place: Water Quality, Fish Ecology, and Hydropower in the Merrimack River since the Time of Thoreau

Timothy Melia
University of New Hampshire, Durham

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Abstract
The Merrimack River and its landscape reflect the priorities that have shaped the stream for two centuries. When Henry David Thoreau and his brother John put their dory into the Merrimack in September of 1839, they were paddling into a landscape that was shifting towards water-powered industries and mill cities. The legal transformation of water and the completion of the Great Stone Dam at Lawrence in 1847 spelled the end of the anadromous fish runs that had populated the Merrimack for centuries. Salmon restoration proceeded for three decades after the Civil War until fish passage failed. Later, water filtration plants allowed communities to draw clean water from the Merrimack, although it ran as an open sewer well into the middle of the twentieth century. After World War Two suburban growth rapidly expanded the water map beyond the old mill cities, increasing the need for local supplies. Starting in 1965, the restoration of the Merrimack began with new efforts at federal water pollution control and federal-state fisheries partnerships. An instrumental vision of nature had given way to a wider consideration of what a river could do for local people, and in the multiple restorations that followed leadership was provided at different times by the federal government, state governments, local groups, and private citizens. Along the way, the dams were put back to work generating cheap local hydroelectricity. While some anadromous fish came back to a cleaner river, many did not. The legacy ecosystem of the Merrimack River today reveals how the tension between industry and nature continues to define the priorities that shape local landscapes.

Keywords
Fish, Hydropower, Merrimack, River, Thoreau, Water, American history

THE SWIFT WATER PLACE: WATER QUALITY, FISH ECOLOGY, AND HYDROPOWER IN THE MERRIMACK RIVER SINCE THE TIME OF THOREAU

BY

TIMOTHY F. MELIA

Bachelor of Arts, University of New Hampshire, 1992

Master of Liberal Arts, Harvard Extension School, 2007

DISSERTATION

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This dissertation has been examined and approved in partial fulfillment of the requirements for the degree of Doctor of Philosophy in History by:

Dissertation Chair: W. Jeffrey Bolster, Professor (History)

Ellen F. Fitzpatrick, Professor (History)

Eliga H. Gould, Professor (History)

Kurk Dorsey, Professor (History)

William E. Ross, Professor (Special Collections)

On May 25, 2016.

Original approval signatures are on file with the University of New Hampshire Graduate School.

DEDICATION

This dissertation is dedicated to all of the people who will have ever lived in the Merrimack River watershed.

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ABSTRACT

THE SWIFT WATER PLACE: WATER QUALITY, FISH ECOLOGY, AND HYDROPOWER IN THE MERRIMACK RIVER SINCE THE TIME OF THOREAU

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The Merrimack River and its landscape reflect the priorities that have shaped the stream for two centuries. When Henry David Thoreau and his brother John put their dory into the Merrimack in September of 1839, they were paddling into a landscape that was shifting towards water-powered industries and mill cities. The legal transformation of water and the completion of the Great Stone Dam at Lawrence in 1847 spelled the end of the anadromous fish runs that had populated the Merrimack for centuries. Salmon restoration proceeded for three decades after the Civil War until fish passage failed. Later, water filtration plants allowed communities to draw clean water from the Merrimack, although it ran as an open sewer well into the middle of the twentieth century. After World War Two suburban growth rapidly expanded the water map beyond the old mill cities, increasing the need for local supplies. Starting in 1965, the restoration of the Merrimack began with new efforts at federal water pollution control and federal-state fisheries partnerships. An instrumental vision of nature had given way to a wider consideration of what a river could do for local people, and in the multiple restorations that followed leadership was provided at different times by the federal government, state governments, local groups, and private citizens. Along the way, the dams were put back to work generating cheap local hydroelectricity. While some anadromous fish came back to a cleaner river, many did not. The *legacy ecosystem* of the Merrimack River today reveals how the tension between industry and nature continues to define the priorities that shape local landscapes.

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riverrun, past Eve and Adam's, from swerve of shore to bend of bay, brings us by a commodius vicus of recirculation back to Howth Castle and Environs. [1]

James Joyce, *Finnegans Wake*

1. James Joyce, *Finnegans Wake* (New York: Penguin, 1967 [orig. pub. 1939]), 1.

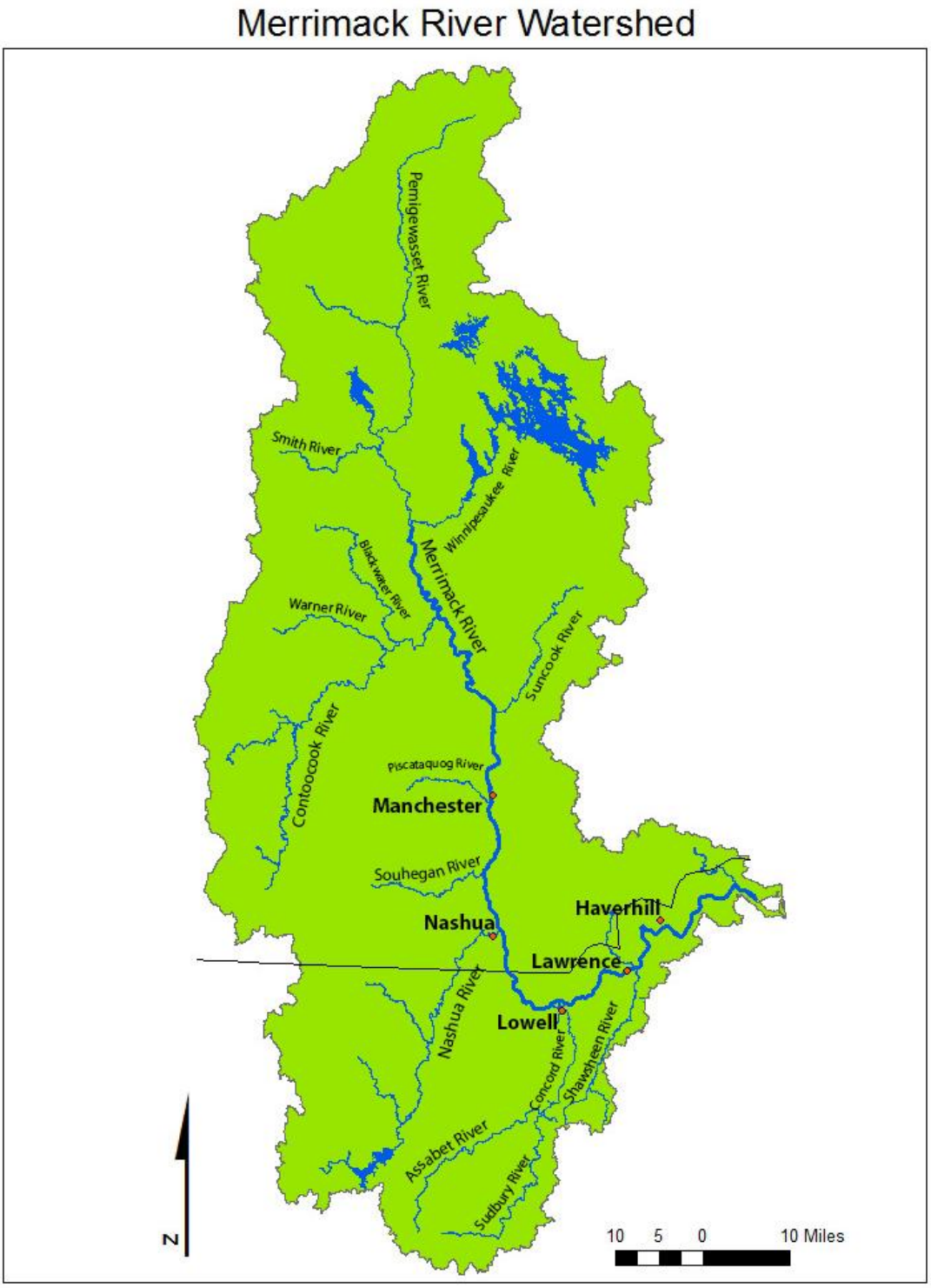

Figure I.1. "Merrimack River Watershed," by the Merrimack River Watershed Council.[2]

2. Merrimack River Watershed Council, "Merrimack River Watershed." http://www.merrimack.org/web/wp-content/uploads/2015/05/MRWC-Map.jpg. Accessed: April 11, 2016.

Native Americans called it the *merruasquamack*, or "swift water place". Where the "steep, swift, cold" Pemigewasset meets the "gentler, warmer" Winnipesaukee River, the Merrimack River is born. The daughter of the Pemigewasset and the Winnipesaukee scampers from out behind the high school in Franklin, New Hampshire, for 127 miles through the State of New Hampshire and the Commonwealth of Massachusetts. Flowing southeasterly, the Merrimack River drains 5,010 square miles as it runs until it turns perpendicular to its axis and then runs 45 miles northeasterly to a point where it returns to the sea at Plum Island Sound. The Merrimack River watershed (or Basin) extends outward from the river to the land along the stream. This much larger area drains from various freshwater sources into the river. Tributaries, lakes, and ponds fill out the landscape. The Merrimack took on its basic form approximately 550 million years ago when the heavy mantle of metamorphic and "buckled, igneous rocks" folded and collapsed in on the core of a cooling earth, giving rise to high mountain ranges.[3]

The fish that colonized the Merrimack River came after the recession of the Laurentide continental ice sheet, a process that began about 14,000 years ago.[4] These were various species of salmons, chars, sculpins, and burbots. They were followed by other anadromous species like alewives, striped bass, and shad, which need warm water for development. As old river beds were captured, and moraine and kettle ponds formed, some of these fishes became landlocked, and these gave rise to subspecies such as landlocked salmon and Sunapee trout. As the waters

3. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin and Advisors to the Technical Committee, *Strategic Plan & Status Review: Anadromous Fish Restoration Program, Merrimack River* (1997), 3. The original article by Peter H. Oatis, "The Merrimack River," appeared in *Massachusetts Wildlife*, XXVII, No.3 (1977): 2 – 15.

4. Margaret Martin, "Laurentide Glaciation of the Massachusetts Coast," http://academic.emporia.edu/aberjame/student/martin1/laurentide.html. Accessed: June 6, 2016.

warmed, another group of strictly freshwater species invaded the river basin, either from a now-defunct waterway that connected with the Great Lakes and Mississippi drainages, or from the middle Atlantic region when ice melt reduced the salinity of the ocean. Such species are represented nowadays by the common and longnose suckers, dace, pickerel, pumpkinseed, perch, bullheads and some shiners. There are five historic anadromous fishes: the Atlantic salmon (*Salmo salar* [L.]), the American shad (*Alosa sapidissima* [Wilson]), the alewife (*Alosa pseudoharingus* [Wilson]), the blueback herring (*Alosa aestivalis* [Mitchill]), and the striped bass (*Morone saxatilis* [Walbaum]). [5]

The Merrimack is a fast river downstream from the dams. United States Geological Survey (USGS) streamflow data show that the river fluctuates between four and eight feet above gage at Haverhill, Massachusetts, to about 42 feet at Lowell.[6] In 1964 the Massachusetts Division of Marine Fisheries sampled at five points between West Newbury and Plum Island, Newburyport for pesticides, bacteria, and thermographic information. In those days, mean water flow varied so that the area of submerged contours of the estuary at low tide was 2,110 acres, expanding to 3,957 acres at high tide. The salt marsh at the estuary stretched 4,208 acres. Although less than half the size of Quincy Bay, the Merrimack flushes over five times the

5. Technical Committee, *Strategic Plan & Status Review*, 4, 15; Fishbase, "Salmo salar," http://www.fishbase.org/summary/Salmo-salar.html; "Alosa sapidissima," http://www.fishbase.org/summary/Alosa-sapidissima.html; "Alosa pseudoharengus," http://fishbase.org/summary/1583; "Alosa aestivalis," http://www.fishbase.org/Summary/speciesSummary.php?ID=1574&AT=blueback+herring; "Morone saxatilis," http://www.fishbase.org/summary/Morone-saxatilis.html. Accessed: April 15, 2016. Fishbase gives the name "blueback shad" for *Alosa aestivalis*, although the page cited above says "blueback herring". In keeping with my fish ecology sources, I will refer to *Alosa aestivalis* as the blueback herring, except when it is counted along with alewife as "river herring".

6. United States Geological Survey, United States Department of the Interior. "WaterWatch: Current Water Resources Conditions; Map of Real-Time Streamflow Compared to Historical Streamflow for the Day of the Year (Massachusetts)," http://waterwatch.usgs.gov/?m=real&r=ma&w=map. Online version: Accessed: November 18, 2012.

proportion of acreage between low and high tides.[7] The relative shallowness of the estuary promotes greater fertility.[8]

Since the rise of industrialization, the Merrimack River has been shaped by patterns of construction and reuse. In September of 1839, Henry David Thoreau remarked on the industrial landscape that was growing up around him. "Unfitted to some extent for the purposes of commerce by the sandbar at its mouth," he wrote, "see how this river was devoted from the first to the service of manufactures.

> Issuing from the iron region of Franconia, and flowing through still uncut forests, by inexhaustible ledges of granite, with Squam, and Winnepisiogee, and Newfound, and Massabesic lakes for its millponds, it falls over a succession of natural dams, where it has been offering its *privileges* in vain for ages, until at last the Yankee race came to *improve* them. Standing here at its mouth, look up its sparkling stream to its source, – a silver cascade which falls all the way from the White Mountains to the sea, – and behold a city on each successive plateau, a busy colony of human beaver around every fall. Not to mention Newburyport, and Haverhill, see Lawrence, and Lowell, and Nashua, and Manchester, and Concord, gleaming one above the other.[9]

By the time of *A Week on the Concord and Merrimack Rivers*, the railroads were already reshaping the Merrimack's landscape. At the mouth of the Merrimack, there were a few small vessels which would "transact the commerce" of Haverhill and Newburyport. "But its real vessels are railroad cars, and its true and main stream, flowing by an iron channel further south, may be traced by a long line of vapor amid the hills, which no morning wind ever disperses, to where it empties into the sea at Boston. This side is the louder murmur now. Instead of the

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7. William C. Jerome, Junior, Arthur Chesmore, Charles O. Anderson, Junior, and Frank Grice, *A Study of the Marine Resources of the Merrimack Estuary* (Boston: Division of Marine Fisheries, Department of Natural Resources, Commonwealth of Massachusetts, 1965), 6, 8, 12, 15.

8. Jerome et al., *Study* (1965), 15. The water in the estuary is about six feet deep. This allows for more nutrient exchange and photosynthesis.

9. Henry David Thoreau, *A Week on the Concord and Merrimack Rivers Unabridged*, Dover Thrift Edition, ed. by Kathy Casey (Mineola, NY: Dover, 2001), 53.

scream of the fish-hawk scaring the fishes, is heard the whistle of the steam-engine, arousing a country to its progress."[10]

During the life of Thoreau, the river that Natives called "the swift water place" was turned into an engine. [11] It was not long after Thoreau's *Week* that the Great Stone Dam was completed at Lawrence in 1847. Atlantic salmon and American shad had been heavily fished for decades, but with the new dam in Lawrence came the crash of both fisheries. By 1850, the salmon fishery was worth a dollar; the shad fishery had collapsed; and the factories were roaring.[12] Private and public efforts to protect fish passage were both denied by the Supreme Judicial Court in Massachusetts when the rights under the corporate charter were upheld.

Within a few years of Thoreau's death in 1862, the Merrimack was a public and private sewer. Theodore Steinberg recalls the increasing pollution of the industrialized stream in 1870. Nashua, New Hampshire had a population over ten thousand inhabitants, textile mills, two dye works, and one paper mill. Steinberg calls it "a significant pollution threat to the river." Below the mills, the city board of health noted, "the water is almost black, is unfit to drink, and in very hot weather is sometimes odorous, but not to the extent of causing general complaint."[13] The unavailability of public water supplies led to the innovation of sanitation biology. That new science – combining biology with engineering – led to work at Louisville, Kentucky and at the

10. Thoreau, *A Week on the Concord and Merrimack Rivers*, 53.

11. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review: Anadromous Fish Restoration Program, Merrimack River* (Nashua, NH: Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, 1997), 15.

12. Lawrence Stolte, *The Forgotten Salmon of the Merrimack* (Washington, DC: United States Department of the Interior, Northeast Region, 1981), 7 – 9.

13. Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Amherst: University of Massachusetts Press, 1991), 211.

Lawrence Experiment Station on the banks of the Merrimack River. The slow sand filter revolutionized water pollution control – but only for intakes.[14]

By the end of the nineteenth century, the Merrimack River had been fished and depleted, polluted and degraded. Steam power had been joined in its efficiencies by electric power.[15] It was less important to be at the water's edge; but the industrial landscape was firmly in place. This is why the industrial landscape was reused. Power systems were refitted; factories continued to run. Salmon restoration had been discontinued in the eighteen-nineties because there were too many poachers and fish passage was unreliable. But the first half of the twentieth century was likewise a contest of market forces for the use of the River. An effort to dredge the channel of the river to eighteen feet, as far as Haverhill, came up against the growing realization that there was no real future in steamboat traffic in the Merrimack. The same efficiency stopped a plan to build a trunk sewer from Lowell to the ocean. No one wanted to pay even a fraction of the costs required to maintain it.[16]

The end of World War II reopened world markets that challenged the old mills.[17] At the same time, local people were starting to move out of the old mill cities into the surrounding towns. The suburban landscape was thus an expression of two trends – first, to move beyond the cities; and second, to redraw the water map to account for the new suburban neighborhoods.

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14. Joel S. Tarr, *The Search for the Ultimate Sink: Urban Pollution in Historical Perspective* (Akron: University of Akron Press, 1996), 162 – 163.

15. Patrick M. Malone, *Waterpower in Lowell: Engineering and Industry in Nineteenth-Century America* (Baltimore: The Johns Hopkins University Press, 2009), 202 – 203.

16. "Lowell-to-Sea Sewer Urged: Would Be Cheaper Than Disposal Plants, Says Kelly Report," *Christian Science Monitor*, April 11, 1924, SECTION; "Merrimack River Improvement Sought," *Christian Science Monitor*, April 2, 1926, 4A.

17. "Merrimack Mill to Close: 1000 Will Lose Jobs," *Boston* Globe, December 11, 1957, 7. In Lowell, the Merrimack Mill, which opened in 1822, closed in 1957 because the company could "'no longer buck the trend and market conditions' stemming from Japanese textile imports."

Urban economies began to feel the strain of declining populations, closing businesses, and rising costs. In the meantime, everyone wanted clean water, whether for the backyard or for a sink at a local garage. Economics and geography controlled the assessments of local costs, and smaller local communities balked at massive tax increases when the cities were standing by.

This was the situation when federal water pollution control matured in 1965. The passage of a federal law, Public Law 89-234, led to the formation of a Federal Water Pollution Control Administration. This agency would soon give way to the new Environmental Protection Agency (EPA), created in 1970. Public Law 92-500, the Clean Water Amendments of 1972, charged the federal government to address every pollution discharge, public or private, into the navigable waters of the United States. Federal standards would be fitted to local places, one by one, until water classifications could be achieved and then maintained.

The results were dramatic. By 1979, coliform bacteria levels were down 99 percent from what they had been in 1965. Most of that progress had only come since 1974, when 1,000,000 total coliform could be measured in less than four ounces of water twenty-five miles from the ocean.[18] The Clean Water Amendments of 1972 had been written, in effect, to render all of the navigable waters of the United States suitable for aquatic life. According to the system that water managers developed, that meant that the Merrimack had to become Class B. By 1985, clean water was flowing in the Merrimack River. If there were not so many people swimming in

18. Federal Water Pollution Control Administration, Northeast Region, United States Department of the Interior. *Report on Pollution of the Merrimack River and Its Tributaries, I: Summary, Conclusions, and Recommendations* (Boston: Federal Water Pollution Control Administration, 1968), iv; Arthur S. Johnson, *A Report on Water Quality Conditions and Pollution Abatement in the Merrimack River Basin in Massachusetts* (Westborough, Massachusetts: Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, Technical Services Branch, 1985), 87. In 1965, 9,200,000 coliform bacteria could be measured in 100 milliliters (ml), of water, which is 3.38 ounces in the English system. In 1979, the measured amount at the 40-mile mark – right near the state line – was about 5,000 ml, which would be a decrease of approximately 99.95 percent in only fourteen years.

the cleaner river, then at least it could be a good destination for boating and fishing.[19] In about the same time that it took to subdue the Merrimack – the two decades between 1830 and 1850 – the Merrimack was brought back from the dead.

What about the fish? Public Law 89-304, the Anadromous Fish Conservation Act of 1965, created federal-state partnerships between fisheries managers. In 1968, the Merrimack River Anadromous Fish Restoration Program was created. It was originally intended to focus on restoring Atlantic salmon. But within a few years, a national energy crisis changed how the Merrimack would be used. Hydropower structures that had been "scenic" were now seen as local sources of electric power. Refitting the old dams meant keeping the old dams. The natural Merrimack would have to flow through this impounded landscape even as its water became cleaner. The completion of a fish lift at the Essex Dam in Lawrence gave fish biologists measurable counts of Atlantic salmon, American shad, alewife, blueback herring, and a few other river-running species after 1983. But these counts were usually low, especially among the salmon. The Essex Dam in Lawrence, the Pawtucket Dam in Lowell, and the Amoskeag Dam in Manchester are more than enough to keep salmon and shad and river herring well downstream.

The Merrimack River that we see today is what I call a legacy ecosystem: a legacy, in the sense of a received series of things and practices; and an ecosystem, in the sense of a series of ecological relations that supports living things. If a river can be series of places, then such a watershed is a landscape: "an area of land" which "consists of a collection of different, but

19. Johnson, *A Report on Water Quality Conditions and Pollution Abatement in the Merrimack River Basin in Massachusetts*, 24. "Figure 3, Merrimack River Water Use Classification Map" shows that the river was Class B ("Cold or Warm Water Fishery, Primary & Secondary Contact Recreation"), from the state line to the estuary, where the classifications SA and SB denote ratings approved for marine fisheries, shellfisheries, and recreation.

interacting patches (also called landscape elements)."[20] According to ecological usage, a landscape is a measurable unit of analysis where people interact with nature and with nonliving things. A landscape is heterogeneous, with patches that can be grouped into patterns. Patches are a matter of perspective; we can define them according to "the point of view of the organism under study."[21]

If a river can have a landscape, and that landscape can have a series of places, then managing a river means entering local places. Historically, Americans have managed rivers in three general disciplines: water quality, through water supplies and then pollution control; fish ecology, through market-driven restoration and ecological restoration; and hydropower, through energy and flood control.[22] Restoring a river means acclimating ourselves to patterns of resource

20. Richard J. Hobbs, "The Ecological Context: A Landscape Perspective," from *Handbook of Ecological Practices*, I, *Handbook of Ecological* Restoration, ed. by Martin R. Perrow and Anthony J. Davy (Cambridge and New York: Cambridge University Press, 2002), 24.

21. Rudy van Digglen gives a "practical approach" in defining a landscape: "a spatial matrix at the human scale in which interactions of biotic and non-biotic elements take place." Typically, "it has a size of at least a few square kilometres and can be photographed or put on a map." Rudy van Diggeln, "Landscape: Spatial Interactions," from *Restoration Ecology: The New Frontier*, ed. by Jelte Andel and James Aronson (Malden, MA and Oxford, UK: Blackwell, 2006), 31 – 32. Please note that when I refer to "patterns of resource use", I am not referring to the ecological term for a series of patches of land; I am referring to ways of living and using resources.

22. Here I am referring directly to the stream. This dissertation includes discussions of the ecology of birds, as well as of the ecological restoration of landscapes. But fish ecology has been paramount historically, both in the Merrimack River and in other American streams, since the nineteenth century. Richard Judd cites Arthur McEvoy's observation that the rivers of New England were an early warning to other parts of the country "that the frontier was not, in fact, boundless." Richard W. Judd, *Common Lands, Common People: The Origins of Conservation in New England* (Cambridge, MA and London: Harvard University Press, 1997), 145, note 67. McEvoy was referring to the establishment of the U.S. Fish Commission. "New England states were the first to act," he argues, "ordaining special administrative agencies to study fisheries problems and to recommend remedial legislation. By 1880, some thirty states had followed suit." Arthur F. McEvoy, *The Fisherman's Problem: Ecology and Law in the California Fisheries, 1850-1980* (Cambridge and New York: Cambridge University Press, 1986), 100 – 101 (quotation 100). In the Merrimack River, flood control has used the means of hydropower to sell itself. "A perpetual supply of 'white coal' for all New Hampshire, steady work for approximately 1000 men for not less than two years and the stabilizing of the flow of the Merrimack River are not so far from fruition if plans of the state planning board carry through." The proposed plan was expected to cost between $20 million and $60 million, but the argument was still underway in 1939 when the U.S. House of Representatives voted an appropriation of $11 million for the Connecticut and Merrimack Rivers. Nearly $3 million of that amount ($2,985,000), was estimated for the flood control plan at Franklin Falls on the Merrimack River. "Plan to Harness Merrimack River Makes Progress: New Hampshire Moves to Control Flow by Storage," *Christian Science Monitor*, February 9, 1935; "Flood Control Advances: States and Congress Act," *Christian Science Monitor*, May 11, 1939, 9. The Franklin

use. A cleaner river could provide more space for fish, but it also offered a cheap local resource. Fisheries can be promoted where the river can run. Hydropower has confirmed the industrial advantage as a public resource. In the case of the Merrimack, the result is a Class B stream with a few more fish and most of the old dams. But that result is a lot better than an open sewer.

Restoring the Merrimack – bringing back more places for nature – means choosing between priorities. Ecological restoration is hard work, and not every idea has worked out. After more than forty years of careful efforts to restore a few dozen adults, the Atlantic salmon restoration program in the Merrimack River was discontinued in 2013. But the program directors had already begun to focus on a more robust American shad program. Since 2011, nearly 200,000 American shad – more than 30 percent of the shad counted since 1983 – have returned to the Merrimack. In 2015, there were 86,857, the most shad ever counted at the Essex Dam Fish Lift. For the first time in years, more than 100,000 river herring came back as well. But only about 20 percent of those shad, and about 25 percent of those river herring, were counted at the Pawtucket Dam Fish Lift in Lowell. No fish of any species were counted at the Amoskeag Dam in Manchester.[23] Even the restored fish returning to the Merrimack will have to enter a disturbed environment.

A restored river is a contested place. Eric Higgs argues that to restore something "means to consider *what that thing is and what it means*."[24] If we generalize that to a river, then we can see how the Merrimack was contested as its meaning changed after 1965 – but also after 1972,

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Falls dam was dedicated on October 22, 1943. "New Franklin Falls Dam Dedicated in Flood Plan: For Controlling Floods," *Christian Science Monitor*, October 22, 1943, 5.

23. The website is here: http://www.fws.gov/northeast/cnefro/returns.html. Accessed: April 4, 2016. Please note that, in 2016, the website shows results that only go back to 1991. Figures quoted from 1983 to 1990 are still on file at the U.S. Fish and Wildlife Service.

24. Eric Higgs, *Nature by Design: People, Natural Process, and Ecological Restoration* (Cambridge and London: MIT Press, 2003), 41.

after 1983, and so on. Higgs argues that ecological restoration is different from the restoration of a stable thing like a historic work of art or a famous building. Restoring the Merrimack River means deciding what the landscape would be and what it would mean. But landscapes are not just physical representations of human priorities. Local places are always in flux because ecosystems shift.

Ecological shift is what makes restoration into a discipline to be practiced rather than a task to be achieved. There is no destination for restoration because the thing being restored will not simply stand still while people fill out the paperwork. There is no destination for ecosystem management, even adaptive management, because ecosystems are not machines that can be calibrated or reset. But there have been improvements, in water quality and fish ecology, even with the big dams still in place. In the Merrimack Valley, the past and present live right alongside the possibilities for the future. The mills may be gone, but there are many more people and a much larger water map than there was even in 1970. These priorities compete with natural places and wetlands for space along the way. The Merrimack has been polluted and degraded, reconsidered and restored. Nearly two centuries after the *Week* of Thoreau, the tension between industry and nature continues to define local landscapes in the swift water place.

* * * *

When I was growing up, I would read the *Boston Globe* every day when it would come to the house. I remember when Peter Gammons invented the notebook column, and when Jeremiah Murphy handed over his brief to Mike Barnicle. I also read the *Fishfinder* columns, the occasional reports of catchable sport fish along the Massachusetts coastline. I read the reports for Area A because the Merrimack River flowed into it. Those columns, which often reported size and numbers along with species, give us important information about how the fisheries of

the Merrimack shifted after World War II. I also looked for newspaper stories about cities, economies, highways, suburbs, and natural places. Stories with names and numbers show how local people saw the Merrimack, and what their observations meant to them.

For longer historical trends, I use three basic sources: the United States Census, public reports of water quality, and similar reports or articles about fish ecology. I also follow the annual anadromous fish returns from the Central New England Fishery Resource Office (CNEFRO) online.[25] Census records tell us where, when and how the economics and demographics of the Merrimack River changed. Public reports of water quality tell us where, when, and how the pollution and restoration of the Merrimack were managed. Fish ecology reports, especially from fisheries managers, tell us where, when, and how the anadromous fish of the Merrimack were restored, or were not restored. Fish returns give us the annual numbers of fish that made it back as least as far as Lawrence. In general, I focus on Massachusetts because most of the pollution and population – and thus most of the restoration – unfolded there. But this is very much a New Hampshire story. After all, most of the good habitat is there, at least for the fish that can reach it. And there are more than a few stories of New Hampshire landscapes as well.

I tell the story of the changing nature of the Merrimack River chronologically, starting with Thoreau and his brother in September of 1839. In my press review, I found that at certain points – in 1960, in 1981, and in 2005 – Thoreau's observations were reawakened by men who took to the river with Thoreau in mind. They read his work in light of the landscapes that they saw after the War. These reference points offer us evidence of a gradually developing sensibility, one that reshaped the Merrimack as much as any policy or innovation. What was

25. See the link in note 23, above.

once instrumental became gradually natural; and yet the remains of the industrial landscape, and of the suburban landscape, were everywhere to see.

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Time and space, price and place; these are the terms of industrial engagement. The Merrimack belongs to an early generation of American industry, when most of modern science was still being discovered. The Merrimack was an early site of discovery for both salmon restoration and water filtration. In both cases, markets defined the restoration of a fish or the delivery of a supply of water. Atlantic salmon restoration was discontinued because it cost too much to keep up with the poachers and the fishways. In the case of water pollution, there was no point in filtering water if they could not provide a marketable resource for public and private consumption. For more than a century after the life of Thoreau, these assumptions were commonly held. The result of these conclusions was a fished and fouled stream.

The instrumental vision of nature strongly controlled how early industrialists made use of the Merrimack. Theodore Steinberg has written the best available history of the Merrimack River in its first industrial century. Steinberg calls the nineteenth century "a rocky, contested path," and he makes his case in two ways. First, industrial leaders sought the control of water in order to power systems to make cloth. Second, industrial leaders sought to transform the legal character of water from a commons to private property. Although local people and public officials objected to the effects of the mills and dams on the fish in the Merrimack, the State Supreme Court upheld the company's charter. The Merrimack soon became a convenient destination for industrial pollution.[26]

26. Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Amherst: University of Massachusetts Press, 1991), 16, 185. In Essex v. Commonwealth (1859), the Supreme Judicial Court upheld the 1848 charter. "In 1848, the state essentially exempted the company from making a fishway by providing damage payments. Eight years later it was nullifying the exemption and leveling new

Steinberg's account closes near the end of the nineteenth century. Other historians have picked up the threads. Patrick Malone argues that steam and electricity provided cheaper and more remote sources of power that forced existing industries to move beyond the water-driven, riverside landscape. Joel S. Tarr has written of the pioneering work in the new science of sanitation biology in Massachusetts. One of the early sites for the slow sand filter, one of the quietest revolutions in human history, was the Lawrence Experiment Station along the Merrimack River.[27] Although the river could never turn the profits that it once had, and it was still an open sewer, it was still useful as a source of power and water. It was still a local resource worth putting to work.

The end of the War was the end of an era. After World War II, suburbs grew up in the old colonial towns. For my appraisal of the suburban landscape as it touched upon urban spaces and industrial problems, I have found inspiration in the work of Andrew Hurley on environmental inequalities in Gary, Indiana. Despite numerous differences – in timing, in demography, in chemistry – Hurley's interpretation is effective. "While some have sought to control urban space for the purpose of accumulating profits," he argues, "others have displayed more variegated motives, including habitation, recreation, and the assertion of social status." But despite such "pervasive environmental manipulation" on the part of industry, "manufacturers encountered little public pressure to amend their practices." Although local people complained about "factory odors and 'murky and unpalatable' drinking water," a political structure "grounded in the promotion of industrial growth" left "little opening for any serious environmental reform initiative." The historic pollution of Gary, Indiana was a matter of

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obligations on the company." It was a contract, the court ruled; to "alter or amend" this contract by rescinding the exemption meant "crossing the fine line into the unconstitutional (185)."

27. Tarr, *The Search for the Ultimate Sink*, 163.

economics, geography, and business. The urban landscape reflected the industrial priorities that polluted land and water alike.[28]

There is a rather large gap between the end of Steinberg's history of the nineteenth century and the postwar world described by Hurley. In contrast, Mark Cioc's "eco-history" of the Rhine River spans nearly two centuries, from the end of the Napoleonic Wars to the early twenty-first century. "Anyone familiar with the Danube, Mississippi, Hudson, Donets, and other major 'industrial rivers' will instantly recognize the general outlines of this story. The Rhine Commissioners set out to manipulate and control the river as fully as possible (to "tame," "train", "rectify", "ameliorate", "straighten," and "improve," it in their terminology), only to find themselves caught in a long war of attrition." When humans "in their folly" depleted the Rhine's "savory" salmon, shad, and sturgeon stocks, "the river served up the less palatable" roach, bleak, and bream "in their place." When industries "overwhelmed" the riverbed with heavy metals, "the Rhine spat them back undigested into drinking water supplies and onto irrigated fields." Steinberg records such excesses in the nineteenth century, and we can trace them into the twentieth century with the well water concerns raised by Anheuser-Busch in the Eighties in Merrimack, New Hampshire.[29]

The history of the Merrimack is more than the story of the stream. There is an emerging need for a perspective that puts the river and its landscape together. This is particularly the case in New England, where the remains of early industrialization are practically everywhere.[30] If we

28. Andrew Hurley, *Environmental Inequalities: Class, Race, and Industrial Pollution in Gary, Indiana, 1945-1980* (Chapel Hill: University of North Carolina Press, 1995), 3, 38.

29. Steinberg, 39 – 41; Mark Cioc, *The Rhine: An Eco-Biography, 1815-2000* (Seattle: University of Washington Press, 2002), 3; John Milne, "$300,000 Buys End to Dispute Over Plant," *Boston Globe*, July 4, 1985, 6.

30. "It's not difficult to find old building foundations and fragments of dams while walking through woods along New England's streams today, or even when observing those streams from roadsides and bridges; old farm

see the landscape as an expression of human priorities – and there are several good historical perspectives on this point – then we can come to a few conclusions about how the landscape reflects what people do.[31] We know from the *Week* that, in 1839, the industrial landscape was both growing and outgrowing. Canals were beaten out by railroads.[32] But for more than a century after 1839, much of the industrial landscape – cities, mills, dams, canals, and pollution – remained.

The field of restoration ecology (or ecological restoration, depending on one's definition) came of age during the Eighties and Nineties, when most of the heavy lifting of pollution control was already underway. In *Beyond Preservation: Restoring and Inventing Landscapes*, a symposium of articles contested the issues that were already emerging by 1994: preservation versus restoration, invented landscapes, changing worldviews, and aesthetics. Whatever the symposium participants thought of the enterprise of ecological restoration, there was a consensus in their conclusions about the enduring place of human beings in nature.[33]

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fields and pastures are not the only sites in the region that are being reclaimed and obscured by the plant growth that occurs when people leave the scene." Kent C. Ryden, *Landscape with Figures: Nature and Culture in New England* (Iowa City: University of Iowa Press, 2001), 237.

31. William Cronon sees the traces of city and country in nineteenth-century Chicago. "By using the landscape," he argues, "giving names to it, and calling it home, people selected the features that mattered most to them, and drew their mental maps accordingly." William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York and London: W. W. Norton, 1991), 25.

32. Thoreau wrote of the Middlesex Canal: "This canal, which is the oldest in the country, and has an even antique look beside the more modern railroads, is fed by the Concord, so that we were still floating on its familiar waters." Thoreau, *A Week on the Concord and Merrimack Rivers*, 37. The Middlesex Canal was already on its way out of business when Henry and John sailed their dory through the locks in the late summer of 1839. In 1909, a feature article about the last living former locktender of the Middlesex Canal was published by the *Boston Globe*. "Jonathan Clough of Guilford, N. H. now in his 90th year is, it is believed, the only living ex-locktender on the old Middlesex Canal, an inland waterway that from 1802 to 1852 connected the waters of the Merrimac [sic] at Chelmsford with those of the Charles in Boston." "Only Living Ex-Locktender of the Old Middlesex Canal. Jonathan Clough, Now in His 90th Year, Resides in Guilford, N. H. – Woburn, as He Knew It in 1840 – Stoddard Conducted Inns Near the Towpath – Bell That Called the Boarders to Meals Kept by the Bosworth Family," *Boston Globe*, August 22, 1909, SM11.

33. A. Dwight Baldwin, Junior, Judith De Luce, and Carl Pletsch, eds. *Beyond Preservation:*

Restoring nature means coming to terms with human priorities, past and present. Certainly we can imagine, along with Eric Higgs, that a landscape could be altered to restore the conditions of a past time. But that process must take into account the human role in the "natural" history of that place.[34] It must also account for the human role in the future of that place. The optimism of some of the early ecologists in restoring fish populations was based in the possibility that if the human role could change, then so could the Merrimack River. In the twenty-first century, restoration ecologists work in woodlands and wetlands around Massachusetts. They benefit from the experience of their forebears in fisheries management, but they are compelled to work in the context of what may come in the future. Ecosystems wait for no one; and even if things look good for now, priorities will change.

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I wrote this dissertation so that I could take the story of the Merrimack out of the nineteenth century and into the life of the pretty river that I see when I cross the John Whittier Greenleaf Bridge on 95, or when I am on the 495 bridge in Lawrence, or when it sparkles through the trees along the way down 110 to Lowell, or when I wander to the water's edge at Sewalls Falls or in Bradford. A local approach to a river history appeals to me for three reasons. First, the word *local* does not connote the same physical boundaries as a jurisdiction, such as a

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Restoring and Inventing Landscapes (Minneapolis and London: University of Minnesota Press, 1994). Articles from this volume include "The Invented Landscape," by Frederick Turner; "Restoration or Preservation? Reflections on a Clash of Environmental Philosophies," by G. Stanley Kane; "Changing Worlds and Landscape Restoration," by Dora G. Lodwick; "Art and Insight in Remnant Native Ecosystems," by Orie L. Loucks; and "The Poetics and Politics of Prairie Restoration," by Constance Pierce. "One topic that *is* addressed by most of the authors in the book is the place of humans in nature," the editors wrote in their conclusion. "Surprisingly, even many of those who reject ecological construction as a new paradigm acknowledge the value of including humans in nature (263)."

34. Higgs refers to wilderness, but his general point applies in other landscapes as well. "To restore the landscape – that is, to address some of the obvious damage accomplished by oversight or careless action by returning to some predetermined time in the past – means incorporating human activities and in this way changing our minds about what counts as wilderness." Eric Higgs, *Nature by Design: People, Natural Process, and Ecological Restoration* (Cambridge and London: MIT Press, 2003), 21.

city, a town, a county, a state, or the United States of America. A neighborhood can be local; a wastewater treatment plant can also be local. Second, the word connotes the involvement of ordinary people and not just political elites or political activists. Readers seeking a disquisition on the override of Nixon's veto of the Clean Water Amendments of 1972, or the effects of Love Canal on environmental activism, will find little about those issues here. Third, I continually find that local stories tell me more about landscapes than stories of how lots of people shaped lands in lots of places around the same time. New England is a diverse and distinctive landscape; its history favors the local setting over the national mood. Local people matter in this book because they make the landscape.

I also wrote this book to offer the possibility that an industrialized river, even an impounded one, can allow local places to reopen to nature. Osprey pairs that could not be counted when Bill Clinton was reelected to the Presidency have returned to the watershed in New Hampshire. Clam flats have reopened that had begun to close when Calvin Coolidge was in the White House.[35] These developments offer the possibility that even if the Merrimack can never be as widely reopened as other dams to the north and east in New England, yet it can still be a place where local people can reencounter the stream and watch the water go by.

"Let the Merrimack be scrubbed clean so even the most fastidious may swim in it," intoned the nature writer Robert Jay Evans in 1960.[36] That task was largely achieved within

35 Robert Braile, "PSNH Pledges Aid for Osprey Recovery," *Boston Globe*, April 30, 2000, WKNH 1; New Hampshire Fish and Game, "Ospreys Soar Off New Hampshire's Threatened Wildlife List," December 8, 2008; repost to the Great Bay Osprey Stewards Website, http://home.myfairpoint.net/dickhughes00/gbospreys/id363.htm, Accessed: January 18, 2014; David Rattigan, "Clam Flats Reopen After 80 Years," *Boston Globe*, October 27, 2013, REG.1. There were no nesting pairs in 1996; by 2008, they had been delisted as an endangered species in New Hampshire. According to David Rattigan, the program that closed the Merrimack River estuarine flats began in 1925 – 1926. "It's been eighty years since they were opened," said Newburyport shellfish constable Paul Hogg.

36. Robert Evans, "Blazing a Trail with Thoreau – VII: A Recreational Paradise Lost by Pollution," *Boston Globe*, September 17, 1960, 14.

twenty years of that article, but the restored river was to flow through a suburban landscape. In 2005, the nature writer John McPhee described the partially restored Merrimack when he and a friend crossed the state line into New Hampshire. "From time to time, we heard the surf of highways we could not see.

> We saw kingfishers along the Merrimack, and blue herons, the fisher kings. Eight Canada geese came in, splat, for belly-flopping crash landings – the only kind of landing they can manage. We saw a shopping cart, a truck muffler, a dolly, dead sweepers full of Styrofoam debris. . . . The Merrimack had its share of foul sweepers, but, over all [sic], the river was remarkably clean, the sight we now came to notwithstanding. [37]

McPhee and his friend saw a "small geyser" where the Nashua Wastewater Treatment Facility was discharging its treated water into the river. "The discharge smelled like laundry detergent and chlorine, nothing worse, but in this place more than anywhere else – including all the rocks and rapids to come – I preferred the cane remain upright." The effluent "seemed to disperse quickly" and the water downstream had been "clear as we approached – peculiarly, the signature of Thoreau and the environmental movement." McPhee closes this meditation with the observation that three hundred thousand people drink the "treated" Merrimack.[38] The trash of industry and the traces of nature are commingled; but the river is cleaner as well.

This book is the story of the Merrimack River since the *Week* of Thoreau. It is a story that follows industrialization out of its most famous days and into the life of the river beyond. When we follow the Merrimack out of the old story and into the new century, we can see how one settled landscape gave way to another, and how one way of doing things gave way to several others. If a river really does have a life, then the Merrimack has most certainly come back from the brink of death. If it wears a few scars, then at least there are more birds and a few more fish,

37. John McPhee, *Uncommon Carriers* (New York: Farrar, Straus, and Giroux, 2006), 130 – 131. "A sweeper is a tree that is still connected to the shore but has fallen into the river. Current moves flotsam into the sweeper, which collects the flotsam (130)." I have seen sweepers in the Merrimack River in Lowell.

38. McPhee, *Uncommon Carriers*, 131.

and many fishers release the ones that they catch. A few local people take to the river in boats from the shoreline. Pathways have been cut into industrial landscapes to allow more green where runners and walkers come by the water's edge. And if some of that water looks brown, then at least it does not smell so bad that people have to stay away.

1. FISHED AND FOULED.

Henry and John Thoreau found their way onto the Merrimack River in September of 1839. "By noon we were let down into the Merrimack through the locks at Middlesex, just above Pawtucket Falls, by a serene and liberal-minded man, who came quietly from his book, though his duties, we supposed, did not require him to open the locks on Sundays. With him, we had a just and equal encounter of the eyes, as between two honest men."[39] The exchange of looks between two young men and a seemingly generous public servant is telling. In 1839, Lowell was only three years old, and Lawrence had not yet been incorporated. Yet the routine of making way in an industrial landscape was already a matter of course, even on a Sunday.

What made that industrial landscape possible? It was the speed and power of the stream. The Merrimack was a site where early investors and engineers took notice of the swift water and the propitious falls. Wheels could turn if water could turn them. Industrialists used new methods, and they planned new cities with mills that made cloth for generations of Americans. These endeavors destroyed fisheries and polluted the river. The pollution of the Merrimack made it almost impossible for anyone reading Thoreau in the twentieth century to imagine even the natural river that the *Week* describes.[40] By the late summer of 1839, the Merrimack River was already shifting towards an impounded stream. It was becoming an industrialized river.

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39. Henry David Thoreau, *A Week on the Concord and Merrimack Rivers Unabridged* (Dover Thrift Edition ed. by Kathy Casey. Mineola, NY: Dover, 2001), 48.

40. "A Night on the Bank of the Merrimack," *Christian Science Monitor*, February 17, 1932, 7. "When we looked out from under the tent," Thoreau wrote, "the trees were seen dimly through the mist, and a cool dew hung on the grass, which seemed to rejoice in the night, and with the damp air we inhaled a strong fragrance." Contrast the idea of that fragrance with a later one. In 1919, F. E. Adams wrote a letter to the editor of the *Christian Science Monitor* with this description. "The river is very beautiful to look at, if one does not get close enough to smell it. I am particularly well acquainted with a point perhaps ten miles from the mouth. At low tide lumps of filthy scum hang from overhanging bushes and tree branches, and that river is the watering place for cattle from the farms along

The first-generation industrial system lasted through most of the nineteenth century. By the eighteen-nineties, steam and electricity had changed the landscape by making remote power more available. The industrial landscape of a previous generation was simply refitted and reused. Local mills and factories used water for power and processing. Local communities used the river for water supplies even as they used it for a cheap sewer. For more than a century after the *Week* of 1839, pollution of the Merrimack was part of the cost of doing local business. Thoreau's fish stories may as well have been medieval legends to most of the people living along the open sewer. The dams went up, and the fish populations went down.

This chapter is the story of the Merrimack from the time of Thoreau until the end of World War II. The transformation of water led to the transformation of the landscape. The industrial landscape was contested, both in the law and in science; but the mills and their dams and the cities and their pollution remained. During the first half of the twentieth century, several plans to "improve" the Merrimack were denied as unmarketable. But when the federal power came to the Merrimack in the Thirties, it created its own markets in flood control and in wildlife protection. Local contests against federalization of flood control, or eminent domain over estuarine territory, were really efforts to control those markets. By the end of the War, industries had controlled the landscape for more than a century. Industry had subdued nature so that water could make power. The Merrimack, the swift water place, had been nearly worked to death.

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When he was not yet nineteen, Ralph Waldo Emerson, a recent Harvard graduate, wrote in his journal in January of 1822 about an inescapable human dilemma. "The fact that the seeds of corruption are buried in the causes of improvement," Emerson observed, "strikes us

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the banks. To whom does the work of keeping the waterways clean belong?" F. E. Adams, "A Merrimack River Need," *Christian Science Monitor*, December 27, 1919, 3.

everywhere in the political, moral, & natural history of the world. It seems to indicate the intentions of Providence to limit human perfectibility and to bind together good and evil like life and death in an indissoluble connection."[41] Emerson looked for a place for nature as he extolled American advancements. But he also knew that improvement carried with it the prospect of corruption, the capacity to degrade.[42]

The American industrial system was born when Emerson was a boy. Francis Lowell and Nathan Appleton visited Scotland in 1810. They met to discuss textiles, and Appleton visited the New Lanark mills developed by Robert Owen. The water-driven mills at New Lanark were among the largest in Britain in terms of the number of people who worked there. When Lowell returned to the United States, he sought a charter from the Commonwealth of Massachusetts and got it. The Boston Manufacturing Company was empowered to build a mill at Lowell. Nathan Appleton was invited by company officials to tour Waltham in the fall of 1813. Forty years later, Appleton remembered "the state of admiration and satisfaction with which we sat by the hour, watching the beautiful moment of this new and wonderful machine, destined as it evidently

41. Ralph Waldo Emerson, *Selected Writings of Ralph Waldo Emerson*, ed. by William Gorman (New York: Signet, 1965), 37. Richard White argues that Emerson's vision of nature persisted into the twentieth century, when it was taken up to advance a kind of progress that "sprang from a regression to nature." White concedes that the centrality of nature in this "classically Emersonian" vision seems "unlikely" to modern people along the Columbia River today, given the slack-water ponds, turbines, pumps, canals, and a bed that became "a highway for barges." Richard White, *The Organic Machine: The Remaking of the Columbia River* (New York: Hill & Wang, 1995), 48, 56.

42. Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (Oxford, London, and New York: Oxford University Press, 1964), 230. Leo Marx summarizes Emerson's connection of industry with the nature around it. "The industrial revolution is a railway journey in the direction of nature." Luckily for us, Emerson observes, "now that steam has made the Atlantic a strait, the nervous, rocky West is intruding a new and continental element into the national mind, and we shall yet have an American genius (238)."

was, to change the character of all textile industry."[43] That system would soon come to dominate and transform landscapes as well.

It was not long before heads would turn. In 1814, Daniel Webster had told the U.S. House, "I am not anxious to accelerate the approach of the period when the great mass of American labor shall not find its employment in the field; when the young men of the country shall be obliged to shut their eyes to external nature…"[44] By 1822, Webster, with the invitation of Nathan Appleton, was looking for subscribers to buy a sixty-thousand-dollar share in the Merrimack Manufacturing Company. Webster could not raise the funds, but his enterprise shows that his mind had changed very quickly.[45] Industrialization looked as though it could really make money, and New England seemed to be one of the places for making it work.

Investors in the "Waltham-Lowell system" recognized that they would have to change how people did things in order to make places for themselves.[46] For industrial enterprises to make money, industrial entrepreneurs had to stake out their places in the landscape. For water-powered industries, this meant planning cities where structures could control water to make wheels turn. The first step in this process was to change what it meant to own water along a stream. In the eighteen-twenties, small pieces of land were conveyed to the Lowell mills with the right to use water. The language of the deeds signed by the Proprietors of Locks and Canals

43. Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Amherst: University of Massachusetts Press, 1991), 39 – 41. The quotation is from Appleton's *Introduction of the Power Loom, and Origin of Lowell* (Lowell, 1858), cited first in note 69 on page 39 of Steinberg's work.

44. Jadviga M. da Costa Nunes, "The Industrial Landscape in America, 1800 – 1840: Ideology into Art," *IA., the Journal of the Society for Industrial Archaeology,* 12, no. 2, IA IN ART (1986): 20.

45. Maurice G. Baxter, *One and Inseparable: Daniel Webster and the Union* (Cambridge, MA and London: Belknap Press of Harvard University Press, 1984), 75, 173 – 175.

46. Theodore Steinberg, *Nature Incorporated*, 59. "Before the Boston Associates arrived in the valley, the river's water had been controlled to a large degree. What the Associates did with the water furthered this same process of reengineering the natural world. Their water power infrastructures were built on a vaster scale, improved the degree of water control, and most important, were designed with an entirely different aim in mind. Not commerce or navigation, but production was at the heart of their efforts at harnessing water for energy."

of the Merrimack River (PLC) and the Lowell mills suggests "a radically new understanding" of the relationship between land and water. The rights to land and water were considered apart from one another, "opening the way" for the separate sale of water. By the eighteen-thirties, the PLC sold water without including land at all – a "pivotal development" in the commoditization of this resource.[47]

The second step was the control of water so that it could actually perform work. Most of the research in hydraulic engineering was in Europe. But the Boston Associates, some of whom had visited England to see the new mills, had good connections with a local family whose son had grown up in France and then had gone to Harvard. After Harvard, the young man went back to France to study hydraulics. Then he returned to Massachusetts to work for the Essex Manufacturing Company. This is how Charles S. Storrow – a Yankee who became a friend of the Marquis de Lafayette from childhood, and an American who saw the Revolution of 1830 for himself – became one of the masterminds of American engineering in the early nineteenth century. Storrow had seen momentous times abroad, but it was the knowledge he brought home with him from France that had a more lasting effect on him and on the country to which he returned in March of 1832.[48] Storrow's ideas and experiences would be invaluable to his future endeavors.

Charles Storrow was an engineer; he was not just a businessman with an interest in the things that engineers could build. Storrow's book on water-powered engineering was highly influential. *A Treatise on Water-Works for Conveying and Distributing Supplies of Water*, published in 1835, was "the first American book on hydraulics." Dennis Hart Mahan's

47. Steinberg, *Nature Incorporated*, 87.

48. Peter A. Ford, "An American in Paris: Charles S. Storrow and the 1830 Revolution," *Proceedings of the Massachusetts Historical Society*, 3rd Series, 104 (1992): 21 – 22, 35.

Elementary Course of Civil Engineering, the most influential book of its kind in the nineteenth century, was published in 1837. Mahan's work was based on principles that Storrow had described in the *Treatise*. For the next generation, American engineers looked at Storrow's book as "a standard and highly usable guide on French, English, and German hydraulic theory."[49] This book would carry hydraulic engineering all the way to the end of the Civil War.

One of Storrow's readers was a man named James B. Francis, who became the chief engineer at Locks & Canals at the age of twenty-two in 1837. Francis applied Storrow's principles to a very specific problem in the City of Lowell, which had been incorporated the previous year. Storrow had been appointed to a board of commissioners who were investigating inefficiencies in the existing system. Francis was enlisted to help with testing. According to a report, Storrow was "so well satisfied" with Francis's accuracy, judgment and skill that Storrow advised company managers "to rely on him for such work as they might need in the future." The like-minded engineers became friends as well.[50]

Francis came to Lowell so that he could investigate a simple but difficult problem. Water discharged on the upper level supplied mills on the lower level. Now Francis was charged with making sure that all lessees got "their fair share" of the water. Francis was less of a theorist than a practical thinker. His work in scientific engineering helped him to develop "reliable procedures" for measuring the efficiency of hydraulic prime movers and the amount of water used by the mills. But there was still backwater, the surplus water that would wash back into the buildings. Backwater would slow the wheels, reducing production. Sometimes the factories

49. Patrick M. Malone, *Waterpower in Lowell: Engineering and Industry in Nineteenth-Century America* (Baltimore: The Johns Hopkins University Press, 2009), 102; Peter A. Ford, "Charles S. Storrow, Civil Engineer: A Case Study of European Training and Technological Transfer in the Antebellum Period," *Technology and Culture*, 34, no. 2 (1993): 290 – 292.

50. Malone, *Waterpower in Lowell*, 101 – 103.

would shut down. On April 15, 1843, a woman named Susan Brown wrote in her journal. "Back water – came out at noon." The next day she called at Middlesex Mills, but there was back water again as the river flooded. Susan Brown did not work. "Great, long, dull day. . . . Went down to see the water." Francis soon availed himself of newer turbines that could drive water horizontally instead of turning vertically like the breast wheels then in use. Once again, recent advances in French research had led to an American solution.[51]

For a time, there was a need to emphasize nature in the midst of industrial growth. Kirk Boott was one of the three men most directly responsible for the new system developed at Lowell. Although he was not involved in the operations at Waltham, Boott was invited to become the new agent for the Merrimack Company. He then bought a hundred acres of land in Chelmsford which he transferred to the Merrimack Company. He was later appointed treasurer and agent for the PLC, "a post he held until his death in 1837."[52] From these auspices he took a position at the promontory of early American industrialism, the water-driven know-how of the newly industrial landscape.

Boott was among the industrial leaders who sought to have their factories rendered in landscape art. The accuracy and forcible repetition of engineering certitude, the lines and clauses of blueprints and contracts, made engineering seem exact and orderly. In contrast, the artistic representation of mills and towns was almost deliberately inexact. Jadviga M. da Costa Nunes argues that the pro-industrial ideology of a "divine mission" for industrialists continued to rely upon "the myth of the purifying powers of nature." Until about 1840, factory landscape art

51. Malone, *Waterpower in Lowell*, 101, 104 – 105.

52. Steinberg, *Nature Incorporated*, 63. "Three men – Patrick Tracy Jackson, Paul Moody, and Kirk Boott – were responsible for creating the initial water delivery system at Lowell (additions to it were made in the 1840s). Moody and Jackson both had been closely associated with the development and maintenance of waterpower at the Waltham mills. Boott, however, was not involved with the Boston Associates until the Lowell venture."

showed rural scenes to balance against the industrial forms. As the industrial landscape expanded, the buildings became smaller so that more of the farm life could be depicted to balance the landscape. Eventually it got to the point where paintings of Lowell created a landscape balancing rural and industrial elements – a place no one could find anywhere in the Mill City.[53]

The Merrimack Valley soon became famous for its newfound industries. Andrew Jackson came through New England in 1833 to see how things were running, and starting in the eighteen-forties, important people – writers like Charles Dickens, and political figures like Davy Crockett – were invited to tour Lowell.[54] Factory tours were an effective means of selling the importance of growing American industries to public figures who would comment about them elsewhere. Within only a few years of its inception, the industrial landscape had become a source of public pride. It was already a marvel worth seeing for oneself.

But that marvel, that source of public pride, came at the cost of local environs. Engineers and industrial leaders proceeded from buying plots to planning sites and building structures. In the course of that process, the Boston Associates and their experts transformed the legal meaning of a drop of water so that it could no longer be claimed as a common resource. It could be

53. Nunes, "The Industrial Landscape in America, 1800 – 1840," 24 – 25, 28 – 30. Alvan Fisher , a noted landscape artist of Native American scenes, was commissioned by Kirk Boott to portray Lowell. "Fisher's renderings may be said also to be the most evasive representation of the factory in decades. In the painting *The Falls in the Merrimack near Lowell*, for instance, the artist rendered the factory buildings as only a tiny element within the panoramic landscape, although their central location upon the horizon is indicative of the iconographic significance. The scene consists almost entirely of the middle landscape of the river and its surrounding countryside, and the mood of the work is thoroughly idyllic (29)." For Fisher to represent Lowell "pastorally" meant "hardly to represent it at all – to place such a considerable distance between the viewer and the mill that the factory and nature still seemed suspended in a delicate and lyrical balance (30)."

54. William Littman, "The Production of Goodwill: The Origins and Development of the Factory Tour in America," *Perspectives in Vernacular Architecture*, 9, Constructing Image, Identity and Place (2003): 72 – 73.

property; it could be a thing to be bought and sold. Water could be stored or poured at private advantage because its legal character was changed so that it could be marketable.

This was not all bad; women like Susan Brown found work, and the mills spun good domestic cloth. But the dams and their cities commanded the landscape at the expense of nature. By the middle of the nineteenth century, the dams were in place and the machines were humming. The fish – however many of them were still left in the Merrimack – would have to fend for themselves. In barely more than thirty years, the dams killed off fish runs that had lasted for a thousand times as long as the span of time between the end of the War of 1812 and the rise of the Great Stone Dam.[55] The rise of the industrial landscape spelled the end of the olden fisheries of the glacial scrape.

* * * *

There was a time when the Merrimack had plenty of fishing. Natives had their pick of at least fourteen sets of falls, and many of them went to the falls at Amoskeag, Hooksett, and Penacook to catch the annual runs of migrating salmon, shad, and river herring.[56] The "swift water place" in the Merrimack really denoted the stretch between Garvins Falls in Bow and Pawtucket Falls in Lowell.[57] But while the dams may have ended the river-running fisheries,

55. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin and Advisors to the Technical Committee, *Strategic Plan and Status Review: Anadromous Fish Restoration Program, Merrimack River* (Nashua, NH: Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, 1997), 4. "The Merrimack River basin was completely covered by a continental ice sheet twenty to fifty thousand years ago. As the ice cap retreated, fish began to colonize this new habitat."

56. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin and Advisors to the Technical Committee, *Strategic Plan and Status Review*, 15.

57. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review*, 15.

Atlantic salmon and American shad had already been overfished by the eighteenth century.[58] The depletion of colonial fisheries was a strong argument against protecting fish at the cost of industrial development, but salmon and shad still had markets at the outset of the nineteenth century. Fish markets were depressed, but they were still somewhat viable.

One thing that most local people understood was how the blocking of migratory runs left the fish nowhere else to go. Natives had made good use of this knowledge annually. In the Delaware River Basin, some of the Natives had a month in the spring named after the shad. These Natives angled lines of stones to channel shad runs towards a box with holes. A separate party would be sent a mile upstream with a wild vine rope hanging a line of six-foot boughs to scare the fish back downstream to the dam where they could be caught in the box and then beaten to death. This was one of many ways in which Natives fished for shad before colonial settlements excluded them from their favorite spots.[59]

58. Daniel Vickers, "Those Dammed Shad: Would the River Fisheries of New England Have Survived in the Absence of Industrialization?" *William and Mary Quarterly*, 3rd Series, LXI, no. 4 (2004): 685 – 712. Vickers argues that the proliferation of colonial fishing restrictions demonstrates the level of concern. By 1765 there were already limits on fishing in the Mystic River: how long, what gear, and on what days of the week. "Such language sprang from the colonists' belief that, if only the level of fishing effort could be reduced, the fisheries might recover (705 – 706; quotation 706)."

59. C. Boyd Pfeiffer, *Shad Fishing* (New York: Crown, 1975), 1 – 2. Writing in German, George Henry described shad fishing in *The Mission of the United Brethren Among the Indians of North America*, published in 1794 just as industrial dams were coming to the rivers of the East. Lenape had a separate name for the month of March, Chwame Gisuch, the month of the shad, during which they would hold a fish festival lasting five or six weeks. Charles Hardy III, "Fish or Foul: A History of the Delaware River Basin Through the Perspective of the American Shad, 1682 to the Present," *Pennsylvania History* 66, no. 4 (1999): 506 – 534 (citations 508, 530). Although this chapter was not named with Hardy's title in mind, the grammatical shift between the phrases is useful. Hardy's fish-eye view of the Delaware allows him to follow a single species for more than three hundred years of Native, colonial, industrial, and post-industrial settlement in one of *Alosa sapidissima*'s favorite spawning rivers. At the end of the twentieth century, the shad fishery was healthy in the Delaware. Some 70,000 anglers were providing $3 million a year to the local economy, and increasing numbers of fishers were throwing shad back rather than taking them home (528).

Those days were long gone even by the time that the brothers Thoreau put their dory into the Concord River. The struggles of anadromous fish were poignant in the late summer of 1839. Thoreau described the growing conflict between mill cities and fishers of the Concord River.

> Salmon, Shad, and Alewives were formerly abundant here, and taken in weirs by the Indians, who taught this method to the whites, by whom they were used as food and as manure, until the dam, and afterward the canal at Billerica, and the factories at Lowell, put an end to their migrations hitherward; though it is thought that a few more enterprising shad may still be occasionally be seen in this part of the river. It is said to account for the destruction of the fishery, that those who at time represented the interest of the fishermen and the fishes, remembering between what dates they were accustomed to take the grown shad, stipulated that the dams should be left open for that season only, and the fry, which go down a month later, were consequently stopped and destroyed by myriads. Others say that the fish-ways were not properly constructed.[60]

In his appraisal of improvements in the landscape, Thoreau took the side of the fish. "Armed with no sword, no electric shock, but mere Shad, armed only with innocence and a just cause, with tender dumb mouth only forward, and scales easy to be detached," he wrote. "I for one am with thee, and who knows what may avail a crow-bar against that Billerica dam?"[61]

By 1847, Thoreau's question had been answered with an even bigger structure than the dam at Billerica. The Great Stone Dam at Lawrence was an imposing structure of granite and cement averaging thirty-two feet in height, with a base thirty-five feet thick, and a width of 1,600 feet.[62] We can see the effects of such dams in the rapid decline of the anadromous fisheries in only a few decades. Lawrence Stolte estimates that there could have been as many as 27,000 Atlantic salmon in the Merrimack River prior to industrialization. In 1805, a good catch in the Lawrence area amounted to 20 salmon per day, per fisherman. By 1830, a catch of ten salmon a day was exceptional. By the eighteen-fifties, no salmon catches existed. The effects on the

60. Thoreau, *A Week on the Concord and Merrimack Rivers*, 18.

61. Thoreau, *A Week on the Concord and Merrimack Rivers*, 20.

62. Steinberg, *Nature Incorporated*, 168.

salmon market were decisive: in 1789, the salmon fishery was worth about $38,000; by 1805, it was worth $9,500; in 1835, it was down to $4,750 in value. After 1850, the value was projected at only one dollar. The salmon market had disappeared. [63]

The shad followed the salmon down the path to decline. On May 23, 1760, it was reported in the *New Hampshire Gazette* that over two thousand American shad were taken out of the Merrimack at a single haul. In 1789, the estimated value of the shad fishery in the Merrimack River in the area of Lowell and Lawrence was $830,000. By 1805, the fishery was worth about $540,000. By 1835, it was worth $365,000, and by 1865, when the Civil War ended, the shad fishery was worth about $50,000.[64]

Clearly the overall value of the shad market was much larger than the salmon market, even in 1789. Taking the 1789 market as 100 percent, and assuming the market value of salmon in 1865 was still one dollar, gives the results depicted in Figure 1.1.

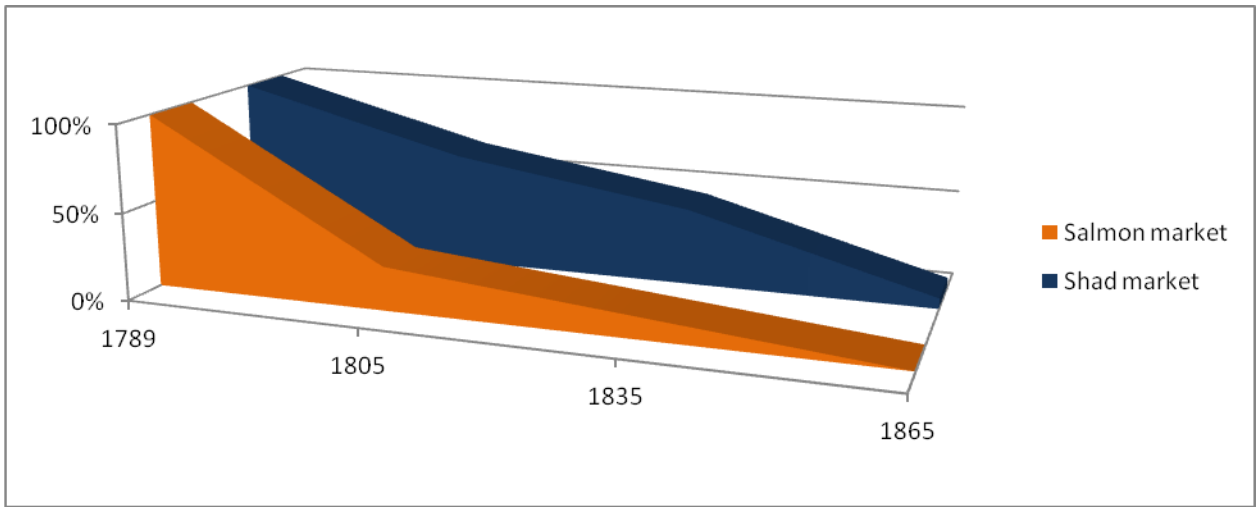

Figure 1.1. Percentage of 1789 Market Value of the Salmon and Shad Markets of the Merrimack River Between 1789 and 1865.

63. Lawrence Stolte, *The Forgotten Salmon of the Merrimack* (Washington, DC: United States Department of the Interior, Northeast Region, 1981), xxi.

64. Stolte, *Forgotten Salmon of the Merrimack*, xxii, 7, 9.

Figure 1.1 shows how the salmon and shad fisheries crashed before the Civil War. The shad market had lost almost 94 percent of its value by the time that salmon restoration was organized in 1865 – and more than 90 percent of the value of the 1835 shad fishery had disappeared by the end of the Civil War.[65] It may be that, the more attractive salmon was gradually replaced by shad, in the way that Atlantic halibut went from a bycatch to a "marketable product" between 1840 and the eighteen-eighties.[66] But the salmon market collapsed before the first of the big new dams was in place, and its absence by 1835 would not explain as much as the rise of the dams that blocked the way home.

After 1850, the social effects of blocked rivers became political issues as well. Local people in Massachusetts began to use state government – not just the state courts, but the General Court – to redress their grievances.[67] Two cases stand out: *McFarlin v. Essex Company* (1852), in which a private citizen sued a powerful company; and *Commonwealth v. Essex Company* (1859), in which that company was opposed by the Commonwealth itself. In the first case, William McFarlin sued the Essex Company in a county court for having so constructed their dam as "entirely to stop and impede" the passage of fish up and down "said river." Mr. McFarlin had purportedly caught nine hundred shad in one good day in 1847 at his private fishing privilege at Pawtucket Falls. McFarlin was awarded damages by a sheriff's jury, which ruling was

65. The West Egg Inflation Calculator offers Consumer Price Index inflation calculations for any two years between 1800 and 2013. $365,000 in 1835 was worth approximately $541,102.41 in 1865. A value of $50,000 in 1865 would be less than ten percent of that estimated value. http://www.westegg.com/inflation/. Accessed: May 16, 2014.

66. Glenn M. Grasso, "What Appeared Limitless Plenty: The Rise and Fall of the Nineteenth-Century Atlantic Halibut Fishery," *Environmental History* 13 (2008): 66.

67. In the Commonwealth of Massachusetts, the legislature is known as the General Court. "The 189th General Court," https://malegislature.gov/. Accessed: April 15, 2016.

confirmed by a court of common pleas. After the decision, the Essex Company appealed the case to the Supreme Judicial Court.[68]

At a first glance, the case seems clear: McFarlin wanted to fish where he had always been able to fish. However, McFarlin had argued according to the standard of adverse use, a relatively new legal doctrine developed in New Hampshire in *Bullen v. Runnells* in 1820. Under the traditional idea of prescription, people who failed to develop water, letting it languish, could still maintain their legal claim to that resource. Adverse use required the first user of water to develop it or be exposed to the loss of the property right.[69] The Supreme Judicial Court found that McFarlin could not claim fishing rights because he had not developed his place along the stream. He had left the place as he had found it; therefore, he had no better right to it than anyone else. The Essex Company's dam was not a nuisance; instead, the Great Stone Dam was evidence that the company had secured the rights to use the Merrimack as a resource at the expense of McFarlin and the other local fishers along the stream.

Public officials began to hear from their constituents, and they soon took action as well. In 1855, the Essex Company was sued in Massachusetts for damages related to flooding and for not constructing a good fishway. The dam in Lawrence blocked fish passage and flooded riparian lands. On June 6, 1856, the Massachusetts legislature required the Essex Company, as of February 1857, to construct "a suitable and sufficient fishway for the usual and unobstructed

68. Steinberg, *Nature Incorporated*, 175 – 176.

69. Steinberg *Nature Incorporated*, 144 – 145, 176. Judge Lemuel Shaw, writing for the Massachusetts Supreme Court, found that it was "now perfectly well established" as "the law of this commonwealth" that "in all waters not navigable in the common-law sense of the term," the "right of the fishery" is "in the soil of the owner upon which it is carried on." Theodore Steinberg argues that this rule meant that "an exclusive right to fish in non-navigable rivers" stemmed from "ownership of the riparian land." A navigable river, "conversely," or stream was considered public, and no such private right could be claimed. The court found that since McFarlin could not "prove ownership of the riparian land," and could not "establish any prescriptive claim to the fishery" without "maintaining" a prescriptive right to the land. The lower court's judgment was therefore set aside (176).

passage of fish" during the months of April, May, June, September, and October – or to be fined for failing to do so. This law came out of a finding, reported in the news, that "there is not the slightest evidence that ever a single fish" had passed from the water below the dam to the water above. But the Essex Company had previously paid damages for fishing rights; and so, the Essex Company held that they were excused from any further responsibility.[70]

The Essex Company took the position that their payment amounted to a deed on the water rights of the Merrimack River. Company officials appealed to the General Court to set aside the 1856 law, which they considered "an Act not to alter a charter, *but to take private property for public uses without compensation*." This became the case of *Commonwealth v. Essex Company*. In the opinion of the Supreme Judicial Court, the 1848 act which had chartered the Essex Company had "all the elements of a contract, executed by one party and binding on the other." The 1856 act, which sought to revisit the costs of fish passage, was found to be unconstitutional. The Chief Justice held that the public right consisted only of the existing private rights to fish that were compensated in 1848. This limited the public's interest in fishing rights to the benefit of water-powered industry.[71] A fishable river was demolished to make way for a working river, and the value of the work was worth the cost.

There were a few occasions of local protest after the *Essex* cases. In 1859, a group of local men attacked a dam owned by the Winnipissioggee Lake Cotton and Woolen Manufacturing Company. The Lake Company dam had been flooding their fields. A sheriff was able to contain the protest, but one man got hit in the hand with a crowbar and a few boards were torn away. A month after the dam attack at Winnipesaukee, a watchman found a bomb set to

70. Steinberg, *Nature Incorporated*, 179.

71. Steinberg, *Nature Incorporated*, 178 – 179, 181, 184 – 185 (quotation 185).

explode at the Amoskeag Dam in Manchester.[72] But there was no sustained movement to connect local communities who had shared interests, and there was no recourse for most of the local people anyway. So much for what a crowbar could avail. The river was tamed; now it would be put to work.

* * * *

The rise of the industrial landscape meant the end of the ancestral river fisheries and the local markets that had depended on them. But what if those marketable fish could be restored? The Harvard naturalist Louis Agassiz had experimented with hatching fish in a washbasin in his bedroom in 1840. Near Cleveland, Theodatus Garlick and H.A. Ackley were able to produce the first propagated fish, a brook trout, in 1854. These experiments were encouraging news to the fishers of New England waters. In 1865, the Governor of New Hampshire signed a bill creating the first state fish and game commission in the United States. New Hampshire's commission was soon followed by one in Massachusetts, where the state legislature increased the budget for the new agency to $3,000 in 1866. If salmon could be restored, then perhaps the market in salmon could return – if the hatching equipment could survive the season intact.[73]

Resistance to fish passage had been a major issue before the Civil War. Given the history with the Essex Company, Massachusetts commissioners went to the Essex and Pawtucket dams to inspect fish passage with a strong rule in hand. Anyone who would refuse to begin construction of a fishway within thirty days would face the prospect of having the Commonwealth contract the work, and then having the state treasurer recoup the expenses from

72. Steinberg, *Nature Incorporated*, 99 – 101.

73. Richard W. Judd, *Common Lands, Common People: The Origins of Conservation in New England* (Cambridge, MA and London: Harvard University Press, 1997), 148 – 150, 155, 158. In 1870, Seth Green's shad hatching boxes, from which Green put 100 million young shad in the Connecticut River, were "vandalized repeatedly."

the company. The Essex Dam fishway was exempted because its fishway had already been built (and because the Commonwealth had already lost in court in 1859). New Hampshire was already requiring fish passage for any structure that would block a stream completely. For the time being, pollution was still a remote threat. Water quality tests found no toxins that would necessarily kill the salmon.[74] So far, the conditions seemed favorable, at least in theory, for fish to be brought back to the Merrimack.

Having established that there was sufficient fish passage and decent water quality, fisheries managers set forth to restore Atlantic salmon to the Merrimack River in 1865. Restoration entailed five steps: harvesting eggs, hatching eggs, releasing juveniles, improving fish passage, and protecting the fish that would survive two winters in the sea to return to the new-old stream. In all of these operations, time and place were crucial. Finding eggs meant looking for related salmon in nearby waters and getting them back to the hatcheries to start at the right time of year. Releasing juveniles meant getting to certain points along the river when the water would be the right temperature. Improving fish passage was oriented to the future, but its place was fixed in the existing structures by past experience. Protecting the fish meant protecting past investments for the future on a daily basis.

The first step was harvesting eggs. The ancestral genetic strain of Merrimack salmon was extinct by 1850. There were other rivers, in New England and Canada, where there were still healthy females whose eggs could be taken. Transport was a problem, but if the eggs could arrive, then they could be used to rebuild a new local strain. For a good part of the history of the program, the Penobscot River in Maine was still home to Atlantic salmon. The diversion of

74. Stolte, *Forgotten Salmon of the Merrimack*, 13 – 15.

some of its eggs to the Merrimack was only one feature of the huge demand for Penobscot salmon eggs in the second half of the nineteenth century.[75]

The second step was hatching eggs. The idea here was to start from fertilization and to guide the new salmon through the early stages of development, when fry become smolts. There were always more eggs than fry, and more fry than smolts. But the more healthy smolts that could be grown, the more chances that the hatcheries would have to release a juvenile that could return as an adult after a couple of winters at sea. The state hatching house was set up at Livermore Falls, near Holderness, New Hampshire. Its first shipment of salmon eggs was not a strain of Penobscot salmon, but of chinook salmon from California. Almost all of them survived the trip, and only four percent of the survivors failed to hatch. Thus the first hatchlings released from the state hatching house in 1878 were chinook salmon, not Atlantic salmon. But it was a start. Soon eggs from landlocked salmon, lake trout, and brook trout were being hatched, "and the young deposited far and wide." In 1879, thirteen females were captured at Livermore Falls, producing some 100,000 eggs and a proud declaration from the man running the hatching house.[76]

The third step was releasing fry into the river. The hatcheries had been constructed at the release points that would most favor the salmon. Many more juveniles are released than are ever expected to return. The release of juveniles provides the baseline for the efficiency of the program when returning fish are counted. For the first five years, releases never exceeded twenty thousand fry. Releases totaled in the six figures when they were released; no fry were released between 1877 and 1879. Of the more than six million fry released in the program, the

75. Stolte, *Forgotten Salmon of the Merrimack*, 16.

76. Stolte, *Forgotten Salmon of the Merrimack*, 62, 71.

majority were set loose between 1882 and 1892.[77] The lack of fry releases after 1892 was a major reason that the program ended in 1896.

The fourth step was improving fish passage. Fish could do well enough to survive two winters at sea, but without better passage, they would simply fail to spawn. Officials in New Hampshire knew that they could not force fishways to be built in Massachusetts. They could, however, pass laws to regulate the dams that blocked the fish. The Lake Company's representative, Josiah French, recalled that the new Governor of New Hampshire, Frederick Smyth, had warned French in 1866 of the "strong feelings" in some parts of the state that some had with regard to the "management and control of so much of the navigable water" of the state. The headwaters of the Merrimack were accessible by 1868, but improvements would continue for another twenty years before fish passage would be considered suitable. [78]

The fifth step was protecting the river-runners until they could propagate freely again. Since colonial times, people had been complaining about other people taking fish. The release of so many juveniles would produce the return of healthy adults, if they were not first caught as hatchlings. Stocking was suspended in New Hampshire in 1867 after only a few fish surmounted the Lawrence fishway that was completed in 1866. Even when the states agreed, there were people waiting to fish the salmon that could be had, including some fishers in Newburyport who complained about a mesh size enforced to protect hatchlings.[79] But New Hampshire began to let its enforcement slide in the eighteen-nineties, and Massachusetts relaxed fishing regulations in

77. Stolte, *Forgotten Salmon of the Merrimack*, 181 – 182.

78. Steinberg, *Nature Incorporated*, 188, 190 – 193; Stolte, *Forgotten Salmon of the Merrimack*, 15.

79. Judd, *Common Lands, Common People*, 161 – 162.

1895. The new dam at Sewalls Falls in Concord had "no fishway whatever," and the Lawrence fishway was washed out by a storm in 1896.[80]

Overfishing of the new salmon led to their ultimate demise. Between 1887 and 1891, over two million fry were released and about eight thousand adults returned to the Merrimack. But they were caught downstream before they could ever spawn. It soon became unreasonable to replace fishways when salmon would not be coming back every year, and it was no longer worthwhile to try to force companies to build better fishways without the prospect of more fish returning.[81] The expense of fish passage and the effects of downstream predation were mutually reinforcing. By the end of 1896, the salmon program was ruined. When the Lawrence fishway was repaired in 1898, it was already too late. There would be no more salmon eggs from the Penobscot, and there were not enough of the new fry to keep it going.[82]

The results of the salmon program were better than most people nowadays would have thought. From practically none, the salmon counts rose to the hundreds by 1877 and hit 2,000 salmon in 1888. The high mark was in 1893, when more than 3,000 were counted. But by 1897, the returns had fallen below 1877 levels.[83] Stolte estimates that 6,381,000 fry were released, and 2,605,000 were produced naturally. He estimates that from these fry, 839 adults, 1,118 grilse (one-winter), 19,531 two-sea-year fish, and 1,987 three-sea-year fish returned. 438 salmon made it all the way to Livermore Falls.[84] Almost nine million fry produced fewer than nine hundred adults, but they also produced more than twenty thousand juveniles. And for a while, it had

80. Judd, *Common Lands, Common People*, 163.

81. Stolte, *Forgotten Salmon of the Merrimack*, 108.

82. Stolte, *Forgotten Salmon of the Merrimack*, 120 – 128.

83. Stolte, *Forgotten Salmon of the Merrimack*, 187.

84. Stolte, *Forgotten Salmon of the Merrimack*, 182.

seemed to work. With good harvests of eggs, scientists could hatch fry and release them. But they could never really protect the fishways that interfered with private business, and public officials did not enforce laws against poaching anyway. By 1900, the effort was at an end.

When we break down the salmon program into its constituent parts, we see how each was contested. Harvesting eggs was a problem. Hatching and releasing fry was fairly routine, at least when it could be accomplished. It was not all in vain; most of the salmon that returned to Lawrence had spent two years in the sea. Lawrence Stolte's estimates for the annual returns of Atlantic salmon to the Merrimack River show that when the first three elements of the program were working, things went well; almost four thousand salmon returned in 1893. But the end of releases after 1892 crashed the new fishery because downstream predation and poor fish passage were already cutting into the number of adults coming back to spawn. Stolte estimates that in three of the years between 1887 and 1891, more than nine hundred salmon returned annually to spawn. After 1891 there were none; and it was only a matter of time before the restored fishery was depleted.[85]

The salmon restoration program ended with the nineteenth century. Even so, it tells us something about how local people held onto the idea of the other Merrimack, the natural stream. For thirty years fish scientists made serious efforts along a stream where pollution was a daily thing. City sewers were only one source of pollution of local water supplies.[86] But for a few of those years – some of the eighteen-seventies, when drought did not threaten water levels and

85. Stolte, *Forgotten Salmon of the Merrimack*, 181 – 182, 187.

86. Steinberg, *Nature Incorporated*, 222. "A doctor visiting a farmhouse outside the city of Concord, New Hampshire, noticed a woman in the kitchen straining water she had just pumped out of a well. When he inquired into her purpose he was told 'that it was done to strain out the dead potato-bugs that had washed into the well during the spring rains.' The insecticide Paris green had been used the previous year on a potato field near the well." According to Steinberg's sources, this story came from an 1882 report.

when floods did not threaten fishways – there were thousands of salmon in the Merrimack for the first time in decades. If salmon restoration could be made more cost-effective, and if its results could be protected, then perhaps there could be another chance to try again someday. But it says something of the power of the industrial landscape that such a chance would not appear for the Merrimack River until the centennial of the end of the Civil War had come and gone.

* * * *

The first industrial epoch ended with the nineteenth century. It seems almost appropriate that both Charles Storrow and James B. Francis retired around the time that their second-generation water-powered system was going out of style. Storrow retired at the age of eighty in 1889, four years after Francis retired as chief engineer of the Proprietors of Locks and Canals in Lowell at the age of sixty-nine. Steam and electricity had made it possible to move power sources away from rivers. By the end of the century, most of the first-generation water-driven turbines had been priced out of the emerging markets. By the end of World War I, most of the textile systems had been connected to electric generators.[87] It was no longer necessary to come right up to the water's edge just to get the power that a river could provide. But the mills and the dams and industries stayed in place, and the daily pollution from cities and towns, industries and sewers, continued well into the twentieth century.

Getting clean water from the Merrimack River was a serious municipal problem. Pollution in water supplies led to disease. During the eighteen-nineties, theorists of sanitation engineering combined biology with physics so that water systems could be made clean enough to carry supplies to the cities. There was a growing suspicion that the prevailing theories of "sewer

87. Ford, "Charles S. Storrow, Civil Engineer," 290 – 291, 293,295, 297, 299; Malone, *Water Power in Lowell*, 101 – 103, 193, 202 – 203, 223 – 224. By the time Storrow died in 1904, electrification had surpassed water-driven systems in the Merrimack River. In the Thirties, only three of the old mills were still running at their original premises, and the last of them closed in the Fifties (Malone 223).

gas" and "miasma" were wrong. Biologists were coming to the recognition that, in fact, the infective agents were living things rather than airborne compounds.[88] Once the sewer gas theory had been set aside, the problem became one of water pollution instead of air pollution. Sanitation biologists looked for places where they could test their new ideas.

In 1893, the Lawrence Experiment Station, in Lawrence, Massachusetts, was one of the primary sites of research into the relationship between typhoid fever and "sewage-polluted" waterways. William T. Sedgwick was Epidemiologist, and under his direction there were experiments "into methods of sewage 'purification' and the further development of intermittent filtration as a means of treatment." The first slow sand filter was built in 1875 in Poughkeepsie, New York. Water filtration came into its own in the eighteen-nineties, and a slow sand filter was developed and applied at Lawrence in 1895. Mechanical filters were developed at another facility in Louisville, Kentucky. The success of the two filters led "many inland cities" to install sand and mechanical filters after 1897, resulting in "an impressive decline" in morbidity and mortality rates from typhoid fever as well as other diseases.[89] The installation of a city filter in Lawrence reduced the rate of typhoid fever after 1894 by an average of 79 percent.[90]

The development of modern water filtration is of a piece with the career of an eximious scientist. Harry W. Clark began working in Lawrence in 1888, and he was still there in 1930. "The development of scientific sewage treatment has been so rapid," said an editorial in the *Sewage Works Journal*, "that in one man's professional lifetime we have progressed from

88. Tarr, *The Search for the Ultimate Sink*, 162 – 163.

89. George A. Johnson, "Present Day Water Filtration Practice," *Journal (American Water Works Association)*, 1, no. 1 (1914), 32; Tarr 162 – 163.

90. Johnson, "Present Day Water Filtration Practice," 33.

pioneering investigations of the biological nature of sewage purification to the enormous and complex activated-sludge plants of the present day."[91]

A few examples of Clark's work appeared in scientific literature. In 1904, Harry W. Clark and S. DeM. Gage tried a copper sulfate solution with a sand filter in order to investigate the possible bactericidal effects of the compound on a sand filter that had been working for eleven years. Clark and Gage found copper in the effluent for three months after that. The copper was depositing on the sand in the filter, putting too much copper in the water. By using copper sulfate, they concluded, "biological actions upon which good results with slow sand filters depend" would be "badly impaired."[92] In other words, the copper sulfate was a good chemical agent, but it also made the filter less efficient. The experimenters set it aside.

Sewage is not merely liquid, or even fluid. There is sludge to be processed as well. Water managers began to look for ways for the sludge to be digested. By the late Twenties, Harry W. Clark was experimenting with acids to determine their utility in sludge digestion. "Probably more research work is being carried on at the present time with regard to the digestion of sludge," Clark and his colleague George O. Adams began, "than on any one phase of sewage treatment." One problem that the two men found was "a tendency to draw definite conclusions from a more or less limited amount of experimental work" and "to a lesser extent" attempts to apply data from one sludge digestion plant or another "without taking into consideration the fact that the digestion of each sludge is a separate problem. . . . The actual amount of free acid is very important." Clark and Adams found that "a sludge which is in active fermentation will

91. "Pioneers of Public Health," *Sewage Works Journal*, 2, no. 3 (1930), 444 – 445.

92. H. W. Clark and S. DeM. Gage, "The Use of Copper Sulphate in Water Filtration," *Journal of Infectious Diseases*, 3, Supplement 2, "Some of the Papers Presented to the Laboratory Section of the American Public Health Association at the Boston Meeting, September 25, 1905" (1906): 172 – 174 (quotation 174).

tolerate more amounts" of organic acid than a sludge which was "just beginning to ferment."[93] In the space of less than thirty years, Clark's experiments had gone from testing methods of sand filtration to assessing the efficiency of sludge fermentation in systems that require multiple tanks and filters.[94] By applying the engineer's methods to biological problems, Clark and his colleagues could make steady advances in technology and practices. But it was already expensive to apply such methods to water intakes. Discharges were still raw with pollution.

In 1930, scientists could look back with satisfaction on the work done at the Lawrence Experiment Station since the end of the nineteenth century. In a historical article, Harrison P. Eddy began with the first water works in Boston in 1652. Eddy traced the history of public health in Massachusetts, from the establishment of the first state board of health in 1869, to the establishment of the Lawrence Experiment Station in 1887. "One of the outstanding characteristics of the investigations at Lawrence," Eddy wrote, "was that they furnished data upon the engineering, chemical, and biological phases of the processes of nature artificially employed." The germ theory, recently established by Pasteur, was applied in 1891 and 1892. The water filter followed in 1893, and its success in reducing typhoid fever in Lawrence was "notable" when it was applied to the municipal water supply.[95]

According to Eddy, the early work of the Lawrence Experiment Station "laid the foundation for both water purification and the biological treatment of sewage." Studies of the

93. H. W. Clark and George O. Adams, "Effects of Certain Acids on Sludge Digestion," *Sewage Works Journal*, 1, no. 4 (1929): 393 – 397.

94. Harrison Eddy, "Massachusetts – The Cradle of Public Health Engineering," *Sewage Works Journal*, 2, no. 3 (1930): 401. The idea of separating the settling solids from the digesting sludge, in order to avoid the objectionable features of septic tanks while taking advantage of the desirable ones, originated at the Lawrence Experiment Station in 1899. Since 1906 sludge digestion has been successfully carried out in the lower chamber of two-story, settling and sludge-digesting tanks, first used by Travis in England and later developed in Germany by Imhoff."

95. Eddy, "Massachusetts – The Cradle of Public Health Engineering," 402.

Ohio, Allegheny, and Mississippi Rivers were either conducted or directed by men previously employed at the experiment station in Lawrence. The work done, and the people trained or inspired by engineers from Massachusetts, "and even abroad," allowed Eddy to say that Massachusetts was "the cradle of public-health engineering."[96] As with the salmon program of the previous century, a site of early depletion was a site of early restoration – at least as far as restoring a marketable resource would be concerned.

Some people complained that more could be done. In a 1930 speech to the New England Health Institute, Harry Clark defended the work done at Lawrence against contentions that the advances, though significant, were too small. Clark's defense was simple: only so much could be done with limited financing.

> In conclusion, the Lawrence work has sometimes been criticized as being carried on a scale too small to be of great value. I believe the success which has followed the installation of municipal plants based on the principles demonstrated by our Lawrence experiments is the answer to this criticism. To obtain accurate data on cost of construction and cost of operation of large plants, experiments on a large scale are required as at Milwaukee, Chicago and elsewhere, where more ample funds have been made available for the purpose.[97]

From 1887 onward, scientists at the Lawrence Experiment Station contributed materially to the modernization of urban water systems in the United States. But the career of Harry W. Clark, one of the pioneers of the field, also tells us about the challenges he faced in spreading his advances to the wider river. Private industries and local communities relied heavily on the cheap cost of discharging raw waste into the river. It was one thing to consider treating intakes; even the mills needed clean water for their operations, and local people could not live without it. But forcing the larger question – of treating every discharge, public or private, large or small – would

96. Eddy, "Massachusetts – The Cradle of Public Health Engineering," 403.

97. H. W. Clark, "Past and Present Developments in Sewage Disposal and Purification," *Sewage Works Journal*, 2, no. 4 (1930), 571.

have meant forcing companies and communities to pay money that they did not have for a social benefit that seemed to cost more than it was worth. The working Merrimack was an open sewer because that was the cost of doing business. No one wanted to be the first to foot the bill while others would continue to dump their filth into the river. The open sewer ran on to the sea.

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For most of the twentieth century, it was cheaper to manage the Merrimack River as a natural toilet. In this sense, thrift was the enemy of a more natural stream. But thrift also provided opportunities to protect whatever was left of the river, even if that were not the intention of those acting at the time. Two proposals – one to dredge the Merrimack all the way to Lowell, and another to build a trunk sewer from Lowell to the sea – were rejected as overly expensive. The same unwillingness to plunk down public money, for new-fangled ideas, prevented "improvements" that could have corrupted the Merrimack far more than it was.

During the first two decades of the twentieth century, one of the big ideas was to dredge the Merrimack to a depth of eighteen feet from the mouth of the Merrimack all the way to Lowell. The dredging plan was essentially conservative; it meant to revive old markets, and not to build a new enterprise. For about forty years, a steamboat ride on the Merrimack was a nice trip. Many of the steamboats were suited to international as well as local travel. In October of 1874, the *Everett* carried General Benjamin Butler to Lawrence from the ocean, making it the first steamboat to make that trip. In the summer of 1876, steamboats left Ferry Wharf in Newburyport for trips up the Merrimack. Those steamers meant business to the people living at the mouth of the river, since the steamers connected the river system to the oceans of the world.[98]

98. "The Merrimack: General Butler's Improvement of Its Navigation – The First Steamer from the Sea to Lawrence," *Boston Globe*, October 27, 1974, 1; "Old Newburyport: What Her People Think of Her; Some Pleasant Gossip Interlarded with Facts; A Glimpse Along the River Banks and Across the Beaches," *Boston Globe*, July 22, 1876, 8. There was a time when the steam trade was worth enough money for local people to protest foreign traders

That business lasted for decades. In a confidential letter to the *Globe* in 1939, the private correspondent Peter Pan told Romance that it had been "more than 20 years since I have taken a steamboat ride (or any other for that matter) down 'Our River.'" Peter was fairly sure that he went on the steamer *Merrimack*, which sometimes traveled as far as the equator.[99] Peter Pan's story reminds us that there was a time, not far from recent memory, when the Merrimack was connected to a wider seagoing traffic.

Steamboats required a deep channel in order to continue past the river's mouth. But by the early twentieth century, the Merrimack was too shallow to admit ships of that size. This problem inspired a proposal to dredge the Merrimack River to a depth of eighteen feet from Lowell to the ocean. This proposal was tabled in 1923 after almost a decade of studies, hearings, and legislative efforts to secure federal funding for a local shipping project. A bill was filed in Congress in 1926 to revive the project, but it went nowhere. "Sparks of hope" attended a brief revival of the idea in 1937, but that plan only considered returning the channel to its normal depth as far as Lawrence, not all the way to Lowell.[100]

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on the river. In early August of 1878, people in Newburyport were indignant that a British steamer, *City of Fredericton*, was allowed to steam the Merrimack until the twenty-fourth of the month. "Who in this neighborhood has a right to grant permission to a foreign-built vessel to run on our river in direct violation of the land?' is asked." After August 1878, the proprietors of the steamer company proposed to alter it "so that no law will be infringed upon." Both the protest and the counterproposal must have been considered in the light of the money that could be made sending steamboats up the Merrimack. " Newburyport: The British Steamer," *Boston Globe*, August 4, 1878, 8.

99. Peter Pan, "Replies: Dear Romance," *Boston Globe*, August 14, 1939, 13; "South America: Brazil, and how to get there – Steamers of the Line – Voyage and Arrival at St. Thomas – West Indian Boatmen and their names – Resort of Invalids – The Single Sentinel – Visit from flying fish – Crossing the line and a rough sea," *Boston Globe*, March 6, 1872, 2. In 1872, the steamer *Merrimack* was one of three steamboats bought recently by C. L. Bartlett & Co. The steamers were designed for the Liverpool trade, but "owing to the want of a back bone among the Boston merchants, they were laid up for a couple of years, and finally sold at an immense sacrifice, and came into the possession of the present company." In late January of that year, H., "Our Own Correspondent," took a trip on the *Merrimack* to Brazil. It took six days to get from New York to St. Thomas and another thirteen to reach the mouth of the Amazon. The *Merrimack* took eight days to steam the Brazilian coast until it crossed the equator.

100. "Government Begins Survey of Merrimack," *Christian Science Monitor*, June 20, 1913, 8; "Defeat of River Project Deplored: Merrimack Development Supporters May Postpone Further Activities," *Christian Science Monitor* , December 21, 1923, 3; "Merrimack River Improvement Sought," *Christian Science Monitor*, April 2,

The disappearance of steamboats did not exclude boats from the river. Smaller boats worked and played on the Merrimack at the turn of the twentieth century. Crew races decided collegiate titles. But by the end of World War I the slow proliferation of highways for automobiles – in particular, for trucks – limited the utility of the Merrimack as a route for business traffic. A few local bridges, like the "ancient" Amoskeag Bridge in Manchester that was closed to traffic in 1920, were replaced, and some of the new bridges would have draws. But with the end of the dredging plan, the age of the big steamboats on the Merrimack was relegated to the strains of distant memory.[101]

If dredging the river to readmit heavy shipping would have been a bad idea in the long run, then a trunk sewer from Lowell to the sea would have been even worse. A little bit of local history is in order. At the turn of the century, the water in the Merrimack River estuary was still clean enough for people to eat soft-shell clams, and there were plenty of takers. The harvest in clams in Massachusetts increased its yield by more than a third between 1880 and 1905. Over the same time period, the price per bushel of clams more than doubled. At the turn of the

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1926, A4; "Hopes of Deeper Merrimack Flee in Light of Developments," *Christian Science Monitor*, February 20, 1937, 10. Although the 1926 bill died in Congress, the idea persisted for a little bit longer. In 1927, a lawyer from Cambridge, Henry J. Roper, investigated "conditions" along the Merrimack "from the perspective of a citizen interested in public welfare." Roper supported the dredging project, arguing that if New England were to "retain her supremacy as an industrial center, which she has to date by reason of an unlimited supply of labor and capital, raw materials must be brought to manufacturing centers like the Merrimack Valley at the lowest possible cost." Roper cited reasons – the necessity to develop the river and the primacy of the economic value of water – that Theodore Steinberg cites as evidence that the Merrimack Valley was an early site of the legal reinterpretation of water law for productive use. "New England Textile Problem Believed to Rest in Merrimack: Investigator Believes Navigable River Would Cut Freights, Improve Business, Put Wages Up and Generally Revivify Mill Industry," *Christian Science Monitor*, July 5, 1927, 5B; Theodore Steinberg, *Nature Incorporated*, 164.

101. "Rowing on the Merrimack. Michael Lynch of Salem Victorious by Two Lengths Over Kennedy of Lowell," *Boston Globe*, June 29, 1878, 2; "The Merrimack. General Butler's Improvement of Its Navigation – The First Steamer from the Sea to Lawrence," *Boston Globe*, October 27, 1874, 1; "New Bridges to Be Built," *Christian Science Monitor*, April 8, 1920, 2; Peter Pan, "Replies: Dear Romance," *Boston Globe*, August 14, 1939, 13.

twentieth century, a digger of clams in the flats of Newburyport could make between $12 and $14 a day, which was good money at the time.[102]

Over the next few decades, this market showed the strains of intensive extraction as well as of the daily pollution from a dozen cities and towns upstream. In 1925, the clam flats of Newburyport were closed to digging clams for human consumption due to pollution. The flats were not reopened until the Shellfish Purification Plant was opened on Plum Island in 1928. But business at the plant did not last long before it started to decline. In 1935, some 23,204 bushels of soft shell clams from Salisbury and Newburyport were processed at the plant. By 1945, the clam harvest brought from those towns was down to 3,132 bushels.[103] The soft-shell clam fishery at the mouth of the Merrimack, judging by the amounts processed at the Shellfish Purification Plant on Plum Island, declined 86.5 percent in only ten years.

But it could have been a lot worse. In 1924, Eugene R. Kelley, Commissioner of Public Health, filed a report advocating a trunk sewer line from Lowell directly to the sea. The estimated cost of construction was $10,000,000, but the sewer system would have served seventeen cities and towns in the Merrimack Valley. The alternative plan – the construction of separate disposal works in each city and town – was rejected in the report. The rationale was that to construct such works would have cost only $8,370,000, but their annual maintenance – $360,000 a year – would have been more than twice as much as the $173,500 estimated to

102. William C. Jerome, Junior, Arthur Chesmore, Charles O. Anderson, and Frank Grice, *A Study of the Marine Resources of the Merrimack Estuary* (Boston: Division of Marine Fisheries, Department of Natural Resources, Commonwealth of Massachusetts, 1965), 60.

103. Jerome et al., *Study*. 60 – 62; Federal Water Pollution Control Administration, Northeast Region, United States Department of the Interior, *Report on Pollution of the Merrimack River and Its Tributaries, I: Summary, Conclusions, and Recommendations* (Boston: Federal Water Pollution Control Administration, 1968), viii. In 1880, 158,626 bushels of clams returned $76,195, for an average price of 41.73 cents per bushel. In 1905, 217,519 bushels were taken, returning $209,545, for an average price of 96.19 cents per bushel.

maintain the trunk sewer annually.[104] It was cheaper, Kelley and others argued, for one sewer to serve all of them than for each of the communities to take care of its own pollution.

The trunk sewer was never built. When the idea came back around in 1962, the mayor of Newburyport rejected it as expensive and unworkable.[105] Newburyport, with its historic clam flats, had a vested interest in stopping the proposal. Even if the trunk sewer could have extended into the ocean, it would have contaminated the marine life at the mouth of the river. The best fishing at Plum Island during the postwar years – between the late Forties and the early Seventies – would have unfolded during a period of intensive public and private pollution of the ocean. The best fishing would be sport fishing. The catches would be inedible.

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For most of the industrial history of the Merrimack, pollution conflicts were between state and local actors. The federal government had no role in controlling the pollution of waters within a state. Starting in the Thirties, federal officials began to enter local landscapes with big ideas about how the federal government could manage those environs. Two cases – flood control at Franklin Falls, and a wildlife refuge at Parker River – show us how federal plans were contested by state and local actors in the Merrimack River watershed during the first half of the twentieth century. Changes in those plans reveal the acknowledgment of federal officials that

104. "Lowell-to-Sea Sewer Is Urged: Would Be Cheaper Than Disposal Plants, Says Kelley Report," *Christian Science Monitor*, April 11, 1924, SECTION.

105. John J. McKone, "New Plan Pushed to Solve River Problem," *Boston Globe*, December 23, 1962, 6. "Burnley S. Thurlow, former member of the Newburyport Planning Board, has come up with a revised Lowell-to-the-sea trunkline sewer plan. He believes it will solve the Merrimack River pollution problem at practically half the price already quoted. It would avoid the installation of sewage disposal plants, suggested as a more orthodox approach to a clean river." William H. Taylor, chief sanitary engineer of the Massachusetts Department of Health, had estimated the costs of that plan to be $60 million. Thurlow's trunk sewer would run 60 miles, including "15 or 20 miles out into the ocean for discharge." Thurlow estimated that at $43 a foot, his plan would cost $29 million. But the mayor of Newburyport, Albert H. Zabriskie – who was also completing his eighth term as a state representative – disagreed. "I appreciate Mr. Thurlow's interest in the pollution problem, but I do not agree with his proposal," he said. He elaborated. "The trunkline sewer idea has been going for 30 or 40 years. We are on the right track now. We must act fast, for legislation of 1960 puts it up to the community to correct the pollution situation or else. The time limit is three years."

although they could enter local landscapes, they would still have to connect with local people in order to enact federal purposes.

With the advent of the New Deal, the redevelopment of rivers for energy projects became attractive as a federal enterprise. In May of 1933, President Franklin Delano Roosevelt managed the enactment of a new Tennessee Valley Authority (TVA). He was ready with a clever metaphor for anyone who would question the political philosophy behind his proposal. "I'll tell them it's neither fish nor fowl," he told one senator, "but, whatever it is, it will taste awfully good to the people of the Tennessee Valley." The TVA was so successful that, in time, private interests came together to prevent such programs from being initiated in other parts of the country.[106]

Although New England was considerably more developed economically and industrially than the Tennessee Valley, the Depression had hit industries hard. In August of 1934, an "elaborate" ten-year plan to develop the natural resources of New England "on a scale with the Tennessee Valley experiment" was announced by the Department of the Interior. This plan entailed development of public works, including "parks, highways and parkways." There was to be a study of transportation facilities and "suggestions" of their coordination, as well as a study of "the major existing and desired land uses." The plan and the studies would lead to a report on legislation "necessary" to carry out the plans. Although the Connecticut River was the focus of the plan, other "specific" projects included the Merrimack River watershed. Victor M. Cutter, the head of the new planning commission, described the plans to coordinate conservation, including forests, streams, fish and game, transportation, highways, preservation, historic sites,

106. Robert S. McElvaine, *The Great Depression: America, 1929-1941* (New York: Times Books, 1984), 147, 155 – 156. "The main reason the TVA was not replicated was not that it failed," McElvaine argues, "but that it worked so well (156)."

and recreation.[107] In those days, improving a highway and building a park were both "improvements". If properly planned, they could provide benefits at a decent cost.

A few weeks after the initial announcement, Mr. Cutter sat with a group of men from the commission in a conference room on the twenty-first floor of the Federal Building in Boston. It was not for the commission to think up new ideas, but "merely to get the wisest use of the projects proposed by the State and local planning boards." A study of population and maps of the region would form the "basis" for future action and recommendations. In the present study, commission members would "take up the decentralization of industry and population away from the large urban centers and try to forecast what that will mean to the future of New England." This would be followed by a land use survey. The commission was only able to make "definite recommendations" on the Connecticut and Merrimack Rivers' pollution surveys. [108]

Mr. Cutter turned up a few days later at the annual meeting of the New England Water Works Association to describe the ten-year program. But this was no federal takeover, he said, when he addressed the group the next day. Private capital was competing with government in the financing of many of the Public Works Administration projects. "This private capital," he said, "is overcoming the timidity which existed in 1931 and 1932." Apparently, business professionals could be New Dealers when it would suit their purposes.[109]

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107. "Ten-Year Plan Is Outlined for New England: Victor M. Cutter Is Named Head of Commission in Charge; Centers on Rivers; Connecticut and Merrimack Valleys to Be Like Tennessee Project – Scope Is Wide," *Christian Science Monitor*, August 3, 1934, 1.

108. "Planning Begun for This Area: Regional Board Studies Task in Session Here; One Air Line Is Laid Out on the Basis of Their Report," *Daily Boston Globe*, September 13, 1934, 3. The men selected for this commission were not just bureaucrats, but business leaders as well. Cutter was the director of New England Mutual Life Insurance and the New England Telephone and Telegraph, as well as a trustee of Dartmouth College, when he was made "chief god" of the commission (a reference to the lofty height of the building rather than the power of the office).

109. "Annual Water Works Convention Opens Today," *Daily Boston* Globe, September 18, 1934, 9; "N. E. Water Works Ass'n Convene Here," *Daily Boston Globe*, September 19, 1934, 9. Thomas Ferguson argues that

Economic relations were difficult to manage, even when important people got involved. At the thirty-eighth meeting of the New England Council in 1935, officials announced a survey of the 366 mills in New England to see "which way" the industries were headed: how they were doing in sales, how they were rated in the industry, and how they coped with the processing tax, foreign competition (especially from Japan), production in comparison with demand, and "the North-South wage differential." A publicity official for Northern Cotton Mills said that it was "about time that the textile industry ceased to be the No. 1 guinea pig for the New Deal laboratory." But by July there was a "business spurt" in New England, especially the shoe industries in Haverhill. Payrolls were rising. At the end of the year, Lawrence, Massachusetts was the busiest textile city in New England for the second year in a row, with an increase in textile workers of more than a third over the twenty thousand workers counted in 1934.[110]

1936 was a particularly bad flood year in the Merrimack River. In March, eleven people died because of the rising waters, including a seven-year-old boy who slipped off a rail and fell

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this occurrence is not as inconsistent with New Deal policies as some historians would have us think. At the center of Roosevelt's political coalition were not "the workers, blacks, and poor" who had preoccupied liberal commentators, "but something else: a new 'historical bloc' (in Gramsci's phrase), of capital intensive industries, investment banks, and internationally organized commercial banks." This "new kind of power bloc" constituted the basis of "the New Deal's great and, in world history, utterly unique achievement: its ability to accommodate millions of mobilized workers amid world depression." Capital-intensive firms use relatively less "direct human labor (and that often professionalized and elaborately trained),," so they were "less threatened by labor turbulence." They had "the space and the resources" to "envelop, rather than confront, their work force." Thomas Ferguson, "Industrial Conflict and the Coming of the New Deal: The Triumph of Multinational Liberalism in America," from *The Rise and Fall of the New Deal Order, 1930 – 1980,* ed. by Steve Fraser and Gary Gerstle (Princeton: Princeton University Press, 1989), 7.

110. "New England Council Meets Today: Considers Problems of Textile Industry," *Daily Boston Globe,* March 22, 1935, 2. The cotton processing tax was 4.2 cents a pound. "Cotton Textile Survey Ordered: Chamber Group to Study New England Situation; Elimination of Causes for Industry's Plight Sought," *Daily Boston Globe,* January 11, 1935, 8; "Textiles Faced With Raise in Tax: Wallace Refuses Cut -- Labor Angry at N. R. A.," *Daily Boston Globe*, March 28, 1935, 1; "Baylies, Hood Oppose Any Cotton Tax Rise," *Daily Boston Globe,* March 28, 1935, 12; Daniel O'Brien, "Business Spurt in New England: Number of Vacationists Biggest in Years; Shoe, Textile, Hat, Clothing, Canning Plants Reopening; General Retail Trade in City Continues Gains," *Daily Boston Globe*, July 28, 1935, A1; Daniel O'Brien, "Business Gains in New England: Further Increases in Payroll Reported; Survey Shows Plant Expansions and New Buildings," *Daily Boston Globe,* November 24, 1935, A16; "New England Industry Gains in All Sections: Employment, Payrolls Growing as Plants Seek Skilled Workers," *Daily Boston Globe,* December 29, 1935, A1. The increase in Lawrence was from 20,000 to 27,460.

into Salmon Brook just above where it meets the Merrimack River in Nashua, New Hampshire. His body was found sixty feet downstream in fifteen feet of water.[111] After the flooding of 1936, Massachusetts expected about ten times what New Hampshire would get for flood damage, but only about a tenth of the expected funding was available. But there were also political objections to a federally led flood control program. In 1937 the Army Corps of Engineers temporarily cancelled a project when New Hampshire officials would not agree to federal control.[112] In March of 1938, President Franklin D. Roosevelt proposed federal funding and federal control, but even a May proposal to nationalize flood control at a 70 percent reimbursement was turned away in the Senate.[113] State officials were chary of any proposal that would put federal laws ahead of state laws.

New England states differed over how to respond to federal power. In early October 1938, an allotment of $11 million was approved by President Roosevelt to expedite flood control work in New England. Governor Charles F. Hurley of Massachusetts had already withdrawn objections to federal control, but the Governors of Vermont and New Hampshire worried about the expansion of federal power. "What concerns us," said Governor George D. Aiken of Vermont, "is that if the Federal Government can come into Vermont and take land for one dam

111. "Rain Threat Menaces Maine: Flood Conditions Elsewhere Show Definite Drop but Danger Continues to Be Grave in Pine Tree State," *Daily Boston Globe,* March 13, 1936, 1.

112. "Federal Aid Prospects in Flood Shrink: Early Forecasts of Vast Sums for Rebuilding Swiftly Fading," *Christian Science Monitor,* March 26, 1936, 9; Flood Control Indorsed Before New England Council; Cost Is Set at $300,000,000," *Christian Science Monitor,* June 27, 1936, 9; Estimated damage for the 1936 flood was $2,800,000 for New Hampshire and $27,600,000 for Massachusetts.

113. "New Program Outlined for Flood Control: Measure Would Embrace Both Connecticut and Merrimack Rivers; President Confers; Federal Government Would Shoulder Entire Cost of Plan," *Christian Science Monitor*, March 7, 1938, 9; "Funds Curtailed for Flood Control in New England," *Christian Science Monitor,* April 18, 1937, 9; "$375,000,000 Fund on Flood Control Voted by House," *Christian Science Monitor,* May 20, 1938, 11; "Funds Sought to Start Work on N. E. Rivers: Protest of States Pushed Despite Passage of Flood Bill; Pacts in Question; Taking of Land by Government Defended by Spokesmen of Administration," *Christian Science Monitor,* June 16, 1938, 9; Mary Hornaday, "New England Lawmakers Seek Approval of Voters," *Christian Science Monitor,* June 21, 1938, 1.

without consulting us, it can also come in here and take land for other dams and natural resources without our permission." Governor Aiken was concerned that the federal government "might build dams that would flood our fertile farm land and destroy our scenic landscape." Governor Francis P. Murphy of New Hampshire said, "The issue is way too fundamental for us to give ground upon. Much as we need these protective dams, we cannot sell our inherent rights."[114]

Rivers had to be tamed, like they were in Europe. The U.S. Army Corps of Engineers (USACE) had built their reputation on a received French tradition.[115] There was an emerging market in public works projects, and the Engineers wanted their share of the action. Army Engineers argued that four measures would be effective: levee construction, providing means for escape of excess waters, enlargement of the discharge capacity of main channels by "straightening, widening, or deepening" them; and construction of reservoirs "temporarily to regulate" the flow of waters in the natural channels of streams "within safe limits."[116]

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114. "President Says Go Ahead on NE Flood Control: Allots $11,000,000 for Work – Committee Says Fresh $11,000,000 Is Needed Before July," *Christian Science Monitor*, October 4, 1938, 1; State Rights Issue Raised," *Christian Science Monitor*, October 6, 1938, 11.

115. The Army Engineers' principles reflect the principles of river engineering handed down from the nineteenth century. Mark Cioc argues that, since the time of the American Revolution, European engineers had seen rivers as potential enemies of humanity, and "therefore in need of being 'domesticated,' 'tamed,' or 'harnessed'. . . . Also common to the language of river engineering was the notion that free-flowing rivers were by nature somehow imperfect, or defective, and therefore in need of improvement – here 'rectification' and 'amelioration' were the most common terms. . . . Widespread among European engineers was the perception that the perfect or 'ideal' river was really a canal: straight, predictable, easily controlled, specifically designed for navigation, not prone to flooding, easily contained within a single channel, and not so sluggish as to breed disease." The national orientation of the Army Corps of Engineers also preceded the New Deal. Todd Shallat argues that the Army Corps of Engineers was founded in 1802 at a "crossroads" between French and British ideals, and the Corps chose the French tradition. "The ideal of the engineer-scholar left the new Corps of Engineers with French inclinations and values: a talent for `planning and applied mathematics, a flair for monumental construction that empowered the nation-state." Mark Cioc, *The Rhine: An Eco-Biography, 1815-2000* (Seattle: University of Washington Press, 2002), 39; Todd Shallat, *Structures in the Stream: Water, Science, and the U.S. Army Corps of Engineers* (Austin: University of Texas Press, 1994), 2 – 3.

116. "Eyes Turned to Rivers of New England: Some Work Finished; Hitch in Proposal; 4-Point Program; Walls, Dikes Planned," *Christian Science Monitor*, October 9, 1938, TS7.
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But the details sketched on drafting tables and printed into public reports had real implications for the people living along the rivers of New England. The Connecticut Valley dispute led to changes in the regime established by the 1936 Flood Control Act. The Flood Control Act of 1938 dropped any requirement that state or local authorities pay for "land acquisition, rights-of-way, construction, or maintenance for flood control reservoirs and channel alterations."[117] Federal agencies like the USACE were barred from seeking state or local funding to support their proposals.

Not all of the flood years were as bad as 1936. In 1939, several mill buildings were flooded in Lawrence, Massachusetts, but it was believed that the waters would crest "well below" 1936 levels. By May, New Hampshire, which had asked the War Department to consider three new dams on a new list of six dams, was down to four projects, and Massachusetts had its four. In June, the War Department was awaiting a "go-ahead order" to start work at Franklin Falls on the Merrimack River in New Hampshire.[118] The possibility of another world war had provided an independent purpose for flood control: national defense.

Construction at Franklin Falls was set to begin in October 1939, but the original appropriations would have to be supplemented for the work to be completed.[119] The Franklin

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117. Karen M. O'Neill, *Rivers by Design: State Power and the Origins of U.S. Flood Control* (Durham and London: Duke University Press, 2006), 168. The two measures are Public Law 74-738, June 22, 1936, 49 Stat. 1570, and Public Law 75-761, June 28, 1938, 52 Stat. 1215. Section 2 of Public Law 75-761 amends Section 3 of Public Law 74-738 in the manner that O'Neill described. It also updated the authorization for the Merrimack River Basin to provide, "in addition to the construction of a system of flood control reservoirs, related flood control works which may be found justified by the Chief of Engineers." 52 Stat. 1216. The powers outlined in the amendment were most likely what Mr. Hollis had in mind when he asked for a "favorable" report from the Engineers in December 1938.

118. Vermont Lifts State Restrictions on Flood Control," *Christian Science Monitor*, April 18, 1939, 9; "Rivers Above Normal, But Starting to Drop," *Christian Science Monitor*, April 21, 1939, 9; "Flood Control Advances; States and Congress Act," *Christian Science Monitor*, May 11, 1939, 9; "Engineers Ready to Begin Work on Flood Control," *Christian Science Monitor*, June 7, 1939, 1.

119. "Merrimack River Anti-Flood Work Is Soon to Start," *Christian Science Monitor*, October 14, 1939, 11.

Falls Dam in the Pemigewasset River in Franklin, New Hampshire was begun on November 14, 1939. The dam was officially dedicated on October 22, 1943. Four years after it was begun, and more than nine years after the first regional plan for New England flood control had been announced in August of 1934, there was finally a flood control installation in the Merrimack River watershed. [120]

Another federal intervention was met with much more local resistance that led to a contest between the state and federal governments. In January of 1945, the federal government began taking lands to create a new wildlife refuge at Parker River. Back in 1931, Massachusetts had passed a law allowing federal takings of land for bird sanctuaries. When the takings began, protests ensued. In February 1945, Governor Maurice Tobin signed a bill that barred the federal taking of any new lands for federal preservation. That law was repealed, but not until after Parker River Wildlife Refuge had already been established. Opponents claimed that the affected farmland was providing some 90 percent of the feed for the dairy industry in the Commonwealth. S. B. Locke, regional director of the U.S. Fish and Wildlife Service, suspected that "politics" was behind the opposition to the plan. First, U.S. Fish and Wildlife could lease or deed any lands or properties affected back to the owners of those lands or cottages. Second, there were only twenty acres of salt hay taken from the affected area in the previous year. That was not nearly enough to support the state's dairy industry.[121]

120. "30 Million Urged for N. E. Flood Control: Army Engineers Outline Projects; States Likely to Get 2 Million," *Boston Globe*, March 23, 1942, 3; "New Franklin Falls Dam Dedicated in Flood Plan," *Christian Science Monitor*, October 22, 1943, 5.

121. "Tobin Signs Measure Barring Further U. S. Wildlife Land Seizure," *Daily Boston Globe*, February 1, 1945, 6; Earl Banner, "Fight Against Waterfowl Refuge in Court Tomorrow," *Daily Boston Globe*, February 4, 1945, B9.

The wrangling continued after the War, with bills introduced in the legislature to reduce the size of the refuge or to eliminate it completely. As late as July of 1947, with the refuge more than two years old, the chairman of the Massachusetts Conservation Council had to publish an editorial defending the measure against various charges. Wm. P. Wharton argued that previous experience on Plum Island eliminated the possibility of reducing the area of the refuge to that section of the estuary. Clamdiggers who challenged the taking of clam flats were also wrong because their fisheries would be supported by the Fish and Wildlife Service and their fishing rights would not be taken away in any case. Certainly some duck hunters would lose good spots, but there would be more birds to shoot anyway. Wharton's solution was to reduce the refuge, not from 12,000 acres to 2,500, but to about 6,000 acres. "We of the Massachusetts Conservation Council and of the statewide Committee to Retain the Parker River Refuge believe that this bill is the only one that will give full protection to all local interests and at the same time maintain an adequate migratory bird refuge," he concluded.[122]

By 1948, protests were vehement. There was even one man who claimed that Fish and Wildlife had deliberately fed grain to the ducks to keep them in the refuge so that they could get good photographs of numbers as "favorable propaganda" for the bitterly opposed refuge.[123] In August, a compromise was reached after President Harry Truman vetoed an earlier bill to abolish the refuge altogether. Instead, the 12,000-acre refuge would be divided in half, and the Interior Department would move to return property to local owners at the prices they had been paid.[124]

122. Wm. Wharton, "What People Talk About: The Parker River Wildlife Refuge," *Daily Boston Globe*, July 17, 1947, 14.

123. "Wildlife Service Blamed by Page for 'Starving' Ducks," *Daily Boston Globe*, February 10, 1948, 13.

124. "U.S. to Return Parker River Seized Lands," *Christian Science Monitor*, August 6, 1948, 5.

Today the Wildlife Refuge spans more than 4,700 acres, including more than three thousand acres of salt marshes. It is certainly smaller than the 12,000 acres originally conceived, but some three hundred species of birds come there annually.[125]

Federal intervention in local landscapes inspired state and local officials to defend their jurisdictions against nationalization. At Franklin Falls, resistance from public officials led to problems with funding, which pushed back the schedule for completion. At Parker River, local conflicts delayed and reshaped the wildlife refuge. What can we conclude from these examples? First, we can see that the federal government had to respond to local concerns that had been passed over by state officials almost a century earlier. New Deal officials could not point to a sovereign charter that could give them the capacity to ignore unforeseen consequences; even eminent domain had political limits. Second, we can conclude that even with the widespread political popularity of the New Deal, there was still plenty of skepticism about federal control of local places. The War was an event, not a regime; and for the federal government to control interstate water pollution, it would have to find a way to enter local landscapes that had been closed to federal involvement for more than a century.

* * * *

In 1944, the journalist Edwin F. Collins took a stand for the rivers of Massachusetts. Three-fifths of the population of the Commonwealth lived within the basin of five rivers: the Merrimack, the Mystic, the Charles, the Neponset, and the Taunton. All five were polluted, and Collins dedicated a full article to each of them. The titles of the features are revealing. The Charles was "A Mud-Hole Made Beautiful". The Mystic was "An Impaired Industrial Artery". The Neponset was "the Mother Brook". The Taunton was "Fouled in Watery Nest." For the

125. "About the Refuge," http://www.fws.gov/refuge/Parker_River/about.html. Accessed: April 24, 2015.

Merrimack, Collins chose a phrase rather than a name: "How the Mighty Has Fallen." The Merrimack, the Mystic, and the Taunton were all "so charged with domestic sewage as to render large stretches of them unfit for bathing in populous territories where there are beaches." The river that Thoreau had paddled and sailed was dead and gone.[126]

In his article about the Merrimack, Collins recounted the local history up to his time. He was both nostalgic and revolted: the Merrimack was an "open sewer" that was once a waterway for steamboats. On the other hand, Lawrence was also a site for technical advancements in the science of sanitation engineering. By 1944, the city was annually withdrawing 2,400,000,000 gallons of water from the river. "The miracle of chemistry gives hope to public-spirited men all along its route who hanker to get some big effort started to return the Merrimac to something like its primal purity." Collins described the preferential system that allowed the pollution of the Merrimack to continue. Acts passed in 1941 allowed the State Health Department to exercise "strict supervision" over any new industrial companies that "might locate" on one of these rivers and make "further contributions" to pollution. But an amendment excluded the power to supervise any industries "that may offend on this score," but which were in existence before 1941. That convention definitely included the old mills. [127]

Collins was told that "whereas 'a worm couldn't live long in the sludgy Merrimac today,' the river used to swarm seasonally with salmon, shad, alewives, bass, pickerel, and sturgeon." But pollution had ended the ice-cutting industry as surely as it had destroyed fishing and swimming. Nostalgia also recalled the age of the steamboats cruising eighteen miles to Haverhill, and the crew races at the turn of the century. The critics of the polluted river clamored

126. Edwin F. Collins, "The Rivers of Massachusetts," *Boston Globe*, July 24, 1944, 10. The Merrimack, in Collins's words, had been "embalmed in literature a century ago" by Thoreau.

127. Collins, "The Rivers of Massachusetts," 10.

for "stoppage somehow of industry's slow poisoning" of the Merrimack's waters which may "finally take its toll" on the general community's health" and for restoration of "some measure of the earlier wholesome recreational privileges which really are the natural heritage of all the people." "Old Father Time," Collins wrote, would know "a generation hence" the answer to their cry.[128]

For a century after the *Week* of Thoreau, the Merrimack River was a depleted stream and an open sewer, fished and fouled. But we do well as we continue our story out of the War to remember that it was not simply allowed to rot. Salmon restoration was a serious state enterprise for thirty years after the Civil War. Water filtration experiments in Lawrence led to the quietest revolution in modern history – the elimination of fetid water as the necessary evil of urban living. Nor was every bad idea tried, even if many of the good ideas – to filter water at both ends, and not just for intakes – were left to the imagination of scientists without the money to make them happen.

When the War ended, the Army and Navy began to cancel contracts. In Massachusetts, this process affected the jobs of some 200,000 workers. Several thousand workers in Lowell would be laid off on the following Monday "due to cancellations of many big war contracts." Lawrence was better positioned, at least for the time being. "Twenty-five thousand persons have been employed in the textile mills in Greater Lawrence, which have been almost solely engaged on war work," wrote Leonard Lerner in the *Boston Globe* on August 16, 1945. "The mill

128. Edwin F. Collins, "The Rivers of Massachusetts: Their Present and Future; How the Mighty Has Fallen," *Daily Boston Globe*, July 28, 1944, 10. The spelling "Merrimac" would continue to appear from time to time until the Sixties. "Merrimac Spelled 20 Different Ways: Coast Guard Boathouse Starts Controversy," *Daily Boston Globe*, January 10, 1937, B10; Robert McLean, "Suburban Notebook: Jaywalk Law Tough Sledding in Bay State," *Boston Globe*, April 21, 1963. McLean answered a "challenge" to the statement "in this space last week" that the Merrimack River "has been spelled at least 20 ways." He was able to list twenty versions, including "Merrymacke", which is how it was pronounced (e.g. "Merry-mack Valley"), when I was growing up.

owners, however, say they have civilian orders and that it will take little time to reconvert their machinery to civilian work."[129]

At the time, there was good reason to have confidence that an industrial landscape erected before the middle of the nineteenth century, and refitted at the turn of the twentieth century, could carry on into the middle of the twentieth century. But the end of the War meant the reopening of foreign markets that would compete with the venerable mills – and put those mills out of business forever. The economic future of the Merrimack Valley would hardly resemble the historic past. Edwin F. Collins rued pollution measures that may well have made sense during wartime. But the legacy of a century of industrialization and urban settlements would have to be confronted after the War. Local people would need more clean local water.

129. Leonard Lerner, "War Jobs Ending: Flood of Cancellations Hits N. E. Industries; Governors to Meet," *Daily Boston Globe*, August 16, 1945, 1.

2. MILLS TO MALLS.

In 1960, Robert Jay Evans followed Thoreau's *Week* for a six-day trip on the Merrimack River. Like Thoreau, he was paddling into the middle of a social transformation; unlike Thoreau, Evans paddled alone. The series, "Blazing a Trail with Henry Thoreau", ran in the *Boston Globe* for seven days in September. Evans's series shows us how a postwar naturalist and historian took up literature to challenge his contemporaries about the condition of the Merrimack and what he thought that people could do about it. But it also reveals how quickly things had changed since the end of the War fifteen years earlier.

Evans's voyage, he wrote, was "the culmination of months of study, reading, field trips, and research." Yet, "in a more important sense," it was "just the beginning of an adventure," a five-day journey over a "historical waterway," one that had been "a main artery to the interior" for Native Americans, had "heard the first shots" of the American Revolution, which had "once borne some of a young nation's commerce" between its banks, and which had seen "the phenomenal rise and fall of some of the world's largest industries."[130] Evans put his paddle in the Concord River near the Lowell Bridge in Concord. He knew the history of the river – it had "witnessed and had been a part of the remarkable march of transportation, from foot to horseback and on to oxcart, through canal and stagecoach to railroad." The river had seen "each decline in its turn, the railroad now giving way to the superhighway and in the sky above to the jet-powered air age and beyond into outer space." It had "bravely borne first rafts, then canoes, flatboats, canal boats, even a few steamboats."[131] The final section, like the section on the "historical"

130. Robert Jay Evans, "Blazing a Trail with Thoreau: Scholar and Sportsman Retraces River and Mountain," *Boston Globe,* September 11, 1960, A30.

131. Robert Jay Evans, "Blazing a Trail with Thoreau," *Boston Globe,* September 11, 1960, A30.

Merrimack, was printed in boldface type for emphasis. "Now it catered, mostly on week-ends, to a host of hornet-like speedboats, powered by outboard motors, which tore headlong up and down the river in a mad, recreational race to nowhere."[132]

On the second day, Evans contrasted the peace of nature with the noise of engines. Writing from the same island where Thoreau pitched a tent 121 years earlier, Evans noted how small of a place there was for nature on the Concord River. "It was somewhat difficult for me," Evans wrote, "as I drifted down the Concord River, to imagine that I, too, had left all science behind me and had been able to enter nature with one stroke of my paddle with so much civilization present." There were airplanes above, circling to land at the air force base in Bedford, and automobiles on the Lowell Street Bridge as Evans paddled under it. "The ducks and turtles still abound on the Concord River as in Thoreau's day – but the rural stillness of the river is now shattered by the constant roar of outboard motors on the water, the rumble of nearby traffic, and the scream of jets overhead," Evans complained. "Thoreau would have been dismayed by all the advances of civilization on nature."[133]

Evans found that each of the rivers on his journey had its own "distinct" personality. The Concord was "close, cozy, busy, folksy." The Merrimack, on the other hand, was "much less intimate and more impersonal. It sings a different song." Above Tyngsborough, the Merrimack looked, felt, and smelled much cleaner than at Lowell. There was no need, however, to announce the approach of Nashua. "The water clouded up so that when I dipped my paddle it would disappear 6 inches from the surface." Industrial waste, "various kinds of debris, sewerage

132. Robert Jay Evans, "Blazing a Trail with Thoreau," *Boston Globe*, September 11, 1960, A30.

133. Robert Jay Evans, "Blazing a Trail with Henry Thoreau – II: Nature and Jets Make Strange Bedfellows," *Boston Globe*, September 12, 1960, 25.

and all sorts of unidentified and unattractive material" passed by Evans as he "hurried" through Nashua and beyond to a point just above where the Nashua River empties into the Merrimack.[134]

At Hooksett Pinnacle, where the river part of the journey ended, Evans looked eastward to see the beautiful Merrimack Valley, which had been witness to "Indian explorer, surveyor, canal boats, electric trolleys, and railroads." Westward was the latest means of getting up the valley, and as a jet aircraft "screamed" overhead it made Evans mindful of "still a newer frontier valley." Thoreau would be "appalled and sickened" to see what some people and industries had done to "lay waste to his river." Evans offered a "fervent prayer" for the traveler in the valley 121 years in the future, to "let us in the meantime, by zoning, by law, by argument, and by persuasion" put an end to the pollution of the Merrimack River. That industrial process, in retrospect, was "an ignorant, short-sighted thing to do.

> Let the Merrimack be scrubbed clean so even the most fastidious may swim in it. Let it be a marvelous recreational playground. New Hampshire and New England need the Merrimack River for recreational use. I saw hundreds of sandy beaches waiting to be used. Let the old canal locks be revitalized so recreational boats can travel from Lowell to Concord, N. H. in a day. . . . Let the Merrimack Valley be a nature lover's paradise. The wolf, the wild turkey and the passenger pigeon are gone, but the beaver, the muskrat, the fox, and the squirrel are still here along with countless varieties of birds.[135]

In 1960 the concatenation of real estate development, boat traffic, and a "nature lover's paradise" was still plausible. A beach or a cove was a thing to be put to use or reuse. A bird or a fish was a thing to be taken, whether for food or for a prize. Roads could cut into the American countryside wherever two points could be connected by a fairly straight line. Rivers and streams would carry off pollution (eventually). Lakes and ponds were water supplies and places of

134. Robert Evans, "Blazing a Trail with Thoreau – IV: Awakens to Find Kayak Floating Mid-Stream," *Boston Globe*, September 14, 1960, p. 16.

135. Robert Evans, "Blazing a Trail with Thoreau – VII: A Recreational Paradise Lost By Pollution," *Boston Globe*, September 17, 1960, p. 14.

private recreation. Owning nature meant more than using it up, but it still meant more than just stewardship. For more than a century, the value of property in nature was in its availability to human needs.

After World War II, local people in the Merrimack Valley were part of an economic transformation that changed the rules even as new rules were being written. Mill cities that had commanded the economic heights were quickly abandoned for other markets. Sleepy colonial towns became suburban bedroom communities where new neighborhoods needed sewer lines and clean local sources of water. Interstate highways redrew local maps to take traffic away from the ailing cities and into the surrounding countryside. It was not long before suburban shoppers looked to malls – climate-controlled structures that replaced the experience of the downtown shopping district. Cities declined as suburbs grew. By 1970, even the Merrimack River landscape that Robert Jay Evans beheld in 1960 was gone from the scene.

This chapter is the story of the twenty-five years between the end of World War II and 1970, between the mills and the malls. Mills closed and people moved out of the cities. Local water maps – made up of the distribution systems that carried from streams and reservoirs through sewer lines – quickly expanded as neighborhoods opened. The emerging suburban landscape was promoted by the arrival of the federal highway system. These new highways were designed for economic and social mobility rather than urban renewal. Out at sea, the peace following World War II was belied by the rapid industrial growth of a heavily extractive marine fishery in the northwest Atlantic. Bycatch slew thousands of fish. The needs of a growing economy played themselves out in every sphere.

The quarter-century after World War II transformed the Merrimack River and the Merrimack Valley. Changes in the water map followed changes in settlement. Changes in the

highway map confirmed the new suburban patterns of driving and shopping. Urban decline that had begun during the Fifties was only intensified by the retraction of economic activity from their downtown districts. These disparate patterns transformed the Merrimack, its water map, and the economic future of the landscape. And yet, for all of that prosperity and possibility, the dirty old Merrimack still flowed daily to the sea.

* * * *

Afta the Waw, as my father would say, the mills closed. We can see through contemporary artwork how quickly the industrial landscape was undone. The cover of the paperback edition of Theodore Steinberg's *Nature Incorporated* shows Charles Sheeler's *Amoskeag Canal*, a postwar depiction of the canal in Manchester where Sheeler had been resident for a short time in 1948. Sheeler had been "drawn to the pristine geometries of both vernacular architecture and modern industry."[136] But by 1958, Sheeler was talking in very different terms about the industrial forms that he saw in Ballardvale, in Andover, Massachusetts. The industrial collapse was frightening.

> Well, there was a place just on the edge of Andover which is old, it goes back to when New England was the great textile center, you've probably (seen) many places where all those places are just, I mean those textile mills are just carcasses now, the windows are out and all that sort of thing. Well, there was [Ballardvale], which was adjacent to Andover, it was a place like that, and was certainly of enough interest to me to devise a picture of it, and that was the subject for one.. . . They're pretty gruesome, those places, aren't they. The worst of all that I know, when I got to Manchester I walked down the main street and I was just flabbergasted. I wanted to turn right around and come home again. Oh, it was so ghastly, because they had vastly more than this, that I was describing at [Ballardvale].[137]

136. Cécile Whiting, "A New England Lament: Charles Streeler and Paul Strand in the 1940s," *The Art Bulletin*, 89, no. 4 (2007): 797-798.

137. Whiting, "A New England Lament," 797. The quotation is from an interview with Bartlett Cowdrey, December 9, 1958, in which Sheeler mispronounced the name of a section of Andover as "Ballardsdale". He certainly knew the name *Ballardvale*, his 1946 painting that now hangs in the Museum of Fine Arts in Boston, Massachusetts.

The postwar collapse of those industries, once underway, was precipitous. In 1947, Lawrence was second only to Boston in revenues from import duties.[138] A century after its founding, the Immigrant City was still a money-maker for the Commonwealth of Massachusetts. But within a decade, the great industrial story of Lawrence was on its way to the history books. In 1956, Lawrence registered 224 permits for new buildings, with a total value over two million dollars. In 1957, there were 196 permits, which meant a loss in value of about eight hundred thousand dollars.[139] There were still new tenants, but fewer of them. Lawrence was becoming a place to leave rather than a place to work.

Lawrence had held its own for so long that it was ill suited for the economic transformation after the War. For one thing, the city's buildings were old. Lawrence had nearly eighty thousand people living in seven square miles, but there were still 112 empty living units, and more than 80 percent of the living units in Lawrence were built before 1920. City officials hoped that urban development would provide, in the words of Mayor John J. Buckley, "an essential part of the program to maintain and extend the attractiveness and value of the center of the city."[140] But that hope would compete with the realities of rapid decline and financial abandonment. Future highways would go around Lawrence rather than through it.

In the case of the Merrimack River, the end of the War was the end of the mills. The mills, which had done a good business during wartime, had to close when they could no longer compete with Southern industries or foreign industries. In public statements, industrial officers

138. "Lawrence's Hundredth Year," *Christian Science Monitor*, April 19, 1947, 20.

139. John McKone, "Lawrence News Letter: Andover Building Boom Spreads Optimism," *Boston Globe*, January 5, 1958, 48.

140. John McKone, "Lawrence News Letter: Andover Building Boom Spreads Optimism," *Boston Globe*, January 5, 1958, 48.

tended to be upbeat. There was no point in being pessimistic. In December of 1957, the Merrimack Manufacturing Company, incorporated in 1822, and still employing a thousand workers, announced that it would be going out of business within six months. Five hundred workers had already been laid off in October. Competing with cheaper Japanese textiles finished the work of an industrial epoch. A third of a mile of river frontage would become vacant, and more than a hundred thousand dollars of property taxes annually would be lost.[141]

Ten years after the centennial of Lawrence, the great industrial history was coming to a close. 1957 ended with the closure of the last of the "Big Five" – Massachusetts Mills, the Lawrence Manufacturing Company, Boott Mills, Tremont & Suffolk Mills, and now the Merrimack Manufacturing Company – that had dominated Lowell for decades. Two weeks before Christmas, the president of the Merrimack Manufacturing Company announced that the firm could no longer "buck the trend" of market forces driven by cheaper textiles from Japan. The closure would cost Lowell over a hundred thousand dollars in annual property tax revenues. A thousand jobs would disappear forever.[142]

The end of the Fifties was the end of the old industrial history. The week before Thanksgiving 1960, the Lawrence industrial revolution was "completed" with the sale of the last big textile mill, the United States Worsted Company (USWOCO) mill on South Broadway, to Abraham Gosman of Newton, president and treasurer of Precision Processing Corporation of Newton and A. D. Gosman of Carteret, New Jersey. The conversion of the USWOCO plant completed the "switch," which saw Lawrence fight back from "near-ghost-town status," when

141. George H. Favre, "Lowell Mill Airs Plans to Close," *Christian Science Monitor*, December 11, 1957, 5; James B. Ayres, "The Merrimack, Playground or Sewer? – : Textiles Gone, Debris Left," *Boston Globe*, May 5, 1965, 12.

142. "Merrimack Mill To Close; 1000 Will Lose Jobs," *Boston Globe*, December 11, 1957, 7.

the textile mills moved south, to "diversified industrial health."[143] This assessment was optimistic given how many of Lawrence's buildings were already empty.

In the absence of private investment, city officials would have to find public funding for urban initiatives. But reliance on public funding meant coming up against local priorities from other communities. The postwar era was a time of two competing trends: suburban growth and urban renewal. "By the close of World War II," argues Samuel P. Hays, "a majority of urbanites could establish home and community in truly residential areas, often in the suburbs." There were also "attempts to improve the urban environment from within." These attempts were "often limited to ideas and plans drawn up by landscape architects and fostered by civic leaders rather than the public." There were few "tangible results," but the plans did serve as "focal points for hope and aspiration" as to how a city could be improved.[144]

In the Fifties, city leaders in the Merrimack Valley knew that they were competing against everyone in the area for economic survival. The competitive elements showed themselves in urban landscapes. In 1954, Haverhill officials sought to expand off-street parking to supplement metered parking so that they could increase business activity and therefore enhance the city's tax revenues.[145] In the Mill City, Lowell officials were discussing eminent domain and retail development as components of their plans for urban renewal in the fall of 1957. Takings planned for the South End of Lowell would cost about $400,000, and clearing the buildings would push the project cost to $1 million. A retail development – "We have all the Federal housing we need," said City Manager Frank E. Barrett – was planned for the renewed

143. "Last Big Lawrence Mill Sold for Diversification," *Boston Globe*, November 20, 1960, 50.

144. Samuel P. Hays, *Beauty, Health and Permanence: Environmental Politics in the United States, 1955-1985* (Cambridge: Cambridge University Press, 1987), 71 – 72.

145. "New Haverhill Lots Parking Lots Seen Key to City's Growth," *Daily Boston Globe*, October 24, 1954, 16.

space, replacing the current annual tax revenue of $27,000 with projected revenues of $125,000. Another plan, estimated at $5 million, would renew the downtown northward along Moody Street to Aiken Street. The Yorick Club and the Ancient Masonic Temple would remain; the rest of the structures would be razed, inviting a commercial district with shopping centers and wholesale firms where "low-value dwellings and run down industrial property" then stood.[146]

Every feature of an urban landscape was contested ground.[147] While public officials in Lowell were drawing up plans to expand city parking to help local merchants, Lawrence officials were looking for ways to strengthen city ordinances against parking violations.[148] Experts looked for urban blight in every American city, even if they disagreed over what the term really meant. Most of the studies up to that time had investigated residential blight in favor of industrial or commercial blight. In 1958, Quintin Johnstone argued that blighted areas were seen as "economic liabilities" to local government, "for they almost always produce less in tax revenue than the cost of public services that they receive, such as police and fire protection and welfare assistance."[149] A blighted area was not just unproductive; it was consumptive as well.

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146. "Lowell Planning Face Lifting at $6 Million Cost: Big Projects for Lower Moody Street and Broadway Area," *Boston Globe,* July 7, 1957, B34.

147. Andrew Hurley, *Environmental Inequalities: Class, Race, and Industrial Pollution in Gary, Indiana, 1945-1980* (Chapel Hill: University of North Carolina Press, 1995), 3. "Especially since the rise of industrial capitalism in the mid-nineteenth century," he writes, "the urban environment, in both its natural and human-altered forms, has been contested terrain."

148. "New Auto Park Will Be Ready Soon in Lowell: 650 Cars Can Be Stored; City Nears 40% of Goal to Help Its Merchants," *Daily Boston Globe*, September 15, 1957, B10; John McKone, "Lawrence Eyes Parking Crackdown: Expert Asks Heavy Fines for 'Chronic' Violators," *Daily Boston Globe,* September 8, 1957, 42.

149. Quintin Johnstone, "The Federal Urban Renewal Program," *The University of Chicago Law Review,* 25, no. 2 (1958): 302 – 303 (including *n*3). "Statistical data on the amount of blight" were "very limited" and unsatisfactory, he argued, "due to the difficulty of defining blight, difficulties in quantitatively measuring it, and the insufficient statistical survey work that has been done on the subject." More "progress" had been made on measuring residential blight "than that of a commercial or industrial character." The University of Chicago was one of the centers of the urban geography movement that started in the Thirties under the "tutelage" of Charles Colby. *Urban Geography in America, 1950 – 2000: Paradigms and Perspectives*, ed. by Brian J. L. Berry and James D. Wheeler (New York and London: Routledge, 2005), xi.

Old neighborhoods were now in conflict with newer priorities. Some officials tried to mediate that conflict by making public assurances that things would change *and* that they would remain the same. In January of 1958, Lawrence obtained approval to redevelop 35 acres of the downtown. The Lawrence Housing Authority (LHA) intended to remove all substandard and blighted properties. In the words of a reporter, "Leaders call it the biggest forward step in years." John J. Sirois, director of the LHA, put the problem simply. "Realty had to be appraised a determination made as to the possible re-use and marketability of the properties," he explained.

> Most important was the impact on families. It will be our job to see that they are relocated with as little inconvenience as possible. Right here I want to assure these families that they will not be asked to leave in a hurry. They will have up to three years to move. It will take three to five years before any project is completed. In many cases it will be up to three years before a family is actually forced to move. According to income they will be re-located in public housing if they wish. We have weighed the family problem carefully and interviewed many people involved. Some have deep roots in the locality. They have lived there for as long as 50 or more years. Some of them prefer the area of necessity. Their means have not permitted them to move elsewhere. All in all, those we have talked to have been understanding and cooperative.[150]

Such comments, coming from the head of a city housing authority, tell of more than just the desire of public officials not to push for the radical urban renewal seen in the West End of Boston.[151] The time scale – three-to-five years – would push the urban renewal of the blighted section of Lawrence into the early Sixties. By then, Lawrence would have seen thousands of manufacturing jobs disappear; more were leaving all the time. In the suburbs, local banks could offer federally-supported loans to get people into their new homes. In Lawrence, city officials

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150. John McKone, "Dream to Become a Reality: Lawrence Gets Federal Nod On 35-Acre Redevelopment," *Daily Boston Globe*, January 19, 1958, 27.

151. Thomas H. O'Connor, *Building a New Boston: Politics and Urban Renewal, 1950 – 1970* (Boston: Northeastern University Press, 1993), 122 – 129. O'Connor argues that the "narrow mysterious European streets and alleys" of a former resident's reminiscence were seen by younger, more conservative, and professional observers as "an impoverished, overcrowded, and dangerous slum area, an explosive tinderbox that should be wiped out as soon as possible" Some residents had burned to death because firefighters could not reach them in time. Public officials and private bankers agreed. The West End had to go.

could only get federal assistance so that they could catch up to where they had already begun to fall behind other communities in the Merrimack Valley.

Urban populations changed as their economies shifted away from the old mills. There are six major cities in the Merrimack River watershed: Concord, Manchester, and Nashua, in New Hampshire; and Lowell, Lawrence, and Haverhill, in Massachusetts. In 1950, Concord's population was about a third of that of Manchester, and it was about the same proportion in 1970. In 1950, Manchester was more than twice the size of Nashua, but Nashua was nearly two-thirds the size by 1970. In 1950, Lowell was more than twice the size of Haverhill, which was barely more than half the size of Lawrence. In 1970, Lowell was still more than twice the size of Haverhill, but Haverhill was now more than two-thirds the size of Lawrence.[152] In general, the smaller cities grew in proportion to the larger ones. The increase of local people during the twenty years after 1950 forced the reconsideration of water relations in the Merrimack Valley.

Most of the population of the watershed was in Massachusetts. The populations of Concord, Manchester, and Nashua comprised 173,596 inhabitants in 1970, whereas Lowell, Lawrence, and Haverhill comprised 225,055 inhabitants – a margin of 51,459 inhabitants, nearly the population of Nashua, over the cities of New Hampshire. Most of the mill jobs were in

152. U.S. Census Bureau, "Massachusetts 1950, Table 6, Population of Counties by Minor Civil Divisions: 1930 – 1950," https://www2.census.gov/prod2/decennial/documents/38840572v2p21ch2.pdf; "Massachusetts 1960, Table 5, Population of Incorporated Places of 10,000 or More from Earlier Census to 1960," https://www2.census.gov/prod2/decennial/documents/37722946v1p23ch2.pdf; "Massachusetts 1970, Table 6, Populations of Towns and Places: 1970 and 1960," https://www2.census.gov/prod2/decennial/documents/1970a_ma-01.pdf; "New Hampshire 1950, Table 6, Population of Counties by Minor Civil Divisions: 1930 – 1950," https://www2.census.gov/prod2/decennial/documents/12899326v2p29ch1.pdf; "New Hampshire 1960, Table 5, Population of Incorporated Places of 10,000 or More from Earlier Census to 1960," https://www2.census.gov/prod2/decennial/documents/10669824v1p31ch2.pdf; "New Hampshire 1970, Table 6, Populations of Towns and Places: 1970 and 1960," https://www2.census.gov/prod2/decennial/documents/1970a_nh-01.pdf. Accessed: May 11, 2016.

Massachusetts as well. Figure 2.1 shows the local employment in nondurable manufacturing industries in six cities between 1950 and 1970.[153]

	Concord	Manchester	Nashua	Lowell	Lawrence	Haverhill
Manufacturing, 1950	2065	17192	7920	19568	27441	10664
Manufacturing, 1960	2666	16778	8130	15982	14587	11156
Manufacturing, 1970	2642	12440	10906	15080	12975	7987
1960 – 1950	601	-414	210	-3586	-12854	-492
Percentage change	29.1	-2.41	2.65	-18.3	-46.8	-4.61
1970 – 1960	-24	-4338	2776	-902	-1612	-3169
Percentage change	-0.9	-26.2	34.1	-5.6	-11.1	-28.4
1970 – 1950	577	-4752	2986	-4488	-14466	-2677
Percentage change	27.9	-27.6	37.7	-22.9	-52.6	-25.1

Figure 2.1. Employed Nondurable Manufacturing Workers in Six Major Cities along the Merrimack River, 1950 – 1970.

The decline of Lawrence's textile manufacturing economy is immediately apparent. In 1950, more than one in three people in Lawrence had been employed in a manufacturing job. By 1960, the fall from one-in-three to one-in-five – a loss of 12,854 jobs – meant the end of Lawrence's status as one of the manufacturing centers of the Merrimack Valley. The ratio of manufacturing workers to total inhabitants was about the same in 1960 and in 1970 – roughly one in five. But by 1970, almost one in six (16.4 percent) of the inhabitants in 1950 was not

153. U.S. Census Bureau, "Massachusetts: Table 35, Economic Characteristics of the Population, by Sex, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1950," https://www2.census.gov/prod2/decennial/documents/38840572v2p21ch2.pdf; "New Hampshire: Table 35, Economic Characteristics of the Population, by Sex, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1950," https://www2.census.gov/prod2/decennial/documents/12899326v2p29ch2.pdf; "Massachusetts: Table 75, Industry Group of Employed Persons and Major Occupation Group of Unemployed Persons, by Sex, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Selected Towns of 10,000 or More: 1960," https://www2.census.gov/prod2/decennial/documents/37722946v1p23ch4.pdf; "New Hampshire: Table 75, Industry Group of Employed Persons and Major Occupation Group of Unemployed Persons, by Sex, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Selected Towns of 10,000 or More: 1960," https://www2.census.gov/prod2/decennial/documents /10669824v1p31ch4.pdf; "Massachusetts: Table 87, Industry of Employed Persons for Areas, Towns, and Places: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-04.pdf; "Massachusetts: Table 106, Industry of Employed Persons and Occupation of Experienced Unemployed Persons for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-06.pdf; New Hampshire: Table 87, Industry of Employed Persons for Areas, Towns, and Places: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_nh-04.pdf; Massachusetts: Table 106, Industry of Employed Persons and Occupation of Experienced Unemployed Persons for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_nh-06.pdf. Accessed: May 11, 2016.

counted anymore. Those jobs, and many of those families, had left the Immigrant City forever.[154]

Cities that did not depend so heavily on manufacturing were better off after 1960 than the old industrial leaders of the Merrimack Valley. Figure 2.2 shows us how median family incomes were affected by changes in the industrial bases of the six cities of the Merrimack River. The less a city had relied on manufacturing before 1960, the better off that city was in 1970.[155] And

154. U.S. Census Bureau, "Massachusetts: Table 37, Income in 1949 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1950," https://www2.census2.gov/prod2/decennial/documents/38840572v2p21ch3.pdf; "New Hampshire: Table 37, Income in 1949 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1950," https://www2.census2.gov/prod2/decennial/documents/12899326v2p29ch2.pdf; "Massachusetts: Table 76, Income in 1959 of Families and Persons, and Weeks Worked, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Urban Places and Selected Towns of 10,000 or More: 1960," https://www2.census2.gov/prod2/decennial/documents/37722946v1p23ch4.pdf;"New Hampshire: Table 76, Income in 1959 of Families and Persons, and Weeks Worked, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Urban Places and Selected Towns of 10,000 or More: 1960," https://www2.census2.gov/prod2/decennial/documents/10669824v1p31ch4.pdf; "Massachusetts: Table 87, Industry of Employed Persons for Areas, Towns, and Places: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-04.pdf; "Massachusetts: Table 106, Industry of Employed Persons and Occupation of Experienced Unemployed Persons for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-06.pdf; New Hampshire: Table 87, Industry of Employed Persons for Areas, Towns, and Places: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_nh-04.pdf; Massachusetts: Table 106, Industry of Employed Persons and Occupation of Experienced Unemployed Persons for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_nh-06.pdf. Accessed: May 11, 2016. Accessed: May 11, 2016. I recalculated income levels to 1970 dollars used the West Egg Inflation Calculator: www.westegg.com/inflation. Accessed: May 11, 2016.

155. U.S. Census Bureau, "Massachusetts: Table 37, Income in 1949 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1950," https://www2.census2.gov/prod2/decennial/documents/38840572v2p21ch3.pdf; "New Hampshire: Table 37, Income in 1949 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1950," https://www2.census2.gov/prod2/decennial/documents/12899326v2p29ch2.pdf; "Massachusetts: Table 76, Income in 1959 of Families and Persons, and Weeks Worked, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Urban Places and Selected Towns of 10,000 or More: 1960," https://www2.census2.gov/prod2/decennial/documents/37722946v1p23ch4.pdf; "New Hampshire: Table 76, Income in 1959 of Families and Persons, and Weeks Worked, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Urban Places and Selected Towns of 10,000 or More: 1960," https://www2.census2.gov/prod2/decennial/documents/10669824v1p31ch4.pdf; "Massachusetts: Table 89, Income in 1969 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-04.pdf; "New Hampshire: Table 89, Income in 1969 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_nh-02.pdf ; "Massachusetts: Table 107, Income and Poverty Status in 1969 for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-04.pdf; "New Hampshire: Table 107, Income

most of the downtown shoppers would not be driving into the old city centers from their new homes in the old towns.

	Concord	Manchester	Nashua	Lowell	Lawrence	Haverhill
Median family income, 1949	4790.67	5316.99	5215.96	4991.09	4966.65	5087.23
Median family income, 1959	8479.67	7728.41	8222.59	7426.04	7810.99	8144.00
Median family income, 1969	10687.43	10349.61	11507.09	10055.20	10067.91	10331.60
1959 – 1949	3689	2411.42	3006.63	2434.95	2844.44	3056.77
Percentage change	77.00	45.35	57.64	32.79	36.42	37.53
1969 – 1959	2207.76	2621.20	3284.50	2629.16	2256.92	2187.60
Percentage change	26.03	33.92	39.95	35.40	28.89	26.86
1969 – 1949	5896.76	5032.62	6291.13	5064.11	5101.26	5244.37
Percentage change	123.09	94.65	120.61	101.46	102.71	103.09

Figure 2.2. Median Family Incomes in 1970 Dollars for Six Major Cities along the Merrimack River, 1949 – 1969.

Median family income is an effective means of studying how families adjusted to economic changes, but numbers can be deceiving. At a glance, Concord's rise looks a lot like Lawrence's decline, but median incomes are also influenced by population. In a smaller population, there are fewer data points on either side of the median. The decline in Lawrence's population (13,611) between 1950 and 1970 was more than half of the population of Concord in 1950 (27,988).[156] Lawrence lost nearly 15,000 manufacturing jobs in the two decades during which Concord gained less than six hundred. With more activity and a smaller population,

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and Poverty Status in 1969 for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_nh-02.pdf. Recalculation of income levels to 1970 dollars used the West Egg Inflation Calculator: www.westegg.com/inflation. Accessed: May 11, 2016.

156. U.S. Census Bureau, "Massachusetts 1950, Table 6, Population of Counties by Minor Civil Divisions: 1930 – 1950," https://www2.census.gov/prod2/decennial/documents/38840572v2p21ch2.pdf; "Massachusetts 1960, Table 5, Population of Incorporated Places of 10,000 or More from Earlier Census to 1960," https://www2.census.gov/prod2/decennial/documents/37722946v1p23ch2.pdf; "Massachusetts 1970, Table 6, Populations of Towns and Places: 1970 and 1960," https://www2.census.gov/prod2/decennial/documents/1970a_ma-01.pdf; "New Hampshire 1950, Table 6, Population of Counties by Minor Civil Divisions: 1930 – 1950," https://www2.census.gov/prod2/decennial/documents/12899326v2p29ch1.pdf; "New Hampshire 1960, Table 5, Population of Incorporated Places of 10,000 or More from Earlier Census to 1960," https://www2.census.gov/prod2/decennial/documents/10669824v1p31ch2.pdf; "New Hampshire 1970, Table 6, Populations of Towns and Places: 1970 and 1960," https://www2.census.gov/prod2/decennial/documents/1970a_nh-01.pdf. Accessed: May 11, 2016.

Concord ended up with a median family income that was nearly 16 percent higher than that of Lawrence by 1970.

Lawrence's early advantage – a compressed industrial landscape – was now a deficit. Lowell's decline was similar to that to Lawrence, but Lowell has a larger area than that of Lawrence. Its population has been larger and more stable in times of economic difficulty. The population of Lawrence's city core ("Lawrence city" in the census) dropped by nearly 10 percent during the Twenties, and it dropped nearly 12 percent during the Fifties. Lowell lost just over 11 percent of its population during the Twenties, but only 5.3 percent during the Fifties. In contrast to Lawrence, Lowell's population actually grew 2.3 percent during the Sixties, but Lowell had lost twenty thousand inhabitants between 1940 and 1960, so that the repletion of 2,135 people was barely more than two percent of the city's population of 94,239 reported in 1970.[157] With a larger core, Lowell had a stronger economic base than Lawrence.[158]

The differences between Lawrence and Lowell played out in the suburbs and in the local water maps around the old mill cities. The "Greater" model – "Greater Lawrence", "Greater Lowell" – is one way to see how cities compared to their suburbs. Figure 2.3 shows the median

157. U.S. Census Bureau, "Massachusetts 1950, Table 6, Population of Counties by Minor Civil Divisions: 1930 – 1950," https://www2.census.gov/prod2/decennial/documents/38840572v2p21ch2.pdf; "Massachusetts 1960, Table 5, Population of Incorporated Places of 10,000 or More from Earlier Census to 1960," https://www2.census.gov/prod2/decennial/documents/37722946v1p23ch2.pdf; "Massachusetts 1970, Table 6, Populations of Towns and Places: 1970 and 1960," https://www2.census.gov/prod2/decennial/documents/1970a_ma-01.pdf; "New Hampshire 1950, Table 6, Population of Counties by Minor Civil Divisions: 1930 – 1950," https://www2.census.gov/prod2/decennial/documents/12899326v2p29ch1.pdf; "New Hampshire 1960, Table 5, Population of Incorporated Places of 10,000 or More from Earlier Census to 1960," https://www2.census.gov/prod2/decennial/documents/10669824v1p31ch2.pdf; "New Hampshire 1970, Table 6, Populations of Towns and Places: 1970 and 1960," https://www2.census.gov/prod2/decennial/documents/1970a_nh-01.pdf. Accessed: May 11, 2016.

158. One measurement of the implications of the differences between Lawrence and Lowell came from a 1977 feature article that listed the tax levy increases for cities in Massachusetts for 1976. Lawrence's tax levy increased 16.9 percent; Lowell's increased 6.9 percent. Haverhill's tax rate increased only 4.7 percent. Ian Menzies, "Massachusetts Cities: The Buck's Stopped Here," *Boston Globe*, January 11, 1977, A2.

family incomes between 1959 and 1969 for Lawrence and three of its neighbors: Andover, Methuen, and North Andover.[159] Although Lawrence made similar proportional gains to its suburbs, the results were unmistakable by the end of the Sixties.

	Andover	Lawrence	Methuen	North Andover
Median family income, 1959	10248.70	7336.79	8362.45	9048.44
Median family income, 1969	15249.60	10067.91	11567.46	12978.05
1969 m.f.i. – 1959 m.f.i.	5000.90	2731.12	3205.01	3929.61
Percentage change	48.8	37.2	38.3	37.6
1969 m.f.i./Lawrence m.f.i.	1.52:1	1:1	1.15:1	1.29:1

Figure 2.3. Median Family Incomes for Lawrence and Three Neighboring Communities, 1959 – 1969, in 1970 Dollars.

Greater Lowell shows a different pattern of economic activity. Figure 2.4 compares the median family incomes of Lowell to those of three of its neighboring towns – Chelmsford, Dracut, and Tewksbury – between 1959 and 1969.[160] Other than Chelmsford, the towns around Lowell made similar proportional gains to the Mill City.

159. "Massachusetts: Table 76, Income in 1959 of Families and Persons, and Weeks Worked, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Urban Places and Selected Towns of 10,000 or More: 1960," https://www2.census2.gov/prod2/decennial/documents/37722946v1p23ch4.pdf; "New Hampshire: Table 76, Income in 1959 of Families and Persons, and Weeks Worked, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Urban Places and Selected Towns of 10,000 or More: 1960," https://www2.census2.gov/prod2/decennial/documents/10669824v1p31ch4.pdf; "Massachusetts: Table 89, Income in 1969 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-04.pdf; "New Hampshire: Table 89, Income in 1969 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_nh-02.pdf ; "Massachusetts: Table 107, Income and Poverty Status in 1969 for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-04.pdf; "New Hampshire: Table 107, Income and Poverty Status in 1969 for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_nh-02.pdf. Recalculation of income levels to 1970 dollars used the West Egg Inflation Calculator: www.westegg.com/inflation Accessed: May 11, 2016.

160. "Massachusetts: Table 76, Income in 1959 of Families and Persons, and Weeks Worked, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Urban Places and Selected Towns of 10,000 or More: 1960," https://www2.census2.gov/prod2/decennial/documents/37722946v1p23ch4.pdf; "New Hampshire: Table 76, Income in 1959 of Families and Persons, and Weeks Worked, for Standard Metropolitan Statistical Areas, Urbanized Areas, and Urban Places and Selected Towns of 10,000 or More: 1960," https://www2.census2.gov/prod2/decennial/documents/10669824v1p31ch4.pdf; "Massachusetts: Table 89, Income in 1969 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-04.pdf; "New Hampshire: Table 89, Income in 1969 of Families and Unrelated Individuals, for Standard Metropolitan Areas, Urbanized Areas, and Urban Places of 10,000 or More: 1970,"

	Chelmsford	Dracut	Lowell	Tewksbury
Median family income, 1959	9497.33	8265.21	7564.57	8852.63
Median family income, 1969	13864.43	10888.64	10055.20	11913.75
1969 m.f.i. – 1959 m.f.i.	4367.10	2623.43	2490.63	3079.12
Percentage change	46.0	31.7	32.9	34.8
1969 m.f.i./Lowell m.f.i.	1.38:1	1.08:1	1:1	1.19:1

Figure 2.4. Median Family Incomes for Lowell and Three Neighboring Communities, 1959 – 1969, in 1970 Dollars.

There were similarities between the towns of Greater Lawrence and Greater Lowell. Although Andover's median family income stands apart, there are two good pairings: North Andover with Tewksbury; Methuen with Dracut. Chelmsford was only about as far behind Andover as it was ahead of Tewksbury; and Chelmsford outpaced Dracut by more of a margin than Andover outpaced North Andover. The margin between Methuen and Dracut was not much different from the margin between Lawrence and Lowell. Suburbs absorbed the economic and financial activities of the cities. If some towns were doing better than others, then all of them were doing better than the cities that were still right over the bridge or just down the road.

Suburban growth strained local water maps. During the Sixties, Chelmsford's population rose by more than 100 percent. In 1972, there were water restrictions in two of Chelmsford's four districts. Supplies were not always available, and town engineers estimated that Chelmsford's water needs would double by 1982. The Town of Billerica also had water restrictions. Billerica voters faced difficult choices in financing new water supply projects in a

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https://www2.census2.gov/prod2/decennial/documents/1970a_nh-02.pdf ; "Massachusetts: Table 107, Income and Poverty Status in 1969 for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_ma-04.pdf; "New Hampshire: Table 107, Income and Poverty Status in 1969 for Towns and Places of 10,000 to 50,000: 1970," https://www2.census2.gov/prod2/decennial/documents/1970a_nh-02.pdf. Recalculation of income levels to 1970 dollars used the West Egg Inflation Calculator: www.westegg.com/inflation. Accessed: May 11. 2016.

town where the population had increased 77.1 percent between 1960 and 1970.[161] The arrival of new people was as much a challenge to local governments as it was an opportunity to increase local revenues.

For these reasons, there was no such thing as an equitable plan for the shifting landscape of the postwar Merrimack. The advantage of 1947 was the ache of 1970. New Hampshire cities did a little better because they gained jobs, but also because they had depended less on nondurable manufacturing – of which textiles are a major category – than the mill cities south of the state line. If Lowell were abler at withstanding economic decline than Lawrence because of a larger core population, then Lowell was no better off in relative comparison to the suburbs that lived in its "Greater" limits. And even in the suburbs, there were still problems finding water.

The industrial retreat was of a piece with suburban growth. "If the postwar years were kind to the new middle class," argues Andrew Hurley, "it was in no small measure due to the largesse of federal programs that supported suburban development." New Deal rhetoric about the "forgotten man" was focused on the "suffering" of the nation's most underprivileged citizens. But after World War II, liberalism "reflected a much greater sensitivity to middle-class quality-of-life concerns."[162] That sensitivity played itself out across the suburbs of the watershed in lending, building, and the search for local water.

From an economic standpoint, development was a business, but it was hardly a free market. The federal government provided loans for new homeowners, often on terms so attractive that lenders struggled to keep up with demand. In November of 1957, Andover's

161. John O'Keefe, "Communities Look Drily at Regional Water Togetherness," *Boston* Globe, June 11, 1972, 26. Billerica's voters rejected the first phase of an $8 million water plan by one vote at a recent town meeting. Billerica's Public Works Commissioner, Edward Leahy, said that Billerica's water needs had been increasing by 10 percent annually since 1968 despite an annual population growth of 7 percent.

162. Hurley, *Environmental Inequalities*, 50 – 51.

money total for new homes was $302,000, fourth in the entire Commonwealth. Methuen reported a more modest amount, $86,000. In Lawrence, the spending was only $35,000. Even when people were willing to buy new homes, the demand for federal loan monies often exceeded the supply of money available from local banks. One local bank had to close down homeowner lending for six weeks because the funds were not available even when the borrower could come up with the down payment for a new house.[163] The housing market was expanding more quickly than the money could arrive.

Money was one thing; water was another. Every new home would need a domestic supply of water. Domestic supplies were drawn from streams and reservoirs. In 1957, the Metropolitan District Commission (MDC) could boast of some of the "purest" water found, but the State Public Health Department assigned an emergency status to seventeen communities across the Commonwealth. In those cities and towns, local officials were allowed to shut off water to private homes whose owners did not comply with a ban. Lowell and Andover both made the list. Local water needs did not simply follow local economics; they were tied to local waterscapes as well.[164]

Temporary limitations on water cost local people money. In 1957, market gardeners in Andover protested the water restrictions that limited their use from six p.m. to midnight, when most of them would be carrying their produce to the Boston market, while factories were allowed to run without such restrictions. The farmers living along the Merrimack River were able to draw supplies directly from the stream, but most of them used Haggett's Pond, the local

163. John McKone, "Lawrence News Letter," *Boston Globe*, January 5, 1958, 48.

164. Richard L. England, "Bay State Rates High in Water: Quality Water Cited," *Christian Science Monitor*, June 22, 1957, 2. Methuen was on another list of cities and towns where local restrictions were being enforced.

reservoir. Typically, the water use was somewhere around 1.6 million gallons a day, but with the drought that figure rose to 2.3 million gallons a day. But it was not all bad. The relative scarcity of produce kept the prices up for those market gardeners who could stay in business.[165]

Even in suburbs that were prospering, droughts continued to affect how water was allocated. In 1966, Andover had to issue an outside-use ban on water because Haggett's Pond was six feet below the usual level and the town was 500 million gallons short of its needs. A local plan to connect Haggett's Pond to Fish Brook, and thus to draw water from the Merrimack, was considered "unusual" for Andover. But the unusual was also necessary at a time when people could not even wash their own cars in their driveways.[166] Even when people could afford to move out of the cities, they would still need water wherever they would resettle.

The need for more water, rather than the need for more nature, led to water pollution control after 1965. In August of 1970, Governor Frank Sargent signed a $250 million bond issue. "The people of Massachusetts have made it clear that they have had enough of polluted waterways," he said. $92 million of the bonds were slated for the Merrimack River, of which more than $70 million were dedicated to Greater Lowell ($37 million) and Greater Lawrence ($35 million).[167] In October, a $30 million treatment plant was announced for Greater Lawrence. A wastewater treatment plant would be built on Charles Street in North Andover. The plant was announced with a start date of 1972 and an expected completion date of 1976.[168] If Greater

165. "Andover Farmers Protest Water Curb: Factory Use Cited Meeting Scheduled," *Christian Science Monitor*, June 26, 1957, 2.

166. James B. Ayres, "No State Money for Sewage Works," *Boston Globe*, May 12, 1965, p. 11; John J. McKone, "Merrimack Valley: But Not a Drop to Drink," *Boston Globe*, January 30, 1966, 68.

167. Richard Ray, "$250m in Pollution Bonds Set," *Boston Globe*, August 25, 1970, 1.

168. Ray, "$250m in Pollution Bonds Set," 1; Frank Donovan, "$30m Plant Will Attack Water Pollution," *Boston Globe*, October 12, 1970, 33.

Lawrence could not promote economic activity in Lawrence, then at least the rising towns could share the costs of water pollution control with a city in decline.

Public officials were optimistic. John B. Casazza, assistant director of the State Division of Water Pollution Control, anticipated that before the end of the Seventies, people would be swimming in the Merrimack.[169] The Greater Lawrence Sanitary District (GLSD) was the only regional plan among the fourteen communities ordered by the Commonwealth to stop polluting the Merrimack River.[170] If the costs of water pollution control could be shared, then at least the river would be cleaner. For the other amenities of postwar prosperity, cities would have to fend for themselves. Whatever the future of the Merrimack River, the days of mill cities controlling the riverine landscape were gone forever.

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The Fifties were economically decisive in the Merrimack Valley. Cities that had ruled the heights for decades were suddenly scrambling for jobs. Towns that had abided since the Revolution were now building dozens of new homes. The shift to a suburban landscape had moved economic activity out of city centers, and now there was talk of a new highway system. But the new highways would have to connect cities to the new landscape without forcing traffic through downtown sections that had been planned and constructed before the Civil War. Economics and geography were inseparable.

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169. Donovan, "$30m Plant Will Attack Water Pollution," 33. Casazza actually turned out to be right, although there were only a few swimmers. In June of 1979, Nathan Tufts had been living along the Merrimack for seven years. When he and his wife Rosalind had bought their house for $21,000, local people were dismayed at the price. In 1979, Tufts was fairly confident in the value of his investment. "Everything's coming back – the eagles, the fish and the people. In the last few years, people have been putting in boats, and there were none before. That's dramatic. They are finding out that the river is a pleasure to be on, if not in." Chris Steiger, living downstream, went a little further. "We went swimming in it, much to everyone's surprise. We just dived off the dock and it was wonderful. I didn't get out feeling grimy or dirty." Nathan Tufts was more cautious. "I probably won't go in for another three years," he said. Kay Longcope, "Merrimack Comes Back: Some Even Dare Swim in It," *Boston Globe*, August 12, 1979, 21.

170. Donovan, $30 Million Plant Will Attack Pollution," 33.

Urban leaders saw highways as opportunities to revive their cities. If a major road could carry traffic into a city center, then it could be profitable for the city. But one of the main principles of regional planning was in its use of highways to carry traffic away from cities and into the surrounding countryside. Paul Mason Fotsch argues that conflicts between regional planning and automotive convenience were recognizable from the beginning. When Lewis Mumford and Benton MacKaye helped to found the Regional Planning Association of America (RPAA) in the Twenties, they were aware that automobiles were already spanning out into the countryside. Fotsch argues that Mumford and MacKaye believed that the automobile's "flexibility" might be "ideal" for traveling through uneven topography. Thus the car "suited their call for regional development in accord with the natural contours of the landscape."[171]

The "limited" ability of Mumford and MacKaye and the RPAA to influence urban development reflected "deep resistance" among Americans to "the redistributive efforts of planners." But the convenience of the automobile also inspired Mumford and MacKaye, as early as 1931, to propose the idea of "townless highways" – a phrase that "embodied" the desire to get away from urban traffic. Between the aspiration of suburban drivers to get away from industrial spaces, and the dangers to pedestrians posed by motorists, the solution was "to separate the heavy automobile traffic from the neighborhoods and eliminate the mixing of automobile and pedestrian traffic completely." Thus, Fotsch argues, the townless highway "provides shelter

171. Paul Mason Fotsch, *Watching the Traffic Go By: Transportaton and Isolation in Urban America* (Austin: University of Texas Press, 2007), 37 – 38. Ironically, Fotsch notes, "accommodation" of the automobile "eventually led to sprawling development and the drastic razing of the natural landscape," consequences against which both Mumford and MacKaye had "specifically" warned. This effect was less noticeable in the settled landscape of the Merrimack Valley, but the growth of the towns *did* shift people into the natural places that had grown over the old town farms.

from the industrial and safety from the mechanical."[172] Such a highway carries traffic away from cities and out into natural places.

Before World War II, the cost of primary construction dominated all discussions of highway development. In 1930, $15,000,000 in roads was planned. This series of projects was to be financed through fees, fines, and gasoline taxes on the owners of automobiles. "Some states float highway bonds," wrote Louis Lyons of the *Boston Globe* in 1930. "But Massachusetts pays for every strip of roadway as she builds it, and it doesn't cost her a cent." The "greatest" of the new road projects was "the first stretch of the Worcester turnpike." Forty feet of "motoring surface" on a seventy-foot right-of-way would be divided in the center by "a grass plot," so that "the only way a motorist can have a collision will be to bump into the car ahead of him or the car behind him." The model road was the bypass. "The problem of routing traffic out of town is one of the constant studies of the project engineers of the Highway Department." The Commonwealth was spending $800,000 in 1930 to bypass Middleboro. Andover's "academic district" – the section of Main Street that runs past Phillips Academy – would be "relieved" of through traffic to Haverhill and "much of the Lawrence traffic" when a state highway then under construction would be finished.[173]

After the War, highway construction was tied to development. In the spring of 1950, the Commonwealth of Massachusetts announced plans to develop state beaches near Salisbury. The Commonwealth had been able to purchase some of the best land in Salisbury in 1935 during the Depression. Fifteen years later, Salisbury officials argued that if the state were going to develop

172. Fotsch, *Watching the Traffic Go By*, 40 – 41.

173. Louis Lyons, "Spending Fifteen Million So Your Sunday Ride Will Be More Fun: Bypass Freeing Cities and Towns of Traffic Congestion, While Landscape Artists Employ Seeds and Axes to Make Roadsides More Attractive," *Daily Boston Globe*, July 27, 1930, C2.

beaches, then the state should add new roads. Planners would do well to expand Route 1A to six lanes and add a spur road to connect 1A to the beach.[174] And in 1953, a plan twenty times as expensive – $300,000,000 – was announced to connect all of Massachusetts together. Projects worth $80 million were already under construction. Public Works Commissioner John A. Volpe said that another $64 million in projects would soon be available for construction bidding. [175]

When the Federal Aid Interstate Act was passed in 1956, local planners in the Merrimack Valley were ready. In September, a new bridge was proposed to allow Route 28 to span the Merrimack River between Andover and Methuen. Not all of the problems were financial, or even political. Highway construction meant bridge construction, and there was a steel shortage. Although the bid would not be awarded by the Commonwealth until a $300 million highway plan should pass the state legislature, the bids had to be announced as soon as possible because steel deliveries were running about fifteen months from date of order.[176] By the end of November 1957, there were sixty public officials meeting with the state's public works commissioner to plan the new Route 110 that would connect seven towns from Andover to Salisbury. The new project, slated to cost $55 million to run 21.7 miles, was to be supported with federal funding – on a 90-10 basis.[177]

New interstates were soon connected to local roads. By the spring of 1961, city planners were thinking in very detailed terms. "The only cloud on our horizon," said Lowell City Planning Director Charles Zettick, "is the present Rte. 3 dead-end at Rte. 128. Rte. 495 will be

174. J. Barter, "State Plans for Beaches Stir North, South Shores," *Boston Globe*, April 23, 1950, C1.

175. "State Plans $300,000,000 Highway Net: Portion of Funds Already Provided; More to Be Asked," *Daily Boston Globe*, July 2, 1953, 1.

176. "State Advertises Merrimack River Bridge Bids," *Daily Boston Globe*, September 16, 1956, B40.

177. "60 Officials Talk Route 110 Plans For Relocation," *Daily Boston Globe*, November 26, 1957, 20.

valuable only when we have at least connections with Rte. 93 on the east and the Massachusetts Turnpike in the west."[178] Tying the new roads to the older cities would help to justify urban renewal as well as to slow the decline of municipal tax revenues from lost business.

The stakes were high. The big new highways were created from scratch, and every decision to cut the road a certain way, or to allow so many lanes, or to put a ramp here or there, had measurable effects on local economies. Samuel P. Hays argues that the highway system planned during the Fifties "was intended to bypass cities in order to provide faster nationwide traffic." The federal Highway Trust Fund was established in 1956. But during the next few years, urban pressures shifted the plans to make city centers "more accessible to the periphery and to construct beltways around them." Appropriation of land for this purpose "destroyed" many residential communities. Community reaction was "intense" as both "the more and the less affluent" fought to protect themselves, their homes, and their businesses.[179] No one wanted to lose a neighborhood to an on-ramp, and no one wanted to lose business because of a diversion of traffic from one place to another.

Highways became sites of local competition. When Route 495 was planned, its premise was simple: west of Boston, a new highway would connect eastern and central New Hampshire to eastern and central Massachusetts. In this way it was similar to the trend that Hays describes, since the road was deliberately intended *not* to run through the capital of Massachusetts or the congested roads of Greater Boston. On the other hand, the highway would also be running past Lowell, Lawrence, and Haverhill before connecting with Route 95 at the New Hampshire border. City officials saw the opportunity to divert traffic to downtown districts where urban renewal

178. Robert A. McLean, "Lawrence, Lowell Ready for Rt. 495, Haverhill Speeds to Get in on Big Boom," *Daily Boston Globe*, April 11, 1961, 7.

179. Hays, *Beauty, Health and Permanence*, 84.

was fighting back against urban decline. These officials knew that if they were not able to get enough traffic, then they would lose out on tax revenue from local businesses.

In the spring of 1961, the three big cities of the Merrimack Valley were preparing to welcome the new Route 495. Haverhill officials differed over how ready the Shoe City was for the new highway. The managing director of the Haverhill Chamber of Commerce mentioned 500 acres of "properly-zoned land" along the proposed 495 route, and said that "we've been waiting five years for this highway." But the head of the Haverhill Industrial Council said, "We have no sites of any size for industry along the I-495 route," and the City Planner noted that Haverhill had no industrial park. In contrast, "Lawrence and Lowell have been depressed areas long enough to learn the ropes," according to one federal official. Lawrence had gotten out ahead early with the aid of some federal funding through the efforts of a private developer to use one of the few major pieces of available land along the proposed 495-93 route. "We need only a feeder road to serve our industrial park, and that road will open up still more industrial sites along the Merrimack River," according to John J. Sirois, the director of the Lawrence Redevelopment Authority. "This highway will be a tax boon," said Lowell City Manager Frank E. Barrett. "We are waiting eagerly for it."[180]

State officials were reassuring, at first. "There are many people who believe that this highway will help greatly to solve the economic ills of many of the cities and towns it will serve," wrote Jack P. Ricciardi, Commissioner of Public Works, in February of 1962. "I am myself firmly convinced that it will prove a blessing, not alone to all motorists, but as a shot-in-the-arm to industrial and residential development on both sides of the highway." There was "no escaping" comparisons to Route 128, that "Cinderella of a highway that rose from a despised and

180. Robert A. McLean, "Lawrence, Lowell Ready for Rt. 495, Haverhill Speeds to Get in on Big Boom," *Daily Boston Globe*, April 11, 1961, 7.

belittled 'road to nowhere' to become a queen, one of the richest, busiest, most commercially successful highways in the country. . . . that constantly grows richer and busier, more successful." But if there were communities which should "desire to exclude commercial interests," and desire to retain "a suburban or rural atmosphere," then this was "wholly within their right, and no invasion of rights is expected." Route 495 should be "a godsend to the industrial cities of the north, Haverhill, Lawrence, and Lowell." If those cities should wish it, Route 495 "could make of the Chelmsfords, and Boltons, Milfords, Hopkintons, what the Burlingtons and Lexingtons and Needhams of 128 have become."[181]

But no highway, by itself, could become "a miracle worker" for local communities. Ricciardi argued that it would require "citizens of foresight and courage in each community." This they would decide, "and it is outside the province of the Department of Public Works to do more than speculate" upon such prospects. But Ricciardi made sure to emphasize that "the preservation of natural beauty" was already planned, "with care to save trees that might otherwise be bulldozed flat, to plant shrubs and grasses to hold embankments and to add color and interest, to use weed inhibitors to discourage unsightly growths, and in general to make driving more pleasant and relaxing."[182] Pleasant driving was a civic duty for state officials to deliver for the convenience and safety of the general public. Community development, on the other hand, was for the cities and towns to work out on their own.

The cold reality of public funding was its adherence to the newly convenient traffic pattern over the traditional economics that had obtained for most of the automotive history of the Merrimack Valley. Changes in policy and tone were soon apparent. Both Route 495 and Route

181. Jack P. Riccardi, "The Outer Belt: Just Another Highway or Another Route 128? Only the People Can Work Route 495 Miracle," *Boston Globe*, February 22, 1962, A11.

182. Jack P. Riccardi, "The Outer Belt," A11.

93 would pass by Lawrence without connecting to the city center. In June of 1962, Mayor John J. Buckley led a delegation of fifty "business, civic, and political" leaders to Boston to protest the "asphalt curtain" that separated Lawrence from the interstate traffic, he brought with him a request for at least three access roads into the city. Ricciardi turned him down. "We haven't the funds to build these roads at this time," he explained. "When the money is available, we will consider your situation." The connector road had a potential price tag of $3.5 million, and Lawrence did not have the cash on hand. Although the state Department of Public Works was already building a bridge across the Merrimack River at a cost of $4.8 million, the "sole link" from the new highway to the city was Marston Street. The projected traffic of 35,000 cars per day would be too heavy to be carried by a single road that was only thirty-five feet wide.[183] In 1963, the 495 link from 93 in Andover to Route 2 in Littleton was opened. The highway, which cost $4.5 million, opened traffic to Lowell, Chelmsford, and Tewksbury.[184]

The new highway map drew economic activity out of downtown city districts and into the suburbs. Suburban shoppers were soon availing themselves of new structures that brought series of stores into a single space. In the late Sixties, in Massachusetts, some sought to establish "malls" in the midst of urban environs. These would be downtown districts open to sunlight.[185] But a new meaning – an enclosed structure, with controlled environs – had already been demonstrated in Natick in 1966. The climate-controlled Burlington Mall opened in the late Sixties. Developers of the Burlington structure cited their postwar experience as the basis for the

183. "Lawrence Plea Rejected for Links With New Pikes," *Boston Globe*, June 7, 1962, 26.

184. "495 Link Opens," *Boston Globe*, October 4, 1963, 16.

185. John Goodnow, "Place for a Mall," *Boston Globe*, January 13, 1966, 14. Writing of a space on the north side of the State House in Boston, Goodnow wondered: "Why don't they see the need of a mall right there, keeping an avenue open for contemplation of really good old architecture? I think a city worker who is not in state or city employ deserves his spot of green grass and trees, and would benefit from a park far more than another '40-story building' so boastfully advertised. The 'New Boston' makes me sick!"'

new concept. "Burlington Mall was designed to be the most beautiful shopping place in New England," said the executive vice president of the Meyerhoff Corporation. "In our 19 years in the development of shopping centers, we have learned a great deal about the planning and operation of centers this size and we have endowed Burlington Mall with the total benefit of our experience."[186]

That "experience" was instructive. In the Merrimack Valley, the construction of a new Methuen Mall was announced in September of 1972. At about 66 acres, it was to be smaller than the 86-acre Burlington. But it would not be built in Methuen's downtown district; instead, like the Burlington Mall, it would be built right off the highway. The new Methuen Mall was to be sited on Route 213, the connector highway between Routes 93 and 495. This would take commerce out of the city centers of Lawrence and Haverhill altogether. Up in New Hampshire, the City of Manchester became the home of the new Mall of New Hampshire in 1973. But this was also to be an enclosed structure, not a "mall" in the older sense. "Not only are southern New Hampshire and Manchester rapidly growing areas," the partners said, "but the enclosed all-weather concept is becoming increasingly popular with shoppers."[187] Downtown businesses

186. "Natick Mall Opens to Shoppers Wednesday," *Boston Globe*, April 24, 1966, A39; "The Mall: A Place in the Sun. . ." *Boston Globe*, May 21, 1967, p. F24; "Mall Air Conditioned for All Seasons," *Boston Globe*, July 28, 1968, p. A11. "City planners and architects," the 1967 editorial argued, "have discovered the 'mall' and through it are emphasizing 'planning for the pedestrian' in their schemes for new buildings and designs. The pedestrian may soon find himself strolling down the middle of what was once a busy street. The harried walker, competing for a place on the sidewalk, may be a thing of the past. . . While the plaza-mall plan sounds exciting, it may take several years to achieve." But by that time, the Natick Mall had already been open for more than a year. It was an enclosed structure that boasted its defiance of the weather outside. "All Shoppers' roads Wednesday will lead to Natick's fantastic new mall, the most unusual complex of quality stores in New England. And don't let the weather keep you away. The Mall is weather controlled from end to end, guaranteeing a healthful and comfortable 72 degrees Winter and Summer. Palms and exotic tropical flowers will be available year-round inside the fashionable stores." The Burlington Mall was likewise "enclosed", and "topped by a distinctive and unusual curved arch roof with skylights to provide daylight. This gives the center a year-round feeling of Spring. The Mall is completely air-conditioned and remains a balmy 72 degrees regardless of the season or outside temperature."

187. "Mall Air Conditioned for All Seasons," *Boston Globe*, July 28, 1968, A11; "Real Estate Mart: Homestock Signs Westboro Lease," *Boston Globe*, July 2, 1972, A9; "Real Estate Mart: Instrumentation Labs Buys Lewando Bldg.," *Boston Globe*, September 2, 1973.

could no longer count on a sunny day to bring a few more shoppers into their stores. With the enclosure of shopping in suburban buildings, the days of shopping on Essex Street or Merrimack Street for the amenities of modern life were on their way into the history books.

* * * *

The Merrimack River flows from Franklin to the sea. The suburban development of old colonial towns redefined water maps all over the basin. Suburban growth intensified the needs of local communities as populations grew and public initiatives reshaped local landscapes. But there was a longer trend at work down the estuary where the river met the ocean. Prewar fishing had been quite intensive, but the wartime closure of the Atlantic had been a respite. With the peace came a new interest in cheap fish – and the reopening of a massive market opportunity just off the coast of New England.

Fisheries were hardly pristine in 1945. Before World War II, Edward Ackerman had had warned of overfishing in New England waters. "In 1902," he wrote in 1938, "13,500,000 pounds of halibut were landed by New England boats – in 1936, a little more than 2,000,000." Bigger boats with bigger catches intensified the extraction of marine biomass. By the end of the Sixties, the big catches were leading to rapid decline. Daniel Pauly and Jay Maclean note that by 1968, the cod catch in the northwest Atlantic rose to 810,000 metric tons, or more than 1.7 billion pounds. Cod fisheries in Canada were collapsing by 1972.[188]

Sport fisheries are more selective and less extractive than commercial fisheries, but anecdotes can be signals of larger problems out at sea. For example, the International Tuna Derby in Wedgeport, Nova Scotia had to be cancelled in 1959 because there were not enough

188. Edward A. Ackerman, "Depletion in New England Fisheries," *Economic Geography*, 14, no. 3: 235; Daniel Pauly and Jay Maclean, *In a Perfect Ocean: The State of Fisheries and Ecosystems in the North Atlantic Ocean*. Washington, DC, Covelo, CA, and London: Island, 2003), 16.

bluefin in local waters for the derby to be worthwhile.[189] At the mouth of the Merrimack, there was good sport fishing after the War. In 1946, two men from Haverhill caught 150 fish in two hours at the jetties.[190] In 1950, a 36-pound, seven-ounce striped bass measuring 45 inches was caught from a 26-foot cruiser by an electrical engineer from Bangor, Maine.[191] In 1957, charter boats that ranged 10 to 14 miles offshore brought back "400 to 500 pounds of haddock and cod" on a September weekend.[192]

A 1960 report by the U.S. Fish and Wildlife Service argued that fishing and hunting, "outdoor living opportunities provided by water resource projects, provide a better antidote for the stress of modern living than tranquilizer pills." But the antidote "found in nature" would depend in future years on "action" taken to protect fish and wildlife from being "evicted from their natural habitat" of water and land. The market for hunting and fishing in 1955 comprised 25 million Americans over the age of eleven spending 567 million man-days and more than $3 billion. Ecologists estimated that, by 1980, some 68 million Americans would be spending 1,260 million man-days and $6.3 billion – if the facilities could be made available.[193]

Along the Massachusetts coastline, sport fishing had become a healthy business by 1960. Party boat skippers "out for groundfish" were working "as hard as their brother striped bass fishermen." One boat that would cover 50 miles daily could readily deliver up to 2,000 pounds of cod and haddock on every trip. Pollock were "still running good, up to 22 pounds." Flounder

189. Mike Beatrice, "Tuna Refuse to Bite," *Boston Globe*, July 6, 1961, 35.

190. Paul H. Provandie, "Hook, Line, and Sinker," *Daily Boston Globe*, September 23, 1946, 9.

191. "Patience Rewarded," *Daily Boston Globe*, June 30, 1950, 14.

192. Pat Harty, "Stream and Forest: Stripers at Plum Island; Duck Flocks Growing," *Daily Boston Globe*, September 24, 1957, 14.

193. "Conservation: Hunting and Fishing Seen Good Tranquilizers," *The Science News-Letter*, 78, no. 6 (1960): 94.

were "plentiful" by the number 9 buoy at the mouth of the Merrimack. David Nunes, who had landed 2,000 pounds of striped bass the previous year, took stripers weighing 18, 28, and 30 pounds in one day. Other striped bass catches in the area included a 30-pounder, two 29-pounders, and a 19-pounder.[194]

Sport fishing partially relied on boating, and boating relies on access to the Merrimack from Lawrence to the ocean. In 1964, the biggest boat launch in Newburyport was a private concern, Range-Lights Marina, developed at a cost of a quarter of a million dollars by Gene DeMaggio of North Billerica. "I could see what was lacking in service," he said, "because as a boat owner I had problems." DeMaggio said that he knew that if he went into the business, "I could give boat owners what they want, and No. 1 on that list is space." Range-Lights could accommodate twenty-five medium boats in slips, and another forty on moorings. DeMaggio hoped to increase those figures to 100 for slips and 75 for moorings, and he counted on the ready access to sport fishing to promote his new site. "Here we have tuna, mackerel, striped bass, cod, pollock – you name it. And you don't have to go 10 miles to get them. These fish are right here, close at hand." Anyone living within seventy-five miles of Newburyport could get to his marina easily, especially with the new highways in place. "You can drive from Boston," he said, "in 45 minutes."[195]

Within a couple of years, sport fishers started to see gaps in the fish populations in the Merrimack River. Plum Island "exploded" with stripers in May of 1963, earlier in abundance

194. Mike Beatrice, "The Sportsman: Every Time You Hook a Striper It's Like Catching Your First Fish," *Boston Globe*, June 28, 1960, 36. Nunes admitted that he had lost several fish despite his good haul. "Friday, in the fog, I spotted a large school, on the surface, moving between the jetties. I panicked. In fact I got so excited I cast into them with a plug that hadn't been securely tied to my line. The plug broke free and I wasted precious minutes chasing it down river. I had eight on yesterday. I say I lost five because I was too excited."

195. Mike Beatrice, "DeMaggio Hits $250,000 HR: Runs Busy Marina," *Boston Globe*, August 9, 1964, 78.

than anyone could remember.[196] Tuna fishing was good off Provincetown in 1964, with five bluefins between 500 and 600 pounds. But there were other fishermen who experienced "tuna frustration" on the last Sunday in June, when they cruised for twelve hours between the mouth of the Merrimack River and the Isle of Shoals up in New Hampshire. "Fish showed, but there were no takers."[197]

By 1965 there were already differences between sport fishers and lucky catchers. "The best fishermen I know," wrote Mike Beatrice, "don't waste time." One young fisherman explained that expert fishers "knew their water." They were naturalists, noting "tides, time of day, currents, bait, habits of fish and water depths, type of bottom and temperature." Such fishers knew when fishing should be "most productive." This is why fisheries management personnel were "so quick to explain how 10 percent of the fishermen (or 25 percent) get 90 percent (or 75 percent) of the fish." Persistence and research were necessary to get good fish.[198]

In 1966, the stripers were running in the first week of July, but their sizes were inconsistent. One fisher took what was called "a typical Plum Island racer," 40 ½ pounds, 48 inches long. Another fisher caught bass on just about every cast, but of the forty that he caught, only three of them were big enough to keep. "That's the way it has been," reported one local fisherman. "One school will have fish 20 to 26 pounds, another will have eight to 14-pound bass, then comes one with eight-inch fish."[199] In 1967, the "fishless scare" at Plum Island ended

196. Mike Beatrice, "The Great Outdoors: Plum Is. Stripers Go for Worms," *Boston Globe*, June 2, 1963, 85.

197. Mike Beatrice, "The Great Outdoors: Tuna Canned Off Cape-Tip," *Boston Globe*, June 30, 1964, 36.

198. Mike Beatrice, "The Great Outdoors: Expert Anglers Lucky? Don't Kid Yourself," *Boston Globe*, June 20, 1965, 55.

199. Mike Beatrice, "Fishing: Anglers Having Field Day Along Coast," *Boston Globe*, July 2, 1966, 15.

just before the Fourth of July when the bass were finally big enough to score in the derby. A forty-pounder was taken a week earlier, and then a forty-four-pounder.[200]

This pattern – a few big days, a few big runs, and a lot of empty water – was part of a longer pattern of decline. Sport fishing, like commercial fishing, was extractive. When sport fishers would hit fish, they would take them; and only the difference of legal limits on the sizes or weights of various sports fishes kept the fish from being hit even harder than they were. In 1966, small school bass came to Plum Island "by the ton." Irene Davis and her husband Dave landed 28 fish at the top of the tide, but they had to release twenty more stripers because they were below the legal limit. In July of 1970, stripers had turned away from their usual inshore shoals "for reasons only known to the fish. Maybe one of those squid-chasing merry-go-rounds is in the making." These fish were landed "to the tune of a dozen to 30 fish per boat per day in a weight range of 18 to 40 pounds, with a lot of the latter."[201]

On the crest of autumn in September of 1970, two big fish were landed at the mouth of the Merrimack River. An 881-pound tuna was landed on 80-pound test line by Wilbur "Slim" Toby of Eliot, Maine. If it were to be affirmed by the International Game Fish Association, then it would beat the world record, set back in 1941, by a single pound. The other big fish was a striped bass weighing 58 pounds and one ounce, and it was taken by Pat Mambro of Lawrence. Mambro was leading the Plum Island Striper Derby that year, but his big striper was still more than a pound short of the 60-pounder that Mambro would need to record to collect a thousand-dollar prize offered by Mickey Villane, who ran the derby every year. Villane's prize would finally be claimed in 1972, when Larry Comeau landed a 61-pound, two-ounce striper at the

200. Mike Beatrice, "Fishing: Joy Grips Plum Island as 40-Pounder Caught," *Boston Globe,* July 3, 1967, 18.

201. Mike Beatrice, "Anglers Having Field Day Along Coast," *Boston Globe*, July 2, 1966, 15; Henry Moore, "Rod and Gun: Tuna Finally Reach Mass. Bay Waters," *Boston Globe*, July 10, 1970, 22.

derby. But Comeau's striper would be the last of that size taken in the Merrimack in competition, and no one would see anything like an 881-pound tuna again.[202] The big old fish in the bad old river would soon be the stuff of legend.

Heavy fishing of coastline populations has three basic effects on the marine ecosystem. When the major predators, the biggest fish available, become less available, they cannot be replaced in time to keep a healthy population in the swim. The average biomass decreases quickly, leaving less biomass for everything else that lives in the ocean. Less food for larger fishes also means that the bigger fish have to eat increasingly smaller fish, collapsing the food web. When larger fish disappear, fishers take to "fishing down the food web," taking smaller fish on which larger aquatic predators would otherwise survive. If the biggest fish are taken out, and their bait fish are killed even by a cause other than human predation, then the ecosystem is less robust. Relations become frayed. With most of the biomass gone and several species fished out completely, the fishery crashes.[203]

Daniel Pauly and Jay Maclean have recorded how rapidly those fisheries crashed during the Sixties. The main culprit, especially in the late Sixties, was not the official catch but the discarded bycatch.[204] The removal of such quantities of biomass in only a few years led to the later crash of the fisheries that had sustained the eastern littoral of New England for more than four centuries. Machine trawlers finished the bad business of those years within the first term of Richard Nixon, who was inaugurated in 1969 and then again in 1973.

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202. Henry Moore, "Plum Island Fisherman Nets 61-Pound Bass," *Boston Globe*, September 26, 1972, 33.

203. Pauly and Maclean, *In a Perfect Ocean*, 34 – 35, 48 – 56.

204. Pauly and Maclean, *In a Perfect Ocean*, 16, 33. Figure 7 on page 33 depicts the bycatch effect for the North Sea.

The good old days may not have been as good as they may have looked in retrospect. There had not been an inland commercial fishery for centuries, and there had not been riverine fisheries of commercial value for more than a hundred years. But there had been good fish, and big ones, for those who could get to them. The Merrimack River fisheries were part of a regional pattern in the northwest Atlantic. The cleanup of the Merrimack unfolded during the Seventies. But by that time – and only within about the previous fifteen years, back to the mid-Fifties – the fisheries of the Merrimack River had been decisively transformed. The cleaner river would be a healthier environment for fish to thrive. But the fish of the estuary and the coastline would be smaller and fewer. By the time the Merrimack was clean enough for fish, the damage was already done.

* * * *

In 1969, Bill Tremblay went to Jack Kerouac's funeral in the old French section of Lowell. In 1970, Tremblay's poem, "Jack Kerouac's Funeral", was published.[205] Tremblay recorded, in free verse, a few images of Lowell at the end of the Sixties, when the Mill City was already a thing of legend. After getting off at the "Rte. 495 cut-off/DOWNTOWN LOWELL the sign", he had to make his way into Lowell to find the church where the Rite of Christian Burial would be held.

the second part is
finding jean baptiste in a rundown
wounded neighborhood
gaping spaced lots waiting for urban renewal
like an old hag waiting for false teeth

Tremblay looked around and tried to picture Kerouac in his old neighborhood.

yeah, I thinks, this is where
the tenement three-deckers

205. Bill Tremblay, "Jack Kerouac's Funeral," *The Massachusetts Review*, 11, no. 3 (1970): 442 – 448.

the backlot pickup baseball games in the twilight
before the mothers callin' kids home
to fridaynight fish fries
and the omnipresent sacred heart of Jesus calendar
hung on the inside of the bathroom door
in french naming the saintsdays
are
an' wow here's the merrimack river
rocks and the riverwater's in three channels
Jesus! I thinks, just like
southbridge I knew it

On his way from the funeral home to the church, Tremblay encountered the Merrimack from a bridge. He envisions the old landscape, the place that Kerouac had known as a boy; and after a humorous interruption, Tremblay's thoughts return to the Jack Kerouac who walked along the Merrimack a generation earlier, when Lowell was still an old mill town.

out on the street I hears the merrimack
rushing over its rocks
standin' on the high bridge the wind
bright with October morning blue sky

I hear
boys in bathingsuits yelling running barefooted
over 1935 rocks
a lowell tech kid walking by says
don't jump/christ, do I look that bad

I see
jack straying along the river thinkin'
about serpentine monster in the core of the planet
getting ready to rise, its sulphurous snake-eyes springing
into the atmosphere of lowell and rising
like a rocket menacing the cellstructure of the universe [206]

The City of Lowell declined during Kerouac's famous years, and its manufacturing jobs were never coming back. The open sewer that flowed under the bridge when Bill Tremblay went to Lowell in 1969 was not much healthier than the dirty old river that had flowed through the

206 Bill Tremblay, "Jack Kerouac's Funeral," *The Massachusetts Review,* 11, no. 3 (1970): 443, 445.

Mill City when Jack Kerouac was born in 1922. Instead another native son, Congressman Paul Tsongas, came up with the idea of a national park. Some of Lowell's ruins would become museums, and there would be a University of Lowell as well.[207] The landscape built to tame a river for power had given way within the short lifetime of the mighty Kerouac. But the pollution of the Merrimack continued; and it would take a federal initiative, fitted to local landscapes, to chase the sewer away from the Merrimack now that the old mills had left the cities for good.

207. Nina McCain, "University of Lowell Is a Fact; Now It Must Become a Reality," *Boston Globe*, August 3, 1975, p. 29; Peter Anderson, "Lowell Is Seeking Its Future in Its Past," *Boston Globe*, December 2, 1978, p. 1.

3. "THE MERRIMACK, PLAYGROUND OR SEWER?"

A series of articles appeared in the *Boston Globe* in May of 1965. James B. Ayres, who would win an award for the series in 1966, investigated the history of one of the most polluted rivers in New England.[208] Ayres saw the Merrimack River as a reflection of local priorities that had led to its historic levels of pollution.[209] "The same gallon of water in the Merrimack River," Ayres began, "may carry away chemicals from a paper mill in Lincoln, N.H., drive a turbine in Manchester, N.H., flush a toilet in Lowell, Mass., quench a family's thirst in Lawrence and spray a water skier's face in Newburyport." Although each use of the river by an upstream community affected the "health and economy" of a downstream community, there had never been a comprehensive study of the river nor an "integrated" development program. It would take initiative from a member of Congress to get things going.[210]

The problem, as Ayres framed it, was financing. In the early Sixties, Massachusetts had received $2.1 million a year for sewage treatment construction, but contemporary estimates put the cost of cleaning up the Massachusetts stretch of the river at $140 million. The New

208. "Globe's Ayres Wins Conservation Award," *Boston Globe*, May 5, 1966, 17. Ayres won a third-place Edward J. Meeman Award from the Scripps-Howard Foundation for "distinguished work in writing on conservation," for this series on "pollution in the Merrimack River and the state's coastal waters, and a series of news articles which assisted in the passage of the state's Coastal Wetlands Act of 1965." He was also presented with a check for $100.

209. James Ayres, "Can a Polluted River Become a Recreational, Health Asset? The Merrimack, an 180-Mile Municipal Sewer," *Boston Globe*, May 2, 1965, A5. "In happiness and distress, for good and for evil the Merrimack River is a mirror of this entire era," the editor wrote. "The picture this mirror reflects is full of radiant beauty, historic color scenes, New England's rare culture – but also of neglect, abuse of natural resources and misery. Globe staff reporter James Ayres spent many weeks researching this eminently readable story and he found that it is moving toward a happy ending: a rejuvenation, cleanup and construction program which will affect every man, woman and child up and down the Merrimack Valley and beyond.

210. James Ayres, "The Merrimack, Playground or Sewer? – XII: Time for Intelligent Planning," 19. Ayres noted that a five-year, $2.9 million comprehensive plan on the Connecticut River Basin was already underway, and a similar study could be "called for" on the Merrimack by a Massachusetts or New Hampshire Congressman.

Hampshire stretch of the river would cost $40 million, but New Hampshire was only receiving $1 million a year from in federal grants-in-aid.[211] At the current rates of funding, Massachusetts communities would complete their work in two-thirds of a century. And even in New Hampshire, it would take four decades to complete the work required to address the pollution of 1965. And it was not as though the river would be left alone in the meantime.

Ayres based his arguments on the premise that state officials were not necessarily opposed to water pollution control. There was no abiding hostility to a federal presence, but state officials were quick to point out the disparities between costs and financing. John Palazzi, chairman of the New Hampshire Water Pollution Commission, testified at a conference of federal, state, and local officials at Faneuil Hall in 1964. "The key to solving the pollution problem is money," Palazzi admitted, "and we might as well face the fact that the speed of the abatement program can be no greater than the present rate" unless "additional funds" were to be appropriated. New Hampshire estimated that at the current rate of funding in 1965, the pollution abatement program would not be finished until 1983. One Merrimack Valley resident observed that the federal loans were interest-free. "The cities and towns are just going through the motions; they're still waiting for manna from Heaven."[212]

In 1964 a "near-unanimous appeal" was made to the federal government for increases in federal aid at the Faneuil Hall conference. Eight sewage plants were proposed: two regional facilities at Lawrence, and six separate plants at Amesbury, Haverhill, Merrimac, Newburyport, Salisbury, and Westford. Those eight plants would cost $94,750,000, and with chlorination

211. James Ayres, "The Merrimack, Playground or Sewer? – VI: Fish at $20 a Pound," *Boston Globe*, May876 7, 1965, 10.

212. James Ayres, "The Merrimack, Playground or Sewer? – VII: Waiting Federal Manna," *Boston Globe*, May 8, 1965, 4.

works at Lowell, Lawrence, and Haverhill costing $46 million, the total cost of the recommended program would be "a whopping $140 million." Nor would cities and towns share these costs equally, even with the maximum federal aid available at the time. Ayres estimated the tax assessment per thousand for thirteen communities in the lower Merrimack Basin. The increases would be $1.40 for Andover, $8.67 for Methuen, $7.62 for North Andover, $11.35 for Lawrence, and $16.04 for Haverhill, for the next thirty to forty years based on 1963 tax rate and assessing practices. City officials in Lawrence and Lowell complained about the possible increase in tax rates by as much as $20. "The only people who will benefit will be fishermen," one Lawrence taxpayer said. "Why those damn fish will cost $20 a pound."[213]

Ayres was still hopeful about the future. After all, if the funding could be found, then the pollution could be abated; and if the pollution could be abated, then the recreational potential of the river would return. "The Merrimack River," Ayres predicted, "will be Greater Boston's fresh-water playground on the North Shore before the end of the century." There would be "riverside parks" with boating and fishing on a river "freed of disease-producing pollution from Pawtucket Dam in Lowell to Haverhill." From Rocks Village Bridge to the sea, on "a 15-mile stretch of river below Haverhill now considered suitable for the transportation of sewage and industrial wastes," there would be swimming. Charles H. W. Foster, commissioner of the Department of Natural Resources, considered the Merrimack to be one of the "outstanding" rivers for recreation in Massachusetts. Foster's department was "interested" in a series of

213. James Ayres, "The Merrimack, Playground or Sewer? – V: $140 Million Cleanup," *Boston Globe*, May 6, 1965, 48; James B. Ayres, "The Merrimack, Playground or Sewer? – VI: Fish at $20 a Pound," *Boston Globe*, May 7, 1965, 10.

riverside reservations. But, for the Merrimack, Ayres worried, "the danger is already there, and it may already be too late now for action."[214]

The impetus for the Ayres series was a bill that passed the United States Senate in January of 1965. It would come before the House of Representatives in May. If signed into law, the bill would create a new Federal Water Pollution Control Administration under the Department of Health, Education, and Welfare. Until that time, the "classic response" of industry, when "approached" by a state government to clean up its polluted discharge into the river, was: "'Clean river; no jobs.'" Ayres summarized the dilemma: given such constraints, "industry threatens to pack its bags and move elsewhere," and "the state backs down." National standards would prevent industries from using this argument to "blackmail" local authorities since the same standards would apply nationwide.[215]

In Massachusetts, state officials were already offering local communities assistance with funding their existing projects. If a bill that had come before the Massachusetts House Ways and Means Committee were to pass, then the state would pay 30 percent of the annual payment, principal and interest, of what a community would owe on its bond issue. That would decrease the local tax burden for each of the communities.[216] There were other cost-sharing ideas in mind. A regional project that would serve Lawrence, Andover, Methuen, and North Andover would be

214. James Ayres, "The Merrimack, Playground or Sewer – VIII: 15-Mile Swimming Hole," *Boston Globe*, May 9, 1965, A5; James B. Ayres, The Merrimack… … Playground or Sewer? – IX," *Boston Globe*, May 10, 1965, 11.

215. James Ayres, "Money Is Still the First Problem in Cleaning Rivers: The Merrimack – Playground or Sewer? No. 10," *Boston Globe*, May 11, 1965, 17. By 1965, industrial opinions of water pollution controls had begun to shift. One Massachusetts Department of Health official said that industries had retreated from the dilemma of jobs and pollution in the last dozen years because "'industry sees the handwriting on the wall.'"

216. James Ayres, "No State Money for Sewage Works," *Boston Globe*, May 12, 1965, 11. He estimated the tax relief of 30 percent: Andover's $1.40 would become $0.98; Lawrence's $11.35 would become $7.95; Methuen's $8.67 would become $6.07; North Andover's $7.62 would become $5.33; and Haverhill's $16.04 would become $11.23. Given how things went economically for these communities over the next thirty years – especially for Lawrence – the distribution even of these reduced tax rate increases would have been unworkable.

eligible for $2.4 million under the present law and $4.8 million under the proposed legislation towards its "estimated cost" of $31.2 million.[217]

It was an attractive scheme, but that funding only made up 15 percent of the cost of the project. The City of Lawrence wanted 50 percent from the federal government. In the absence of more federal funding, Ayres proposed a "clean up the Merrimack" fund, financed by "interested citizens", that would cut across town, city, "and even state boundaries," affording conservationists an opportunity to contribute to a clean Merrimack River. Perhaps the fund would amount to only "a small proportion" of the $140 million needed to clean up the river, but it would also serve to show valley residents that "they are not alone in the fight for a clean Merrimack."[218] Maybe local people could take their river back from the brink of depletion.

The river was disgusting. Swimming the Merrimack was a feat for the brave.[219] But it says something about the state of things in 1965 that a playground could be imagined from the evidences of one of the most polluted rivers in American history. The restoration of American rivers soon became an industrial enterprise, and the Merrimack – as it had been in the eighteen-nineties – was right up front for the establishment of a market in clean local water for public and private use. We are accustomed, in imagining water pollution control, to thinking of a federal law that compels states to make local communities fall into line. James Ayres thought so in 1965. "The right to say how clean our rivers should be is the subject of a bitter tug-of-war

217. James Ayres, "No State Money for Sewage Works," *Boston Globe*, May 12, 1965, 11.

218. James B. Ayres, "No State Money for Sewage Works," *Boston Globe*, May 12, 1965, 11.

219. In 1950, Mike Rynne, a retired Lowell policeman, was seventy years old. He decided to commemorate the occasion by swimming 300 yards across the Merrimack River, and back again, while towing a boat with five 200-pound men across the stream. "I've been doing this stunt for 20 years," he explained. "I have a harness that is connected to the boat with a hook. My hands and feet are tied with black neckties so if I drown they'll have something to put on me." "Lowell Cop, 70, to Swim River with Hands, Feet Tied," *Daily Boston Globe*, July 23, 1950, C54.

between Federal and state officials."[220] That tug-of-war was a contest over the control of local environs. And if federal officials would control water pollution in state and local waters, then they would have to contend with local landscapes as they sought to impose effective standards that would put the open sewer out of business forever.

This chapter is the story of the years between 1965 and 1972, when the "legitimate uses" of the Merrimack were decided for the foreseeable future. The early industrial retreat had reduced the daily load of industrial pollution on the river, but there were still raw sewage discharges and only some communities had treatment systems. When state officials assessed the conditions in local landscapes in 1965, they found that cost and solvency were complicated by economics and geography. A small town could need much more funding than a small city, and big cities were losing money as it was. For local water maps to expand, the Merrimack would have to be cleaned up incrementally. Federal funding would have to be fitted to local situations, local settings, and local budgets. There would be no other way to get the job done.

* * * *

In 1965 the Merrimack River was a site of economic transformation and ecological degradation. For twenty years after World War II, cities and towns in New Hampshire and Massachusetts had been sending their raw waste directly into the Merrimack River. In the Fifties, pollution officials from Massachusetts could easily record overwhelming sewage coming down the river from New Hampshire.[221] In 1965, twelve communities in New Hampshire and

220. James Ayres, "Money Is Still the First Problem in Cleaning Rivers," *Boston Globe*, May 11, 1965, 17.

221. New Hampshire Water Supply Control Commission, State of New Hampshire, *MERRIMACK*. This undated logbook, giving handwritten results taken at various points along the state border, is in the possession of the Merrimack River Watershed Council (MRWC). It is undated, but results begin in 1946 and end in the Fifties. The biochemical oxygen demand (BOD) coming over the state line in 1965 amounted to the sewage from 169,000 people. The BOD estimated in 1965 represented more people than were counted in the populations of Franklin, Concord, Manchester, Nashua, and Hooksett in the United States Census in 1960. Federal Water Pollution Control Administration, Northeast Region, United States Department of the Interior, *Report on Pollution of the Merrimack*

fourteen communities in Massachusetts were discharging raw municipal waste into the river daily. From Ashland in New Hampshire to Haverhill in Massachusetts, major industrial discharges from paper mills, leather manufacturers, and wool factories put tons of waste into the Merrimack. The majority of suspended solids and coliform bacteria originated in Massachusetts, but about a third came from New Hampshire. 92 percent of the coliform bacteria – measured at levels as high as 9.2 million colony-forming units (cfu) – came from untreated discharges into the river.[222] In such conditions, few fish could be expected to survive – and treating all of this pollution was becoming more expensive all the time.

The pollution of the Merrimack in 1965 was shaped by economics and geography. In 1960, 70 percent of the population lived in one-quarter of the Merrimack River Basin in Massachusetts. Two-thirds of the pollution in the river could be found there. This meant, in effect, that although the Merrimack was much more polluted in Massachusetts, the per capita pollution in New Hampshire was actually pretty close – 30 percent of the population, 33 percent of the pollution – to that found in Massachusetts. There were wide stretches of lower pollution in the Granite State, but the daily load coming over the state line was enough to make the Merrimack one of the most polluted rivers in the United States of America.

Although the Merrimack was still an open sewer, much of the old industrial pollution was already disappearing before 1965. In 1962, the state "chief" of water pollution control could say, "right now," that "the river is actually cleaner than it was 15 or 20 years ago," but that stream

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River and Its Tributaries, I: Summary, Conclusions, and Recommendations (Boston: Federal Water Pollution Control Administration, 1968), v; "New Hampshire: Table 6, "Area and Population of Counties, Urban and Rural: 1960 and 1950," https://www2.census.gov/prod2/decennial/documents/10669824v1p31ch2.pdf. Accessed: June 1, 2016.

222. Federal Water Pollution Control Administration, Northeast Region, United States Department of the Interior, *Report on Pollution of the Merrimack River and Its Tributaries, I: Summary, Conclusions, and Recommendations* (Boston: Federal Water Pollution Control Administration, 1968), ii – iv.

was still Class C – unfit for fishing or bathing – for significant stretches of the Merrimack.[223] In 1963, an engineering plan for constructing nine regional wastewater treatment plants had an estimated cost of $68 to $99 million for thirteen communities along the Merrimack River. "We just can't afford it," said Mayor John Buckley of Lawrence, when faced with a tax rate increase of $3.15 per thousand.[224] A few officials were hoping to combine that cost with the savings from resolving other local problems, killing two birds with one stone. [225]

Federal and state jurisdictions classify waters – rivers and streams, lakes and ponds – by their patterns of resource use. Water classifications, ranging from A to D, represented different uses of different parts of the Merrimack. Class A was for something like Haggetts Pond, a town reservoir in Andover where swimming was banned. Class B was good enough for recreation, but not for taking drinking water right from the stream. Class C was too polluted for recreation. Class D was what James B. Ayres would have called a sewer – unsuitable for fishing, swimming, boating, or human consumption.

When public officials began to reconsider classifications, they were met with local resistance from urban leaders. In June of 1964 the Commonwealth of Massachusetts classified the river D from Pawtucket Dam to Chain Bridge in Newburyport. From Chain Bridge to the sea, the river was classed C. Reclassifying the river to B, "suitable for bathing," had been recommended by state officials. But reclassification of the Merrimack, with all of the attendant

223. Jean Dietz, "State Gaining Upper Hand on Water Pollution," *Boston Globe*, September 23, 1962, A6.

224. John J. McKone, "Merrimac Valley: Costs of Sewage Plant Worry Area Communities," *Boston Globe*, December 15, 1963, 80.

225. On the day after Christmas in 1965, Gloucester City Councilman-elect Joseph F. Grace discussed a $3 million pipeline to get water from the Ipswich River. Water was not the only consideration. "Land is so expensive to buy for dump sites, burning is a smelly proposition and much of the North Shore is too rocky to make it feasible for sanitary fill," he said. "It will be cheaper in the long run to get water and electricity and get rid of refuse in one clean sweep." "North Shore: Water, Disposal Solutions Seen," *Boston Globe*, December 26, 1965, 49.

local costs, would "probably cause a greater storm along the river valley than the 1936 and '38 hurricanes combined."[226] In the meantime, the pollution took its toll on local fisheries. 1965, shellfish diggers in Salisbury, Massachusetts were estimated to have lost $100,000 annually for the previous fifteen years in a row. The federal government estimated in 1968 that pollution in the Merrimack had depreciated more than 98 percent of the potential value of the soft-shell fishery.[227] In the absence of such a fishery, the exorbitant costs of wastewater treatment seemed unjustifiable for local communities that were already struggling to meet their own water needs.

Enforcing water qualifications cost money that some communities did not want to provide from their local budgets. In 1964, communities along the Merrimack would have been expected to supply the $94,750,000 estimated for building eight wastewater treatment plants along the river. A March 1967 proposal to gain 80 percent of the funding from the federal government and from the Commonwealth (in a 55-25 ratio) was endorsed by many local officials, but classifications were controversial. Andover Town Manager Richard J. Bowen argued that the Merrimack, from New Hampshire to the ocean, should be Class B, suitable for aquatic life, instead of Class C. "It is inevitable that we will have to turn to the river for water supply," he said. "The Merrimack is a virtually inexhaustible water supply, so why don't we use it?" The mayor of Lawrence, Daniel P. Kiley, Junior, disagreed. A Class B rating would cost Lawrence a $26 rise in the city's tax rate compared to a $6 rise for a Class C rating. Richard H. Young, planning director of the Central Merrimack Valley Regional Planning District, sided with

226. James B. Ayres, "The Merrimack, Playground or Sewer – VIII: 15-Mile Swimming Hole," *Boston Globe*, May 9, 1965, A5; James B. Ayres, The Merrimack… … Playground or Sewer? – IX," *Boston Globe*, May 10, 1965, 11.

227. William C. Jerome, Junior, Arthur P. Chesmore, Charles O. Anderson, Junior, and Frank Grice, *A Study of the Marine Resources of the Merrimack Estuary* (Boston: Division of Marine Fisheries, Department of Natural Resources, Commonwealth of Massachusetts, 1965), 59, 64; Federal Water Pollution Control Administration, *Report on Pollution of the Merrimack River and Its Tributaries*, v.

the Class C rating. The "expenditure" of millions of dollars for swimming was "not realistic." Instead, those sums should be spent "on other areas."[228]

These discussions, and the comments cited by James Ayres in his series, show how communities struggled to meet their responsibility for water treatment budgets. But if we look at the actual figures cited, we can see how varied and uneven the struggle was. The economic decline of the major cities of the lower Merrimack was a fact of life by 1965. But the actual figures cited by James Ayres show that the distribution of costs had as much to do with geography as well as economics. And it was these differences, and not just the reluctance to shell out local money, that made the implementation of federal water pollution control so complex a task as it would soon become.

Local populations had been rising since the War. Figure 3.1 depicts the populations of Massachusetts communities in the Merrimack Valley between 1940 and 1970.[229] The population decline in Lowell, Lawrence, and Haverhill was more than repleted by the rising populations of surrounding communities. On the other hand, those growing suburbs would need water and sewer lines that would have to be built from scratch. Thus the water map was complicated by the realities of declining urban revenues and the struggles of urban development. Everyone, it seemed, had some problem with water pollution that could not be addressed with local money.

228. James B. Ayres, "Communities Back Merrimack Cleanup," *Boston Globe*, April 5, 1967, p. 11.

229. U.S. Census Bureau, "Massachusetts 1950, Table 6, Population of Counties by Minor Civil Divisions: 1930 – 1950," https://www2.census.gov/prod2/decennial/documents/38840572v2p21ch2.pdf; "Massachusetts 1960, Table 5, Population of Incorporated Places of 10,000 or More from Earlier Census to 1960," https://www2.census.gov/prod2/decennial/documents/37722946v1p23ch2.pdf; "Massachusetts 1970, Table 6, Populations of Towns and Places: 1970 and 1960," https://www2.census.gov/prod2/decennial/documents/1970a_ma-01.pdf. Accessed: June 2, 2016.

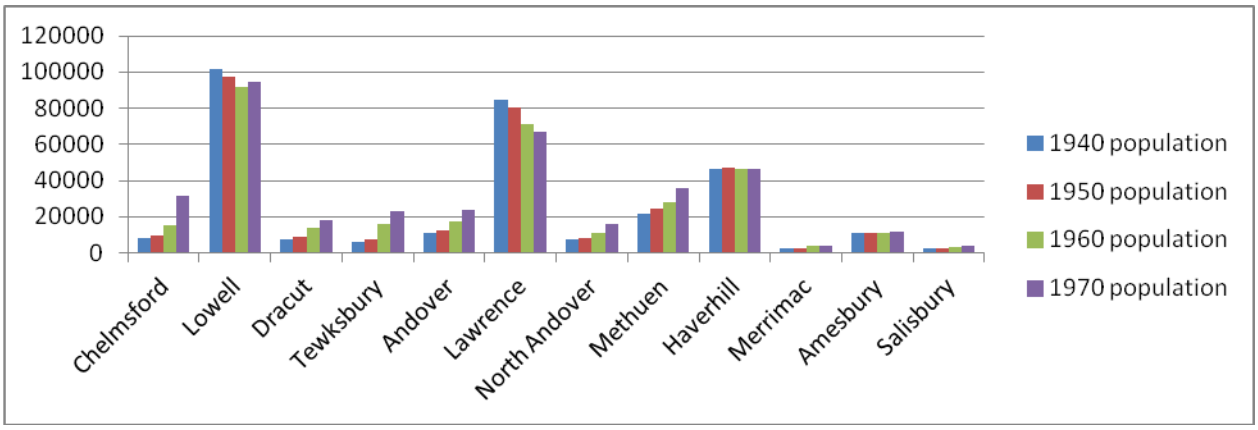

Figure 3.1. Populations of Selected Communities along the Merrimack River in Massachusetts, 1940 – 1970.

Differences in population were only intensified by differences in geography. There were slightly fewer than eleven thousand people living in Amesbury in 1965. In December of that year, Amesbury was taken to state court to enforce the orders of the Commonwealth to begin local construction of a treatment plant. The letter of referral was filed after the town refused to act on a previous plan. This went on for months. In July of 1967, the Town of Amesbury was denied permits to extend a local sewer line after a site was approved at one town meeting and the approval rescinded at the next town meeting. The town had decided on an "indefinite postponement of a site selection" in April of 1967.[230]

Geography put Amesbury in a tough spot. Upstream were more than two hundred thousand city dwellers in Lowell, Lawrence, and Haverhill, to say nothing of the human and industrial waste coming downstream from New Hampshire.[231] Amesbury's percentage of tax increases was low compared to the percentages expected of other towns, but the size of the actual

230. "State Moves to Force Amesbury Sewage Plant," *Boston Globe*, December 26, 1965, 45; "Sewage Again Topic in Amesbury," *Boston Globe*, July 31, 1967, 30.

231. U.S. Census Bureau, "Massachusetts: Table 6, Populations of Towns and Places: 1970 and 1960," https://www2.census.gov/prod2/decennial/documents/1970a_ma-01.pdf. Accessed: May 11, 2016. The population growth patterns during the Sixties further complicated the problem. Amesbury (10,787 in 1960) had grown 5.57 percent. Haverhill (46,346 in 1960) had lost about 0.5 percent of its population. Lawrence (70,935 in 1960) had lost 5.7 percent of its population, while Lowell had grown 2.3 percent since 1960. These changing populations affected water needs. Lawrence's economic situation surely contributed to its later inclusion in the GLSD. Its water costs could be spread among three more affluent towns.

increase – more than $4.00 per thousand assessed – forced the town to resist the Commonwealth at all costs. It was not until 1970 that John Casazza, supervising sanitary engineer for the Division of Water Pollution Control for the Commonwealth of Massachusetts, could report that consulting engineers in Amesbury were preparing "final plans and specifications" for a waste treatment facility. "They finally did find a site that was acceptable to both the State and all of the various factions in the community."[232]

The general problem before 1965 was the rising local cost of water pollution control. Figure 3.2 compares the tax rate estimates from the Ayres series, in May of 1965, to a similar article from December of 1963. Figure 3.3 renders the changes between 1963 and 1965 as percentages of cost increase since the 1963 estimate.[233] In both states, costs were rising quickly.

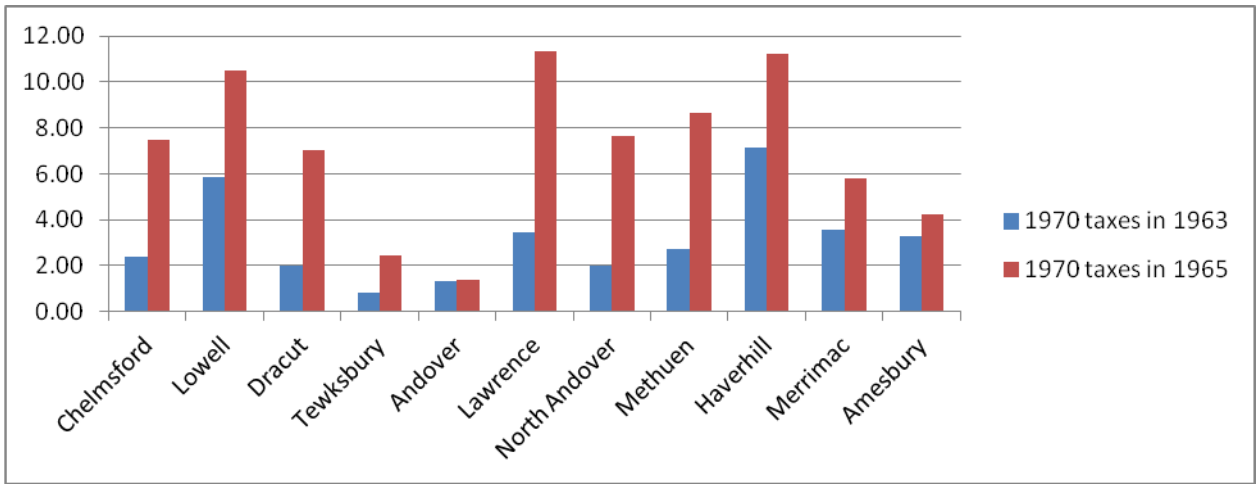

Figure 3.2. 1963 and 1965 Estimates of Local Tax Increases in the Merrimack Valley in Massachusetts.

232. Federal Water Pollution Control Administration, United States Department of the Interior, *Conference in the Matter of Pollution of Interstate Waters of the Merrimack and Nashua Rivers and their Tributaries (Massachusetts – New Hampshire), and of the Intrastate Portion of Those Waters in the State of Massachusetts* (Boston: Federal Water Pollution Control Administration, 1970) 166.

233. "Clean Merrimack Cost: $94 Million," *Boston Globe*, December 11, 1963, 10; James Ayres, "No State Money for Sewage Works," *Boston Globe*, May 12, 1965, 11.

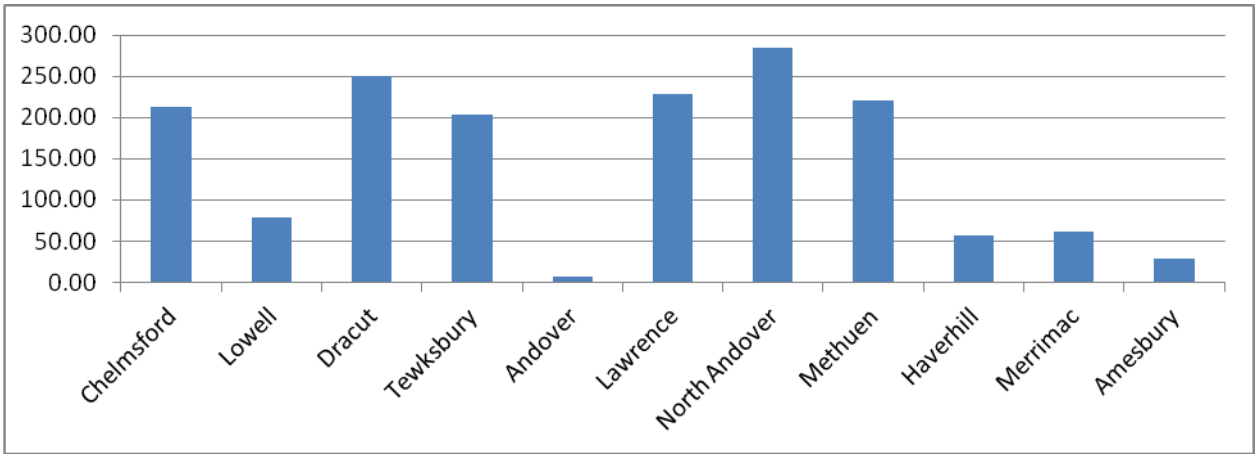

Figure 3.3. Percentages of Tax Rate Increases Between 1963 and 1965, for 1970 Budgets in Local Communities Along the Merrimack River.

In New Hampshire the population was lower, but the position of a community along the stream meant as much, if not more, than its population alone. Figure 3.4 gives population figures of selected communities along the Merrimack River. Figure 3.5 shows projected costs for those communities from a state report issued by the New Hampshire Water Supply and Pollution Control Commission in 1966.[234] The comparison between Franklin and Manchester is revealing.

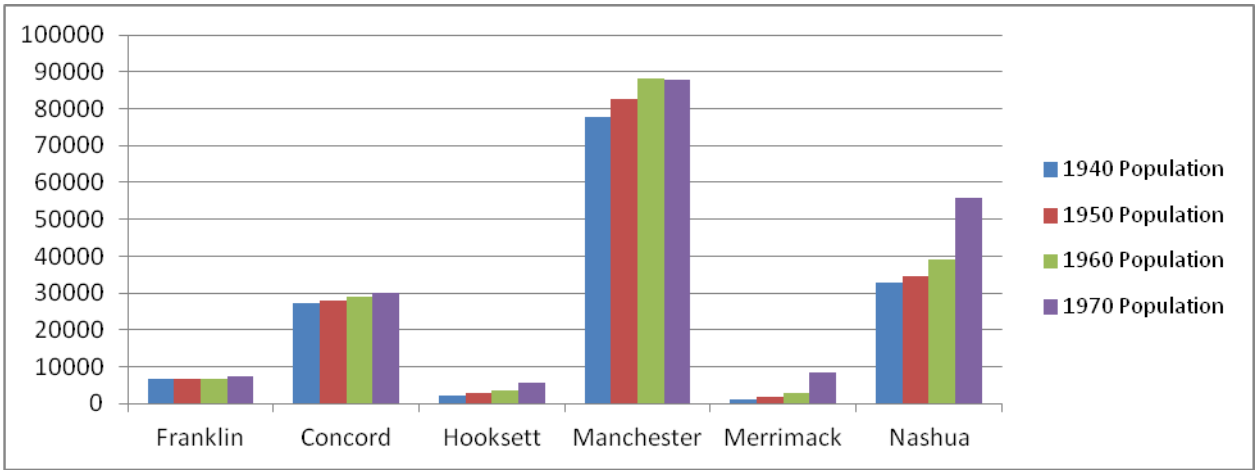

Figure 3.4. Populations of Selected Communities along the Merrimack River in Massachusetts, 1940 – 1970.

234. New Hampshire Water Supply and Pollution Control Commission, State of New Hampshire, *Staff Report on Portions of Androscoggin River, Connecticut River, Merrimack River Watersheds, Report No.* 53 (Concord: New Hampshire Water Supply and Pollution Control Commission, 1966), 64 – 65.

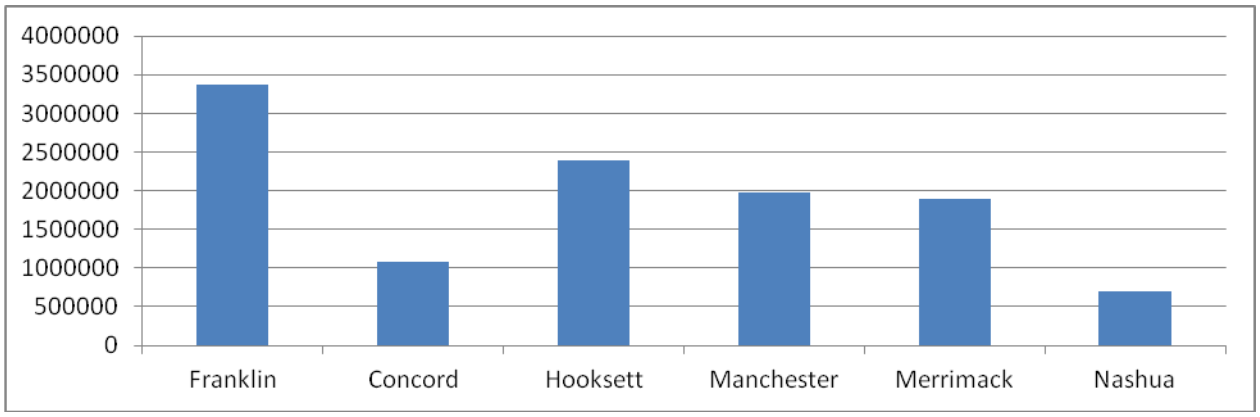

Figure 3.5. Estimated Costs (1970 Dollars) for Local Wastewater Treatment Projects Along the Merrimack River in New Hampshire.

These local differences – in size of community, in position of community, in expected costs to reduce water pollution – were intractable under the arrangements that had existed in May of 1965. The bill that Ayres had championed became Public Law 89-234, the Water Quality Act of 1965. The Water Quality Act of 1965 began by setting standards for water classifications. According to Section 5 (c) 2, states that would not comply would have their standards set for them.[235] With a new law and new powers in hand, federal officials began to move state governments towards the cleaner Merrimack. Federal funding would soon arrive.

Federal funding meant federal oversight. With most of the Merrimack's pollution in Massachusetts, it seemed a logical step for federal officials to address the General Court. In the spring of 1966, Murray Stein, head of the new Federal Water Pollution Control Commission, testified at the Massachusetts State House. Stein said that if the Commonwealth would not

235. "If a State does not (A) file a letter of intent or (B) establish water quality standards in accordance with paragraph (1) of this subsection, or if the Secretary or the Governor of any State affected by water quality standards established pursuant to this subsection desires a revision in such standards, the Secretary may, after reasonable notice and a conference of representatives of appropriate Federal departments and agencies, interstate agencies, States, municipalities and industries involved, prepare regulations setting forth standards of water quality to be applicable to interstate waters or portions thereof. If, within six months from the date the Secretary publishes such regulations, the State has not adopted water quality standards found by the Secretary to be consistent with paragraph (3) of this subsection, or a petition for public hearing has not been filed under paragraph (4) of this subsection, the Secretary shall promulgate such standards." 79 Stat. 908.

establish water quality standards and create a timetable for sewer treatment works construction, then the federal government would do so at "probably a greater cost to the state." Stein argued that "there is no reason that all streams should not be able to support shellfisheries at their mouths" and "substantially the kind of fish you had when your ancestors lived here." Senator Joseph D. Ward, Democrat of Fitchburg, headed the state's fact-finding commission. He asked Stein, "If we're not going to do something then, you will?" Stein replied that "the answer is a big, loud, resounding 'Yes.'" Senator William X. Wall, Democrat from Lawrence, was chairman of the joint committee on public health. Wall said that he was "interested" in cleaning up the Merrimack, but the cost – nearly $100 million – was "prohibitive."[236]

In the meantime, local communities still needed water. In such conditions, allowing pollution was a waste of public resources. In August of 1966, Governor Everett Saltonstall of Massachusetts reported to the people of the Commonwealth on recent Congressional activity towards controlling water pollution. Saltonstall alluded to Thoreau as he set forth his case for making waters available for public use. "More than a century ago, Henry David Thoreau wrote in 'Walden' of the 'crystalline purity' of the waters around Concord," the governor wrote. "I am sure that if Thoreau were to spend another week on the Concord and Merrimack Rivers he would have written much less pleasant prose about these Massachusetts waterways."[237] Saltonstall's next paragraph summarized the problem from his perspective.

> As one who has rowed on Massachusetts rivers for many years, I have a special awareness of their problems and can certainly sympathize with the many sportsmen who write to me to complain of the pollution of this or that waterway. The importance of our rivers as priceless recreation areas would be enough reason in itself to clean them up.

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236. James B. Ayres, "State Told to Clean Up Water Pollution NOW," *Boston Globe*, May 10, 1966, 2. Ayres's article was topped by a photograph of a salmon leaping out of the water, with this caption: "MASSACHUSETTS STREAMS SHOULD SUPPORT SALMON."

237. "Saltonstall Cites Anti-Pollution Progress," *Boston Globe*, August 21, 1966, 18.

> But those of us who live in an area of growing water scarcity face the absolute necessity of using river water for human and industrial needs. It is these conditions that make water pollution an issue of the most serious concern for all. [238]

Federal oversight meant federal attention. A report from the director of the Merrimack River Project of the Federal Water Pollution Control Administration was expected to be delivered in September of 1966. One activist hoped that the federal role would force more immediate action. "This would be on the part of Washington," he said. Up to that time, the state had to be the "bad guy" in pressuring local communities to build water treatment plants. Moving water pollution from the Department of Health, Education, and Welfare to the Department of the Interior had freed up more funding for local sewage treatment. With more possibilities for funding, "the approach is becoming more realistic from the standpoint of a city or town's ability to pay."[239]

Federal attention meant federal appropriations. By 1970, most of the local resistance had dissolved in a flush of federal and state money. For their part, local communities had appropriated $80 million. "This is a lot of money," said John Casazza of the Division of Water Pollution Control. Chelmsford had already appropriated its local money, and its construction plans were "reaching completion." Lowell had already accepted a grant from the Commonwealth for the preparation of "final plans and specifications for its waste treatment facility." Haverhill had appropriated $12 million for a local plant. Lawrence joined Andover, North Andover, and Methuen in a new sanitary district, the Greater Lawrence Sanitary District (GLSD). The GLSD had already appropriated funds for projects "totaling $30 million." In Newburyport, the only city in the lower Merrimack to have a municipal wastewater treatment

238. "Saltonstall Cites Anti-Pollution Progress," *Boston Globe*, August 21, 1966, 18.

239. John McKone, "Merrimack Valley: Report on River Pollution Expected Sept. 16," *Boston Globe*, August 28, 1966, 42.

plant, local officials were already in consultation with engineers to upgrade to a secondary treatment facility.[240]

Public discourse began to change as state officials began to see federal support for a cleaner Merrimack. In 1966, William F. Healy, chairman of the New Hampshire Water Supply and Pollution Control Commission, had written the introduction to a staff report on the Connecticut, Androscoggin, and Merrimack Rivers. Healy appealed to social benefits above cost.

> We must realize that the removal of pollution will cost real money – important sums will be spent – and each one of us in the long run will be required to pay his share directly or indirectly. While some enthusiasts have freely claimed that pollution abatement will pay for itself because of the offsetting benefits, it may be a considerable time before the average taxpayer will be repaid his share from the savings he may have accumulated due to benefits. Furthermore, many of the benefits, though real, are of such a nature as to defy evaluation on a dollar basis.[241]

Federal funding was already behind schedule as Healy's words went into publication. Nashua's treatment plant was in operation well before the 1967 reclassification, to Class B, of most of the Merrimack River in New Hampshire. In contrast, Concord was faced with two wastewater treatment plant projects costing $15 million. City Manager John Henchey argued that the capital city had always gone along with the state's new standards for water classifications. The Penacook plant was expected to cost $6 million, and the plans had already been completed. But without prefinancing or "financing at the State level," the City of Concord would not be "in a position" to build its downtown treatment plant. But even with financing, the projects would take time, and every project had its own local challenges. In 1970, Healy

240. Federal Water Pollution Control Administration, *Conference in the Matter of Pollution of Interstate Waters of the Merrimack and Nashua Rivers and their Tributaries (Massachusetts – New Hampshire), and of the Intrastate Portion of Those Waters in the State of Massachusetts* (Boston: Federal Water Pollution Control Administration, 1970), 163 – 165.

241. New Hampshire Water Supply and Pollution Control Commission, *Report No. 53*, 4.

estimated that with financing the North Concord plant could go online in June of 1973, but he would "rather look forward to December of 1973 and give the city adequate time to contend with any other obstacles that might develop. This is not to create obstacles, but, rather, to be more realistic as to the actual completion date."[242]

Federal funding inspired local compliance. At the beginning of 1972, the Merrimack River Basin in New Hampshire had twenty-three treatment facilities in operation and twenty-four more in "various phases of completion." The estimated cost for completion of the system in New Hampshire was $210 million: $120 million federal, $54 million state, $36 million local. And in order to make the water of the Merrimack River "suitable for use and *reuse*," a plan of four "*regional water renovation plants*" in Franklin, Concord, Manchester, and Nashua. These would make use of "advanced wastewater treatment techniques."[243] But cost participation for future projects would be "predicated" on the assumption that the federal share of costs would increase from 50 percent to 70 percent. The state share had been "assumed" to be 25 percent, while the local share had been "decreased" to 5 percent.[244] This measure was a frank admission that New Hampshire communities did not make enough money to participate in the 55-25-20 ratio that would be applied in Massachusetts.

The 1965 bill championed by James Ayres was the beginning of a revolution in local water relations. The Water Quality Act of 1965 allowed federal officials to set standards that would redefine local landscapes. In general, state officials were compliant with federal

242. Federal Water Pollution Control Administration, United States Department of the Interior, *Conference in the Matter of Pollution of Interstate Waters of the Merrimack and Nashua Rivers and their Tributaries*, 9, 13 – 14, 20.

243 New Hampshire Water Supply and Pollution Control Commission, State of New Hampshire, *Staff Report No. 56: Merrimack River Basin Plan* (Concord: New Hampshire Water Supply and Pollution Control Commission, 1972) 17 – 20.

244. New Hampshire Water Supply and Pollution Control Commission, *Staff Report No. 56*, 36.

requirements. Under the Water Quality Act, the Federal Water Pollution Control Administration (FWPCA) had the powers to set classifications and to consult with local officials to assess the costs and schedules for projects. The FWPCA did not, however, have the necessary mechanism to control every source of pollution. For all the good news since 1965, the Merrimack River was still an open sewer in 1972. A cleaner river would mean more funding and a stronger federal law to control water pollution wherever it would be found.

* * * *

Water pollution control, nowadays a routine, was at one time a controversy that could stir up a number of issues: states' rights, industrial practices, local budgets, and compliance, among other public and private irritations. After the War, there was a momentary effort to begin federal water pollution control. But the Federal Water Pollution Control Act of 1948 and its amendments in 1956 fairly well opposed each other; one offered a national purpose, and the other asserted states' rights. Laws passed in 1961 and 1963 offered a little more funding, but even the 1965 law – the one that James Ayres touted – had left much of the pollution where it flowed. In 1970, the pollution measured even at the state line was greater than the proportion for which New Hampshire's population would be responsible. How could the Merrimack be so polluted, twenty-five years after World War II, despite technical knowledge, public recognition, and public funding?

The answer takes us back to the moment of triumph. American liberals retreated from the ideology that had driven the early New Dealers to question the feasibility of capitalism. By the end of the War, Alan Brinkley argues, the concept of New Deal liberalism "had assumed a new form; and its assumptions could be seen in the outlines of a transformed political world." Those who were "taking the lead" in defining a liberal agenda after the war still called

themselves New Dealers, but they showed "relatively little interest" in the corporatist and regulatory ideas that had once played so large a role in New Deal planning. Postwar leaders largely ignored the New Deal's "abortive experiments" in economic planning, its "failed efforts" to create "harmonious associational arrangements," its "vigorous if short-lived" antimonopoly and regulatory "crusades," its "open skepticism toward capitalism and its captains," or its "overt celebration of the state." Instead, these postwar leaders emphasized those New Deal "accomplishments" that could be "reconciled" with the vision of "an essentially compensatory government."[245]

Above all, Brinkley argues, postwar liberals celebrated the New Deal for having discovered solutions to the problems of capitalism that required "no alteration in the structure of capitalism; for having defined a role in the state that did not intrude too far into the economy." This transformation "had proceeded slowly, at times almost imperceptibly, so much so that for a time many liberals were unaware that it had even occurred. But for those who cared to look, signs of the postwar change were abundant. The 'planners,' 'regulators,' and 'antimonopolists' who had dominated liberal circles eight years earlier" – in 1937 – were, by 1945, "largely in eclipse."[246] There would be no further move to the left.

For most of the industrial history of the Merrimack River, pollution was an accepted cost of doing business cheaply. Andrew Hurley argues that, after World War II, politicians and civic leaders who "refused" to challenge industrial environmental practices "merely reflected broader popular views." With the rising standard of living, opportunities quickly emerged for those who were able to move out of the old city neighborhoods and into new suburbs. City budgets were

245. Alan Brinkley, "The New Deal and the Idea of the State," *The Rise and Fall of the New Deal Order* 109 – 110.

246. Brinkley, *The Rise and Fall of the New Deal* Order, 110.

already declining as appropriations were being discussed. Even in a time of economic growth, local resources were limited.

Federal water pollution control had a tentative history since 1945. The first effort to control water pollution used a venerable premise: public health. Under the Federal Water Pollution Control Act of 1948, the Surgeon General could only "encourage" controls if petitioned by the Governor of a State because of a health concern coming over a state line. This mechanism was so deliberate that it hardly controlled water pollution at all.[247] Amendments in 1956 proclaimed that "it is hereby declared to be the policy of Congress to recognize, preserve, and protect the primary responsibilities and rights of the States" in preventing and controlling water pollution.[248] Laws passed in 1961 and 1963 offered more funding, and then there was the Water Quality Act of 1965. But Public Law 89-234 did not provide an enforcement mechanism for discharges. Companies could still dump waste into the river.

Until 1972, those who sought to prosecute pollution events had to hearken back to the turn of the twentieth century to find a statute under which they could bring a suit. Section 13 of the Rivers and Harbors Act of 1899, known as the Refuse Act of 1899, made it illegal to "throw, discharge, or deposit" any refuse matter "of any description, whatever, other than that flowing from streets and sewers "and passing therefrom in a liquid state," into the navigable waters of the United States. The intention of the law was to prevent dumping that would impede

247. 62 Stat. 1156 – 1157. If, on the basis of "reports, surveys, and studies," the Surgeon General would find that water pollution had become a "public nuisance", then the Surgeon General had to give two notices to "the person or persons discharging or causing or contributing to such pollution" – and then a "reasonable time" had to expire before a committee could be summoned to make "reasonable and equitable" recommendations for abatement. And only after "affording" a "reasonable opportunity" for the discharger to "comply with the recommendations of the board" could the Federal Security Agency "request" the Attorney General to bring a suit "on behalf of the United States" to secure abatement of the pollution.

248. 70 Stat. 498.

navigation.[249] But it also could apply, at least in theory, to the private dumping of refuse in public waters.

There were a couple of local cases in the Merrimack River watershed. In March of 1972, Microfab, an electronics firm in Amesbury, Massachusetts, was discharging up to 40,000 gallons of wastewater daily into the Merrimack River. At least two years after the Army Corps of Engineers had advised Microfab that it was engaging in unlawful activities, the firm's vice president admitted that the company was polluting the Merrimack. Although the company vice president denied discharging human wastes, he was willing to concede that Microfab had discharged copper, nickel, lead, and other substances "deleterious" to the water. "We hadn't tried to willfully violate the rules," said Richard Blais. "We had been making plans. But we haven't done it quickly enough. We had been dragging our feet." Blais noted that after changing consulting firms, and with antipollution recommendations forthcoming, he believed that Microfab would not have to go to court. "We are coming up with a plan to reduce the impurity content of the water we are discharging to a level that will be acceptable" to federal and state officials.[250]

Another local case was a little more straightforward. The Granite State Meat Packing Company of Manchester, New Hampshire was convicted in May 1972 in a federal district court for discharging approximately 10,000 pounds of oil and grease and 3,580 pounds of suspended solids into the city sewer system on November 22 – 23 and December 1 of 1971. For these convictions, which U.S. Attorney William B. Cullimore cited as the first case decided in federal

249. Paul Charles Milazzo, *Unlikely Environmentalists: Congress and Clean Water, 1945-1972* (Lawrence: University of Kansas Press, 2006), 166.

250. "Microfab Says Cleanup Plan Due Soon: US Sues Amesbury Firm for Polluting," *Boston Globe*, March 29, 1972, 11.

courts for industrial discharges through a public sewer, the company faced fines of up to $6,750. On June 15, 1972, the meat packing firm was fined $1,500 by U.S. District Judge Hugh Bownes. The company's argument was that it had discharged into a public sewer and not into the Merrimack River itself. This argument was rejected.[251]

These two cases show the limitations of the Refuse Act in resolving industrial pollution complaints. Tens of thousands of gallons of pollution could be discharged before anyone would be the wiser. Private firms could hold out, sometimes for more than a year, before the courts would catch up to them. Judicial rulings could perhaps establish pro hoc standards for given situations, but litigation was costly and arduous. Taking companies to court was too specific, too costly, and too focused on local situations like the Microfab plant. Pollution controls would be better if there could be a reliable system for measuring pollution against responsibility, as opposed to catching up to pollution long after the damage was done.

The pathway to the Clean Water Amendments of 1972 began in 1969 with the National Environmental Policy Act (NEPA). NEPA's framers had discrete goals in mind. The purposes of this act were:

> To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment, and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.[252]

Under such auspices, NEPA enunciated a national mission. Section 101(c) states: "The Congress recognizes that each person should enjoy a healthful environment and that each person

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251. "N. H. Meat Plant Fined $1500 for Polluting River," *Boston Globe*, June 15, 1972, 2.

252. Public Law 91-190, "An Act to Establish a National Policy for the Environment, to Provide for the Establishment of a Council for Environmental Quality, and for Other Purposes," Section 2, 83 Stat. 852 (January 1, 1970).

has a responsibility to contribute to the preservation and enhancement of the environment."[253] NEPA both empowered private citizens and challenged them to take action wherever they saw threats to local environs. Environmental impact-analysis, which came to be known as the environmental-impact statement (EIS), added a new series of costs to be considered in building new factories or in dredging swamps.[254] With this instrument, concerned citizens had the necessary information to challenge future projects on the basis of what they would do to local environs. If a thing could be demonstrated empirically, then it could be a cause for action.

NEPA left open the question of an "environmental protection agency" per se. President Richard Nixon moved quickly to establish an executive agency before Congress could take up that power. Executive Order 11514, signed March 5, 1970, asserted a leadership role for the federal government "in furtherance of the purpose and policy of the National Environmental Policy Act of 1969." The Federal Government would provide "leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life." Federal agencies "shall initiate measures needed to direct their policies, plans and programs so as to meet national environmental goals." The Council on Environmental Quality (CEQ), "through the Chairman," would "advise and assist the President in leading this national effort."[255] But the

253. 83 Stat. 852, 853.

254. Hays, *Beauty, Health and Permanence* 279 – 280.

255. "Executive Order 11514 – Protection and Enhancement of Environmental Quality." March 5, 1970. Online version: http://www.archives.gov/federal-register/codification/executive-order/11514.html. Accessed: March 7, 2013. Lynton Keith Caldwell argued in 1998 that the Council has shrunk in importance in recent years in spite of the unchanged language in NEPA because of the lack of a congressional authority to enforce the CEQ's statutory prestige. "Since 1980, presidents have not treated the CEQ as a council, appointing only a chairman, and from 1993 to 1995 no chairman. In as much as the CEQ serves at the pleasure of the president and there is no joint oversight committee in Congress with explicit responsibility for NEPA, there appears to be no compelling means to persuade the president to appoint a full council." Lynton Keith Caldwell, *The National Environmental Policy Act: An Agenda for the Future* (Bloomington and Indianapolis: Indiana University Press, 1998), 39.

CEQ would not lead it. Instead, Nixon's new agency – the Environmental Protection Agency (EPA) – would become the mechanism for enforcing environmental policies nationwide.

The rise of the EPA fundamentally changed the purpose of NEPA. The CEQ was intended as a kind of environmental cabinet for the President, but it was never empowered as the law's framers had originally intended. One of its principal architects, Lynton Keith Caldwell, argued in 1998 that the weakness of the CEQ changed how NEPA has been interpreted by courts and by other federal officers. The CEQ was, at the outset, "integral to the purpose and the intended implementation" of NEPA. But after mid-Seventies, the CEQ had a "tenuous" existence, not least due to "the persisting perception that environmental policy is important primarily in relation to antipollution measures being administered by the EPA." The temporal and spatial limits of most environmental problems made them "correctable by a few new laws." It does not help that members of Congress are less likely to fight for environmental policies that would meet with opposition from some of their constituents.[256]

Another problem with the Council of Environmental Quality was the concentration of so much authority in so few hands. The Administrator of the EPA could report directly to the President, but the real work of environmental policy was on the ground in thousands of local settings across fifty states. The CEQ, even if it had been properly authorized and supported, could only have delegated its decisions to the states. A small group of well-meaning individuals is only as effective as the composite intelligence and experience of the group.[257] Given these

256. Lynton Keith Caldwell, *The National Environmental Policy Act: An Agenda for the Future* (Bloomington and Indianapolis: Indiana University Press, 1998), 42, 159.

257. David Schoenbrod, David, Richard B. Stewart, and Katrina M. Wyman, *Breaking the Logjam: Environmental Protection That Will Work* (New Haven and London: Yale University Press, 2010), 4. Schoenbrod's experiences with environmental policy convinced him that too many decisions had been forced into too few hands. "The fundamental barrier to getting the job done," he wrote in 2010, "is that Congress has charged the EPA with dealing with a complex environment through a method of regulation that is defeated by complexity. Even if Congress gave EPA a blank check to bulk up its staff, the chain of command would still end in a small group of

constraints, and the scale of the work set forth for the new EPA, the CEQ was simply put off to the side. Nixon's new agency would be the instrument of national environmental policy.

Now that the matter of enforcement had been settled, the EPA began to organize itself for federal water pollution control. Under Section 8 of EPA Order 1110.2, issued on December 4, 1970, a "Water Quality Office" would arrange for water pollution controls under the leadership of a Commissioner who would report directly to the EPA Administrator. The responsibilities of the new Water Quality Office were defined in seven categories: federal financial assistance "to help support the construction of municipal waste treatment facilities, encouragement of improved operation and maintenance of such facilities, and improved planning to assure that the grants contribute to effective basinwide cleanup," a "water quality standards management program in cooperation with states, cities, and industry," a "research, development and demonstration program," a "national water quality monitoring system coordinated with monitoring activities of state and other Federal agencies," a "manpower development and training program," a "technical assistance and support program for public and private agencies and institutions," and "continued Federal financial assistance" to state water pollution control agencies to "assist them in carrying out their responsibilities for water quality management" under the Federal Water Pollution Control Act – at least in the form that it had taken up to that time.[258]

One of the basic problems with water pollution control is its unavoidable complexity. It has to be local enough to address every pollution source, but it also had to cover interstate

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leaders at the very top. No matter how brilliant, they would still have only so much brain power to process information and to devise detailed prescriptions in an effort to dictate to a complex and constantly changing mass of activities across a vast and diverse country."

258. William D. Ruckleshaus, Administrator, "EPA Order 1110.2, Environmental Protection Agency, ORDER 1110.2, December 4, 1970. INITIAL ORGANIZATION OF THE ENVIRONMENTAL PROTECTION AGENCY," http://www.epa.gov/aboutepa/history/org/origins/1110_2.html. Online version: Accessed November 2, 2012.

waters. This dilemma had occupied most of the public space since World War II. The Clean Air Amendments of 1970 represented the first attempt to embrace the contradiction of local contrl and interstate control. Scott Hamilton Dewey argues that the Clean Air Amendments of 1970 "first formally acknowledged that pollution problems, left in the hands of state and local governments, were often by their very nature interstate, nationwide problems properly subject to federal authority." The federalizing of an environmental issue set the "pattern" for subsequent federal policy, including the Federal Water Pollution Control Act of 1972, the Endangered Species Act of 1973, and "other enactments." Meanwhile, Dewey argues, changes in federal policy and pressure from environmentalists "triggered a flood of new state laws on air pollution" during the late Sixties and early Seventies, as states "rushed" to bring their control programs into "conformity" with federal mandates.[259] Air pollution generated "serious public concern about human survival," giving the issue a "pressing urgency" far beyond that in traditional conservation, "and perhaps even more than that provoked by its closest competitor at causing environmental anxiety, water pollution." [260]

By 1970 it had become clear that the Refuse Act would not be an effective means of generally controlling water pollution. Samuel P. Hays argues that the "lengthy" court battles of earlier years led to an innovation in Public Law 92-500 to "bypass" proof of cause and effect and to require each discharger to install "a given level of technology per se." The technology standards that emerged had a new qualification – the "average of the best" – that EPA had decided would mean "the average of the top 5 – 10 percent of existing technology." Industry argued that it meant "the meridian plant in the entire industry," which would compel only 50

259. Scott Hamilton Dewey, *Don't Breathe the Air: Air Pollution and U.S. Environmental Politics, 1945-1970* (College Station, TX: Texas A&M University Press, 2000), 5.

260. Dewey, *Don't Breathe the Air*, 4.

percent rather than at least 90 percent of the plants to modernize. The courts favored EPA's interpretation.[261]

Even with the cooperation of state and local officials, members of Congress had recognized that much of the nation's water pollution in 1972 "came from far more diffuse, *nonpoint* sources" and that the objective of the act "required a more comprehensive approach."[262] Richard Lazarus argues that early statutes "promised dramatic, immediate change, but both the ecological problems and the regulatory solutions created to resolve them proved to be far more complicated and nuanced than had been thought." Science had not caught up to legislative mandates, "and early gains in scientific knowledge seemed mostly to underscore how much we did not understand" rather than to provide "clear answers and pathways to the desired environmental improvements."[263]

The language of Section 105(d) of the Clean Water Amendments of 1972 reveals how many layers of effort would be needed to make the new system work effectively. The Administrator of the EPA "shall conduct, on a priority basis," an "accelerated effort" to "develop, refine, and achieve practical application" of

> (1) waste management methods applicable to point and nonpoint sources of pollutants to eliminate the discharge of pollutants, including, but not limited to, elimination of runoff of pollutants and the effects of pollutants from inplace or accumulated sources;
>
> (2) advanced waste treatment methods applicable to point and nonpoint sources, including inplace or accumulated sources of pollutants, and methods for reclaiming and recycling water and confining pollutants so they will not migrate to cause water or other environmental pollution; and

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261. Samuel P. Hays, *Beauty, Health and Permanence: Environmental Politics in the United States, 1955-1985* (Cambridge: Cambridge University Press, 1987), 78 – 80.

262. Robert W. Adler, Jessica C. Landman, and Diane M. Cameron, *The Clean Water Act 20 Years Later* (Washington, DC and Covelo, CA: Island, 1993), 9.

263. Richard J. Lazarus, *The Making of Environmental Law* (Chicago and London: Chicago University Press, 2004), 87.

> (3) improved methods and procedures to identify and measure the effects of pollutants on the chemical, physical, and biological integrity of water, including those pollutants created by new technological developments.[264]

These national principles were to be applied to local landscapes – rivers and streams, lakes and ponds. We have seen from the history of the Merrimack River in this chapter that there were more than a few places where the costs were out of scale with the local economy. In such an environment, a policy of enforcing ambient standards would never have been as efficient as the control of pollution from point sources. Legislators who had drafted the Clean Air regulations in 1970 adapted them directly to water pollution control, with the notable exception that the "latest available technology" required in the Clean Air Act became the "best available technology" in Public Law 92-500.[265] Otherwise the system was similar.

Smokestacks were fairly easy to count, but water pollution proved to be more complex than regulating the discharges from the end of a pipe. For one thing, engineers and ecologists differed on tactics. Section 101(a) stated that the "objective" of Law 92-500 was "to restore and maintain the physical, chemical, and biological integrity of the Nation's waters."[266] Paul Charles Milazzo argues that the concept of integrity, for the staffers of Ed Muskie's Senate Public Works Committee, "exposed the 'ecological fictions' underlying the fundamental tenets of sanitation engineering." Sanitary engineers had assumed that "aquatic systems had a natural capacity to absorb pollutants that could be calculated mathematically, and factored into sewage treatment requirements." The concept of "integrity" was, from a sanitarian's perspective, an "objective"

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264. 86 Stat. 826.

265. Harvey Lieber, *Federalism and Clean Waters: The 1972 Water Pollution Act* (Lexington, MA, Toronto, and London: Lexington, 1975), 27 – 28.

266. 86 Stat. 816.

that "represented an impractical, prohibitively expensive abstraction, because water quality could not be defined apart from the impact of human society." The committee staff "turned such thinking on its ear," as when staffer Thomas Jorling defined "integrity" as "'that character of the aquatic ecosystem as it is determined by evolutionary factors including man, *but not technological man*.'" Pollution controls had to take place with those conditions as the "background", and could not alter it "beyond an acceptable range of 'flux'." Restoring and maintaining its integrity, Jorling argued, would be "more cost-effective in the long run than relying on assimiliative capacity."[267]

The development of an effective model – measuring discharges, and not just ambient levels –gave the EPA the ability to enforce water pollution controls at every point along a stream. In 1965, James Ayres had sought a national plan to attack local water pollution. With the funding from Congress, the EPA could now set forth new standards that would render the Merrimack River a Class B stream – and punish anyone, public or private, who would violate those standards. The local history of the Merrimack shows that, in fact, there was considerable activity in making arrangements for environmental policies. It was just that some of the projects were held up.[268] Now they could move forward, and the water map of the Merrimack could expand to meet the local needs of the future.

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267. Paul Charles Milazzo, *Unlikely Environmentalists*, 217 – 219.

268. Alan H. Magazine, *Environmental Management in Local Government: A Study of Local Response to Federal Mandate* (New York: Praeger, 1977), 34 – 39. Using surveys from 1973 and 1974, Magazine found that neither the EPA regional office nor the New England Regional Commission had "revealed" any "notable environmental activity" on the part of state or local jurisdictions. From the perspective of forming a discrete state agency, this was arguable. But Magazine's discussion of Region 1 only alluded once to the Merrimack during a description of local participation in Concord, Massachusetts. Also, the presence of a state planning agency does not mean that plans will move forward. Local planners along the Merrimack still had to fit those plans to local landscapes.

The prospect of a cleaner river was concomitant with the possibility of restoring fisheries. Public Law 89-304, the Anadromous Fish Conservation Act of 1965, was intended for the purpose of "conserving, developing, and enhancing within the several States" the anadromous fishery resources of the nation that were "subject to depletion from water resources developments and other causes," or with respect to which the United States had made conservation commitments by international agreements. The law authorized the Secretary of the Department of the Interior to enter into "cooperative agreements with one or more States, acting jointly or severally, that are concerned with the development, conservation, and enhancement of such fish, and, whenever he deems it appropriate, with other non-Federal interests."[269]

It took a few years to put the agreements into practice, but by 1969 the Merrimack was among the rivers where a restoration program was deemed at least possible. A Statement of Intent for a Cooperative Fishery Restoration Program for the Merrimack River Basin was issued by Massachusetts, New Hampshire, and the United States Bureau of Sport Fisheries and Wildlife and Bureau of Commercial Fisheries. They announced that they would "agree to, and support, a fisheries program" for the Merrimack River Basin.[270] Like the water pollution control model of Public Law 89-234, the fisheries management plan in Public Law 89-304 offered federal support for state fish and game agencies to manage their local environs more effectively.

In the late Sixties, local fishers began to find new fish on their hooks. Coho salmon fingerlings released into the Lamprey and Exeter Rivers were caught at places from Hampton to Marblehead "by some fishermen who don't know what they are catching and are keeping instead

269. 79 Stat. 1125.

270. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review: Anadromous Fish Restoration Program, Merrimack River* (Nashua, NH: Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, 1997), Appendix I.

of releasing them." Bill Jerome, the Massachusetts marine fisheries biologist at Newburyport, confirmed four catches at Plum Island at the mouth of the Merrimack: two that were 9.5 inches, one that was 11.5 inches, and one that was 14.5 inches. One party boat captain had thrown back "between 25 and 30 in the same size range" that he had while seining sand eel bait. In theory, if the salmon could live long enough at sea, then perhaps they could live long enough to be catchable.[271]

In the Sixties, it was still possible to project the recreational returns from the future restoration of fisheries in American rivers. A 1968 report estimated that $21,300,000 in "recreational visitor income" was lost in 1964 due to pollution in the Merrimack River Basin. In 1970, Bernard W. Corson, director of the New Hampshire Fish and Game Department, spoke at the Conference in the Matter of Pollution of Interstate Waters of the Merrimack and Nashua Rivers and their Tributaries on behalf of the 200,000 sportsmen in the Merrimack watershed. Corson said, "We don't have all the hay in the barn, so to speak, but I feel we have made some splendid progress."[272]

Even with such progress, the work was complex and painstaking. Corson elaborated on the "coordinated program of fisheries management" for the Merrimack River Basin which would require fish passage facilities in the cleanup work currently underway. "This program," Corson explained, "is designed to restore runs of American shad and Atlantic salmon to the Merrimack." Fisheries managers had just, "as a matter of interest, introduced shad in 1969 – that is, shad eggs – and again in 1970." More recently, they had found "some of the migrants or fish that have

271. Henry Moore, "Rod and Gun: Anglers Urged: Return Cohos," *Boston Globe*, July 8, 1969, 24.

272. Federal Water Pollution Control Administration, United States Department of the Interior, *Conference in the Matter of Pollution of Interstate Waters of the Merrimack and Nashua Rivers and their Tributaries (Massachusetts – New Hampshire)*, 36 – 37.

resulted from this hatch" downstream. The Pemigewasset, from Lincoln down, as a result of pollution abatement, was currently being managed by Corson's department. This provided forty miles of "additional stream that for many, many years has not supported sport fisheries." That part of the Pemigewasset was currently being managed for trout, and it had provided "some excellent fishing opportunities during this past summer." Corson felt that "progress, good progress, is being made in the Merrimack River system," so that it would "realize its full recreational values."[273]

Benjamin Corson knew that such recreational opportunities would still take place in an impounded river. When he mentioned fish passage, Corson was citing one of the main reasons that the first salmon program had failed a century earlier. The capture of dozens of released coho salmon resembles the downstream predation of the eighteen-nineties, but the quicker communications of the twentieth century made it possible to contain such threats to the growing populations of salmon and shad at the coastline. Once the fish would make it up the river, however, they would meet much larger threats in the dams that blocked their way.

When James Ayres wrote his series in the spring of 1965, the Merrimack was an open sewer. But for it to become a playground – a swimming hole before the end of the century – the very premise of the Merrimack River had to be changed. By 1965, Ayres could record the growing realization that water pollution controls were coming to the Merrimack. Against the prospect of industrial "blackmail" – forcing states to compete for the most lenient pollution

273. Federal Water Pollution Control Administration, Northeast Region, United States Department of the Interior, *Report on Pollution of the Merrimack River and Its Tributaries, I: Summary, Conclusions, and Recommendations* (Boston: Federal Water Pollution Control Administration, 1968), 8; Federal Water Pollution Control Administration, United States Department of the Interior, *Conference in the Matter of Pollution of Interstate Waters of the Merrimack and Nashua Rivers and their Tributaries (Massachusetts – New Hampshire)*, 36 – 37.

standards – one state official said that such an argument had not been heard in twelve years, since "industry sees the handwriting on the wall."[274]

Industry may have seen the future, but even with fewer industries the "open sewer" was accepted as a fact of life by most of the people that Ayres encountered in the Merrimack Valley.[275] State and local officials began to move forward with plans after 1965, but the plans were inconsistent and some did not even offer the latest technology, secondary treatment. Public Law 92-500 was the summit of a series of laws passed between 1969 and 1972. Its mechanism, the National Pollution Discharge Elimination System (NPDES), assigned permits to every public or private discharger along the Merrimack River. Building all of those wastewater treatment plants, with secondary treatment, with the best available technology (BAT), became an industry in itself. A cleaner river would emerge within a decade of 1972.

This would mean, however, that the playground of the Merrimack would come from the same landscape that had made the open sewer. Suburbs and highways drew whole populations away from the stream. And with the dams in place, most of the fishing would be downstream of Lawrence. But within only a few years of 1972, most of the big old fish would be harder to find, let alone catch. The newly managed fisheries offered some hope that industrial purposes – hatching, releasing, and so on – could bring back experimental stocks of salmon to New England streams. But even in a cleaner Merrimack, there would be many fewer salmon than there were a century earlier; and those fish would still have to get past the big old dams if they were to

274. James B. Ayres, "The Merrimack – Playground or Sewer? No. 10: Money Is Still the First Problem in Cleaning Rivers," *Boston Globe*, May 11, 1965, 17.

275. James B. Ayres, "The Merrimack, Playground or Sewer? – IV: Textiles Gone, Debris Left," *Boston Globe*, May 5, 1965, 12. "But besides leaving a history of boom and bust, the textile industry has left a legacy of 100 years of pollution – tons of grease, oils, soap, dyes, starch, chlorine, dirt, and other by-products of the industry daily flushed in the river. This has conditioned Merrimack River Valley residents to accept the river as an open sewer despite the fact that the textile mills took with them to the South 70 percent of the industrial pollution of the [Merrimack]."

reproduce. For all of the enthusiasm with which James B. Ayres reported on the Merrimack River in the spring of 1965, the matter would be decided before his untimely death in 1982.[276] Whatever the potential for the Merrimack River as a playground, the cleaner river would be too valuable not to be put right back to work as a source of hydropower.

276. Jeff McLaughlin, "James B. Ayres, Globe Reporter, Rewrite Man: Dead at 57," *Boston Globe*, May 10, 1965, 23. Ayres was found dead in his home almost seventeen years to the day after the final installment of "The Merrimack –, Playground or Sewer?" appeared in the Boston Globe on May 13, 1965. Globe writer Jack Thomas recalled his old colleague. "What was special about Jim Ayres was that in a business increasingly populated by empty suits, he was full of gusto in everything he did, whether he was laughing or drinking or singing or planting tomatoes or banging the keyboard. Sitting at his desk in the city room, from time to time, for no apparent reason, he'd let out a bellow -- a roar -- that would serve to startle young reporters and serve notice that they had enlisted in a very unusual business."

4. GETTING OUT OF THE HOLE.

In the summer of 1981, David Arnold and Peter Woodberry made a trip down the Concord and Merrimack Rivers, covering 45 miles in two-and-a-half days. Unlike Thoreau, they took the Merrimack downstream to the sea. Their craft was not a dory with a sail, but a canoe, with "a well-stocked cooler, 10 pounds of charcoal, a hibachi, a guitar, two umbrellas, two partially deflated air mattresses, a can of Raid, and a piano dolly" to carry the canoe. It made "quite a splash when boat meets the meandering currents of the Concord." Thoreau's "chuckle", Arnold wrote, "whispered from high in the hemlocks." But just maybe his spirit "smiled" to learn that "peace and discovery still pervaded these rivers 142 years later" as the two men paddled down to the sea.[277]

The Middlesex Canal was defunct, so Arnold and Woodberry had to load the canoe on the piano dolly for a trip through an empty parking lot in North Billerica. "Circumnavigating" waterfalls in Lowell and Lawrence "required considerably more finesse. Prodding a pregnant-looking canoe through congested city streets approximates how it must feel to arrive in a parade float in the wrong city." Looking for a drop-in site below the falls, the two men parked their loaded canoe at a meter on East Broadway Street in Lawrence. A resident must have thought that they meant to camp there, and called the police. "Seldom do urban explorers receive better assistance: when these officers learned of our worthy intentions to float again, they not only

277. David Arnold, "Paddling to Sea: Modern-Day Canoeists Trace a Historic Route… and Thoreau Comes Along for the Ride," *Boston Globe*, June 20, 1981, 29. They soon found a kind of sail for their canoe. "'Set umbrellas,' cocaptain Woodberry commanded, speculating that the power of a tail wind could be harnessed." For three days, the wind remained astern, but the umbrellas helped them downstream later in the trip.

recommended a drop-in spot but helped muscle the canoe and dolly over all of the railroad tracks that lay in the way."[278]

At Haverhill, nigh sixteen miles from the ocean, the flood tide "lifted" the Merrimack into "the fingers of overhanging willows." A great blue heron, "poised motionless midstream like the plastic garden variety, watched our umbrellas pull us by." When the canoe reached Newburyport, the river widened to "perhaps a half-mile" before "sifting" through the Newburyport salt marshes.

> Trees lurched over open water; their roots fought for dry land. We saw neither chattering monkeys nor snoozing snakes nor trumpeting elephants. They did not return our calls. But at least we tried. It was that kind of shore.
>
> It had been that kind of trip.[279]

Arnold and Woodberry did not fish, but along the coastline of Massachusetts, there were sport fish for those who would wait for them. One of the "rare occurrences of a decade" took place in the last week of June, 1981, when "acres and acres of large stripers" were schooling in Cape Cod Bay. Five "good-sized" stripers in the Merrimack, "25 – 35 pounds," were taken by boats off Plum Island. But those were small compared to the 61-pound, two-ounce prize-winner taken by Larry Comeau at the Plum Island Striped Bass Derby in 1972.[280] The changes in the striped bass caught at the mouth of the Merrimack – from weights between 40 and 60 pounds, to weights closer to 30 pounds – resulted from hydropower development in the Hudson River that began in the mid-Sixties. Those projects on the Hudson cut into the striped bass population of the Merrimack even as the water in the Merrimack became clean enough for healthier fish.

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278. David Arnold, "Paddling to Sea: Modern-Day Canoeists Trace a Historic Route… and Thoreau Comes Along for the Ride," *Boston Globe*, June 20, 1981, 29.

279. Arnold, "Paddling," *Boston Globe*, June 20, 1981, 29.

280. Tony Chamberlain, "Fishfinder: Stripers on Parade in Rare Cape Show," *Boston Globe*, June 26, 1981, 37.

The landscape that Arnold and Woodberry encountered in the early summer of 1981 was certainly healthier for the river than it had been in 1972. On the other hand, the relative absence of natural things and natural places showed how the suburban landscape had spread into the woods along the way. In 1839, Thoreau had remarked on the decline of the grasses as dams had flooded the fields. In 1981, the dams were still there; but there were now many more people than there had been even at the end of World War II. It may well be that some of the monkey chatters coming from that aluminum canoe were overheard in local backyards. But the trees only looked like a forest from a distance; and the fish in the cleaner Merrimack were smaller and fewer than those in the dirty old river.

This chapter is the story of the Merrimack from the Clean Water Amendments of 1972 to the opening of the Essex Dam Fish Lift in 1983. In this chapter we will follow three trends: water quality, in the reports of oxygen levels and of nutrient levels; fish ecology, using anecdotal and scientific evidence of a shifting waterscape for striped bass and reports of the early efforts at hatching and releasing Atlantic salmon; and hydropower, in the hard limits set on anadromous fisheries in the Hudson and Merrimack Rivers during the "environmental decade" of the Seventies. These three trends – towards cleaner water, towards better knowledge of fish populations, towards cheaper hydroelectric power – reshaped the restoration of the Merrimack even as it unfolded. Water quality was achievable, and fish ecology looked promising in a cleaner river. But hydroelectric power was too affordable for river managers to ignore the opportunity to save money for local people living along the stream. Once the olden structures could be reused, local hydropower would simply push most of the river-running fish out of the way.

* * * *

In the early Seventies, fish in the Merrimack were good to catch, but not to eat. In September of 1973, Monty Montgomery wrote a "Woods and Shore" column about fish in the Merrimack River. "Every once in a while," he began, "I feel like commenting on the quality of fish caught in the Merrimack River, and then I fear a horrible fate, like having a bucketful of the Merrimack poured on me, or worse, being forced to eat a piece of Merrimack-steeped striped bass." He gave three anecdotes to illustrate his point. A friend who caught a striped bass on the Cape impressed his mother-in-law "and was blessed with much familial bliss." When he gave her a striper that he'd caught from the Merrimack, "and after she started speaking to him again," his mother-in-law "accused him of giving her two different species of fish."[281] A friend from Pepperell caught a bluefish in the middle of the summer "blitz". When he got it home, he "didn't think much of it while fileting it," but they cooked it anyhow. "It tasted like the worst kind mud," the man said. "In fact, it tasted so bad that after we threw it all away, we tried to eat something else for dinner and found that all our appetites had been ruined."[282]

Then there was the man who had driven "all the way down" from Brattleboro, Vermont. This man caught a bluefish that tasted like "the filets had been soaked in kerosene." This man had never eaten a bad bluefish in his life, and he wondered if fish could absorb "waste matter" from outboard engines or other polluters. Montgomery mused about the length of time that it would take for a fish to absorb pollutants at different points on the river. "Is there some place on the river where they are all lousy, mostly lousy, or just fine?" It is "a great place to fish, the Merrimack," he concluded, "but until further notice, I think I will suspect the fish themselves."[283]

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281. Monty Montgomery, "Woods and Shore: Fish Marinated in the Merrimack River Taste Just Plain Lousy," *Boston Globe,* September 20, 1973, 59.

282. Monty Montgomery, "Woods and Shore," 59.

283. Monty Montgomery, "Woods and Shore," 59.

There were a few efforts to inspire other kinds of recreational interest in the Merrimack River. In October of 1973, an "armada" of canoes, kayaks, and rowboats, "whose only weapon was an idea," launched on the Merrimack. These were people who "want the river, one of the country's worst polluted, back again – for fishing, swimming, and boating." The group of boaters was cosponsored by the Merrimack Valley Regional Planning Commission and the Army Corps of Engineers. It comprised elements of the Andover League of Women Voters, high schools, canoe clubs of Phillips Academy, and the Haverhill Garden Club. The river was so dirty that one canoeist, "remembering where he was," pulled up his hand from gliding in the water. "God, I hope I don't have a cut on my hand," he said. "It will get infected for sure." The senior planner of the commission, Maria Eigerman, said that the armada wanted people to know that the river was there, and not just because it stank in the summertime. "We want everyone to realize the river can be the bright spot of the valley, instead of its biggest blight." They hoped to continue their efforts with another paddling trip in the spring, and there would be annual armadas, the reporter hoped, to "dramatize" the river's potential as "the best recreational area in the Merrimack Valley."[284]

Depending on where he was, that canoeist may have had good reason to be worried about the river water on his hand. In 1974 the most polluted stretches of the Merrimack River were immediately downstream of the cities, but the whole river was polluted enough to make the fish polluted. Under the new Clean Water regime, Class D waters were to be eliminated from the Merrimack River.[285] But in New Hampshire, a 1976 report stated that where the Merrimack and

284. Bernardine Coburn, "Armada Strikes Blow for Clean Merrimack," *Boston Globe*, October 28, 1973, 32.

285. Water Quality Section, Division of Water Pollution Control, Massachusetts Water Resource Commission. *Merrimack River 1974 Water Quality Survey Data* (Westborough: Massachusetts Division of Water Pollution Control, 1974), 6 – 9, 20. Some towns were fortunate to have lakes and ponds. Local water supplies in

Nashua Rivers ran to the state line, they were classified D. The intended classification was C; there was no plan for either stream to reach Class B as per the mission of Public Law 92-500.[286]

The need for a table of projects that would be less than Class B is indicative of at least two things: first, that water classification changes were expensive; and second, that they were important enough that a table had to be written explaining why Class B would not be applied everywhere. On the other hand, there were already secondary treatment plants in operation at Concord-Penacook and Merrimack, and a primary treatment system in operation in Nashua. A secondary treatment plant was 87 percent completed in Manchester, and the new sludge incinerator at the plant in Merrimack was already halfway done.[287]

In Massachusetts, Lowell's plan, approved in January of 1974, was for a wastewater treatment plant handling 32 million gallons a day (MGD). Greater Lawrence – Lawrence, Andover, North Andover, and Methuen – had a November 1972 plan for a plant handling 52 MGD. Haverhill's plan, also approved in November of 1972, was for a plant handling 18 MGD.

Andover, North Andover, and Haverhill were classified A. On the other end of the scale, Class D waters, suitable only for power, navigation, and limited industrial uses, were to be eliminated. In 1974, all such waters had to be reclassified C1, suitable for "a variety of uses, including recreational boating and fish and wildlife habitat (20).

286. New Hampshire Water Supply and Pollution Control Commission, State of New Hampshire, "Table VII, Causes of Water Quality Problems for River Segments Below [Class] B/B*," *1976 Water Quality Inventory Report to Congress, Bicentennial Issue* (Concord, NH: New Hampshire Water Supply and Pollution Control Commission, 1976), Sheet 1; 89 Stat. 816. Section 101(a)(2) states: "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983."

287. New Hampshire Water Supply and Pollution Control Commission, *1976 Water Quality Inventory Report to Congress, Bicentennial Issue*, 27 – 28. Primary treatment "involves the removal of solid matter which either floats to the surface or settles out due to gravity." Secondary treatment "involves the preparation of a suitable habitat for a community of microorganisms that will slowly decompose the organic matter available to them in the wastewater." The "fundamental principle" underlying secondary treatment is "no different from that which would occur more slowly in a receiving stream." Arthur S. Johnson, *A Report on Water Quality Conditions and Pollution Abatement in the Merrimack River Basin in Massachusetts* (Westborough, Massachusetts: Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, Technical Services Branch, 1985), 95.

The treatment of such massive quantities of water would soon have wide-ranging effects on the river.[288]

If we look at water classifications in Massachusetts in 1974, we can see that Class C was still a common thing in the early Seventies. Figure 4.1 shows how the Merrimack River Basin was classified in the Commonwealth of Massachusetts.

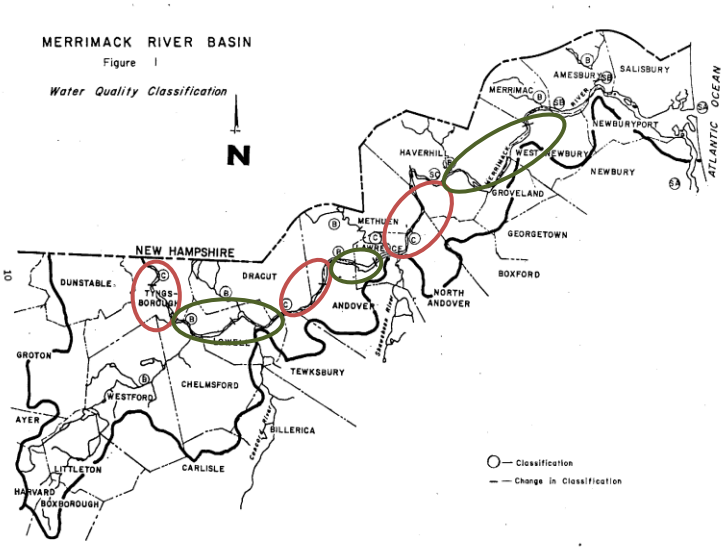

Figure 4.1. "Merrimack River Basin, Figure 1. Water Quality Classification," July – August 1974. Red and green ellipses (added) show where the Merrimack was rated Class C (red) or Class B (green). Ratings SB and SA are special ratings approximating Classes B and A for waters that touch the ocean.

We can recapture a few readings from some of these stations in order to see how the Merrimack was sampled and what those samples revealed. Figure 4.2 is a map of sampling stations for the testing done in 1974.[289] Station MR01 was at the New Hampshire-Massachusetts state line (mile marker 49.82). Station MR03 was 0.4 miles upstream from Pawtucket Dam in Lowell (mile marker 41.00). Station MR08 was at the Lawrence-Methuen line (mile marker 26.36). Station MR11 was at Rocks Village Bridge, on the west side of the channel, in Haverhill

288. 18 million gallons is equivalent to the amount of water that would run from the average American shower, at a gallon a minute, for just over 34.3 years.

289. Water Quality Section, Division of Water Pollution Control, Massachusetts Department of Environmental Quality Engineering. *Merrimack River Water Quality Survey Data 1974* (Westborough: Massachusetts Department of Environmental Quality Engineering, 1974), 14.

(mile marker 11.80). Station MR18 was located between Buoy 7 and Buoy 9 off Plum Island Point between Salisbury and Newburyport (mile marker 0.30). When we put Figures 4.1 and 4.2 together, we can see that stations MR01(state line) and MR08 (Lawrence) were in Class C waters, but MR03 (Lowell) and MR18 (Plum Island) were not. Lowell's discharges polluted waters downstream.

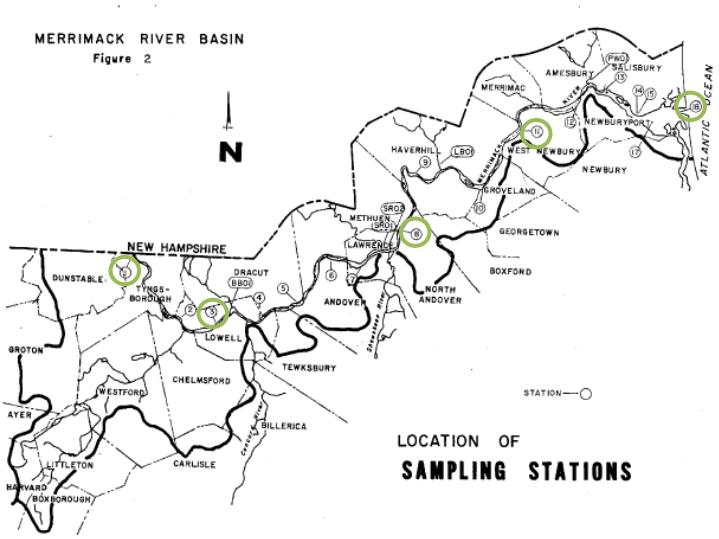

Figure 4.2. "Merrimack River Basin, Figure 2. Location of Sampling Stations," July – August 1974.
Green circles (added to original) show the locations of stations MR01, MR03, MR08, and MR18.

At each of these stations, surface and bottom samples were taken. They were tested for dissolved oxygen (DO), biochemical oxygen demand (BOD), and certain nutrients – in particular, nitrogen and phosphorus. Dissolved oxygen is a dependent variable; the more consumers there are in the water, the higher the biochemical oxygen demand, and the lower the available dissolved oxygen. Chemicals that consume oxygen are measured as chemical oxygen demand (COD).[290] In either case a river with a high BOD or a high COD will probably have a

290. Water Quality and Research Section, Division of Water Pollution Control, Massachusetts Department of Environmental Quality Engineering, *Merrimack River 1976 Wastewater Discharge Survey Data* (Westborough: Massachusetts Department of Environmental Quality Engineering, 1976), 31. BOD is measured by taking a sample, exposing it to a certain amount of organic material, and measuring how much of the material is oxidized over a

low DO because either organisms or chemicals are using up the oxygen that would otherwise be available to fish.

BOD is a good indicator of pollution from sewage because the coliform bacteria consume oxygen that would otherwise be available to other forms of aquatic life. In 1974, over 99.9 percent of benthic macroinvertebrates – snails and slugs and worms living in the muck at the bottom of the river – were found to be pollution tolerant.[291] Figure 4.3 shows the biochemical oxygen demand (BOD) levels measured at the stations circled in Figure 4.1. The pollution coming downstream from the cities was only partially diluted by the flush of the estuary.

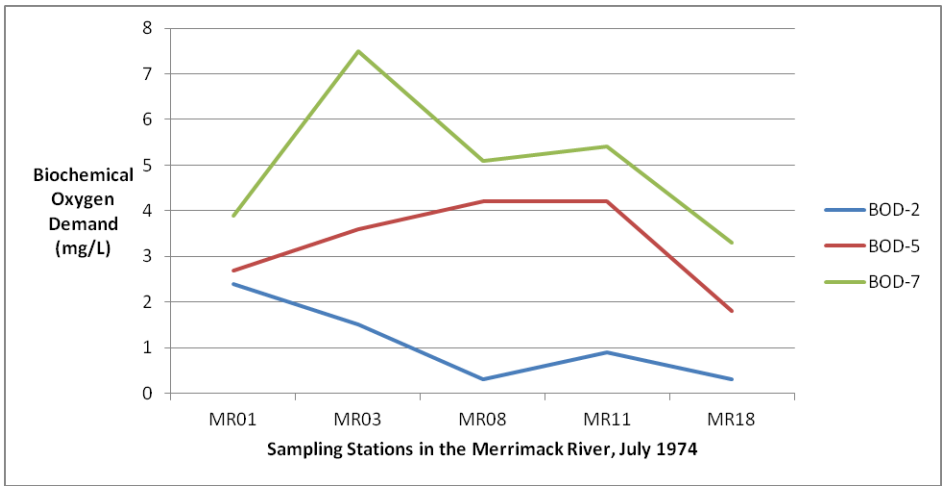

Figure 4.3. Biochemical Oxygen Demand (BOD) Measured at Five Sampling Stations in the Merrimack River, July 9, 1974. Biochemical oxygen demand represents the competition for resources between pollution-tolerant biota and fish. When BOD increases, the oxygen available to fish decreases.

Usually we think of nutrients like nitrate or phosphorus in a positive sense; a nutritious environment is "healthier" than a depleted one. However, phosphorus, like nitrate, can be a problem for fish. The excess of nutrients in water, known as *eutrophication,* can lead to the depletion of oxygen over time. Unlike nitrate, the majority of phosphorus in domestic sewage

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certain period of time at a specified temperature over a certain period of time. COD differs from BOD in that the test does not differentiate between stable and unstable organic matter consumed by the chemical oxidant.

291. Michael D. Bilger, *Merrimack River 1974 Water Quality Survey: Benthic Macroinvertebrate Analysis* (Westborough: Massachusetts Division of Water Pollution Control, 1976), 26.

comes from detergents.[292] Algal blooms growing on an excess of phosphorus compete for oxygen with fish in the water. Over time, if the plants proliferate quickly, they will win that race, and the fish will disappear from that body of water. This is why fertilizer and other human uses of nitrogen can threaten aquatic life.

The creation of a wastewater treatment regime in less than a decade made the Merrimack River cleaner in June of 1981 than it was less than a decade earlier. Treated water had much lower levels of nitrogen, phosphorus, and bacteria from Lowell to Amesbury.[293] Figure 4.4 compares nitrogen levels measured in 1974 with those measured in 1981.

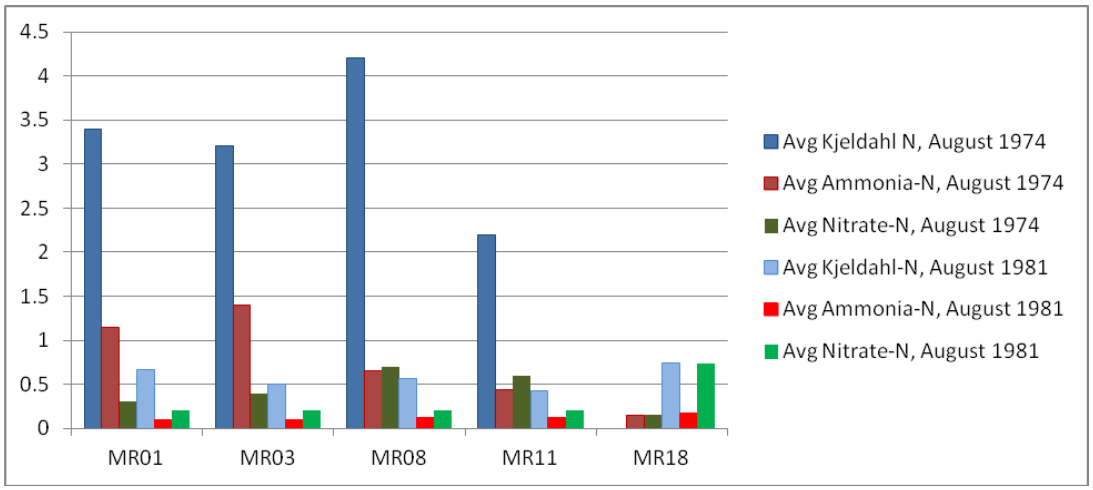

Figure 4.4. Average Nitrogen Levels Measured at Five Stations Along the Merrimack River in August 1974 and in August 1981.

With effective testing, scientists could draw a few conclusions about where and when nutrients were being released into the Merrimack River. In a 1985 report, Arthur S. Johnson noted that decreases in ammonia-nitrate levels (the two red series in Figure 4.6) could not be ascribed to the completion of wastewater treatment plants in Lowell, Lawrence and Haverhill because influent and effluent levels in 1979 and 1981 remained "fairly constant." It appeared

292. Water Quality and Research Section, *Merrimack River 1976 Wastewater Discharge Survey Data*, 33 – 34.

293. Technical Services Branch, *The Merrimack River: 1981 Water Quality Survey Data, Wastewater Discharge Data*, 86, 89, 95; Johnson, 35.

that "some reductions in ammonia loadings" may have occurred upstream due to nitrification of wastewater at Fitchburg, reducing ammonia-nitrate in the Nashua River and therefore in the Merrimack River as well.[294] Reducing nitrate levels would free more oxygen into the water.

Phosphorus concentrations were high enough to be worrisome, at least in theory. Often phosphorus concentrations in excess of 0.1 mg/L can lead to "the abundant growth of algae or macrophytes." But here the dams helped the stream. Although concentrations of phosphorus exceeded 1.0 mg/L, "the hydraulics of the river basin severely limit the potential for eutrophic conditions."[295] In other words, the very thing that made the Merrimack such a challenge for river-running fish was keeping algal blooms at bay. Figure 4.5 shows the levels of phosphorus measured in August 1974 and in August 1981 at the same stations as in Figure 4.5.[296]

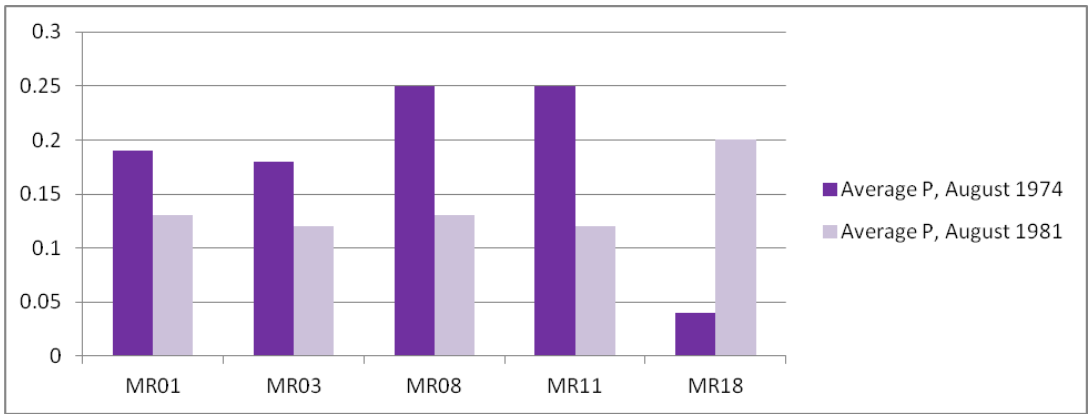

Figure 4.5. Average Phosphorus Levels Measured at Five Stations Along the Merrimack River in August 1974 and in August 1981.

With reductions in nitrates, phosphorus, and coliform bacteria, dissolved oxygen levels increased. Figure 4.6 compares the DO measured in the Merrimack River in August of 1974 and

294. Johnson, *A Report on Water Quality Conditions and Pollution Abatement in the Merrimack River Basin in Massachusetts*, 82.

295. Johnson, *A Report on Water Quality Conditions and Pollution Abatement in the Merrimack River Basin in Massachusetts*, 84.

296. Water Quality Section, *Merrimack River Water Quality Survey Data 1974*, 49 – 59; Technical Services Branch, *The Merrimack River: 1981 Water Quality Survey Data, Wastewater Discharge Data*, 52 – 58.

the DO levels measured in July of 1979. The change in DO since 1972 can mostly be attributed to the removal of municipal wastes that demand oxygen from the river. Of the mile markers from the 1974 study, only one of them (MR18) has a mean DO of 5.0 mg/L or higher. By 1979, every station from Stony Brook to Plum Island had measured at least a DO of 5.0 mg/L – as a *minimum* level. Mean values regularly exceeded the Class B standard by 60 percent.[297]

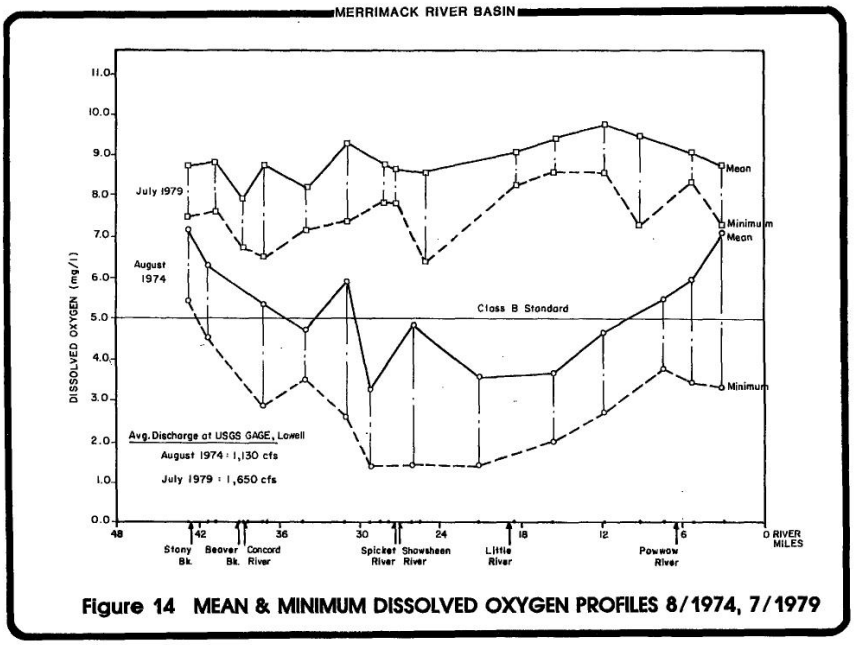

Figure 4.6. "Figure 14, Mean & Minimum Dissolved Oxygen Profiles 8/1974, 7/1979."

Wastewater treatment eliminated most of the waste that had been deposited in the river from urban discharges. Compared to the biochemical oxygen demand of the river before water treatment, Lowell saw a 62 percent reduction by 1985. For Lawrence, it was a reduction of 88 percent, and for

297. Johnson, *A Report on Water Quality Conditions and Pollution Abatement in the Merrimack River Basin in Massachusetts*, 74 – 75. Dissolved oxygen is partially dependent on biochemical oxygen demand, as well as the reaeration potential of the stream and photosynthetic oxygen input. Reaeration potential depends largely on hydrogeological factors that will remain stable over time. Reaeration potential is based on depth, velocity, and turbulence, and photosynthetic oxygen input by phytoplankton, periphyton, and aquatic vascular vegetation (74). Water quality surveys regularly report DO, but wastewater discharges are not measured for DO because it is an ambient rather than a discharge standard.

Haverhill it was a reduction of 94 percent.[298] Evidence of the changes in water quality corresponds with the anecdotal evidence offered by Arnold and Woodberry in the summer of 1981. They put into the river at Lawrence, near mile marker 29.20. Figure 4.7 summarizes the results measured at mile marker 29.20. The minimum values of dissolved oxygen measured in 1981 exceeded the mean values of dissolved oxygen measured just seven years earlier.[299]

Test date	minimum DO (mg/L)	mean DO (mg/L)
July 1974	5.0	6.7
August 1974	1.4	3.2
June-July 1981	7.6	8.4
August 1981	7.5	7.8

Figure 4.7. Dissolved Oxgyen (DO) Levels Measured at Mile Marker 29.20, Lawrence, Massachusetts.

Water pollution control used industrial means to achieve more natural ends. In this way it was a direct departure even from the river management of the Sixties. The removal of so much of the biological oxygen demand between 1974 and 1979 was an achievement by any measure. The relatively safe levels of nutrients – nitrogen and phosphorus – afforded the possibility that there could be more aquatic life in a stream with more dissolved oxygen available. For the first time since the *Week* of Thoreau, entire stretches of the Merrimack were open to new possibilities – fish, wildlife, and recreation. It would now remain to be seen how much nature could be afforded when rivers could still be useful as sources of power.

298. Johnson, *A Report on Water Quality Conditions and Pollution Abatement in the Merrimack River Basin in Massachusetts*, 51. The information is adapted from Table 11, "Estimated BOD Loadings to the Merrimack River in Lowell, Lawrence, and Haverhill.

299. Water Quality Section, Division of Water Pollution Control, Massachusetts Water Resource Commission. *Merrimack River 1974 Water Quality Survey Data* (Westborough: Massachusetts Division of Water Pollution Control, 1974), 36; Technical Services Branch, Massachusetts Division of Water Pollution Control, Department of Environmental Quality Engineering, *The Merrimack River: 1981 Water Quality Survey Data, Wastewater Discharge Data* (Westborough: Massachusetts Department of Environmental Quality Engineering, 1982), 34.

* * * *

Hydropower came to the Merrimack River before the Civil War. But in the years since World War II, the industries had left the dams in the stream. For as long as anyone could remember, the dams had kept the sport fishing downstream of Lawrence. One writer called the Great Stone Dam "almost solely scenic" as late as 1978.[300] But the presence of those dams was a given. Fisheries managers could work around them because they were familiar. The first real change in the anadromous fisheries was not in populations of managed species – salmon, shad, and river herring – but in the marine populations of *Morone saxatilis*, the striped bass.[301]

In 1972, there were still good striped bass by Plum Island for anyone who could catch them. In September of that year, Larry Comeau of Salem claimed a bounty at the Plum Island Striped Bass Derby. For several years, Mickey Villane had offered a hundred dollars to anyone who could land a striper of sixty pounds or more in weight. For several years, the uncollected bounties were carried over to the next year. When Comeau took that 61-pound, 2-ounce striper in September of 1972, he collected more than a thousand dollars for the biggest striper in recent memory.[302] The conversion of another Eastern river would make it almost certain that stripers of that size would never be catchable in the Merrimack River again.

In the early Seventies, a few groups came together to discuss the striped bass of the Massachusetts coastline. In May of 1973, the Striped Bass Fund held its charter meeting for the Boston area at Boston University. It was, in the words of Monty Montgomery, "the group that

300. Jerry Ackerman,"The Economy: Water Power – New England's Neglected Legacy; Hundreds of Area Dams Could Generate Electricity," *Boston Globe*, September 18, 1977, 65.

301. "Morone Saxatilis (Walbaum, 1792) Striped Bass," http://www.fishbase.org/summary/353. Accessed: March 15, 2016.

302. Henry Moore, "Plum Island Fisherman Nets 61-Pound Bass," *Boston Globe*, September 26, 1972, 33.

has come into being for the preservation of striped bass," especially in their spawning grounds in the Hudson River, "whence cometh our New England stripers." The "umpteenth annual" Plum Island Fly Rod Tournament would be on June 23 and 24. The stripers were already in the river in May, "running from 12 to 18 inches, with about three shorts for every legal fish. Last year it was 25 shorts for every legal fish."[303] Striped bass were already becoming smaller and fewer.

In July of 1974, Monty Montgomery reported on what people were seeing out in the coastline waters off Massachusetts. "If you are the sort of person who likes to speculate on how our world changes," he wrote, "the Fishfinder has added information. . . . something is happening out there with the fish." Nine squeteague between eight and ten pounds were taken at Eastham Beach. A large catch of bluefish was made at Brunswick, Maine, "the first time they have been found so far north since the 1880s." There was "something slowly evolving out there, some basic change in the ocean, of which these fish are a sign."[304]

In 1976, John Botty reported on what people were saying and offered an explanation.

> From every port along the Massachusetts coastline comes the haunting question: Where have all the striped bass gone? What has happened to the bass fishing that we used to know and love? The emergence of the bluefish into area waters in numbers larger than ever may be the cause of the bass fishing problem. Big bass remain, but smaller ones cannot peacefully co-exist with the voracious blues, who devour anything resembling food.[305]

Where were the big old striped bass? The story goes back to the early Sixties. In 1964, the Consolidated Edison Company of New York (Con Ed) proposed the Cornwall Project, a large, pumped-storage facility to be built on Storm King Mountain "overlooking the scenic

303. Monty Montgomery, "Striped Bass Need Friends," *Boston Globe*, May 17, 1973, 66.

304. Monty Montgomery, "Globe Fishfinder: Squeteague, Blues Disrupt the Pattern," *Boston Globe*, July 19, 1974, 33.

305 John Botty, "Globe Fishfinder: Where Have All the Stripers Gone?" *Boston Globe*, August 20, 1976, 34.

Hudson River Valley." Aesthetic issues raised by opponents of the project soon gave way to a series of lawsuits and hearings that soon focused on the "potential impacts" of the facility's water withdrawals on the Hudson River striped bass population. These litigations came to involve five utility companies, four federal agencies, the states of New York and Massachusetts, and "a host" of local and national civic organizations and citizens' groups.[306]

When the Indian Point Unit 2 nuclear plant was completed just over fifteen miles downriver from the Cornwall Project, "it could not be denied" that two projects on the river would kill striped bass. Young stripers would be entrained through the condensers with the water and killed by "thermal and mechanical stress." Other fish would be killed by impingement, or trapping, on the trash screens at Indian Point. But it was less clear whether these deaths would really affect the striped bass population "as a whole." Of the hundreds of thousands of eggs were laid by the average spawning female, only a few survive to adulthood. Removing smaller fish may actually allow the remaining fish to grow faster or survive better, or both – thus "compensating" for the loss. In the absence of direct evidence to explain such complex relationships, ecologists and engineers turned to mathematical modeling.[307]

The engineers designing the Cornwall project were typically expansive in their predictions for the effects of the dam on the Hudson River. Their first model compared the average daily withdrawal by the Cornwall facility to the average daily tidal flow of the Hudson. It was found to underestimate "systematically" the magnitude of entrainment losses. A second and "more advanced" model, developed by an engineering firm for Con Ed, assumed that all

306. L. W. Barnthouse,, J. Boreman,, S. W. Christensen, C. P. Goodyear, W.Van Winkle, and D. S. Vaughan, "Population Biology in the Courtroom: The Hudson River Controversy," *BioScience*, 34, no. 1 (1984): 14.

307. Barnthouse et al., "Population Biology in the Courtroom," 14. The authors give 25 kilometers as the measurement; 25 × 0.62 = 15.5 miles.

"entrainable" striped bass life stages were "uniformly distributed" throughout the estuary, and then compared the volume of water withdrawn by Indian Point to the total volume of the estuary. According to the calculations performed by the engineering firm, the operation of Indian Point Unit 2 with "once-through cooling" for one year would have "only a negligible effect" on the adult striped bass population."[308] It seemed as though the people of the Hudson could have it all – cheaper power, year-round, and a few stripers to catch in the warmer months.

Public officials were less sanguine about such happy predictions. The Atomic Energy Commission (AEC) rejected that second model and focused instead on the effect of estuarine circulation on the "vulnerability" of striped bass eggs and larvae to entrainment. River surveys in the Fifties and Sixties had shown how stripers had spawned upstream of where Indian Point now stood, but that their eggs and larvae "spread rapidly downriver," possibly in a saltwater layer of water moving upstream below a freshwater layer flowing downstream above it. Fish carried upstream at night could be carried back downstream by day on an "endless belt" that could expose fish to the Indian Point system many times more than a single run. Oak Ridge National Laboratory specialists developed a model from this that showed how 30 to 50 percent of striped bass could be killed by this process. This model, like the one from the engineering firm, was later criticized for being too simplistic.[309]

In 1972, ecologists were making new models from older ones. The latest version combined hydrodynamic transport equations with density-dependent mortality-rate functions designed to "simulate" the effects of biological compensation. That compensation was assumed to allow entrainment mortality to be "offset" by a decrease in the natural mortality rate of the

308. Barnthouse et al., "Population Biology in the Courtroom," 15.

309. Barnthouse et al., "Population Biology in the Courtroom," 15.

nonentrained striped bass. In other words, fish killed by the turbines would be offset by a decrease in fish mortality among fish that were not killed by the turbines. When the Atomic Safety Licensing Board ruled that the effects of entrainment had not been sufficiently studied, Con Ed appealed that decision. This was roughly the situation when Monty Montgomery invited interested parties over to Boston University to hear from "the heavy hitters" in fish ecology and sports fishing in the spring of 1973.[310]

In 1973, the appeal board sided with Con Ed's engineers. Other entrainment models proliferated fairly quickly over the next several years, but these models failed for two reasons. First, hydrodynamic equations – like the ones designed to predict the actions of a layer of saltwater – do not explain the movement of young striped bass by themselves. Second, it has proven impossible to obtain "reliable estimates" of the magnitude of biological compensation.[311] In other words, no one could tell – even in 1984 – how many of the fish would grow up to replace the ones that were killed. The development of a massive database of information on the life history, abundance, movement, and distribution of "young-of-the-year" stripers in the Hudson River allowed scientists to replace simulations with observations. They could base their predictions on what they were actually measuring.

Ecologists applied classical fishing theory to the Hudson River. They used Ricker's conditional mortality rate equation, $\mathbf{m = 1 - e^{-Ft}}$: **F** is the instantaneous rate of fishing mortality, and **t** is the duration of the period during which young fish are "vulnerable" to entrainment and impingement. As **F** and **t** increase, $\mathbf{e^{-Ft}}$ approaches zero, and the mortality rate approaches 1. Ecologists found that the conditional mortality rate of stripers was approximately equal to the

310. Barnthouse et al., "Population Biology in the Courtroom," 15 – 16; Monty Montgomery, "Striped Bass Need Friends," 66.

311. Barnthouse et al., "Population Biology in the Courtroom," 16.

fractional reduction in year-class abundance caused by entrainment and impingement.[312] In other words, stripers of every age were dying because they were being trapped by the dams in the Hudson. The survivors were smaller, and they were easier pickings for the invading bluefish.

The release of such information in the direct impact assessments led to a settlement in December of 1980. Ecologists showed that "the only demonstrably effective way" to reduce entrainment would be to reduce the amount of water withdrawn by the plants through cooling towers, reducing cooling flow, and increasing the temperature of discharged water, or by shutting down generating units when "entrainable organisms" are abundant in the river. The utilities were willing to "implement" flow reductions and scheduled shutdowns as an "alternative" to cooling towers.[313] Cooling towers would be expensive to build. Schedules could always be adjusted.

In the meantime, the fisheries were shifting away from the populations that were available less than a decade earlier. Smaller bass were easier game for bluefish. 1978 was the sixth straight summer that bluefish had moved inshore north of Boston, although there were a few large stripers, "to 34 pounds," in the Merrimack River-Parker River estuary. There was "fairly steady fishing" on the Joppa Flats for school bass, and "a few anglers" had been "cut off" by bluefish inside the Merrimack. Bluefish were being seen "far offshore."[314] In July of 1980, bluefish had "taken over" the Massachusetts shoreline and were "even moving inland."[315] In

312. Barnthouse et al., "Population Biology in the Courtroom," 17. **e-Ft = 1/eFt** . As **F** and **t** increase, **1/eFt** approaches **1**/∞. **1**/∞ = 0. The natural logarithm **e** has a transcendental decimal, so **1/eFt** will never reach zero. But we can imagine a few stranded fish that could escape the predation of fishers, and how such fish could become unable to reproduce another generation.

313. Barnthouse et al. "Population Biology in the Courtroom," 17.

314. Monty Montgomery, "Globe Fishfinder: Army of Bluefish Due," *Boston Globe*, June 30, 1978, 37.

315. Spider Andresen, "Globe Fishfinder: Bluefish Are Hogging the Limelight," *Boston Globe*, July 18, 1980, 28.

June of 1981, Tony Chamberlain reported "one of those rare occurrences of a decade – acres and acres of large stripers schooling on the surface of Cape Cod Bay near The Path, most likely chasing shrimp." Five "good-sized" striped bass, between 25 and 35 pounds, were taken by boats off Plum Island a few days earlier.[316] In September of 1981, one fisherman said, "You know, I'm getting tired of the stuff. We've got it coming out of our ears." He meant bluefish.[317]

The story of the Hudson tells us about some of the challenges in developing an American river for modern hydropower. For one thing, no one could predict how the fish would react. Engineers and scientists argued about models. Private industry competed with government to set rules that would keep the companies from having to finance every new idea, or from having to pay to redress every unexpected ecological downturn. In the meantime, the stripers continued to wane. Even if there were some biological compensation – a major factor that no one could reliably predict – the newer stripers would now have to endure a bluefish invasion that cut further into their juvenile populations off the Massachusetts coastline. So it was that the only healthy anadromous fishery in the Merrimack would already be in trouble when fish restoration would resume upstream after nearly three-quarters of a century.

* * * *

For the managed fisheries of the Merrimack River, the Seventies were a time of experimentation with different ways of restoring salmon. But Atlantic salmon returns were quite modest. From 1978 to 1980, more than 300,000 fry, and more than 100,000 smolts, were released. The conversion of Atlantic salmon to lake fish during the Seventies showed that salmon could survive in lakes, but it did not necessarily mean that other transplanted Atlantic

316. Tony Chamberlain, "Fishfinder: Stripers on Parade in Rare Cape Show," *Boston Globe*, June 26, 1.

317. Tony Chamberlain, "Fishfinder: Bluefish Tasty in Variety of Recipes," *Boston Globe*, September 4, 1981, 47.

salmon would then become river-runners. Only 0.57 per thousand of the smolts released in 1981 were counted among later returns.[318] At that rate, it would take a million smolts to return 570 salmon. To get to a respectable number – say, 5,000 Atlantic salmon – there would have to be almost nine million smolts released into the Merrimack River, and the survival rates would have to stay up long enough to bring back so many adults. And even in such happy circumstances, the dams would still be in the way.

Shad had a different history; after all, the shad is a very different fish. The American shad (*Alosa sapidissima* [Wilson]) is generally smaller, but sturdier, than Atlantic salmon.[319] In 1933 an ichthyologist at the *Lowell Courier-Citizen* had estimated that as many as 365,000 American shad had once returned annually to the Merrimack River.[320] In June of 1969, Richard Seamans of New Hampshire Fish and Game observed that although it probably would be "impractical" to restore shad and salmon to "their original historic abundance," research in the last few years had clearly demonstrated that "the Merrimack watershed still contains the potential for producing annual runs approaching a million adult shad and up to 11,000 Atlantic

318. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review: Anadromous Fish Restoration Program, Merrimack River* (Nashua, NH: Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, 1997), 38, 44, 46. Smolt releases for 1978 and 1979 are unavailable.

319. "*Alosa sapidissima* (Wilson, 1811): American Shad," http://www.fishbase.org/summary/1584; "*Salmo salar* (Linnaeus, 1758), Atlantic Salmon," http://www.fishbase.org/summary/Salmo-salar.html. The maximum length of an Atlantic salmon is 150 cm (about four feet); American shad have a maximum length of about 76 cm (about two-and-a-half feet). But in terms of common length, the average shad comes in at 50 cm, while the common length of an Atlantic salmon is 39 cm. Thus an Atlantic salmon *can* be physically twice the size of an American shad, but is typically only about 78 percent the size of a commonly found American shad. An American shad is commonly just under two-thirds (65.8 percent) its maximum size; in the case of Atlantic salmon, the common size is more like 26 percent of the maximum size.

320. "Memories Along the River Banck," *Boston Globe*, December 21, 1933, 36.

salmon.[321] Even if a fraction of those million shad could be restored, those new shad would represent many more fish – and much more marine biomass – than most people would recall.

Shad work started on the Connecticut River. From the late Sixties through 1978, shad eggs were harvested from adult shad gill-netted downstream of the Holyoke Dam. From 1969 through 1971, there were releases in two locations. In 1969, almost a million were released above Hooksett Dam, while 1,420,000 were broadcast above Pawtucket Dam. In 1970 and 1971, the release locations were above Sewalls Falls Dam and above Pawtucket Dam. Numbers released varied, but the usual minimum was in the range of a half-million eggs.[322]

Shad were gill-netted in the early Seventies, but the "few shad" netted in 1973 and 1974 and "the lack of any visual observations" at the base of the Essex Dam or downstream "suggested that the population entering the river was extremely small." Adult shad were observed in 1976 and 1977, and even without fish counts "the visual observations indicated that more shad were in the lower river than in the past." A few shad "managed to negotiate" the "ineffective" fish ladder at the Essex Dam, but a new fish lift would be part of the plan to convert the dam for hydroelectric power. Reliable fish counts would arrive with the opening of the new Essex Dam Fish Lift in 1983.[323]

Two species, alewife and blueback herring, were rated as "river herring". Alewifes and blueback herring can only really be discerned by cutting open fish to see the color of the

321. Henry Moore, "Rod and Gun: Maine Salmon Below Peak," *Boston Globe*, June 3, 1969, 30.

322. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review*, 55. In 1970, the releases were 450,000 above Sewalls Falls Dam and 540,000 above Pawtucket Dam. In 1971, the releases were 1,330,000 and 568,000 respectively.

323. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review*, 57.

innards.[324] Unlike the salmon and shad, river herring were not hatched and released from transplanted stocks. In the late Sixties, there were still so many herring that fishers had to try different strategies to attract striped bass. "You see why we're loaded with bait," explained Mickey Villaine, who was fishing the mouth of the Merrimack in July of 1968. "The river is full of herring. There's plenty of mackerel and eels." The stripers were "so full of a natural diet" that fishers had to "tease them into striking by offering something different. That's the way we did it in the past."[325]

For years the herring were plentiful, but heavy overfishing after the War had demolished their numbers by the Seventies. An estimated 75 million pounds of river herring were taken by humans along the eastern coastline of the United States in 1958.[326] Commercial landings of alewife in Massachusetts ranged between 8,000 and 16,000 metric tons in the Fifties and Sixties.[327] Birds and fish liked river herring, too. A 1968 study showed that blueback herring made up 99.6 percent of the fish eaten by fifteen red-breasted mergansers collected in Rhode Island.[328] In May of 1971, striped bass were "feeding all night" on "spent" alewives.[329] In 1979,

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324. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review*, 62 – 63. "The most reliable identifying characteristic is the color of the tissue lining the body cavity, dark brown or blackish in the blueback herring and grey or silvery in the alewife."

325. Mike Beatrice, "The Great Outdoors: Stripers Demand Different Diet Off Plum Island," *Boston Globe*, July 16, 1968, 28.

326. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review*, 62 – 64.

327. Tim Purinton, Frances Doyle, and Robert D. Stevenson, *Status of River Herring on the North Shore of Massachusetts* (2003) 8. www.businessevision.info/parker_river/Final_anadromous_fish_report.pdf Accessed: January 2, 2014.

328. Richard S. Stott and David P. Olson, "Food-Habitat Relationship of Sea Ducks on the New Hampshire Coastline," *Ecology*, 54, no. 5 (1973): 996 – 1007 (citation 1003). Stott and Olson cite a study by Cronan and Halla.

329. M. R. Montgomery, "Woods and Shore: Bass Fishing at Night Just Right on Merrimack River," *Boston Globe*, July 7, 1971, 28.

a half-million alewives would still make their run up Stoney Brook on Cape Cod, where they would deposit between 60,000 and 100,000 eggs in Lower Mill Pond.[330] But with every year of heavy fishing in the northwest Atlantic, the transformation of the marine fisheries would lead the river herring into decline. In a 1990 report, the "status" of each of fifteen river herring stocks along the East coast was "examined" and nine of them were "judged to be either overfished or severely depleted."[331]

Fish ecologists who worked with anadromous species knew that they were releasing their crafted juveniles into the wild. We can probably envision bluefish predation of juveniles. We know that the "blues" took plenty of bait fish at the mouth of the river in the summer of 1973.[332] We can also see, from the early reports of fish restoration during the Seventies, that the Merrimack was at least hospitable to some of the returning populations of salmon, shad, and river herring. It was possible, at least on the smallest scale, to conceive of ecological relations restored for a few dozen fish at a time or for a few hundred fish at a certain point below Lawrence. With proper fish passage, it would be conceivable that more such ecological relations could be restored – and that more fish would come back annually.

But it was the prospect of cheaper energy that really came to challenge the fisheries of the Merrimack. There was a national energy crisis, and local communities were looking to reduce energy costs even as the first efforts at anadromous fish restoration unfolded in the watershed. The cost of primary construction that was contested in the Hudson River Valley was mooted by the historic structures already in place. If the dams could be tied into the energy system, then

330. Anne LeClaire, "See How They Run: Where to Catch the Herring' Annual Migration on Cape Cod," *Boston Globe*, April 26, 1979, A16.

331. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review: Anadromous Fish Restoration Program, Merrimack River*, 63.

332. Henry Moore, "North Shore Bluefishing Turns Plum Wild," *Boston Globe*, July 24, 1973, 35.

their product – millions of gallons of water, every day of the year, for anyone who could use that power – would be readily available. So, the dams were put back to work. The fish just being restored in the Seventies would have to adapt to a broken stream in the years ahead.

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Nowadays the environmentally conscious thinker is an opponent of new dams that cut fish off from their natural habitats. But in the vaunted "environmental decade", the benefits of hydropower were still very seductive. In September of 1977, Jerry Ackerman wrote that water power, the "motive force which propelled New England to industrial dominance over the nation a century and a half ago," was "making a comeback." Lawrence was one of the sites that he mentioned where plans were being laid to "tap the flow of the region's rivers for some of the cleanest, most efficient energy production available – hydropower." The dams already in place carried "practically no pollution problems – no sulfur fumes upsetting the public health and plant life downwind, no threat of nuclear accidents should a reactor run amok."[333] White coal, it seemed, was the answer to every modern energy problem.

The Merrimack Dam, as Ackerman called the 132-year-old structure standing in the Merrimack River at Lawrence, was "almost solely scenic." A Boston-based group, Lawrence Hydropower Associates (LHA), had filed an application with the Federal Power Commission for a license to make electricity in a powerhouse at the south end of the dam. The group said that with a $16 million investment, they could install two turbines with a capacity of 14 megawatts. Ackerman noted that this was about 2 percent of what the Pilgrim nuclear power plant in Plymouth or the Mystic No. 7 generator in Everett could produce, but that amount could light the town of North Andover. LHA partner Geoffrey Mitchell said that the plant would only run about

333. Jerry Ackerman, "Water Power – New England's Neglected Legacy: Hundreds of Area Dams Could Generate Electricity," *Boston Globe*, September 18, 1977, 65.

70 percent of the year. In Ackerman's words, it would run "almost nonstop, with a fuel cost of zero." The New England Power Company had agreed to purchase the electricity at a price to be negotiated, "but expected to be in the range of 3 to 3 ½ cents per kilowatt hour – competitive with any other new source of power."[334]

Government officials were right on board. "A lot of people don't realize that the industrial revolution took place right here," said Joe Pecoraro of the Department of Energy. "It developed around cheap water power." Pecoraro noted in March of 1978 that seventy percent of the power in New England was being generated with oil. "A more balanced picture is what we're shooting for. I'm not saying we don't need nuclear. That's part of it. But so is low-head (small-dam) hydro. God put the water there, and we should use it." A 1977 estimate by the Army Corps of Engineers put the productive value of small dams at 2432 megawatts, in contrast to the existing regional hydroelectric facilities that had a capacity of 1426 megawatts. Estimates of the per-kilowatt cost of refitting a dam for hydroelectric use would range from $350 to $200. With the current "state of the art," the average cost would be "about $1000." In contrast, the cost for the Seabrook nuclear plant, whose twin nuclear units were each expected to produce 1150 megawatts, had jumped from $100 million in 1968 to more than $2 billion by 1977. That would put the cost of the 2300 megawatts at about $1,000 apiece.[335]

The rising price of oil was a key factor in the argument for hydroelectric power in the Merrimack River. Jack Mankowski, a spokesman for the Lawrence Hydropower Associates, figured the cost for the LHA project at $15.7 million. "In 1973 and 1974 fuel-oil prices jumped several fold and are expected to increase in the future," he explained. The New England Power

334. Ackerman, "Water Power," 65.

335. Alan Henry, "Small Dams: Energy Wasted," *Boston Globe*, March 12, 1978, 33, 38.

Pool estimated a cost of $30 a barrel by 1984. There had also been "major inflationary costs" with nuclear power plants. In capital costs, "as far as inflation is concerned," hydropower was just as cheap. "And our energy costs will stay the same. As time goes on the advantage of hydro will increase, and I think you're going to get more of it."[336]

In May of 1978, Richard H. Stewart, a staff writer for *New England* magazine, did a feature article for the *Globe* that showed a federal hydropower map of the United States, where the concentration of such projects showed "abundance" in the South and Northwest. "None exist in the Northeast." Stewart had a different estimate for the proportion of oil-driven power offered by Joe Percoraro of the Department of Energy, but Stewart's argument was very similar. "Fifty-seven percent of the electric power produced in New England is generated by oil-fired power plants" that consumed 72 million barrels of oil at a cost of $1 billion annually. "That is money that flows out of the United States, escalates our imbalance of trade deficits, and promotes domestic inflation.

> Any alternative that reduces our demand for oil has to be considered a plus. Water is such an alternative. Unlike oil, it is an almost limitless resource and essentially free of charge. Adding to its appeal is the fact that hydroelectric plants don't pollute.[337]

Other experts seized on the allure of local power sources in saving money on fossil fuels. Louis B. Klotz, a civil engineering professor at the University of New Hampshire noted that local residents "could work in the towns where they live. They wouldn't have to commute 30 to 50 miles away and use all that gasoline. That's another saving."[338] It seemed that dams had it

336. Henry, "Small Dams: Energy Wasted," 38.

337. Richard Stewart, "ENERGY: Could Water Bail Us Out?" *Boston Globe*, May 7, 1978, E66.

338. Stewart, "ENERGY," E67.

all – cheap, clean, renewable, local, and independent. No wonder that a federal official from the new Department of Energy thought of the water power as a godsend in a time of crisis.

For a region famous for its hydropower, New England had never been particularly reliant on hydroelectricity. About 16 percent of the United States – 6 percent of New England – got power from hydroelectric plants, compared to 70 percent of Canada. A Maine legislative committee had determined in 1976 that hydroelectric dams were not a "long-run" solution to the state's energy needs, even if they could be used by "business and municipalities." In New Hampshire, a special commission had found in 1977 that redevelopment of former electric sites "should not presently be encouraged as an economical energy source," but this report and the commission were criticized by hydroelectric advocates because the Governor of New Hampshire, Meldrim Thompson, had named the commission and was also known to be a backer of the Seabrook nuclear facility.[339] Environmentalists had also leveled "major criticism" at a federally-sponsored hydroelectric facility, Dickey-Lincoln, planned for the northern part of the St. John River. The massive power dam would create a lake that would flood 88,000 acres of wilderness. But with the size of the dam, in an emergency situation, the Dickey project could provide 35 days of energy before it would run out of water.[340]

Another possible source of energy was the Bay of Fundy, where Canadians were already studying a project. If fully developed, the project would have a capacity of more than 6 million megawatts, comparable to six "current-size" nuclear plants. But the Canadians would only develop "a fraction" of the power unless the United States, "primarily the Northeast," should be willing to purchase the power. Tides in the Bay of Fundy ranged from a low of 19 feet to a high

339. Stewart, "ENERGY," E69.

340. Stewart, "ENERGY," E70, E73.

of 53 feet, "considered among the most favorable in the world" for energy development. "With the world seemingly outstripping its available resources," Richard Stewart concluded, "the power of water – rivers and oceans – may one day offer the only dependable resource. That day may already be in view."[341] A marketable source of energy was only considered worthwhile if a market could be found for it.

Six months later, such a "day" was assuredly in view for Lawrence. In December of 1978, the Federal Energy Regulatory Commission (FERC) gave permission to a group of entrepreneurs to rehabilitate the Lawrence dam for hydroelectric energy. With a $16 million investment in hand, the project had an estimated cost of $23.4 million upon completion. The Lawrence Hydroelectric Associates (LHA) planned to spend $6 million on a turbine house and "related construction" and between seven and eight million dollars "to install two Allis-Chalmers turbines which will generate a peak of 14 megawatts of electricity, enough to supply a town the size of Andover." Another $1 million would be spent on fish ladders required by the U.S. Fish and Wildlife Service as part of its salmon restoration program on the Merrimack River. Real estate developer Barry Flynn, a member of the LHA, assured that the costs of the program would remain low. "As long as the river keeps running and our capital costs are completed, the price stays pretty well fixed."[342]

By the fall of 1980, some were casting aspersions. Jerry Ackerman, who had previously written on the LHA proposal at its inception, now reported on the other side of the argument.

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341. Stewart, "ENERGY," E73.

342. Jerry Ackerman, "Lawrence Dam to Tap River Power – Again," *Boston Globe*, December 14, 1978, p. 1. According to the September 1977 article, the estimated cost for the LHA project would have been $16 million, which would be worth $17,216,000 in 1978. The project went into operation in 1981. If we prorate inflation by the Consumer Price Index from 1978 to 1981, then the $23.4 million estimated in 1978 would be worth more than $32.6 million ($32,663,453.36) in 1981 dollars, or $21,747,211.90 in 1977 dollars – a cost increase of 35.92 percent over the estimate offered when the LHA applied for their license in 1977. West Egg Inflation Calculator, http://www.westegg.com/inflation/. Accessed: January 3, 2014.

"Hydroelectric power offers such a clean, safe, home-grown supply of energy for New England's future that nobody could oppose it, right? Guess again.

> After four years of virtual silence as various government agencies have promoted damming the region's rivers to produce a share of our electricity, the environmentalists are having their say. Whitewater rafting, trout fishing, the return of the Atlantic salmon, farmland, summer homes on old mill ponds – even the hope of reversing a century of river pollution – all may be threatened by the new dams, according to environmentalists and dam developers themselves. Why, since the hydropower idea got rolling in 1976, haven't we heard about these problems? [343]

Ackerman's answer goes back to the old problem of the Merrimack River: what would it cost to build something new, versus reusing what was already there? Part of the answer, Ackerman suspected, was that until that time, too little money was expected to be made from the "small-scale sort" of hydroelectric production "envisioned" for New England for anyone to get "too concerned" about adverse consequences. The "most promising" proposals were for "fixing up" old dams to produce power. All that was needed, apparently, was "some mortar and generating turbines." No one was "about to be flooded out upstream," because the pond of water behind the dam was "already there." A few years earlier, developers could only expect to get two or three cents a kilowatt hour for their output. More recent "economic realities" dictated "twice that and more." Among the 121 projects for New England hydroelectric development now pending before FERC, fourteen of them were for "new construction, where dams never existed. "I think that four months ago none of us involved thought we would ever see any interest in new dams," said Howard A. Ris, a coordinator for the New England River Basins Council. Ris put together a conference the previous Friday on what Ackerman called "hydroelectric's newfound environmental problems."[344]

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343. Jerry Ackerman, "How Worthwhile Is Hydropower? An Opposition Side Is Heard," *Boston Globe*, September 29, 1980, 19.

344. Ackerman, "How Worthwhile Is Hydropower?" 19.

One of the critics was a staff ecologist for the U.S. Fish and Wildlife Service, Vernon Lang. The thirty-six-year-old drafted a proposal the previous spring that sought to "reverse" a century of what Lang considered "abuse of our rivers and streams." Lang, reassigned from Michigan to New Hampshire in 1977 to look at how hydroelectric development would affect the New England environment, said that he was stunned to find bare rock in the bottom of the Merrimack River below the Amoskeag Dam in Manchester, New Hampshire. "All the water that goes through there is what leaks through," he said. Lang suspected that the same situation was happening in other rivers. When he found that it often was, Lang recognized why fish could not survive and why it was so hard to flush industrial and municipal sewage down the Merrimack and out to the Atlantic Ocean. Restoring that flow in the Merrimack River could have good results pretty quickly. "Within three years there's a good chance it could be fishable."[345]

Lang's proposal was straightforward. No stream should be allowed to drop more than its lowest level of water as measured in the unobstructed stream over the previous twenty-five years. Only a stream that would have gone dry in August could be allowed to do so after a dam were in place. This "philosophy" was "standard" in the West, Ackerman noted, but it was "apparently unheard of" in the East. When U.S. Fish and Wildlife adopted the proposal in April of 1980, dam developers – the ones who would have to meet such requirements – demanded that "the environmental issues be finally brought into the open." Once the meeting convened, however, the water level issue was soon swamped by "all sorts of previously unpublicized concerns" about the effects of rehabilitating old dams.[346]

Some local places were already in the way. One Vermont farmer found his low-lying cornfield underwater when a new dam owner replaced a "long-gone" set of flashboards that had

345. Ackerman, "How Worthwhile Is Hydropower?" 19.

346 Ackerman, "How Worthwhile Is Hydropower?" 19, 34.

served as a flood-control measure in earlier days. Summer residents upstream from an old dam in central Massachusetts were considering taking a dam developer to court "to preserve their view of the old mill pond." These were small issues, said Thomas B. Arnold, an environmental lawyer from Boston, compared to the issues that new dams could bring. Arnold was head of the New England Rivers Center in Boston. The 10,000 small dams on 6,800 miles of river in New England worked out to "about one and a half dams per river mile – and I think that many in the environmental community think that's enough." Susan Hockmeyer and her husband Wayne ran a whitewater rafting company, Northern Whitewater Expeditions. The Hockmeyers ran day-long rubber-raft trips through the whitewater gorges of the Kennebec and Penobscot Rivers, where new projects were proposed downstream. "These are the last two rivers of their kind in the Northeast," she explained. "You can't just dam them and have whitewater too."[347]

Fishers were also concerned. Thomas Decoster of Trout Unlimited argued that impounding water behind a dam increases the water temperature, which destroys habitat for trout, salmon, and shad, which thrive in colder waters. U.S. Fish and Wildlife estimated that five percent of the fish sucked into turbines were unable to survive. "And migrating through a turbine must be a hell of an experience," Decoster observed. But adding fish ladders to existing dam structures was not cheap. John Lyons, manager of hydroelectric power for the Public Service of New Hampshire (PSNH), said that adding fish ladders to the other costs of putting dams into operation "shoots the economics all to hell." Lyons said that unless accommodations could be made with environmental interests, no more than fifteen percent of the hydroelectric potential previously estimated for New England could be put into production. "We have to face these competing interests," Lyons explained. "We have to ask: Do we want hydro sites

347. Ackerman, "How Worthwhile Is Hydropower?" 34.

developed, or do we want to go rafting or fishing or what? We all have a right to these kinds of interests, but first we've all got to get together and tell each other what we want for our energy sources." [348]

Competing interests may have intruded on dam proposals in rural settings in Vermont and Maine. In the urban landscape of Lawrence, Massachusetts, developments went apace. On August 16, 1981, after two-and-a-half years of work, seven hundred guests were invited to the opening of what had become a $28 million hydroelectric plant near the Great Stone Dam. Now rated to produce an estimated 1 million kilowatt hours of electricity per year – enough to power 17,000 homes – the Lawrence Hydroelectric Project could now sell its power to the New England Power Company, who would distribute it through New England's power grid. The project also included a $1.5 million fish elevator that would allow Atlantic salmon and American shad to pass the dam on the way to their spawning grounds.[349]

"This plant signals the rebirth of Lawrence," said the city's mayor, Lawrence P. Lefebre, before the structure was officially dedicated. "It shows we've learned from the past how to use our natural resources. When this city was built, which was really when the Great Stone Dam was built, our resources were exploited." Governor Ed King concurred during his remarks at the dedication ceremony. "We're adding a chunk of alternative, nonoil energy to Massachusetts." U.S. Representative James M. Shannon, Democrat of the 5th District, and the Commonwealth's Energy Secretary, Joseph S. Fitzpatrick, also spoke at the ceremony.[350]

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348. Ackerman, "How Worthwhile Is Hydropower?" 34.

349. Joan Vennochi, "New Plant to Go with Old Dam: Lawrence Power Facility Dedicated," *Boston Globe*, August 17, 1981, 11.

350. Joan Vennochi, "New Plant to Go with Old Dam," 11.

The new plant had begun operations in July and would go into full commercial operation during the month of August 1981. Barry B. Flynn, a real estate developer who grew up in Lawrence and was now a member of the Lawrence Hydropower Associates, said that the Great Stone Dam had been impossible to ignore, but that it had also been a kind of symbol of the city's decline. But now, the hydroelectric plant had brought jobs and tax revenue to the City of Lawrence. It had brought $100,000 in 1981 and was projected to bring $7 million to the city over the next twenty years. Mayor Lefebre summarized the difference that the dam would make. "In my generation," he said, "you grew up and you tried to get away from the river. With this plant for our generation, we've highlighted the resources and used the river to our best advantage."[351]

That advantage would cut into the anadromous fish restoration efforts that had been underway for more than ten years. The Essex Dam Fish Lift, completed in 1982, offered the first opportunity for fish ecologists to begin systematic counts of returning anadromous fish that they had been hatching and releasing since the Seventies. In 1982, only Atlantic salmon were counted in the Merrimack River. 23 salmon were counted in 1982, of which 15 were counted at the Essex Dam Fish Lift. Of these, seven were grilse, salmon that have survived one sea-winter; 16 were two-sea-winter (2SW). In 1983, 114 Atlantic salmon were found in the river, of which 88 were counted at the fish lift in Lawrence. Of those salmon, 8 were grilse, 95 had survived two sea-winters, and 11 had survived three sea-winters (3SW). These were modest results, but given how things had been for most of the century, a few dozen Atlantic salmon were a whole lot better than no returning salmon at all.[352]

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351. Joan Vennochi, "New Plant to Go with Old Dam," 12.

352. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review*, 38, 41, 42.

Although American shad had been gill-netted in the early Seventies downstream of Lawrence, and a few adult shad were observed at the base of the Essex Dam in 1976 and 1977, ecologists later concluded that the shad runs must have been very small in those days. But a few shad got over the old fish ladder even before it was replaced. The river herring run of 3,225 observed in the spring of 1976 at Essex Dam did not make it as far as Pawtucket Dam in Lowell.[353] In 1983, 5,629 American shad and 4,794 river herring were counted in the Merrimack River. Along with 114 Atlantic salmon, these were the first stocks of restored anadromous fisheries in the Merrimack River.[354] There was plenty of work to be done.

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The Clean Water Amendments of 1972, which became the Clean Water Act in 1977, transformed the Merrimack River. Historic levels of pollution were systematically removed by a series of wastewater treatment plants. But hydropower also transformed the Merrimack. The estuary was transformed when new projects in the Hudson cut into the striped bass populations that range off the Massachusetts coastline. Upstream, hydroelectric conversion projects in the Merrimack changed the rules for fish in the stream. The river that Arnold and Woodberry encountered in June of 1981 was much cleaner than the one that flowed out of 1974, and the fish in the Merrimack after 1981 were more countable after 1983. But if the stripers at the mouth of the river would no longer taste like kerosene, then they would never again be as big as the lunkers of old. Newer dams had done the same work as the old dams of the nineteenth century. Fish restoration would have to give way to the need for cheap local water power.

353. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan and Status Review*, 57, 64.

354. Central New England Fishery Resource Office, United States Fish and Wildlife Service, "Historic Data, Anadromous Fish Returns, Merrimack River." http://www.fws.gov/northeast/cnefro/returns.html. Accessed: January 3, 2014.

5. COMPLIANCE AND COMPLAINTS.

In May of 1984, Tony Chamberlain touted the recently cleaner rivers of New England in a page-one feature in the *Boston Globe*. In his Fishfinder column, Chamberlain argued for an appreciation of local fisheries for what they held in store.

> The purist fishing snobs, those who hold that angling just ain't angling without a dose of wild, exotic – read expensive – adventure to it, miss the point some about the sport. Of course, the wilderness experience is incomparable. With the exception of certain snakes, alligators and some freshwater bass species, the further north we move, wildlife tends to grow larger and wilder. Pines grow taller and trout brighter. Yet there is another view that Thoreau– as in H.D. Thoreau, the fisherman – brings us back to. Like all things, he says, the simpler the fishing, by mere contrast the more valuable are its two gains: fish, and leisure time itself. From this view, then, the nearer home we are, the more desirable the fishing must be.[355]

Chamberlain cited the early spring returns – more than five thousand shad, nearly five thousand river herring, and 88 Atlantic salmon, among other species – counted at the Essex Dam. "An impressive list that underlines the restorative powers of even the most badly polluted industrial rivers," he wrote.[356] Those "restorative powers" relied heavily on the compliance of state and local agencies with federal standards. The Clean Water Act had allowed federal officials to enter local landscapes. Chamberlain and other avid fishers were seeing the results, not of "powers", but of the power to carry out the daily business of a Class B stream in and among a heavily settled suburban landscape.

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355. Tony Chamberlain, "Woods and Shore by Tony Chamberlain: Once-Dirty Rivers Clean Up Their Act," *Boston Globe*, May 11, 1984, 1.

356. Chamberlain, "Woods and Shore by Tony Chamberlain," 1. The Central New England Fishery Resource Office (CNEFRO) only records 1,769 river herring returning to the Essex Dam Fish Lift in 1984. Shad returns totaled 5,497, and there were 115 Atlantic salmon. May 11 is right in the middle of the spring fish run, so even if Chamberlain's herring number were incorrect the other two figures are quite close to the totals for 1984. Central New England Fishery Resource Office, "Historic Data, Anadromous Fish Returns, Merrimack River." https://www.fws.gov/northeast/cnefro/returns.html. Accessed: May 10, 2016.

In recent years, local people had taken to the cleaner Merrimack. In 1982, the University of Lowell added men's and women's crew as varsity sports. "Adding two varsity programs pleases me very much, and knowing that we'll have a new facility and a cleaner river to row in makes for a very bright picture," said Dr. James Ciszek, the university's athletic director.[357] Up in New Hampshire, there were the Amoskeag Rowing Club in Manchester and the Independence Rowing Club in New Hampshire in May of 1987. Gregory Smith, New Hampshire director of the Merrimack River Watershed Council, saw the future of recreation as a trade-off. "We as taxpayers have invested a billion dollars to clean up the river including private investment, federal, state and local investments," he said. "The recreational use of the river is the payback of that investment. The more people who get a chance to enjoy the river, which is a local asset largely, the more people who will speak up on its behalf when it's being abused."[358] Speaking up for the river meant more than promoting recreational benefits. It meant maintaining the cleaner river that had only just been rediscovered. The tools of environmental policy – impact statements, public campaigns, and the courts – were put to work in resolving local disputes.

This chapter is the story of the Merrimack River from 1984 to the end of the twentieth century. These were the years when cleaner water and river management collided with local interests. In three cases, local people challenged the public or private agencies that sought to reuse their local environs, and forced federal and state agencies to countenance local concerns. The three outcomes – a state buyout, a private buyout, and a state court decision – reveal how public and private actors could work out differences to defend the newer river. But the fish downstream of Lawrence still fought against mighty structures, and by the end of the century it

357. Bob Monahan, "Lowell is Rollin' on the River," *Boston Globe*, June 28, 1982, 1.

358. Nancy L. Marrapese, "Fun on the River: Recreation Abounding on the Merrimack with Improvements in Water Quality," *Boston Globe*, May 24, 1987, 36.

was clear that the early promising returns had collapsed. It was possible, perhaps, for the Merrimack to be a more natural river, and a more local one; but for the river-running fish that swam in cleaner waters, most of the big old dams were still very much in the way.

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The timber dam at Sewalls Falls, in Concord, New Hampshire, was a relic of the industrial past. New Hampshire streams had been tamed by Massachusetts industries for more than a century. By1845, the Boston Associates textile consortium had controlled enough dams, from Lake Winnipesaukee in New Hampshire down through Massachusetts, that they could "get a message up to New Hampshire a couple of days beforehand" and have the gatekeepers release the "requisite amount of water" into the river. "If not on the scale of the modern West," Kent C. Ryden notes, "certainly efforts like these demonstrate how New England waters have been converted into 'organic machines', to return once more to Richard White's term for the modern Columbia River: naturally occurring watercourse that have been put to work doing useful things for humans."[359]

Major rivers may have been put to work, but "even their modest tributaries were put to work as intensely as possible." Ryden argues that this is how the "flowing waters" of New England became "filled with dams and lined with factories virtually from end to end," which meant that much of New England's economy was "directly dependent on people's cultural interaction with this naturally occurring resource.

> It's not difficult to find old building foundations and fragments of dams while walking through woods along New England's streams today, or even when observing those streams from roadsides and bridges; old farm fields and pastures are not the only sites in the region that are being reclaimed and obscured by the plant growth that occurs when people leave the scene. As with the extent of forest clearance in New England through

359. Kent C. Ryden, *Landscape with Figures: Nature and Culture in New England* (Iowa City: University of Iowa Press, 2001), 228.

> the nineteenth century, it's difficult to rebuild this old landscape in the imagination and realize just how different the region's rivers looked in the past, just how extensively they were used, just how many buildings and people they supported.[360]

Despite the extent of their control over nature, Ryden argues, "New England factories' unavoidable dependence on rivers placed implacable geographical and productive limits on both the capacities of individual mills and on the regional growth of the industry as a whole." Limited in some ways by the region's hydrology and topography, factories were "tightly hemmed in by spatial considerations" as well. While entrepreneurs "could *improve* rivers, they could not *move* them," and thus "kept one foot in that older world where time and space were not easily compressed, but long and wide and hard to overcome."[361] Once that boundary was crossed, most of the dams of the Merrimack River Basin became obsolete if they could not be reused.

A century after Reconstruction, the dam at Sewalls Falls was a shambles. The thing had been collapsing for years. In 1969, when fossil fuels were still cheap, Concord Electric turned over its operating license to the Federal Power Commission and then sold the Sewalls Falls Dam to the State of New Hampshire for a dollar. Concord Electric provided $10,000 for maintenance of the structure. But the State of New Hampshire put the funds in the General Fund, annual maintenance came to an end, and the dam was "allowed to deteriorate" to the point that "many individual timbers washed out, weakening the structure."[362]

On the night of April 7 – 8, 1984, a storm destroyed the spillway. A little less than ninety years after the *Concord Evening Monitor* had called it "the finest dam in New England," the

360. Ryden, *Landscape with Figures*, 238.

361. Ryden, *Landscape with Figures*, 240.

362. Historic American Engineering Record, "Sewall's Falls Hydroelectric Facility (Sewall's Falls Dam)," 4 – 5.

largest timber dam in the Eastern United States was destroyed.[363] The collapse of the old dam invited the possibility of a newer and more efficient one, in the manner of the other dams downstream that provided local hydropower to cities and towns. In 1985, an association of developers, led by Rodman Rockefeller, son of former New York Governor Nelson Rockefeller, led a group of investors to the water's edge. The proposed developers, Sewalls Falls Hydroelectric Development Association, "insisted" before the state Water Resources Board that "the public benefits" of their project outweighed any "negative environmental points." The developers estimated, in December of 1985, that their project would make $4.6 million for the state over the next fifteen years, while Concord would get $2.6 million in property taxes. They had planned to sell the energy to a utility for $0.105 a kilowatt hour, according to E. J. Garceau of Seaward Developers. The builders had planned to "sweeten the project" by adding a fish ladder, "'public viewing vistas,'" picnic tables, and a boat ramp, which could be used by power boaters and flat-water canoes "when the river is dammed and backed up for nearly seven miles," according to "project lawyer" Robert Larsen.[364]

"Big deal," said Timothy Savard, a Concord fishing enthusiast. Savard explained the issue as he saw it.

> This whole region has picnic tables and boat ramps. But this is a unique piece of river that's been returned to the way the Indians saw it. Look at it. It's some of the most beautiful water in the state. [365]

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363. Historic American Engineering Record, Northeast Region, National Park Service, "Sewall's Falls Hydroelectric Facility (Sewall's Falls Dam), East End of Second Street, Spanning the Merrimack River, Concord, Merrimack County, New Hampshire," HAER No. NH-20 (HAER NH 7-CON, 11-), 5. http://lcweb2.loc.gov/pnp/habshaer/nh/nh0200/nh0232/data Accessed: January 5, 2014. Please note: The relevant file, which cannot be hyperlinked directly, is nh0232data.pdf.

364. "Fishermen Fight Developers Over Sewalls Falls Hydro Dam." *The Telegraph*, December 6, 1985, 34.

365. "Fishermen Fight Developers Over Sewalls Falls Hydro Dam," *The Telegraph*, December 6, 1985, 34.

Even if we set aside the idea of seeing the Merrimack in anything like "the way the Indians saw it", the rise of a new dam proposal was certainly a threat to a more natural river in the middle of Concord, New Hampshire. The U.S. Fish and Wildlife Service (USFWS) estimated that the population of Atlantic salmon would be reduced by 9 to 14 percent by a future dam project downstream of the old timber dam. USFWS officials, in testimony before the Federal Energy Regulatory Commission, said that "even the most sophisticated fish ladders can't compare with open and unobstructed water." The developers contended that the number of salmon, trout, and other fish that might be disturbed would be "so small" that populations would be affected, according to Mr. Larsen's own words, "in a very small way." Developers would replace the 1.4 miles of submerged rapids by dredging a channel below the falls. The channel, "replete with rocks and boulders," would "give fish a resting place and make up for the lost fishing area above the falls," according to Peter Miller, the developers' environmental consultant.[366] There was plenty of room to be optimistic about fish if it would help the dam project to its conclusion.

Fisheries biologists were less sanguine about the prospects of salmon with a new dam in place. On September 10, 1986, New Hampshire Fish and Game decided to appeal to the state Supreme Court to block construction of the Sewalls Falls hydroelectric dam after a permit was granted in June. The Friends of the Merrimack, a five-thousand-member river conservation group, joined in the appeal. Ted Spurr, supervisor of fisheries research, said that if the dam were

366. "Fishermen Fight Developers Over Sewalls Falls Hydro Dam," 34.

to be built, "we would have one more fish pond, of which we already have 2,000 in the state," whereas the Merrimack was one of only four rapid rivers in New Hampshire.[367]

Public officials started to choose sides. On January 16, 1987, Representative Robert Smith, Republican of New Hampshire, joined United States Senator Gordon Humphrey and Representative Judd Gregg, both New Hampshire Republicans, in opposing the proposed dam. New Hampshire's other U.S. Senator, Warren Rudman, had not announced his position on the dam. In 1986, New Hampshire's Water Resources Board had "narrowly" approved the dam proposal, triggering an appeal to the New Hampshire State Supreme Court. Governor John Sununu, also a Republican, supported the dam, saying that he had seen no good evidence that the dam would harm the fish restoration program established by U.S. Fish and Wildlife and the two state fish and game agencies in the Merrimack River.[368]

It was not long before the local story got out. In early February of 1987, the *Schenectady Gazette* picked up the story of a native son of New York leading a development group that had sought a permit to bring 30 million kilowatt hours of electricity annually to New Hampshire. That was enough power for about 4,000 homes. But this story already showed how local pressure was changing the definition of the dam project. Rockefeller's group had recently offered to stock the river with young salmon, "possibly trucking the fish around obstacles" in the dam.[369] Even the discussion of such concessions shows that pressure was beginning to tell.

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367. "State Fish & Game to Help Block Sewalls Falls Dam." *Lewiston Daily Sun*, September 11, 1986, 51.

368. "Smith Joins Opponents to Proposed Hydroelectric Dam at Sewalls Falls," *The Telegraph*, January 16, 1987, 26.

369. Deirdre Wilson, "Salmon at Stake in Intense Battle Over Hydroelectric Dam," *Schenectady Gazette*, February 5, 1987, 19.

USFWS and more than twenty-five state and private conservation groups disagreed with such industrial solutions to industrial problems. They countered the optimism of company officials with hard scientific evidence of their own. If approved, the dam project at Sewalls Falls would "kill" the twenty-year effort to restore Atlantic salmon to the "once-polluted" Merrimack. The state office of the Fish and Wildlife Service had concluded that the dam would lower to about 25 percent the chance of successfully restoring salmon and other fish to the Merrimack by the year 2035. Without the dam, the fish restoration project had between a 50 and 90 percent chance of success, depending on whether anglers would be allowed to keep the salmon they would catch. The agency contended that the dam would prevent eight percent of the salmon population from reaching spawning areas upstream or migrating to the ocean, even with the required presence of fish ladders. Both the U.S. Fish and Wildlife Service and New Hampshire Fish and Game had "vowed" to pull out of the restoration effort if the dam were approved.[370]

The key, as the dam opponents saw it, was gaining federal support for the local movement. The move for National Wild and Scenic River designation was in its "earliest stages", but Glenn Eugster of the National Park Service, the official who oversaw the protection program in the Northeast, predicted "rapid congressional approval" of the first step, a study of the river. The dam could not be licensed while the two-to-three-year study was being conducted. The "values" of the Merrimack River in the Sewalls Falls area stacked up "very, very well" with other rivers that had been found to qualify for the designation. "It's pretty unique," said Eugster, "to find a river with those qualities so close to concentrations of people."[371]

370. Wilson, "Salmon at Stake in Intense Battle Over Hydroelectric Dam," 19.

371. "Dam Foes Hope for Protection of Merrimack River." *The Telegraph,* February 5, 1987, p. 10. The same AP article, titled "Dam Opponents Eye 'Wilderness' Protection for Merrimack Section" appeared in the *Lewiston Sun* on February 10, 1987. The byline in the *Lewiston Sun* reprint attributed the article to Michael

Activists mounted a letter-writing campaign and had succeeded in winning support from "virtually every congressman and Senator" in New England, as well as the chairman of the House Merchant Marine and Fisheries Commission, North Carolina Democrat Walter Jones. In a letter to Interior Secretary Donald Hodel, co-signed by thirty-five lawmakers, Representative Silvio Conte, Republican of Massachusetts, wrote: "For New England, the precedent of using a mitigation program to justify the construction of a mainstem dam is a major step backward in the restoration program."[372] The prospect of a restored fishery was more important in southern Massachusetts than the prospect of cheaper electricity for a few thousand homes in New Hampshire.

Federal and local pressure began to tell. On February 5, 1987, Governor John Sununu was quoted from a state house news conference that he had just given. "I think the handwriting is on the wall," the Governor said. Sununu was still a supporter of the project, as a "contribution" to "the overall energy mix" of the state, and he still thought that it was a good project "in that respect." But Sununu also believed that the fish restoration project was, in the words of the reporter, "flawed and at risk regardless of whether the dam is built." Sununu said that he hoped that people were not using the dam at Sewalls Falls to justify the failure of the restoration program.[373] But he could not deny that there was legitimate objection to his view of the new dam project.

In 1987, executive power sided with the opposition. On February 10, the United States Department of the Interior argued that the Merrimack River was one of the few in the country

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Mokrzycki.

372. "Dam Foes Hope for Protection of Merrimack River," 10.

373. "Sununu Says Feds Likely to Reject Hydro Dam on Merrimack," 10.

where "natural restoration of sea-run fish" was possible. Therefore, the Interior Department had decided to oppose building a new dam at Sewalls Falls. "This is a great day for all those who hope to bring Atlantic salmon back to Northern New England," said Representative Conte. "This project would give big-money developers short-term profits at the expense of the long-term salmon restoration program."[374] Phil Million, a USFWS spokesman in Washington, D.C., explained why the mitigation program offered by the developers was inconsistent with the fish restoration program.

> The developers had come in with [a very] intensive, hands-on management approach, which they would pay for, which I guess was pretty attractive. But one of the goals of our anadromous fish (sea-run) program is, where possible, to achieve this goal of self-sustaining stocks. We have very few rivers left in the country where we can attempt to achieve that, and the Merrimack is one.[375]

The next day, the developers planned to appeal the rejection of the project by the Department of the Interior. It would make issuance of the license by the Federal Energy Regulatory Commission, the final licensing authority "that much harder," said Robert Larsen, lawyer for the developers. Larsen cited a letter by Assistant Interior Secretary William Horn. The Secretary had noted that it was "a simple fact" that their "intensive management scenario" would have put "as many, if not more, fish in the river" by 2035 than would the "more natural system" preferred by the Fish and Wildlife Service. In Horn's opinion, the "uncertainties" in the developers' proposal could have been reduced "substantially" if people had reached agreement on "a permanent project design modification" permitting natural movement of salmon through the proposed structure. Larsen, noting that the design already included a fish ladder, said that he didn't know "quite frankly" what Horn meant, but the developers were "sending it up to our

374. "Interior Department Rejects Sewalls Falls Dam." *The Telegraph*, February 10, 1987, 24.

375. "Interior Department Rejects Sewalls Falls Dam." 24. The original has "The developers had come in with very an …" In the context of the sentence, this was probably a typographical error.

engineers" to evaluate it. It sounded to Larsen as though "we could come up with a technical fix, to allow fish to move through the dam."[376]

According to Larsen, Horn's suggestion did not resemble previous recommendations from the USFWS, which the developers rejected as "unfeasible". Larsen outlined the approach that the developers would take.

> We're going to take (the dam application) to FERC. . . ask them for an opportunity to present our management plan and possibly for a different technical fix, and to push for a full-blown review of the project and have FERC decide on the license. [377]

Three years and three weeks after the storm, the dam stayed down for good. On April 29, 1987, developers announced that they had given up trying to build a hydroelectric dam on the Merrimack River at Sewalls Falls, ending a six-year battle "pitting" the son of former Vice President Nelson Rockefeller against environmental and recreation groups. Robert Larsen's determination back in February was now tempered by political reality. "It's reached a point where we think the chances of this project ever being licensed are very slim." Governor John Sununu announced an agreement under which the New Hampshire Fish and Game Department would buy the dam and its lease and development rights, and establish a 94-acre recreation area along the scenic stretch of the river. Tim Shea, an aide to Representative Silvio Conte of Massachusetts said, "We won. We couldn't wish for better. It's going to be tied up for public use for as long as we can see." The state agreed on a price of $315,000 to be paid to the Sewalls Falls Hydroelectric Association, which was a good deal given that Rockefeller's group had

376. "Dam Developers Press for License Despite Setback," *The Telegraph*, February 11, 1987, 39.

377. "Dam Developers Press for License Despite Setback," 39.

applied for a $15 million dam and park project. "This is a great victory for the conservation of our state's rich natural endowment," said U.S. Senator Gordon J. Humphrey.[378]

Activists were excited by the result. Timothy Savard, the Concord "fishing enthusiast" who had been quoted back in December of 1985, was now the New Hampshire president of Trout Unlimited. "We're having a party," he said. "I'm thrilled. A lot of work at the local level has paid off." Robert Larsen, lawyer for the developers, said that developers would withdraw their application in a way that would "preclude" further development at Sewalls Falls. Larsen estimated that the developers would receive about $315,000 for the lease and development rights to the Sewalls Falls site, but the developers had spent at least twice that much trying to gain a license.[379] Local resistance had made the Merrimack too expensive for the developers to continue.

The developers sought to make an honorable retreat. "There is the opportunity to ensure that a portion of their plan, which is the park aspect, has been realized," Larsen said. "It is equally important to my clients to leave with their good names intact."[380] New Hampshire Fish and Game would be applying for federal funding to defray the cost of "$1 million or more" that it would take to develop the recreation area near Sewalls Falls.[381] The same state government whose chief executive officer had supported the dam was now paying to get rid of the problem.

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378. "Developers Give Up Attempt to Build Dam at Sewalls Falls." *Lewiston Daily Sun*, April 30, 1987, 23; John Milne, "Developers in N. H. to Drop Dam Project: Seen as Victory for Conservation of Salmon," *Boston Globe*, April 30, 1987, 88.

379. Developers Give Up Attempt to Build Dam at Sewalls Falls," 23.

380. Milne, "Developers in N. H. to Drop Dam Project," 88.

381. "Developers Give Up Attempt to Build Dam at Sewalls Falls," 23.

Governor John Sununu, in his statement to the press, defended the proposal by Rockefeller and Seaward because it had included a recreational area. But the process itself had affected the outcome. Sununu said:

> The lengthy delays in licensing procedures for the project prompted the New Hampshire Fish and Game Commission to approach the governor's office and the developers to seek a solution which would satisfy all parties and benefit the public interest.[382]

In the end, personal connections led to a deal. State Senator Susan McLane of Concord said that she had been approached a few weeks earlier by Rodman Rockefeller, who was a fellow member of the Rockefeller Board at Dartmouth College. Rockefeller asked McLane about starting negotiations to abandon the dam project. Political pressure was mounting. The state Water Resources Board had already approved the new dam, but political pressure had forced other officials to back off from the project. At the time of the Dartmouth meeting, FERC itself was being investigated by a congressional committee for its "handling" of the proposal.[383]

Publicly, the withdrawal of the dam proposal was a happy ending, even if some of the reporters got a little carried away. A *New York Times* article from May 5, 1987 recounted the history of Sewalls Falls since 1984, when the dam "breached… restoring the river to its wild state."[384] In fact, the Sewalls Falls Dam is both "restored" and *not* restored, both "natural" and managed. New Hampshire Fish and Game annually provides brood stock of Atlantic salmon to the river, but these are not wild fish. During the first week of May 2009, a stocking truck broke down near Sewalls Falls. "We were forced to stock a large number of fish, some of which, unfortunately, were meant for Hooksett," said fish biologist Matt Carpenter. "To take advantage

382. "Developers Give Up Attempt to Build Dam at Sewalls Falls," 23.

383. "Developers Give Up Attempt to Build Dam at Sewalls Falls," 23.

384. "Developers Halt Plan to Build Dam on New Hampshire River," *New York Times*, May 5, 1987, 62.

of the situation, head straight for Sewalls Falls!" Interested fishers would need a New Hampshire fishing license and a special brood stock fishing license to avail themselves of the Atlantic salmon that are carefully stocked in the Merrimack River where the longest timber dam in the Eastern United States once stood.[385] Nowadays, there are a few dozen Atlantic salmon, swimming in the Merrimack, right through the capital of New Hampshire. Sewalls Falls, once a site of industrial achievement, has become a local place for nature.

The story of Sewalls Falls is unique in the history of the Merrimack River. Never had a historic structure come down by a natural event; never had a dam project been stopped by local activists. The battle, at all times, was focused on one piece of ground. There was no wider movement to review or improve fish passage at lower dams on the Merrimack, and there was no wider movement to stop hydroelectric development at other dams on the Merrimack River. When the old dam collapsed, the new project became the first such attempt to block an open stretch of the Merrimack in living memory. In this one case, there was a chance to have an open stream, and local people took it. After all, no one was expecting the Amoskeag Dam to come down just because Sewalls Falls had opened back up. For once in the modern life of the Merrimack, a wall came down, and it was cheaper to leave it down. Everywhere else on the river, the walls stayed up, and business went on as usual.

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Hazardous waste management is a feature of modern life that everyone needs and no one wants – at least not nearby. In search of a good site for a hazardous waste management plant, the State of New Hampshire had found its way to Merrimack, New Hampshire. A riverside plant

385. New Hampshire Fish and Game, "Brood Stock Salmon – Strike While the Iron Is Hot," May 11, 2009. http://www.wildnh.com/Newsroom/News_2009/News_2009_Q2/brood_stock_salmon_051109.html. Accessed: January 5, 2014.

could use the stream in its operations. If a private investor could be found, then the plant could be built – and the state would save thousands of dollars, thousands of times annually, to process hazardous waste locally. But Merrimack was already home to a local industry that relied heavily on the river for its operations. After a few years of local complaints, the town and the industry had come to terms on sharing costs. The industry – Anheuser-Busch, which brewed beer with river water – would come to stand with Merrimack in defense of their local river against the State of New Hampshire. Despite its advocacy for an approved plan, the State of New Hampshire was once again forced to retire a plan for the industrial redevelopment of the Merrimack River.

The story of the local brewery goes back to the days of the dirty old river. Merrimack, New Hampshire was a rapidly growing community when a big new industry came to town in the late Sixties. In January of 1968, Anheuser-Busch agreed to build a $40 million brewery on 294 acres in the town. Governor John W. King said that the project, which was one of the largest in the state's history, would have "a tremendous effect on our economy." The company's interest in locating in New Hampshire, the governor said, was "an outstanding result of our efforts to expand our state's industrial economy."[386] A bedroom community whose population had doubled in five years was now the local site of one of the major consumer brands in the United States.[387]

Such a water-intensive industry would require clean water – and soon. Here private interest drove public action. The Town of Merrimack had previously considered building a sewage treatment plant because, in the words of a state representative, residents did not know if

386. "N. H. to Get $40M Bud Brewery," *Boston Globe*, January 11, 1968, 20.

387. Richard Higgins, "Task Force to Study Rapid N. H. Growth," *Boston Globe*, December 25, 1977, 10.

they could afford it, but "we were also aware that Federal participation funds had a way of running out or drying up." After a $75,000 appropriation and an engineering study, Merrimack town leaders realized that they could not afford to build such a plant. After Anheuser-Busch expressed interest in building a brewery there, a bond issue of $10 million, for which the town was liable for 10 percent, passed a town meeting by a vote of 592 to 7.[388] As a result of such expenditures, Merrimack's tax rate went up by nearly 100 percent between 1967 and 1977.[389] Local people were now on the hook for whatever the river would bear.

Merrimack continued to grow. By 1971, a little over three years after the Budweiser deal was signed, there were 300 new homes being built in town.[390] Those new taxpayers could not defray enough of the cost to prevent a local budget deficit. In 1974 the town faced a $620,000 deficit in operating costs for its local water treatment plant when flat surcharges paid by Anheuser-Busch to treat its waste at the plant did not make up the differences between operating costs and the negotiated payments in the 1968 contract. When adjusted to reflect 100 percent valuation, the town's tax rate assessments had risen from $20.80 (per $1,000 assessed) in 1968 to $31.50 by 1972 – an increase of more than 50 percent in only four years.[391]

Company officials pushed back. A company spokesman argued that Anheuser-Busch had paid $230,000 more towards the treatment plant than it had negotiated in 1968, and had paid $2.3 million to build pretreatment equipment into its operations at the brewery. Some Merrimack residents wondered why the company had paid nothing towards the capital costs of

388. William Cardoso, "Merrimack Awakens to the Sound of a Boom," *Boston Globe*, April 4, 1971, 29.

389. Richard Higgins, "Task Force to Study Rapid N. H. Growth," *Boston Globe*, December 25, 1977, 10.

390. Higgins, "Task Force to Study Rapid N. H. Growth," 10.

391. Higgins, "Task Force to Study Rapid N. H. Growth," 10.

building the plant despite contributing 90 percent of its waste to the plant. Local people understood that getting Anheuser-Busch to come to Merrimack was one of the only ways for the town to afford building a water treatment plant, without which Anheuser-Busch, the Nashua Corporation, and General Electric would not have constructed plants in the town. Those plants contributed nearly a million dollars a year in tax revenue to Merrimack, New Hampshire, but Anheuser-Busch's waste also contributed heavily to a three-acre open sludge pit that some people considered an open cesspool.[392]

In December of 1975, the deficit in the operating budget for the sewage plant in Merrimack, New Hampshire had nearly reached $700,000 after five years of operation.[393] In January of 1976, town selectmen in Merrimack sent a letter to the president of Anheuser-Busch appealing for the company to pay for sewage treatment that had caused a deficit of $829,173 since 1970. In October of 1976, the town selectmen approved an $11 million expansion at the brewery, which "culminated" the long conflict between the town and the corporation. National events may have induced the company to settle.[394]

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392. R. S. Kindleberger, "Something's Brewing in Merrimack," *Boston Globe*, May 26, 1974, 2. The size of the community did not necessarily increase its leverage over a national corporation. In 1975, Manchester sent the Anheuser-Busch brewery a bill for $96,000 for the fourth quarter of 1974 that quadrupled the sewer charges negotiated under the original 1968 contract. The EPA informed Manchester that Anheuser-Busch had violated its discharge permit on several recent occasions by discharging wastes, including beechwood chips, directly into the river. Anheuser-Busch had sent a letter to Manchester advising the city that it would not be paying the increased sewer bill, and the city responded by sending out a letter informing the plant that its sewer service could be shut off if it did not pay the new sewer bill. Anson Smith, "N. H. Town and Brewery Brawl Over Sewerage Tab," *Boston Globe*, January 31, 1975, 3.

393. "N. H. Town, Brewery Argue Over Sewer Cost," *Boston Globe*, December 7, 1975, 56. The Teamsters strike at seven Anheuser-Busch plants in the first half of 1976 may have inclined the upper management of the company to make a deal with local politicians before federal regulators could cost the company any more money in fines and administrative costs.

394. On May 22, 1976, the Teamsters overwhelmingly rejected the company's proposal, which meant that a strike of 81 days continued into June. "In Brief: Budweiser Strike," *Boston Globe*, May 22, 1976, 12; Wilfrid C. Rodgers, "Labor," *Boston Globe*, June 5, 1976, 16. It was finally resolved on June 7, 1976, after 95 days, with an agreement announced in St. Louis, Missouri, home of Anheuser-Busch. "Three-Month-Long Beer Strike Ends," *Washington Post*, June 7, 1976, A2.

In 1978, John Sununu wrote an article citing Merrimack's experience with Anheuser-Busch as an example of local control of public affairs in New Hampshire, in contrast to the way things were done in other states.[395] But the battles between Merrimack officials and Anheuser-Busch officials showed that costs could soon outpace contractual arrangements. In such situations, local governments could easily be soaked with the extra costs of water pollution control. Even with a growing population, the Town of Merrimack, New Hampshire could ill afford to pick up the tab for hundreds of thousands of dollars in cost overruns from treating the sewage from the brewery.

The story of the plant proposal goes back to the late Seventies, when hazardous waste management was very expensive. Officials for the State of New Hampshire became interested in building a hazardous waste treatment site somewhere within the boundaries of the state. After all, local businesses were paying a small fortune to transport their waste out of the state; there was almost certainly illegal dumping in some places as well.[396]

Local people were not going to see such a facility in their backyards if they could do anything about it. In Hooksett, voters so strongly opposed a deal that would have put a plant in their town that the state legislature passed a law removing the prerogative from the local to the state level. After 1981, the State of New Hampshire, and not the cities and towns, would issue

395. "N. H. Brewer Gets 'Final Appeal'," *Boston Globe*, January 18, 1976, 36; "In Brief," *Boston Globe*, October 21, 1976, 26. In 1978, John Sununu, chairman of the Governor's Advisory Committee on the Future of New Hampshire, and later the governor of New Hampshire, argued that the town of Merrimack had learned to become "more selective" after seven or eight years of soliciting every industry that would come to town. "They found out that the impact on their utility system was not what they bargained for, and the impact as a whole was not exactly what they had anticipated," Sununu said. "So they're looking much more closely at development. And this change occurred on a local level." "The Boom in New Hampshire – 2," *Boston Globe*, July 3, 1978, 4.

396. John Milne, "N. H. Town Rallies Against Toxic Waste Plant," *Boston Globe*, January 20, 1985, 78. Reportedly, companies were paying up to $150 a drum to transport the waste out of state. When the Stablex Company of Radnor, Pennsylvania wanted to set up a facility in Hooksett in 1980, residents reported "fought back so bitterly" that the state legislature changed the law in 1981. The state supreme court upheld that ruling in 1982. Stablex got a permit on September 20, 1984, but finally gave up on building the plant in November 1984 (78).

the permits to allow hazardous waste treatment plants to be built.[397] Removing the power to decide sites allowed the state to plan local environs, not for local people, but to control costs for public and private customers of the new hazardous waste management plant.

By the time that the state law was changed, people in Merrimack were already worried about a plant in their town. In September of 1981, the Merrimack town planning board had deferred a proposal by Applied Chemical Technology (ACT) when a board member "abruptly departed," leaving the town board without a quorum. When asked for a prediction about how the planning board would vote, Town Manager James McSweeney said, "It's a question of a situation where everybody feels this type of thing is eventually going to come, but please, not in my backyard." Board member Arthur Gagnon framed one of the issues, corporate responsibility for their disposed waste. He was asked what would happen if there were a spill from a truck outside the plant. ""I guess you have to read the name on the side of the truck," Gagnon said.[398]

Town officials stood their ground. In December of 1981, Merrimack's planning board invoked a zoning ordinance that permitted eighteen other industries to set up shop in town – but not a hazardous waste facility.[399] In September of 1984, about a week after a permit was issued for a Stablex facility in Hooksett, the State of New Hampshire issued a permit for ACT to open a 50,000-gallon hazardous waste treatment plant in Merrimack. Company officials assured townspeople that their operations were safe despite the official rating of hazardous waste management. ACT president John Giordano said, "A lot of the chemicals I use are found around your house every day. One of them is very much like nail polish remover." Two months later,

397. Milne, "N. H. Town Rallies Against Toxic Waste Plant," 78.

398. "Town Officials Consider Chemical Recycling Plant," *Boston Globe*, September 27, 1981, 1.

399. "New England News Briefs: N. H. Town Rejects Waste Plant," *Boston Globe*, December 18, 1981, 1.

the town's Hazardous Waste Facility Review Committee, a group of town officials from Merrimack, rejected this contention. "We can find no evidence whatever that the facility proposed by ACT, despite all of its engineering designs and safeguards, will not pose unreasonable risks to the public health and the environment," the committee reported on November 16.[400]

On the morning of the January 16 meeting, another citizens' group went to the governor with the complaint that it was their "perception" that the Office of Waste Management had failed to protect adequately "the public interest in this matter" and had, in fact, "shown an unreasonable bias in favor of the applicant." Sununu promised to investigate. ACT's president felt that New Hampshire was already being too "lenient" with people in Merrimack. "'I think the state has abused me by allowing too much public participation," Giordano said. "They've allowed public comment to drag on and on, and, considering my time and everything, it's cost me, maybe, half a million dollars." At the public meeting, John Harvell's group handed out signs that said "Protect Merrimack's Watershed" and "Not in My Backyard." ACT's presentation, which came first, was "frequently interrupted with catcalls." When asked why ACT was staying with their plan to set up along the river, Giordano said that there was not "any other site that these people would accept." Brian C. Strohm, assistant director of state public health services, presided over the meeting. Just before he adjourned the meeting, Executive Councilor Bernard A. Streeter Jr. took the microphone. "The potential of hundreds of thousands of people drinking contaminated water scares the hell out of me and, hopefully, you," Streeter said. At this point, he reportedly turned

400. Milne, "N. H. Town Rallies Against Toxic Waste Plant," 78.

to face Strohm. “You should be concerned not only with the scientific aspects of this case, but the physical and emotional needs of our citizens.” Streeter got a standing ovation.[401]

In July of 1985, a local industry, following its rational private interest, came to the aid of local people in defense of the cleaner river. Anheuser-Busch officials had never liked the idea of a hazardous waste site neighboring the wells that they used to draw water from the Merrimack River. On the eve of July Fourth, the company issued a statement in Manchester. Anheuser-Busch agreed to pay $300,000 in “legal and business costs incurred by ACT as a result of that company's four-year attempt” to obtain a permit to operate that plant from the state Bureau of Solid Waste Management. In return, ACT agreed not to seek approval to locate such a facility “either within the town of Merrimack or at any site upstream of the town within the general area of the Merrimack River. [402]

ACT’s lawyer confirmed the deal. “That’s the amount,” said J. Bradford Westgate. “ACT has agreed to withdraw.” Wallace Stickney, who served as an environmental “aide” to Governor John Sununu, said that the state would survey public land for possible sites for a state-owned facility. Arthur Gagnon, who believed that the state would probably have rejected the ACT permit, said, “It's pretty hard not to be pleased with the settlement.” Bernard Streeter, who had opposed the plant, said that a state-sponsored plan would be no less controversial. Even if there were more rural places where a plant could be sited, Streeter said that “I, for one, would strenuously oppose the use of any state land for an enterprise of this sort.”[403] The problem of

401. Milne, “N. H. Town Rallies Against Toxic Waste Plant,” 78.

402. John Milne, “$300,000 Buys End to Dispute Over Plant,” *Boston Globe*, July 4, 1985, 15.

403. Milne, “$300,000 Buys End to Dispute Over Plant,” 15.

hazardous waste disposal remained, but Merrimack had found a way out of paying for it with local land and local water.

The activists were not all wet, to say the least. A 1986 study by the Conservation Law Foundation, based in Boston, sampled 41 sites out of 107 hazardous waste sites in New Hampshire, finding that 39 of them – 95 percent – were "cited by the state for violating state rules that require monitoring wells to detect pollution, groundwater studies, and plans for operation and eventual closure." Of the 27 communities that had town wells, 18 were found to be contaminated. State officials did not contest the figures. George Molineaux, an environmental adviser to Governor Sununu, admitted that he did not think that there was "a lot of new information" in the report, but "it clearly catalogues it." It was not that Governor Sununu had not made groundwater protection a priority, Molineuax argued. It was just that industrial hazardous waste sites were a higher priority. "You deal with the worst things first," he said.[404]

Douglas I. Foy of the Conservation Law Foundation argued that there was "a prevailing myth" in New England: namely, that dumps "don't have anything dangerous in them. That's a myth." People would throw away "half-full paint cans, paint thinner, pesticides, cleaning fluids." The containers would "rust and leak." The chemicals would then "percolate" into the groundwater and poison the wells that people used for drinking water. "The town dump," Foy said, "is a miniature hazardous waste site." Foy said that although his foundation was suing four towns in New Hampshire, the Conservation Law Foundation was not doing this to single out the Granite State per se. "It's our belief that the threat in this state is on the same order as the other New England states." Although Foy's announcement was "denounced" by state officials as a

404. John Milne, "Warning Given on N. H. Dumps," *Boston Globe*, May 8, 1986, 27.

publicity stunt, officials and state environmental organizations "accepted Foy's figures" and agreed that the "leaky landfills" posed a serious threat.[405]

How would such leaks be handled? There was already a major federal law on the books, although it had been contested politically almost from its inception. In 1980, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or Superfund, was passed. Public Law 96-510 authorized the Administrator of the EPA to "promulgate and revise," as may become necessary, regulations "designating" as hazardous substances such "elements, compounds, mixtures, solutions, and substances which when released into the environment may present substantial danger to the public health or welfare or the environment," and to promulgate regulations "establishing that quantity of hazardous substance the release of which shall be reported" under section 103 ("Notices, Penalties") of the law.[406] Superfund delegated to the EPA the power to decide what would be considered a hazardous substance, what amount of that substance would be hazardous, and who would be responsible for its cleanup.

The Superfund law was passed in the context of recent national concerns over the threats of hazardous waste. It soon became clear that the problem was larger and more complex than the simple interdiction of pollution discharges. John A. Hird, writing in 1993, argued that the cost argument had no real answer. "Not only is the ultimate cost of the Superfund program uncertain," he argued, "but even the number of sites that need to be remediated is unknown." Craig E. Colton and Peter N. Skinner argue that thousands of Superfund sites "bear testimony to half a century of largely uncontrolled chemical waste disposal."[407] Even if we set aside the

405. John Milne, "Questions of Safety Raised Over Leaking N. E. Landfills," *Boston Globe*, May 11, 1986, 50.

406. 94 Stat. 2767, 94 Stat. 2772.

407. John A. Hird, *Superfund: The Political Economy of Environmental Risk* (Baltimore and

political battles over the Superfund law – and there was a time when the EPA head of the Superfund office opposed renewing the law – we have to confront the reality of thousands of sites across the country, of sites with unforeseen threats, and of limited resources to confront such threats as they would appear in local environs.[408]

John A. Hird summarizes the problem of limited resources very plainly.

> In a world of unlimited resources or few social needs, the "how clean is clean" issue is trivial: permanently remediate every site. [But] spending excessive resources at some sites necessarily denies cleanup resources to other sites or other environmental and public health problems. The consequence of the goal of permanent cleanup when resources are limited is excessive remediation at a few sites and the neglect of others. One environmental attorney has commented, "The incentives are definitely in the wrong place… There is absolutely no incentive right now for somebody to be creative and save money on a cleanup." Resources remediating some sites may better be used to protect health and the environment at another site.[409]

In this context we can understand better the intervention of a riverside industry on behalf of the Town of Merrimack. If the ACT plant were to have been completed, then any leakage from any container or storage unit would have to be addressed through Superfund. In the meantime, any contamination of the groundwater would have forced Anheuser-Busch to pay transactional costs – litigation, site cleanup, and so on – in order to limit the damage that had already been done until the EPA could get caught up to the site. None of those costs would have prevented future accidents so long as the ACT plant would be in operation. In the case that Superfund would have to be marshaled to contain further pollution, Anheuser-Busch would still have to pay to treat water from the wells. The damage to the brand from a direct association with hazardous waste could have been ruinous.

London: Johns Hopkins Press, 1994), 7; Craig E. Colten and Peter N. Skinner, *The Road to Love Canal: Managing Industrial Waste Before EPA* (Austin: University of Texas Press, 1996) 144.

408. Hird, *Superfund*, 11.

409. Hird, *Superfund*, 191.

The ACT plant controversy was a case in which local activists found a powerful business to advocate for them against a threat to local environs. Building a plant that could possibly provide a new and abiding hazard to the Merrimack – right alongside a major business that drew water from the stream – was a hard sell in any case. Historic waste management was one thing; most of the sites along the Merrimack had historic waste to be cleaned up after industries had left town. But with the increasing knowledge of ecological threats from hazardous waste, and the proximity of a water-bearing industry to a new source of hazardous pollution, the cost of primary construction was too expensive for the ACT officials not to take the settlement that was offered to them. For once in the history of the Merrimack, a local industry had stood for a healthier stream, at least as long as they could still draw water from it.

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In the first two cases we can see similarities. A private industry wants to develop something along the river; local people protest the project; a settlement is reached. But what happens when a local community confronts a government agency with a public mandate? This is what happened in the case of the incinerator plant at the Greater Lawrence Sanitary District (GLSD) facility on Charles Street in North Andover, Massachusetts. The GLSD was established by order of the General Court in 1968.[410] A new $30 million plant was announced in October of 1970. It was scheduled to begin construction in 1972.[411] Design plans for the GLSD facility on Charles Street in North Andover were approved in 1973, "along with authorization for additional

410. Mass. Gen. Laws, Acts of 1968 Chapter 750. "An Act Establishing a Greater Lawrence Sanitary District." 24 July 1968. http://archives.lib.state.ma.us/actsResolves/1968/1968acts0750.pdf Accessed: December 1, 2012. The 1982 act added Section 3: http://archives.lib.state.ma.us/actsResolves/1982/1982acts0387.pdf Accessed: December 1, 2012. The legislative history is recounted on the GLSD website on the page, "Greater Lawrence Sanitary District: History." http://www.glsd.org/history.html. Accessed: December 1, 2012.

411. Frank Donovan, "$30m Plant Will Attack Pollution," *Boston Globe*, October 12, 1970, 33.

funding." Ground was broken on February 14, 1974, and after about three-and-a-half years of construction, the facility became "operational" in April 1977 and was dedicated in June of 1977.[412]

The new GLSD plant design was "modular," meaning that as wastewater flows would increase in future years, additional "treatment units" could be built, "boosting" plant capacity. According to a GLSD estimate, the facility served a population of 123,500 in 1977 and it was projected to serve a population of 163,250 in 1995. By 2020, the GLSD hoped to serve 213,000 persons, with estimated average flows of 70 MGD and peak flows of 126 MGD.[413] In effect, the initial expenditures would be repaid by future returns as the plant could manage more volume over time. Local people would make their money back, and then some.

The one weakness in the system was that it had to run constantly in order to be truly effective. Any shutdown at the GLSD facility meant that its sewage would enter the Merrimack untreated. On October 12, 1985, a fire broke out at the GLSD plant that shut down the conveyor belt. As a result, raw sewage was dumped directly into the Merrimack River. For several days, about 30 million gallons of raw sewage entered the Merrimack on a daily basis. A spokesman for the plant said that he was not concerned about a serious pollution problem, since the river flow was "high", so the river was "diluting pretty well."[414]

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412. Greater Lawrence Sanitary District, "Water Pollution Control Facilities: Dedicated June 1977" (North Andover: Greater Lawrence Sanitary District, 1977); "Greater Lawrence Sanitary District: History." http://www.glsd.org/history.html. Online: Accessed: December 1, 2012. The relevant legislation is Mass. Gen. Laws, Chapter 387, Acts of 1982.

413. Greater Lawrence Sanitary District, "Water Pollution Control Facilities." This foldout brochure is not paginated.

414. Carol Beggy, "Raw Sewage Flowing Into Merrimack: Fire Knocks Out N. Andover Plant," *Boston Globe*, October 13, 1985, 33; "Sewage Dumping in Merrimack Continues in Wake of Fire at Plant," *Boston Globe*, October 14, 1985, 1.

Over time the GLSD caught the eye of state regulators. In 1987, when the plant was shut down for repairs, the state Department of Environmental Quality Engineering (DEQE) notified the GLSD that the DEQE would be leveling two fines – one for the raw sewage entering the river, and one for the operator on duty not having the necessary certification required for that position. Ross Hyman, a DEQE spokesman, said that he did not believe that the penalty was based on a single inspection. "I think there are continuing problems," he said. "The facility generally has a good track record with us, but the violations cited here raise the issue of operational problems that we need to address to make sure the facility is in compliance with the law." In addition to the five communities treating their water there, eighty other communities were sending their waste to the GLSD facility as well.[415] For a while, business was booming.

The removal of solids from wastewater leaves a sludge of which the plant must dispose. Typically, the sludge is either buried or incinerated. The incinerator at the GLSD plant was state-of-the-art for its time. But with more business came more volume, and therefore more air pollution from the incinerator. In July of 1987, following a 4-3 vote of the board, the GLSD decided that it would no longer treat waste from communities that were not members of the GLSD. This vote came in the wake of complaints from North Andover residents about "noxious odors" coming from the treatment plant. If the outside waste was not shown to be a cause of the odor, then the vote could possibly be reversed.[416]

State regulators heeded these local complaints. In June of 1988, an order from the DEQE meant that five trucks of sludge a day would have to be sent elsewhere because odors from the GLSD plant were so bad that neighboring residents had to close their windows in the summer to

415. Susan Bickelhaupt, "Lawrence Area Sanitary District Faces Fine," *Boston Globe*, April 4, 1987, 14.

416. Diego Ribadeneira, "Sanitation District to Stop Taking Waste from 81 Cities," *Boston Globe*, July 30, 1987, 21.

avoid them. The fire chief of Methuen, Joe Nicolosi, who lived in Methuen, said that the problem had gotten worse every year, and that more than a few people had complained. "It's more than a handful of people. Last year on Father's Day we had to stay indoors because the odors were so nauseating."[417]

Local people let their feelings be known in other ways. In 1989, James M. Shannon, Attorney General for the Commonwealth, and a Lawrence native, said that he was bringing action against the GLSD for 1,397 violations that could result in $35 million in fines. "As one who has lived in that community all my life, I'm not going to let the Merrimack River become what it was when I was a kid: You used to have to hold your nose when you drove over the bridge," Shannon said. "Too much progress has been made to begin backsliding now, and that's exactly what was going on." City officials were "outraged" by the suit, and tried to block it. "We would have to pay 49 percent of that $35 million, or about $17 million," said Mayor Kevin J. Sullivan. "It would be devastating."[418] Other communities saw increases in their local costs as well. In 1990, Gloucester was forced to continue accepting trucks of sludge after Gloucester's "abrupt" termination of its contract with the GLSD.[419]

Waste incineration was now a business, and it was not long before the GLSD had a local competitor. The North East Solid Waste Committee (NESWC) argued that its incinerator in North Andover could burn the sludge for the same cost as the proposed GLSD incinerators. The NESWC, comprising some twenty-three communities, had been operating below capacity since it opened its incinerators in 1985. Its burned rubbish was sold to the New England Power

417. Maria Alvarez, "North Andover: State Orders Plant to Stop Burning Sludge; Residents Charge Greater Lawrence Sanitary District Ignored Complaints About Foul Odors," *Boston Globe*, June 22, 1988, 18.

418. Larry Tye, "Shannon Sues His Hometown Over Pollution," *Boston Globe*, August 11, 1989, 13.

419. "Gloucester Loses Bid to Bar Sludge," *Boston Globe*, August 18, 1990, 29.

Company, but revenues from those operations had fallen below expectations. Now, with the lawsuit against the GLSD, the NESWC was considering making a bid for the grant that the GLSD had previously won. Donald George, the executive director of the GLSD who had first come to work at the plant in 1977, countered the NESWC proposal. He argued that letting the GLSD build its own incinerators would cut a sixth of the $12 million budget of the GLSD that had been allocated for trucking the sludge to other sites.[420] In October of 1993, Massachusetts Department of Environmental Protection Commissioner Daniel Greenbaum said that NESWC operators had convinced him that they could burn sludge just as cheaply as the proposed GLSD incinerator. [421]

Public officials became heated rivals in the regulatory market of waste incineration. The NEWSC executive director, Steven Rothstein, charged that GLSD commissioners had refused to provide sludge for burning tests, even after Commissioner Greenbaum had authorized the NEWSC to conduct the tests in the summer of 1992. Greenbaum's office had provided a $21 million grant for the project, but the work had been held up since April. According to GLSD commissioners, the contracted company, Barletta, had begun work without authorization, which had come after a vote of the GLSD board. GLSD chairman James Garvey said that the authorization depended on the GLSD getting the adequate funding, which had not happened yet.[422] So it went, from funding to proposals to disputes about funding and proposals.

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420. Andy Dabilis and Caroline L. Cole, "State Reviewing Incinerator Turmoil: Greenbaum Looking at Plans for Retrofit," *Boston Globe*, October 10, 1993, 6; Andy Dabilis, "Battle Line Drawn on Sludge Burning: Outcome of Incinerator Fight Will Affect Taxpayers in Mass., New Hampshire," *Boston Globe*, February 14, 1993, 6.

421. Andy Dabilis, "State Says Region Has 697 Hazardous Waste Sites," *Boston Globe*, March 8, 1992, 1; Andy Dabilis and Caroline Cole, "State Reviewing Incinerator Turmoil: Greenbaum Looking At Plans for Retrofit," *Boston Globe*, October 10, 1993, 6.

422. Andy Dabilis, "State Says Region Has 697 Hazardous Waste Sites," 1; Andy Dabilis and Caroline Cole, "State Reviewing Incinerator Turmoil," 6.

In the meantime, the GLSD diverted as much waste as the traffic would bear. In the year 2000, fifteen trucks a day were leaving the GLSD plant to bring sludge to other disposal facilities in New England and Canada. Richard Hogan, the GLSD director, said in October of 2000 that the district had contracted with the New England Fertilizer Company, which processed sludge for the Massachusetts Water Resource Authority (MWRA) at the MWRA facility in Quincy, to operate the facility. But the members of the North Andover Board of Public Health were worried about the history of GLSD air pollution over the town, as well as the number of waste incinerators in the area. GLSD operators were mulling their options, which included sending the waste to the trash incinerator run by the North East Solid Waste Company in North Andover.[423]

In September of 2001, William J. Patenaude entered the race for mayor for Methuen after the current Mayor and the five town councilors decided not to back a moratorium on building or expanding polluting plants in the Merrimack Valley. "We burn a third of the state's trash in the Merrimack Valley. And now we are going to be processing sludge to make organic fertilizer, which is going to emit more toxins in the air," he said. Patenaude argued that the moratorium would prevent new sources of pollution until a study of the effects of pollution on area health would be completed. "We don't want to become known as 'toxic valley,'" he said. Mayor Sharon M. Pollard of Methuen countered that the majority of councilors had "acted responsibly" because of pending litigation between the GLSD and North Andover.[424]

That "litigation" would come to a head before long. The Town of North Andover sued the GLSD in the summer of 2000 when the GLSD refused to comply with town regulations on "air quality, odors, noise, and traffic generated" because only one of two facilities was approved

423. Caroline Louise Cole, "Town Comes to Terms with Waste Plant," *Boston Globe*, October 22, 2000, 6.

424. Erica Noonan, "Court Rules Town Can Impose Rules on Sludge Plant," *Boston Globe*, March 30, 2003, 3.

by the town's board of health. *Greater Lawrence Sanitary District vs.Town of Andover and Others* (439 Mass. 16 [2003]), the Supreme Judicial Court "concluded" that "the doctrines of essential governmental functions and preemption" did not prevent a town from imposing "antinuisance conditions" on the operation of a sludge treatment facility operated by a regional sanitary district if the conditions "did not interfere with or burden the district's performance of its legislatively mandated waste water treatment function" and did not "conflict" with the regulatory authority granted the Department of Environmental Protection. However, where factual questions, such as "whether the particular existing conditions would interfere with the district authority's legislative mandate," could not be decided on the present record, the court remanded the case for further proceedings.[425]

The Supreme Judicial Court also concluded that a town "had the authority" to issue building permits for a proposed sludge treatment facility operated by a regional sanitary district, "where nothing in the district authority's enabling statute or in the building code suggested that the district authority was not subject to regulation by the local building inspector, and where obtaining the permits did not interfere with the authority's ability to fulfil its essential governmental function." However, where the question whether the town was "contractually obligated" to refund the building permit fees under a previously executed memorandum of understanding "could not be decided on the present record," the court remanded the case for further proceedings.[426] "This decision tells municipalities that they have certain rights," said

425. "GREATER LAWRENCE SANITARY DISTRICT vs. TOWN OF NORTH ANDOVER & others," 439 Mass. 16. http://masscases.com/cases/sjc/439/439mass16.html. Accessed: January 5, 2013.

426. "GREATER LAWRENCE SANITARY DISTRICT vs. TOWN OF NORTH ANDOVER & others," 439 Mass. 16.

Kenneth Kimmel, the lead attorney representing the Town of North Andover. "Not the right to veto, but they have the right to protect citizens against nuisance effects."[427]

In March of 2006, the GLSD and the Town of North Andover signed a settlement agreement.[428] The GLSD agreed "not to burn any refuse or debris" at the site, and that it "shall not cause any detectable odors off-site," meaning "any distinguishable odors" associated with the GLSD facility "detectable at the nearest residence" that would violate the Odor Performance Standard. If there were two complaints in any seventy-two-hour period, then within twenty-four hours of the second complaint the GLSD would order its senior engineer to do a full check of "all existing odor controls" and "remedy" any failure of these controls. This process could take no more than seventy-two hours, and the results would be sent in writing to the North Andover Board of Health. If there were a second violation, then the GLSD would initiate testing at the residence by a qualified expert, during expected hours of plant operation, and the results would be submitted to the Board of Health. Should the results be found to violate the standard, then the GLSD would have to submit a corrective action plan.[429]

The Board of Health reserved the right to mandate actions other than what the GLSD proposed, and the GLSD reserved the right to contest those mandates. But the GLSD was required to allow reasonable access to the improvements to the Board of Health or any of its consultants, even unannounced visits, during normal business hours. In the case of a violation, the visit could be "anytime." The GLSD was mandated, within ninety days, to submit to the Board of Health "for its review and comment" the biofilter design specifications and operations,

427. Erica Noonan, "Court Rules Town Can Impose Rules on Sludge Plant," 3.

428. Town of North Andover, "Settlement Agreement," March 7, 2006, 2 – 3. http://townofnorthandover.com/pages/nandoverma_health/policy.pdf. Accessed: January 5, 2014.

429. Town of North Andover, "Settlement Agreement," 2 – 3.

as well as the O & M (operations and maintenance) plan. Improvements were not to result in an increase in noise "at any residence" by more than five decibels above the ambient levels as they were measured in 2000. Trucks were required not to use the part of Route 133 that ran between the intersection of Routes 133 and 125 and the Boxford town line. The GLSD was required to notify the North Andover Fire Chief of any transport of hazardous materials to or from the sanitary district facility. The GLSD could not dispose of any sewage sludge or fertilizer pellets onsite, but must dispose of sludge, pellets, or both at "an appropriate, off-site location" even when the improvements were not operational. It could, however, use such pellets as fertilizer on its own property "should that use be allowed under all applicable federal, state, and local laws."[430]

The GLSD reserved the right to challenge any of the conditions in the agreement should they determine that "compliance with said conditions either hinder or interfere" with its legislatively-created mandate, or interfere with the GLSD's ability to fulfill its "essential governmental purposes" as further explained in the 2003 decision. Neither the "negotiation, execution, or delivery" of the agreement by the parties thereto, or by any of them, would constitute or be construed as an admission by any of the claims, "the parties hereto having entered into this Agreement solely for the purpose of resolving and compromising disputed matters." The agreement was also severable, meaning that the "invalidity, illegality, or unenforceability" of any portion of the agreement would not affect the validity or enforceability of "any other provisions" of the agreement. Any such provision would be considered severed, and the rest of the agreement would be "construed and enforced" as though it did not contain the

430. Town of North Andover, "Settlement Agreement," 3 – 4.

stricken provision.[431] The GLSD could not abrogate the deal because part of it could be later ruled invalid, illegal, or unenforceable.

The GLSD case shows how a public mandate reshaped local disputes with industrial developers along the Merrimack River. The Greater Lawrence Sanitary District was created in order to share the costs of wastewater treatment between Lawrence and surround communities. Under the Clean Water Act, the GLSD was required to do what it did; it could not have simply refused to treat wastewater, in the manner of the Sewalls Falls withdrawal. Second, the dispute included the state government as an advocate for environmental protection as opposed to economic development. The Massachusetts DEQE fined the GLSD several times. Third, the resolution of the case was not a private meeting but a public forum. The public mandate of the GLSD made it necessary for local citizens to take the sanitary district to court. The precedent from the court was fairly limited, and it turned most of the issues back to the negotiations between the two sides. But where the ACT plant had nearly been built despite local resistance, the Supreme Judicial Court saw the public mandate differently. The GLSD's responsibilities included local environs – and that meant local people as well.

* * * *

After 1981, the Merrimack River was certainly a working river. But how "natural" was it for the anadromous fish that would return? By 1983, fish ecologists had been working with salmon and other populations for more than a decade. But it soon became clear that most of the anadromous fish counted at the Essex Dam Fish Lift were *not* salmon. From 1983 to 1986, more

431. Town of North Andover, "Settlement Agreement," 5 – 7.

than 88,000 anadromous fish returned, but only 505 (0.6 percent) were Atlantic salmon.[432] More than 94,000 fish returned in 1987 alone; only 248 (0.26 percent) salmon were counted.[433] Between 1988 and 1992, 1,475,981 river herring were counted at the Essex Dam Fish Lift. The vast majority of these river herring were alewives; in 1990, nearly all of them were. American shad returns totaled 63,141 between 1988 and 1992. In contrast, only 928 Atlantic salmon returned in all that time.[434] Atlantic salmon were returning in the tens of dozens while shad and river herring were returning in the thousands.

In 1987, the Merrimack River was healthy, at least in New Hampshire. "You have to take into account the safety considerations because of the currents and the steep dropoffs," said Gregory Smith, the New Hampshire coordinator of the Merrimack River Watershed Council (MRWC). "In general, the river meets fishable, swimmable standards from Franklin down to just above the Amoskeag Dam in Manchester." Smith noted that there had been "very little recreation to speak of," at least in the last ten-to-fifteen years, but that the Clean Water Act and the work of public and private groups had done a good amount of work to improve conditions in the river. "Now I would say the restoration program is halfway through," said Smith. "Because now we're starting to get a number of the fish back but they can't all make it to the tributaries to

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432. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan & Status Review*, 28.

433. Central New England Fishery Resource Office, United States Fish and Wildlife Service, "Historic Data, Anadromous Fish Returns, Merrimack River." http://www.fws.gov/northeast/cnefro/returns.html. Accessed: January 5, 2014; Technical Committee, *Strategic Plan & Status Review* (1997), 27, 66.

434. Central New England Fishery Resource Office, "Historic Data"; Technical Committee, *Strategic Plan & Status Review*, 27.

spawn yet. I would say development to the point of the self-sustaining population is about 15 years away."[435]

Downstream, the dams were still very much in the way. Returns began to fall in the Nineties. Between 1993 and 1996, only 136,416 river herring returned, including a count of only 51 in 1996. Shad counts totaled 38,131, although the worst of the years – 1994 – was followed by two years in the five-figure range. 192 Atlantic salmon returned, less than a quarter of the total counted between 1988 and 1992.[436] In ten years of anadromous fish counts at the first dam in the river, more than a million anadromous fish returned to the Merrimack River: 93 percent river herring, 7 percent shad, and 0.09 percent Atlantic salmon. Explanations for the variations in fish returns ranged from population size to the rate of river flows during spawning.[437]

Given the results of the first ten years, the restoration effort would seem like a lot of work for not very much in return. But the program was relatively thrifty; the total program costs in agency expenditures from 1968 through 1992 amounted to $13.1 million. When it came to Atlantic salmon, however, the fish ecologists were not exactly making their money back. Between 1993 and 1996, the six fisheries agencies collectively spent $5.6 million dollars. In their 1997 report, the Technical Committee discussed these figures in light of the years before fish restoration had resumed.

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435. Nancy L. Marrapese, "Fun on the River: Recreation Abounding on the Merrimack; With Improvements in Water Quality, Usage Is Increasing," *Boston Globe*, May 24, 1987, 36.

436. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan & Status Review*, 27.

437. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan & Status Review*, 64. "The number of river herring counted at the Essex Dam fish-lift has varied from year to year. The variation may be related to environmental conditions, fish passage effectiveness, and/or the size of the population entering the river and reaching the Essex Dam. Adults are known to spawn in the river downstream from the Essex Dam. High river flows can retard upstream movement of the adults and reduce fish passage effectiveness because of competitive flows. Low river temperatures, often associated with high river flows, can also retard upstream movement of the adults and may increase the incidence of downriver spawning."

> These expenditures must be viewed in the context of incalculable resource losses that occurred prior to the present restoration program. These losses would be directly related to the extirpation of the shad and salmon populations and the loss of any associated benefits that would have accrued to the public.[438]

With the struggles in river herring returns, fish ecologists decided to try something different. In 1995, the transfer of river herring from coastal rivers in New Hampshire to the Merrimack River was initiated. River herring were released into the river's mainstem and into "ponded areas" of the Concord River, Nashua River, the Piscataquog River, the Suncook River, the Soucook River, the Contoocook River (including the Warner River), and the Winnipesaukee River. Intra-basin transfers also occurred, utilizing the fish passage and trapping facilities at the Essex Dam and the Amoskeag Dam as source locations.[439]

Even with the new transfers, river herring did not rebound to the levels of returns that had been observed even five years earlier. From 1997 through 2000, only 29,068 river herring made their way as far as Lawrence. American shad did rather better: 179,813 shad returned between 1997 and 2000. Atlantic salmon returns were still in the dozens – 71 in 1997, 123 in 1998, 185 in 1999, and 82 in 2000.[440] From 1970 to 2000, about 29 million juvenile salmon, mostly fry, were released into the Merrimack River. But while more than 76,000 Atlantic salmon were counted in the rivers of New England, only three percent of those river-runners were counted in the Merrimack.[441]

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438. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan & Status Review*, 27.

439. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin, *Strategic Plan & Status Review*, 27, 61, 68.

440. Central New England Fishery Resource Office, "Historic Data."

441. United States Atlantic Salmon Assessment Committee, *Annual Report of the U.S. Atlantic Salmon Assessment Committee, Report No. 13 – 2000 Activities* (Nashua, NH: U.S. Atlantic Salmon Assessment Committee, 2001), 76.

The Sewalls Falls protest was predicated on the possible future damage to anadromous fish populations if the Merrimack River could not be left open for salmon and other sport fish. Scientists came forth to challenge the projections of company engineers, and politicians interested in fish markets came forward to oppose the project as well. But Sewalls Falls ultimately became a brood-stocked sport fishery because the rest of the river was not open to salmon runs. For the rest of the Nineties, herring and shad returns rose and fell. The Atlantic salmon remained as elusive in 2000 as it had been when fish counts began nearly twenty years earlier. Even in a cleaner river, no one could say how many fish could survive.

* * * *

The stories of this chapter demonstrate how the cleaner Merrimack became a different river for different people along the way. If we take a landscape to be a series, then the stories of Sewalls Falls and Merrimack and North Andover help us to understand the conditions of the cleaner river at different points in the watershed. In the middle of Concord, it was a local fishing spot; it was also a water supply, a Class B stream maintained at public cost. Nor was Sewalls Falls a trendsetter. Elsewhere the Merrimack could be dammed, if not still polluted; and even the effects of pollution control could lead to other kinds of pollution when new dams were turned back from the stream.

Sewalls Falls was a fairly straightforward case: an open stream, a dam proposal, and a contest for resources. The ACT plant was a different story because a corporate industry at the water's edge defended its clean water on behalf of local people, many of whom worked at the Budweiser plant. The GLSD settlement was a result of federalism: a state court decided a case between a local community and a public agency whose federal mandate precluded removal. The measured result – a process, rather than a payout, and a continuation of many existing practices –

shows us how the federal mandate changed landscapes after 1972. But the victory of private citizens in a state court also shows us that federal mandates had to be fitted to local landscapes if they were to be effective. There was to be no return to the dynamics that had stopped up the Merrimack over a century earlier.

And yet the Merrimack River was stopped, at Lawrence and Lowell and Manchester and beyond. Fish returns counted at Lawrence, however promising, were not reflected in fish counts upstream. The impounded stream was a series of moats, a landscape for the river put to work. The restored stream, the cleaner river, can only be seen in the context of a dammed river, the broken river. Early bumper returns promised that, in a few cases and a few places, the cleaner river could be a better home for spawning river herring and perhaps even the vaunted salmon. But by the end of the twentieth century, it had become clear to anyone observing the returns that it was one thing to restore fish downstream of Lawrence, and another to work with the impounded stream. Many of those new young fish, returning from salt to sweet, found that they could not go home again. But at least the cleaner river, the Class B stream, was something worth defending, at least for the local people along the stream. Now that the river was reliably cleaner, perhaps more places could be made for nature along the way.

6. THE LEGACY ECOSYSTEM

In 2003, the nature writer John McPhee retraced the path that Henry and John Thoreau had taken in 1839. McPhee, one of the most popular nature writers of the previous half-century, made a study of Thoreau's imprint as well as of Thoreau's journey. The landscape McPhee described is one of natural things and human places, of lost canals and rediscovered falls. Near the old crossing point of the Middlesex Canal near the falls in Billerica was the 495-Route 3 cloverleaf. On the Billerica side of that cloverleaf, north and south of Brick Kiln Road, "you can walk nearly two miles through deep woods along the old canal, which has aged there for nearly a century and a half untouched and unrestored, thirty feet wide, water still in it, but low under green algal scum." White pines, tall enough to be the masts of ships, were there, along with honeysuckle, huckleberries, birches, and oaks. "In the low and distant hum of internal combustion," McPhee wrote, "the quiet path is precisely the one the brothers used with their cord and pole."[442]

Like Thoreau, McPhee saw a few fish along the way. He passed two fishermen in a boat just past Old North Bridge on the Concord River. One had caught a fourteen-inch pickerel. "Last week, I caught a thirty-inch northern." The man told the other fisherman, as McPhee and his friend passed them, that a pickerel is crafty and "lies in ambush." After another mile, McPhee and his friend watched "a young guy on a granite outcrop" pull a young pike from the water. "It was two feet long."[443]

442. John McPhee, *Uncommon Carriers* (New York: Farrar, Straus, and Giroux, 2006), 119.

443. McPhee, *Uncommon Carriers*, 122.

On Sunday Thoreau had described their morning in Concord. Thoreau wrote that "the air was so elastic and crystalline that it had the same effect on the landscape that a glass has on a picture. . . . We were uncertain whether the water floated on the land, or the land on the water." The Concord was "similar" for McPhee and his friend on a Sunday afternoon in 2003. "Blue herons lined it like gargoyles. Who knows what pious thoughts they were thinking." In eleven miles on the Concord, McPhee and his friend saw "one beer can (afloat), one orange-and-white plastic barrel (in the alders)," and no other flotsam and jetsam.[444]

When the Thoreau brothers reached the Amoskeag Falls, McPhee recalls, they realized that the roar of the falls that they had heard from the mouth of the Piscataquog was not the falls but "the output of the power canals." Thoreau had commented on the "artificial falls" that they had passed, "where the canals of the Manchester Manufacturing Company discharge themselves into the Merrimack." These were "striking enough to have a name, and, with the scenery of a Bashpish, would be visited from far and near." The water fell thirty or forty feet over seven or eight steep and narrow terraces of stone, "to break its force," and was "converted into one mass of foam." In September of 2003, McPhee wrote, "no roaring water was falling down the terraces of stone, no exotic tourists were present, and there was nothing much to see on the river but forty seagulls in conference."[445]

McPhee ended his story below Hooksett Dam, where the Thoreau brothers had returned from their "week within a week," a trip up to the White Mountains and back again to find the place where they had hidden their boat. "We had come away up here among the hills to learn the impartial and unbribable beneficence of Nature," Thoreau had written. While Thoreau was

444. McPhee, *Uncommon Carriers*, 122 – 124.

445. McPhee, *Uncommon Carriers*, 147 – 148.

"waxing philosophically," one of the melons drifted away. Thoreau had put it into the mouth of the creek to cool, "and it took off." Here McPhee flowed out of Thoreau.

> "In pursuit of this property," the brothers jumped into their boat, chased the melon downstream, and, "after long straining of the eyes, its green disk was discovered down the river, gently flowing seaward." They had cut a tap out of the melon to hasten the cooling, yet the melon had stayed upright, and in the unbribable beneficence of Nature, no water had gone into the tap.[446]

When John McPhee took to the Concord and Merrimack Rivers in 2003, he was following his own melon into a legacy ecosystem of more than three decades of Clean Water, fish and wildlife management, and hydroelectric power. The Merrimack River that he encountered, after publishing twenty-seven books and two anthologies of notable writing, was about as natural as it would be in the disturbed environs of a new century.[447] Most of the big things were settled, or at least on their way to the lawyers to be settled and agreed on paper. Most of the small things were compacted into little riverside vistas and the slow brown procession of the river under highway bridges and down to the ocean. Most people who went to the Merrimack were not in search of a living, or even a pretext to make a point for other people to see. They were simply the people living in and among the local places that made up this legacy ecosystem.

McPhee's trip tells us about those local landscapes. His recreation of Thoreau's track took him across features – under highway bridges, over parking lots, and past a few green places here and there – that showed the history of the Merrimack in the last six decades. The Clean Water Act of 1972, McPhee averred, was among "the highest legislative accomplishments" of the twentieth century. It owed "more than a little to thought set in motion by Henry David

446. McPhee, *Uncommon Carriers*, 151 – 152.

447. The list of McPhee's works comes from the 2006 hardcover edition.

Thoreau."[448] But more than thirty years after its inception, McPhee could still see industrial detritus here and there; and there were still dams in the river. For most of the previous half-century, roads and bridges, cars and traffic turned the Merrimack into an unassuming neighbor, a watery band spanning two states without really defining either one anymore. An age of propertied water had flowed into an age of local water. A time of secondary growth and stone walls gave way to a suburban shuffle. The water map has expanded as sewers were extended and wastewater treatment has become a matter of daily routine.

In the years since 1972, the cities have been resettled by younger and different immigrants, including Spanish-speakers in Lawrence and Asians in Lowell. There are newer people who took up the apartments in older buildings, parking on the streets near the places that they can afford.[449] Meanwhile a dozen good old mill buildings, structures that would be worth a UNESCO feature article in any developing country, were now property for sale or lease. The signs said so, with a big bold phone number for the realty company posted well above street level where it would be clearly visible to drivers who sit at the lights on Broadway in Lawrence or Merrimack Street in Lowell.

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448. McPhee, *Uncommon Carriers*, 124.

449. In the 2010 census, Lawrence reported a population of 76,377 for Lawrence city, of which 32,704 were white, and 56,363 reported as Hispanic or Latino "of any race." Lowell reported a population of 106,219 in 2010. 64,240 reported as white, and 18,396 reported as Hispanic or Latino "of any race". 21,513 reported as Asian. U.S. Census, "Massachusetts: 2010, Summary Population and Housing Characteristics,Table 3, Race and Hispanic or Latino Origin: 2010," "Table 4, Race and Hispanic or Latino Origin: 2010," http://www.census.gov/prod/cen2010/cph-2-23.pdf. Accessed: June 2, 2016. The census report differs from a recent local account. In 2010, Lowell was designated a Cambodia Town in order to give official recognition to the Lowell Cambodian American community's "contribution over the past three decades to revitalizing the partially blighted lower highland neighborhood and to elevate interest in the area's stores and restaurants, attract new businesses, bring in tourists, and increase civic pride." According to Dr. Sengly Kong, a third of the population of Lowell is of Cambodian origin. Lowell has the highest proportion of Asians of any city in the Commonwealth, 20.2 percent, compared to an average proportion of 5.3 percent statewide. "'Cambodia Town of Lowell' by Dr. Sengly Kong," reprint from *Khmer Post USA*, dated August 23, 2013. The reprint is here: http://www.richardhowe.com/2013/08/23/cambodia-town-of-lowell-by-dr-sengly-kong/ Accessed: January 31, 2014.

Coastal fisheries in Massachusetts are no longer commercially viable, except for sport. Where rivers have broken loose of their mills and stones, fish and game agencies assert their brood stock presence with little more than a glance to the world that lived through the childhood of Thoreau. The idea now is to put some kind of fish in a river, for that is what people expect, whether there were brown trout in the Shawsheen in the time of Passaconaway or not. The marine fishery downstream of Lawrence and the brood stock fishery in New Hampshire are separated by miles of confined waters. They may be Class B, but they do not flow freely.

The cleanup of the Merrimack is a public benefit. Clean Water made pollution control a national mandate, above price and beyond place. But breaking off the profit motive from the rest of the waterscape has meant that the cleaner river does little to make jobs or careers for the vast majority of the people now living in the shadows of industrial history. That industrial history has become a kind of franchise for the people in Lowell, but Lawrence has not been so fortunate.[450] The historic urban landscapes blend into a graying familiarity of a half-dozen places where you would never want to get off at the wrong exit – not because the neighborhoods are more or less dangerous, but because it takes so long to turn around and get back on the highway.

It is another kind of turnaround – the work of a half-century of measuring, calculating, listing, presenting, representing, regulating, and managing, from the pigeons on the roof to the crumbling fissures in the sidewalk – that has maintained the restoration of the Merrimack even

450. Ross J. Gittell *Renewing Cities* (Princeton: Princeton University Press, 1992), 74. The first of a series of Lowell urban park bills was filed in 1972. In April 1977, with forty co-sponsors, Congressman Paul Tsongas formally introduced a bill to create a national park in Lowell. Tsongas was able to draw on support from other members of the Massachusetts congressional delegation, as well as from representatives throughout the Northeast and Midwest and from many freshman representatives from the post-Watergate elections, representatives who were "sympathetic" to Lowell's circumstances and liked the "precedent" established by using historical preservation as a "vehicle" for urban economic development. Despite opposition from conservatives and representatives from Western states, Public Law 95-290 (92 Stat. 290) passed both houses of Congress in May 1978 and was signed by President Carter on June 5, 1978. This law authorized a total of $40 million for the Lowell Historic Park and a Lowell Historical Preservation District. Gittell argues that the bill had justified federal involvement with the argument that "without federal assistance, the early buildings and other structures in Lowell would be lost."

while so much of the landscape is potholed and untoward. The disappearance of big steamboats and loud barges, and even outboard racers, has afforded a thousand little places where the trees are strong enough to bear the weight of a grown man, for a moment of the way, down to the water's edge. At many places the water is clear. The murk, the brown swirl of recent sediment and remote possibility, does not assault the nostrils even if it does not entice the eyes. And there are a few more fish in the river now, for those who are willing to go after them.

This chapter is the story of the Merrimack River in the twenty-first century. These are the years of maintaining historic improvements while managing the disparate needs of cities, towns, and local ecosystems. Urban places present new opportunities for old structures and old spaces. Ecological restoration allows nature to come back to local settings, and even to reopen streams where small dams can come down. Down the estuary, fishing is pretty good, although fish ecologists have changed their focus in restoration from salmon to shad. But the clam flats down the estuary are open, at least when it will not have rained. The legacy ecosystem of the Merrimack River is one where more nature can thrive and more people can encounter their local river. The legacy ecosystem is maintained so that it can perhaps be improved, here and there.

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For all the nature that had come back since 1965, the Merrimack was still very much an urban river at the end of the twentieth century. In January of 2000 a gasoline tanker filled up in Chelsea and headed up the highway to Lowell. Going into the turn at the tight little rotary where 38 meets 110, the truck wiped out and the tank was punctured. Thousands of gallons of gasoline were now washing out of the Hunts Falls Rotary towards the river. Although the driver was uninjured, the Merrimack was in danger. Within hours the rotary had been closed and the spill had been contained with foam by teams sent to the site from as far away as Logan Airport and

Nashua. The next day, the rotary was still closed, but the deputy fire chief was certainly relieved. "In some ways we were lucky," said Patrick McCabe. "If this had ignited, it would have been serious." A spokesman for the Department for Environmental Protection was able to rule out any threat of gasoline entering public water supplies. "It could be days before this area is stabilized," said Rick Lombardi. "But we want to assure the public that there's no threat to the drinking water."[451] Hazardous materials cleanup had grown up since the Sixties. Where millions of gallons of waste had once been dumped, now not a drop of gasoline would enter the stream.

The Merrimack has become clean enough to be a local river even in the middle of a city. In August of 2000 the Greater Lawrence Community Boating Program was honored by state environmental officials as the best of its kind in Massachusetts. The program puts about six hundred children and adults every day into the Merrimack River in boats of different sizes. A twenty-three-year-old corporal in the Marine Corps, who grew up in the projects and worked for the program as a teenager, remarked that his experience in the program helped him later in life in the swamps at Parris Island. Director John E. Griffin explained the important place of the program in the community in Lawrence. "Look at our building," he said. "There's no graffiti here. We don't get tagged. We take good care of the city kids. But we don't coddle them:

> There's no swearing, no horse play. The kids take care of the equipment. And we're absolutely airtight on water safety. We want to set a tone here, that you can drop your kids here for a few hours and nothing bad is going to happen to them.[452]

451. Daniel Mac, "3,000 Gallons of Gasoline Spill Near River," *Boston Globe*, January 29, 2000, B8; Thomas Grillo, "Gasoline Spill Keeps Lowell Rotary Closed," *Boston Globe*, January 30, 2000, C10. Grillo reported that most of the tanker's capacity – 11,900 gallons – had poured onto the ground.

452. Mark Sullivan, "Sailing Program Buoys Urban Spirits: Lawrence Operation Draws All Ages," *Boston Globe*, August 8, 2000, WKNW 1.

Canoeists in Lawrence can see plenty of brick buildings along the way. There have been two general trends of recycling old mill buildings and their subsidiary outlying structures: with small businesses, in suites and larger workspaces cut out of the old factory floors; or with residential redevelopments, in the form of assisted living facilities for people in their fifties and sixties. In 1999 the Department of Housing and Urban Development appropriated $250,000 to develop a loan program for "cyber-related companies" that would relocate to Lawrence. The program, which was created for the entire city, focused on the four empty mill buildings by the river in February of 2000. "It puts investment capital alongside some inexpensive and vacant mill space to create opportunities for entrepreneurs," said William J. Luster, who was the director of the program. Lawrence was looking for federal money to help with a plan to renovate mill buildings and maybe to level a couple of structures to allow more parking and open spaces along the Merrimack River. [453]

Although most of the buildings were in use at the end of the twentieth century, about 35 percent of nearly thirteen million square feet were still idle in February of 2000. The mayor of Lawrence, Patricia A. Dowling, explained the rationale for working with mill building owners to "ensure the highest and best use" for the mill building space. "What we'd like to do is convert some of the mill space that's being used now for maybe warehousing or maybe manufacturing. into startup high-tech computer firms." The mayor was hopeful about the possibilities of recycling the old to welcome the new. "On so many fronts, we can build in a totally different way and a much more successful way if we bring these companies to the city," she said.[454]

453. John Laidler, "Lawrence Aims to Develop Old Mills," *Boston Globe*, February 27, 2000, 1.

454. Laidler, "Lawrence Aims to Develop Old Mills," 1.

Some urban spaces could be reopened to nature, at least if the public will could be sustained for the projects to be completed. The week before Christmas 2000, planner Eduardo Lozano sat down in his office in Harvard Square, Cambridge for an interview. Lozano foresaw the possibility of a "master plan" that would include mill building renovations, a possible city museum, and a public space along the Spicket River from Malden Mills to the Methuen town line. "There should be an enjoyable and safe linear park along both sides of the Spicket," he said. "It could be a big asset. Now it's a dumping ground."[455]

Over the next several years, a greenway took shape where a brownfield once stood. Manchester Park opened in June of 2009. "It's perfect," said Glenny Lara, a thirty-year-old mother who brought her children to the park. "I can come here and my kids can enjoy it, instead of staying indoors." More plans for green city spaces were in the works. In July of 2010, the state's Executive Office of Energy and Environmental Affairs announced a $2.6 million Gateway City grant to "design and construct" the Spicket River Greenway, a two-and-a-half-mile stretch along the Merrimack.[456]

It took about three years to develop the little space for nature in the middle of a city. The Spicket River Greenway was dedicated on July 26, 2013 with a ribbon-cutting ceremony at Central Catholic High School. The ceremony culminated a $10 million project that opened three-and-a-half miles of riverfront land to restoration for the first time since textiles had come to the city. Opening a greenway did not mean the revival of economic Lawrence, but it reopened a green place in the urban landscape. The time it took to secure such a space is evidence both of

455. Jerry Taylor, "Lawrence Makeover Plans Unveiled: Planner Envisions Museums, Library, Performance Halls," *Boston Globe*, December 10, 2000, 8.

456. David Rattigan, "The Greening of Lawrence," *Boston Globe*, July 22, 2010, GN1.

the financial challenges of redeveloping urban places and of the determination to make something look more natural even in the middle of a city.[457]

In Amesbury, a different geography affected both the opportunities and the expectations for reuse of urban structures and spaces in the local landscape. The Amesbury-Merrimac Factory dates back to the eighteen-fifties. A $20 million project announced in September of 2000 aimed to develop a 137-slip marina along more than seven hundred feet of boardwalk to front the eighty-unit condominium complex. The Hatters' Point project would go along with existing projects: a $4 million project to renew Amesbury's downtown, a $14 million shopping and business mall, and sewer and water line installation and the replacement of the Powwow River Dam. "We are extremely happy with what is happening here and with developments like Hatter's Point," said Mayor Nicholas J. Costello. "There had been other proposals for the hat factory in the past, but they were always met with opposition and were rejected. But as far as I know there is no opposition to this renewal of the hat factory. Amesbury will have the benefit of new tax revenues without any burden on the school system."[458]

By December of 2004, the Hatters' Point condos were getting good prices: $409,000 for flats, and $571,000 for townhouses. Downtown mixed-use development had become part of the landscapes in Gloucester and Lynn as well as in Amesbury. These communities had active support from the Commonwealth given the rising proportion of Massachusetts residents over the age of 60 that would be expected in the coming years. ""We want the cities and towns to think about the information they need in order to be accommodating for elders, beyond putting street

457. Karen Sackowitz, "August 11, 2013, p. REG3; Groundwork Lawrence, "New Location! Spicket River Greenway Ribbon-Cutting," http://www.groundworklawrence.org/rsvp, Accessed: January 22, 2014. Sackowitz's piece cited a website for Groundwork Lawrence, where the details of the ceremony are posted.

458. Andrew Blake, "Hat Factory to House Aging Baby Boomers," *Boston Globe*, September 3, 2000, WKNW1.

signs in a larger font and building a senior center," said Jennifer Davis Carey the secretary for the elder affairs office in Massachusetts.[459] The prosocial aspect of building senior housing was as inviting as any profit motive.

Separating profit from promise was not as easily done. By 2008, the Marina at Hatters Point was feeling the pinch of rising gasoline prices and rapidly shifting financial priorities. Boating was a fine pastime, but it was not a cheap one. One boater from Brockton, Martin Fernandes, explained why he was selling his boat. His son was entering private school the next year. "That's the basic fact: I don't have the money to waste on it anymore," said the Boston firefighter. "I don't have money to spend like that anymore. I've got to spend it on other things." Some marinas were only able to fill all of their slips by not raising their prices, which limited their profit margins. At Hatters' Point, owner Dan Swift had seen growth in his business every year since 2005. With no growth in 2008, Swift expected to see as many as twenty empty slips. "I'm having heart failure. Yeah, I'm concerned about it," said Swift. "We're probably a little more vulnerable than most. But we'll get through it because we're too stupid to give up." [460]

By the spring of 2009, the marina was under new ownership. After Swift was forced into foreclosure, an auction of the marina was scheduled. It was averted on the day before the auction when three local businessmen – local developer Jay McPartland, well-known dock builder and installer Jay Knapp, and local builder Michael Picard – came together to make an offer that would pay off the mortgage and give Swift about a half-million dollars. McPartland

459. David Rattigan, "Happier Landings for Empty Nesters: Communities Acting to Meet Their Needs," *Boston Globe*, December 12, 2004, 1. Carey, who had been working with Douglas Foy, secretary of the state Office of Commonwealth Development, estimated that the proportion of Massachusetts residents over the age of 60 would rise from 17 percent to 25 percent.

460. Keith O'Brien, "Many Boat Owners Struggling to Jump Ship," *Boston Globe*, April 14, 2008, B1.

noted that he and Picard were both well-known businessmen, while Knapp's expertise was closer to the river itself. "Jay Knapp has had a marine service for over 30 years, building and installing docks and marinas. I think we have a good ownership group — a lot of years of running small businesses, and we also have a vast amount of knowledge of marinas with Jay Knapp. Everyone on the river knows Jay." The new owners expected to be ready to go by May 15, 2009. Since the new ownership took over, business has improved. In 2014, the marina owners advertised on their website that the Marina at Hatters' Point has been voted "'Reader's Choice" marina in North Shore Magazine's 'Best of the North Shore 2012' (For the second year in a row!)." All of the owners "live locally and will provide complete on-site management."[461]

Lawrence and Amesbury present two faces of urban reuse. Lawrence, with its river frontage, can be a place for recreation even if many of the building spaces are unoccupied. The emptiness of a piece of frontage land occasioned its reuse as a greenway. Amesbury had a point where factory buildings could be reused for senior housing. The point's frontage afforded a marina, which was built while the Spicket River Greenway was still being funded. However, the marina had already been bought by new local ownership when the Spicket River Greenway was dedicated. On the other hand, Amesbury's condominiums were more attractive than office space in Lawrence. Local priorities shape local landscapes whenever people find new uses for old things; and it is up to those people, whoever they may be, to make those new ways work.

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461. A link to an article from May 7, 2009, by Lynne Hendricks of the *Newburyport Daily News*, is posted to the marina's website. http://www.marinaathatterspoint.com/contact.html. Accessed: January 22, 2014. The link on the marina website redirects to this link: http://www.newburyportnews.com/local/x845860713/Local-businessmen-save-Amesbury-marina-from-foreclosure-auction. Accessed: January 22, 2014. The quote from McPartland comes from the *Daily News* article. The marina's website also shows a nice aerial photograph of Hatters' Point.

At the end of April 2000, the Public Service Company of New Hampshire (PSNH) announced an agreement with the Audubon Society and with New Hampshire Fish and Game to contribute $100,000 over the next five years to a new osprey recovery program. PSNH, long the subject of complaints about environmental problems from nuclear waste at Seabrook to coal-fired plants, would now be part of the solution. In 1996 there were no nesting pairs in the Merrimack River in New Hampshire at all. By 2008, there were 20 active nests – more than any region in the state – and 30 live young in Great Bay. The osprey, once confined to Coos County up north, were now doing so well that they were delisted as an endangered species in New Hampshire.[462]

In the fall of 2000, Plum Island had found a new industry. "For diversity of species and numbers of birds, this is one of the top 10 sites in the United States," said Bill Gette, the director of the Massachusetts Audubon Society's Joppa Flats Bird Sanctuary. "We get people from all over." Mayor Lisa L. Mead put a name to the new face. "Ecotourism in Newburyport is a substantial and growing part of the economic base of the city." In October Newburyport hosted an ecotourism workshop to "instruct" local governments, state and federal agencies, and travel industry professionals on "how to conserve natural resources and plan for a community-based ecotourism industry." City officials estimated that about a quarter-million cars entered the 4,400-acre refuge on Plum Island each year. During a "typical week," 1,450 boats would be moored or docked in Newburyport harbor, and "up to 700 boats" would enter the Merrimack River at Newburyport's Cashman Park boat launch.[463]

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462. Robert Braile, "PSNH Pledges Aid for Osprey Recovery," *Boston Globe*, April 30, 2000, WKNH 1; New Hampshire Fish and Game, "Ospreys Soar Off New Hampshire's Threatened Wildlife List," December 8, 2008. Repost to the Great Bay Osprey Stewards Website: http://home.myfairpoint.net/dickhughes00/gbospreys/id363.htm. Accessed: January 18, 2014.

463. Amy Callahan, "Ecotourism Is a Boon to Newburyport," *Boston Globe*, October 22, 2000, 1.

This was the shape of restoration at the end of the twentieth century: a public utility partnering with private nonprofit agencies to bring back birds; a public agency providing local communities with access to nature. In the first case, business gave over to nature; in the second, nature became a kind of business opportunity. The salmon program before 1900 showed that restoring nature could be marketable. Sewalls Falls is a more recent example, a place for brood-stock fishing in the middle of a city. But what about those places for nature that cannot be set aside from human settlement? Fish and wildlife take to whatever environs can allow them to thrive. Preserves are beautiful, but they are the exceptions to an otherwise heavily settled landscape.

Ecological restoration, the science of managing natural places, has grown up to meet the challenges of making more places for nature among human environs. Robert W. Adler argues that "the concept of 'restoration' must include

> more than efforts to rehabilitate individual patches of habitat or specific features of the river. Restoration should include changes in how we use and manage the resources of the river, or ways to replace those resources, to strike an appropriate balance between human and environmental needs (to the extent that those goals can be separated), for the Colorado River and elsewhere.[464]

River restoration is at once principle and practice. Anthony D. Bradshaw argues that the place of human beings in nature has always been "ambivalent." Humans cannot live in "any sort of stability and comfort" without subduing nature "to some extent." Thus humans came to believe that they were charged with "domineering" nature.[465] Eric Higgs, who worked at Jasper

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464 . Robert W. Adler, *Restoring Colorado River Ecosystems: A Troubled Sense of Immensity* (Washington, DC: Island Press, 2007), 2.

465. Anthony D. Bradshaw, "Introduction and Philosophy," from *Handbook of Ecological Practices*, ed. by Martin R. Perrow, and Anthony J. Davy, 2 vols. (Cambridge and New York: Cambridge University Press, 2002), I: 3. Bradshaw's essay confronts the necessity of human expansion despite the moral probity of foregoing critiques of "exploitive capitalist cultures" that have dominated the natural world. "Despite [Aldo] Leopold's wish for an environmental ethic, human existence is not possible without damage – every individual needs space to move and to live with protection."

Park in Canada, argues that even if we can conceive of restoring a place, we must accept that the set point to be restored is a human idea in practice. "Wilderness is a constructed notion as well as real place; in the parlance of literary theorists, it is both the signifier and the signified."[466] This is no less true of a settled place like the Merrimack River.

Ecosystem restoration developed with a healthy recognition of its limitations. But its proponents hope to move beyond the worst of abuses to a permanently better baseline – a permanently more natural landscape. Such a permanent shift means that, at some point, the human hand has to be withdrawn. In 1992, the National Research Council defined restoration to include "a goal" of emulating "a natural, functioning, self-regulating system" that is "integrated with the ecological landscape in which it occurs." Depending on how this definition is expanded, there are certain parts of American river systems that are hardly "pristine" and yet may still be "restored". Restoration also implies other terms, like remediation, that emphasize certain aspects of restoration without addressing the larger question of the final result to be achieved and then maintained.[467]

Restoring a "wilderness", or a place where few humans live and thrive, is an entirely different enterprise from restoring a place within a settled and disturbed environment. In New England, ecological restoration as a public policy only dates to the twenty-first century. In

466. Eric Higgs, *Nature by Design: People, Natural Process, and Ecological Restoration*. (Cambridge and London: MIT Press, 2003), 42.

467. Bradshaw, *Handbook of Ecological Practices*, I: 5 – 6. Bradshaw expands his discussion to include how the Society for Ecological Restoration has "broadened" this definition, "possibly excessively, to 'ecological restoration is the process of assisting the recovery and management of ecological integrity.'" Ecological integrity is defined to include "a critical range of variability in biodiversity, ecological processes and structures, and historical context, and sustainable cultural practices." Bradshaw's discussion recognizes the range of possibilities within ecological restoration by discerning between rehabilitation, remediation, reclamation, enhancement, and mitigation within the larger category of restoration. Remediation in particular has an "emphasis" on "the process rather than the goal itself." Eric Higgs concurs. "Setting goals will, and should, be an adaptive process. Thus the concept of pristine wilderness begins to pale as we learn more about human influence." Higgs, *Nature by Design*, 42.

Massachusetts, the Division of Ecological Restoration (DER) was created by Energy and Environmental Affairs Secretary Ian Bowles and the Department of Fish and Game (DFG) Commissioner Mary Griffin in 2009 with the merger of the Riverways and Wetlands Restoration Programs.[468] For the first time in the history of the Commonwealth, there was one discrete agency dedicated to restoring ecosystems – not just renovating spaces, but contesting them and taking them back from previous uses to something approaching a natural scene.

In the Massachusetts Division of Ecological Restoration's *2011 – 2016 Strategic Plan,* the DER defines restoration "broadly and inclusively." Restoration "encompasses activities that will not only help to restore and enhance ecological functions and values through physical actions" but also through" timely education and technical assistance" that leads to protection and preservation of ecosystems. Successful restoration results in "ecosystem integrity, resiliency, repair, revitalization and remediation." Certain activities do not meet the definition of ecological restoration because they are based largely on "the inability of actions to result in ecosystem self-sustainability" and "excessive reliance on operation and maintenance."[469]

The DER's definition of restoration draws on a 2008 report by the Aquatic Habitation Restoration Task Force, convened by the Executive Office of Energy and Environmental Affairs. According to the DER, the report defines restoration as "assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed." The report lists nine attributes that "provide a basis for determining when restoration has been accomplished." While the "full expression" of all of these attributes is not essential to demonstrate restoration," it is only necessary for these

468. Commonwealth of Massachusetts, Division of Ecological Restoration, *2009 Annual Report: Coming Together to Form the Division of Ecological Restoration; The Merger of the Riverways Program and the Wetlands Restoration Program* (Boston: Division of Ecological Restoration, 2009), 2.

469. Massachusetts Department of Ecological Restoration, *2011 – 2016 Strategic Plan Executive Summary*, http://www.mass.gov/eea/docs/dfg/der/pdf/der-strategic-plan-summary.pdf. Accessed: January 23, 2014.

attributes to demonstrate "an appropriate trajectory of ecosystem development towards the intended goals or reference.'" With this definition in mind, the Massachusetts DER's mission is to restore and protect the Commonwealth's rivers, wetlands and watersheds for the benefit of people and the environment."[470]

The Department of Ecological Restoration seeks to connect local landscapes to ecologically sound practices. The DER enunciates six strategic goals: to strengthen existing staff capacities; to expand and strengthen technical assistance and outreach across the Commonwealth; to pursue greater physical restoration "success" across the Commonwealth by increasing sources of funding; to restore "sustainable flows" across the Commonwealth by "keeping water local, implementing flow restoration projects and strategies, supporting a sustainable stream flow policy and raising the profile of the issue of stream flow and balanced water budgets at all scales"; to establish restoration and protection "focus areas" based on "strategic planning to prioritize work efforts"; and to undertake "a watershed or sub-watershed holistic restoration pilot project that integrates physical restoration, sustainable flow, water quality, and ecological protection measures."[471]

If the real problems of limited financial resources and limited scientific knowledge can be separated, then it becomes clear that ecological restoration in the twenty-first century brings the science to local settings as they are found instead of making itself available to provide resources for what people had planned ahead of time. The results have been promising so far. In 2009, the DER "led" the removal of four dams and completed four salt marsh restoration projects,

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470. Massachusetts Department of Ecological Restoration, *2011 – 2016 Strategic Plan Executive Summary*, http://www.mass.gov/eea/docs/dfg/der/pdf/der-strategic-plan-summary.pdf. Accessed: January 23, 2014.

471. Massachusetts Department of Ecological Restoration, *2011 – 2016 Strategic Plan Executive Summary*, http://www.mass.gov/eea/docs/dfg/der/pdf/der-strategic-plan-summary.pdf. Accessed: January 23, 2014.

"improving" the condition of 70 acres of salt marsh in four towns. In 2010, Massachusetts ranked second in the nation in dam removals, and the DER reached a milestone of 1,000 acres of wetlands restored.[472] In 2011, DER and partners restored "access and continuity" to 22 miles of river habitat and completed the restoration of eight wetland projects spanning 143 acres.[473] In 2012, nine dams were removed. Three wetland projects spanning 91 acres were restored. Over 1,040 stream crossings were surveyed.[474]

Not all things are possible. Erosion is a serious problem at the mouth of the Merrimack, where people and sand meet the tides and storms take sand out to sea. When author and naturalist William Sargent suggested in 2012 that a barrier beach like Plum Island should be slowly abandoned by human settlement, his argument followed the preternatural course of the estuarine system. Homes and other structures on Plum Island "don't allow it to move, so it can't re-form. You lose that ability of the beach to rebuild itself." The Army Corps of Engineers had issued permits for beach scrapings to protect five properties on Annapolis Way, but Sargent had little confidence in such measures. "I hate to be the one that says this, but they're all short-term and ultimately they're not going to work," he said.[475]

Local people were unconvinced. Robert Connors, who owned a construction firm in Woburn, had lived on Plum Island since 1979. He rejected the naturalist's arguments out of hand because Sargent "simply overlooks the absolute right of private property." Another local,

472. Commonwealth of Massachusetts, Division of Ecological Restoration, *2010 Annual Report* (Boston: Division of Ecological Restoration, 2010), 2.

473. Commonwealth of Massachusetts, Division of Ecological Restoration, *2011 Annual Report: The Restoration Economy; Bringing You Clean Water, Resilient Systems, and a Vibrant Economy* (Boston: Division of Ecological Restoration, 2011), 2.

474. Commonwealth of Massachusetts, Division of Ecological Restoration, *2012 Annual Report: Focus on Partnerships; Helping Cities & Towns in Massachusetts* (Boston: Division of Ecological Restoration, 2010), 2.

475. Taryn Plumb, "Can Plum Island Be Saved?" *Boston Globe*, October 4, 2012, GN1.

Martin Saridjian, had lived on Plum Island for 45 years. He adduced a more immediate and practical concern. In Newbury, private owners of beachfront properties provide some 40 percent of the town's property tax revenues. If they were to move away, it would create "a state of crisis" for the town. Connors, who was participating in local efforts to truck sand to shore up beaches, made a better argument about the realities of a disturbed environment like Plum Island. "It is impossible to reverse some 300 years of human development," he said.[476]

Some human developments are slightly more moveable, although they still take a lot of work. Dam removal has become a topic for serious discussion as dams become obsolete and even inefficient. In some rivers, like the Kennebec of Maine, these have been major structures that have reopened entire stretches of river to the salmon downstream. But there have also been cases, like the Rappahannock River in Virginia, where the removal has been followed by a release of sediment that polluted the estuary downstream. The Shawsheen River, a tributary of the Merrimack, is rather more modest than the Kennebec or the Rappahannock. But it is also a local river; and changing the local river means changing the local landscape.

Starting in 2007, local people started to wonder whether it would not be better to remove one, or more, of the three dams on the Shawsheen River. "We know for a fact that at the mouth of the Shawsheen River there are salmon, American shad, river herring, sea lamprey, American eels, and striped bass," said Caleb Slater, an anadromous fish biologist with the Massachusetts Department of Fisheries and Wildlife. "If we can get those herring going back up the Shawsheen, the stripers will follow." Atria Marland Place, a "national senior services provider," had bought the Stevens Street dam when it had purchased the former Newton senior complex on the Shawsheen in Andover. Jim Lane, the company's project manager, was at least open to removal

476. Plumb, "Can Plum Island Be Saved?" GN1.

when a company study showed it to be the most economical option. "We're proceeding cautiously here, but there are compelling arguments to do it," he said. "If the striped bass were reintroduced to the river, it could be very exciting. But, we've only had one meeting and we're right now only exploring the concept." The dam was flooding out basements in nearby homes. It was "old and falling apart," and rather than "spending more money to fix it up just to hold a lot of water to do nothing, it's better for the environment to remove it."[477]

In May of 2008, the Shawsheen River Restoration Partnership – a coalition of "government agencies, environmental groups, and key property owners" – authorized a $30,000 grant to study whether removing all three of the dams in the Shawsheen would be feasible as an overall plan. "It's a huge group of people, from national organizations on down to local folks like us," said Robert Rauseo, president of the Shawsheen River Watershed Association, who was at a meeting of the partnership on May 8. "I was incredibly impressed by the width and breadth of talent involved. This is not just someone pulling an old tire out of the river. This is top-of-the-line."[478] In September, a $50,000 grant from American Rivers and the National Oceanic and Atmospheric Administration Research center was approved to study dam removal in the Shawsheen River.[479] Federal agencies were willing to support research for reshaping local landscapes.

In June of 2010, a $25,000 grant from the Massachusetts Environmental Trust – a trust "largely funded by proceeds from the purchase of specialty environmental license plates," a program that had been making about $1 million a year since 1988 – was made to help with a plan

477. Tim Wacker, "Removal of Dams Seen as Fish Lure; Supporters Expect Salmon, Stripers," *Boston Globe*, October 25, 2007, 1.

478. Tim Wacker, "Coalition Eyes Dam Removal: $30,000 Study of Shawsheen OK'd," *Boston Globe*, May 25, 2008, GNW3.

479. "Community Briefing," *Boston Globe*, September 21, 2008, 2.

to remove two of the three dams.[480] In July, members of the Shawsheen River Watershed Association took their kayaks into the river. If the Balmoral and Marland dams could be removed, then paddlers could make their way from the Shawsheen all the way to the Merrimack River. The Department of Ecological Restoration had made the dam removals in the Shawsheen River a priority project.[481]

But some local people liked the standing water. Ballardvale Dam holds up a 60-acre mill pond. "Every day I walk in and open the window and look out at the waterfall and take a deep breath," said local attorney Joel Rosen, "and it just kind of wakes me up and makes me feel like it's going to be a good day." The Ballardvale Dam is "a historic feature," without which there would be no mill pond, "and the mill pond really is the centerpiece of Ballardvale. Once something has been there for 180 years, it defines the area. If we were to eliminate the pond, this would be a much less visually interesting and charming place." Tom Ardito, president of the Center for Ecosystem Restoration in Saunderstown, Rhode Island, took a longer view. "There's an older landscape that's been there for thousands of years and a river that's been there for thousands of years," he said. "In the history of the river, a couple hundred years is a very small amount of time."[482] But those two centuries had been transformative, to say the least. The Shawsheen would still have to flow through the suburban landscape of downtown Andover.

In 2012, dam removal began to advance beyond the study phase, but not everyone was convinced. "The Balmoral is a public safety risk. The case for the Stevens Street Dam is not there," said Suzanne Robert, a hydrogeologist recently elected vice president of the Shawsheen

480. David Rattigan, "Grant Advances Plan to Remove Two River Dams," *Boston Globe*, June 10, 2010, GN1.

481. Elizabeth Gehrman, "River Wild," *Boston Globe*, July 11, 2010, BGM2.

482. Elizabeth Gehrman, "River Wild," BGM2.

River Watershed Association. “A 3.1-acre mill pond will be gone forever. We'll destroy this for this small possibility that these target fish will be introduced. . . . It would be a disgusting, muddy, smelly flat if they drain the pond.” Robert argued that post-industrial urbanization along the Shawsheen has degraded the stream, including its water temperature, past the point where removing the dam would restore the stream to its pre-industrial character. “"There seems to be a Wild West mentality out there that if you take the dams out, everything will be better. I'm not against dams being removed in general. . . . But no loss of wetlands should be the overriding issue here. I don't think you can say it's just one little dam in Andover. It's one ecosystem being destroyed unnecessarily.” The total cost of the two dam removals, “slated” to begin in 2014, was estimated to be somewhere between $750,000 and $1 million. Dam removal at Ballardvale was opposed by the Shawsheen River Office Condominium Association, but the other two were set to move forward. Funding would come from public agencies as well as private sources, including owners of the dams. By October 2012, the Ballardvale Dam had become part of a plan partially funded by Massachusetts Fish and Game to remove all of the dams on the Shawsheen River.[483]

Federal and state funding was approved for two dam removal projects on the Shawsheen River in December of 2015. Those funds -- $25,000 to the Town of Andover, and $12,000 to Atria Senior Living on Stevens Street – helped to match $789,000 from the United States Department of Interior’s Hurricane Sandy Relief-Coastal Resilience Grant program. “Removal

483. Kathleen Conti, “Dams Due to Tumble,” *Boston Globe*, September 13, 2012, GN1; Dan Hall, “Shawsheen River Dams Slated for Demolition,” October 28, 2012. http://homenewshere.com/wilmington_town_crier/news/article_7ff33306-217b-11e2-8b27-0019bb2963f4.html Accessed: January 25, 2014.

of these dams," it was reported, "will restore passage for resident and migratory fish and improve public safety."[484] The millpond will become an reopened stream.

* * * *

Forty years after the Water Quality Act and the Anadromous Fish Conservation Act initiated the restoration of the Merrimack, the best player on the 1965 roster for the Boston Red Sox was fishing incognito off Plum Island. "Just say we're fishing the Merrimack," he told Stan Grossfeld with a smile. "Be vague." Carl Yastrzemski, who never used a fishfinder – they "only spot the bait fish" – was out on his boat, reminiscing with a sportswriter as he caught a few striped bass on a late September afternoon. Yaz, Grossfeld wrote, was "a hard-core fisherman. He is out there, rain or shine, and he never seems to get skunked." He would fish in Massachusetts "almost every day" until the stripers would migrate in mid-October, then head to Florida for the winter. On that late September afternoon, as weather conditions were "deteriorating," Yaz followed a hunch into the reeds. Soon he had a fish on the line, and then a beautiful striper in the boat. "That's a good looking fish," he said. "I'd say 36 inches, 15 – 20 pounds." Then he "gently" removed the hook and let the fish go. The "stunned, exhausted striper" lay on its side for a moment, "one eye staring at the great Yastrzemski." Then, "with a flip of the tail," it disappeared into the water. "I'll get you again someday," Yaz said. "It feels like hitting a home run." When Grossfeld wondered why Yaz would not bring the fish home for dinner, the former captain of the Red Sox started the engine. "If I want fish, I go to the fish market and buy scrod," he said. [485]

484. Brenda J. Buote, "Andover Awarded Grants for Shawsheen River Restoration," *Boston Globe*, December 23, 2015, 109.

485. Stan Grossfeld, "Fishing-Boat Captain," *Boston Globe*, September 27, 2005, E1.

Fishing in Massachusetts had changed in the time since Captain Carl first came to New England. In the late spring of 1961, Yastrzemski was playing in his rookie season for the Sox. Mike Beatrice recorded how two "lunker stripers" had been taken 80 miles apart off the Massachusetts coastline. One weighed 39-and-a-half pounds; one weighed 32 pounds, 1 ounce. Many of the stripers were small in the first week of June – "running up to 5 pounds or better" at Town Cove in Orleans, school bass on the North Shore that "moved all the way up to the Lawrence Dam," and "bass of the 8-pound variety" being taken at the mouth of the Merrimack in the surf.[486] In late May of 1983, when Yaz was taking his final lap around the American League, there were mixed reports of "mackerel schools, cod, and pollock offshore, but these are here today, gone tomorrow fish" on the north side of the Massachusetts coastline. Plum Island was "giving up spotty cod and good flounder. Best fishing there is at night." The Merrimack had seen "some pollock and shad."[487] Most of the good fishing was only for the people who went out in earnest and looked to catch whatever they could find.

The years since Yastrzemski's retirement have seen a rebound in striped bass populations along the Atlantic coastline. Although the dams in the Hudson have altered the age composition of striped bass, there are more fish, and healthier fish among them, near the mouth of the Merrimack. Fish stories report some stripers as big as 40 pounds, but many of the available fish were smaller than the ones that swam in the dirty old river. What water quality had perhaps afforded, hydropower had contained. Fish were more edible in 2005 than they were in 1972, and there were more of them in 2005 than there were in 1983. But by the turn of the twenty-first

486. Mike Beatrice, "Lunker Stripers in Mass. Waters: Big Ones of 39-½ and 32 Ounces Caught," *Boston Globe*, June 1, 1961, 41.

487. Tony Chamberlain, "Fishfinder: Weather Gets Sea for Effort," *Boston Globe*, May 27, 1983, 1.

century, the sport fishery had moved towards preserving the good fish rather than just landing them. It made more sense for a veteran fisherman like Carl Yastrzemski to release a caught fish than to take it home.

By the end of the twentieth century, fishing was pretty good if you'd know where to look. During the Eighties, striped bass populations were in decline up and down the Atlantic coast. The stripers rebounded because Public Law 98-613, the Atlantic Striped Bass Conservation Act of 1984, gave the Atlantic States Marine Fisheries Commission the power to impose a moratorium on any state's coastal fishery. Resource managers reduced fishing some 55 percent along the Atlantic coast in 1984.[488] In June of 2000, Tony Chamberlain wrote, "Against the news of some good-size striped bass moving into our waters is the bleaker outlook that, in general, striped bass sizes have been shrinking in recent years." Chamberlain offered an explanation and a suggested course of action to prevent another depletion of a resource that had only reestablished itself a few years earlier.

> As always, mismanagement is the key, and though we are not facing the kind of striped bass emergency we were two decades ago, the fish are smaller. The goal of sport fishermen should be to see a tough stand against the illegal commercial sale of stripers – which is rampant – and ultimately the categorization of striped bass as a gamefish.[489]

Stripers ranging to forty pounds were taken in the Piscataqua River, Great and Little Bay in New Hampshire, Saco River in Maine, the Isle of Shoals off Portsmouth, Plum Island, and the Merrimack River up to Lawrence. Surfmen at Plum Island were seeing thirty-inch stripers with clams. Cod offshore, along with haddock, continued to be "the staple of party boats." Black bass, tautog, and wolffish continued to "confound" some local anglers who had "rarely seen such

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488. 98 Stat. 3187 – 3189; John Tibbetts, "Ocean Commotion," *Environmental Health Perspectives*, 104, no. 4 (1996): 383.

489. Tony Chamberlain, "Bass Are No Longer Big News," *Boston Globe*, June 9, 2000, p. E13.

species in northern waters."[490] In 2001, live-lined fishing with herring made for "some of the best striper fishing of the spring months." During June and July, fishing with live mackerel bait got good results off Plum Island. In July, the best fishing was before sunrise.[491]

Fishers continued to see decent sport upstream of the ocean. In May of 2002, there was action in the Merrimack, from the mouth right up to the dam in Lawrence, where "shad and schoolies" were in abundance.[492] There was good fishing at Plum Island and Newburyport, "with stripers in the 30-inch range." The jetties at the river mouth and the flats had been "productive." Alewives running up the Merrimack River produced "striper action" by the Lawrence dam. Access was available at the parking lot below the dam.[493] By September, the fall fishing season, "the sweetest of all," was about to begin. Someone caught a 40-inch striper off the coast of Rye, New Hampshire. But the bass fishing at Plum Island and in the Merrimack River had "cooled off."[494] In 2003, the stripers in the Merrimack were chasing shad a week before Memorial Day, and on Memorial Day weekend they were hitting the alewives below the

490. Chamberlain, "Bass Are No Longer Big News," E13.

491. Tony Chamberlain, "Herring Is What They're Biting On," *Boston Globe*, May 11, 2001, D9; Tony Chamberlain, "Wind Has Dealt Blow to Anglers' Chances," *Boston Globe*, June 1, 2001, E9; Tony Chamberlain, "Weather, Fish Rock the Boat," *Boston Globe*, July 20, 2001, F10.

492. Tony Chamberlain, "Weather or Not, They're There: Gloom Can't Doom the Action," *Boston Globe*, May 3, 2002, D10. 2002 was in the middle of a good stretch for the shad counts at the Essex Dam Fish Lift: 56,461 in 1999, 72,800 in 2000, 76,717 in 2001, 54,586 in 2002, and 55,620 in 2003. There were 36,593 in 2004, but after that the numbers fell below 30,000 until 2013. U.S. Fish and Wildlife Service, Central New England Fishery Resources Office, "Historic Data, Anadromous Fish Returns, Merrimack River," http://www.fws.gov/northeast/cnefro/returns.html. Accessed: January 24, 2014.

493. Tony Chamberlain, "Season Earning Stripes: Bass Are Suddenly Busting Out All Over," *Boston Globe*, May 10, 2002, E12. Apparently the stripers were hungry that year. The river herring count at Essex Dam in 2002, which includes alewives, was only 526 – the lowest in five years. U.S. Fish and Wildlife Service, Central New England Fishery Resources Office, "Historic Data, Anadromous Fish Returns, Merrimack River," http://www.fws.gov/northeast/cnefro/returns.html. Accessed: January 24, 2014.

494. Tony Chamberlain, "Stripers Filling Up for Long Haul," *Boston Globe*, September 20, 2002, E13.

stone dam in Lawrence.[495] A month later, someone took a thirty-pound striper off Plum Island with a clam for bait.[496] For the most part, there are a few notable stripers at the mouth of the Merrimack, but few that would measure up to the big lunkers of old. [497]

In the managed anadromous fisheries of the Merrimack River – Atlantic salmon, American shad, and river herring (alewife and blueback herring) – there were fairly large fluctuations in returns from year to year. Figure 6.1 depicts the historic anadromous fish returns counted at the Essex Dam Fish Lift in Lawrence since 1982.

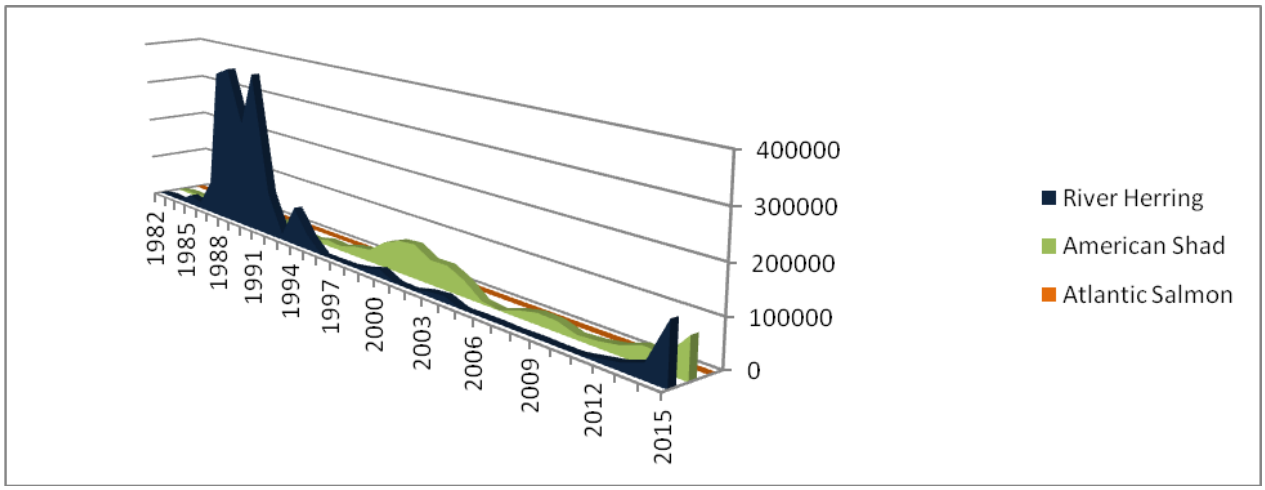

Figure 6.1. Annual Returns of Four Species of Anadromous Fish to the Essex Dam Fish Lift, 1982 – 2015.

A shad program initiated in 2010 has shown some decent results: more than 30 percent of all shad counted since 1983 have returned since the beginning of 2010. The 86,857 shad counted in 2015 was a course record for the Essex Dam Fish Lift, exceeding even the 76,717

495. Tony Chamberlain, "This Weekend Anglers May Be Crying Foul Weather," *Boston Globe*, May 23, 2003, E13; Tony Chamberlain, "Anglers Warm to Task: Increased Action Piques Interest," *Boston Globe*, May 30, 2003, D11.

496. Tony Chamberlain, "Whale of a Prize Awarded," *Boston Globe*, June 27, 2003, D14.

497. Stripers are catchable at the mouth of the Merrimack, but stories do not usually record sizes. "Stripers have been tough to catch because of the excess of bait in the water, but the ones that have been taken are fat and healthy," reported the *Fishfinder* on July 4, 2008. We can see a few stories from along the Massachusetts coastline that give indications of the summertime marine profile. In 2008, a striper weighing 35 ½ pounds was caught off Stellwegen Bank just before the Fourth of July. A week later, a striper measuring 41 inches was caught off Nut Island, where stripers were "plentiful". Jonathan Raymond, "Sparks Will Fly – and Bass Will Be Biting – This Weekend," *Boston Globe*, July 4, 2008, E9; Jonathan Raymond, "Stripers Are Finding Area to Their Liking," *Boston Globe*, July 11, 2008, E8.

counted in 2001. But there can always be spikes; consider the river herring returns for 2015 (128,692), which exceed the total returns of river herring for the period between 1996 and 2014. Each year comprises a percentage of the total numbers of salmon, shad, and river herring that have returned since 1982. Figure 6.2 depicts those yearly percentages from 1982 to 2015.

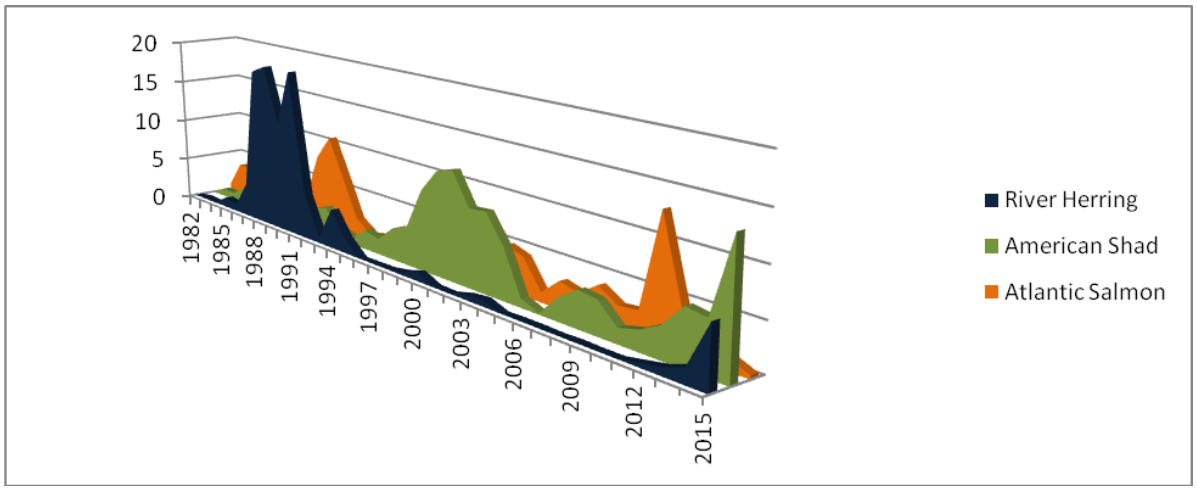

Figure 6.2. Percentage of Total Returns Represented by Each Year's Returns of Four Species of Anadromous Fish to the Essex Dam Fish Lift, 1983 – 2015.

Anadromous fish restoration was shaped by other local priorities after 1972. The keeping of the Essex Dam led to the completion of a reliable fish lift, but only at Lawrence. Fish returns at upstream dams are still low if they are countable at all. Since there is no expectation of a market, most of the salmon were left alone; but there were many fewer of them than in the bad old days of the late nineteenth century. Shad have shown some promise, and river herring have come back very recently. In 2013 the Massachusetts Department of Marine Fisheries announced new rules – a bag limit of three shad per angler, for the Merrimack and Connecticut Rivers – and a catch-and-release fishery elsewhere. River herring are still under a moratorium in state waters; a tolerance for bycatch is only approved in federally managed waters.[498] This last provision –

498. Division of Marine Fisheries, Commonwealth of Massachusetts, "New Regulations Governing the Harvesting of Shad and River Herring," http://www.mass.gov/eea/agencies/dfg/dmf/marine-fisheries-notices/new-regulations-062713.html. Accessed: February 11, 2016.

the allowance of bycatch in federal waters – has been contested by the Herring Alliance. River herring can be taken as long as they comprise no more than five percent of the total catch. The DMF had clarified that this exception applies only to bait fisheries occurring in federal waters in their proposed regulations. But while five percent "may not seem like a lot," industrial trawlers have been reported to catch "hundreds of thousands of river herring in a single net tow" of fish, "and these fish are severely depleted."[499]

On September 5, 2013, the United States Fish and Wildlife Service issued a press release that closed a chapter in the modern American history of fish ecology. "Based on continued low annual sea-run salmon returns and shrinking Federal budgets," the statement read, the U.S. Fish and Wildlife Service announced that it will "end its investment in the more than 30-year old Atlantic salmon restoration program" in the Merrimack River. "This was a hard decision, but the science tells us that there is little chance that we will successfully restore Atlantic salmon to the Merrimack," said Wendi Weber, the Service's Northeast Regional Director. "While the science is driving our decision, our declining budgets hastened it. We need to prioritize. With the lack of success, we need to shift our scarce resources to priority restoration efforts where we can make a difference."[500]

The Merrimack River Policy Committee had met that day in Concord, New Hampshire to ask the Merrimack River Technical Committee "to develop a plan that outlines program next steps, including stocking the last of the Merrimack salmon that are currently at the two hatcheries, and options for continued Atlantic salmon monitoring in river." The Service had

499. Herring Alliance, "Mass River Herring Rules Allow Landing Bycatch," http://www.herringalliance.org/blog/mass-river-herring-rules-allow-landing-bycatch. Accessed: February 11, 2016.

500. United States Fish and Wildlife Service, "Fish and Wildlife Service Ends Investments in Merrimack River Atlantic Salmon Program; Shifts Focus to Shad, other Fish Species," Press release, September 5, 2013. http://www.fws.gov/northeast/fisheries/news.html. Accessed: January 4, 2014.

already begun to "shift resources toward higher priority restoration efforts, such as American shad." Shad were being raised at the National Fish Hatcheries in Nashua, New Hampshire and North Attleboro, Massachusetts. The salmon announcement came after a similar decision in 2012 to end salmon restoration on the Connecticut River. In both the Connecticut and Merrimack Rivers, salmon returns had been "limited" due to poor marine survival, in-river habitat degradation, and dams that impede fish migration. The Service would continue to "focus" on recovery of endangered Atlantic salmon in Gulf of Maine rivers; those were "the last remaining wild Atlantic salmon in the country." For the Merrimack, however, the second salmon restoration effort had come to an end.[501]

The 2013 announcement was a logical development given the recent history of anadromous fish returns to the Merrimack River. In the twenty-first century, 2011 had been one of the biggest years in the whole effort, with 402 Atlantic salmon counted in the Merrimack River. But those 402 salmon comprised nearly a third of the 1,437 Atlantic salmon counted from 2001 to 2012 – an average of about 119 a year. In 2012, there were 137 salmon counted in the river, but as of July 10, 2013, only 22 Atlantic salmon had been observed at the Essex Dam Fish Lift. In contrast, from 2001 to 2012, 340,967 American shad had been counted in the Merrimack River – an average of more than 29,085 a year. More than 240 shad returned for every salmon counted.[502]

The foregoing profile does not seem very encouraging for the living things that depended on human priorities for their habitat and seemly conditions. The distortion of anadromous

501. United States Fish and Wildlife Service, "Fish and Wildlife Service Ends Investments in Merrimack River Atlantic Salmon Program; Shifts Focus to Shad, other Fish Species."

502. Central New England Fishery Resource Office, United States Fish and Wildlife Service, "Historic Data, Anadromous Fish Returns, Merrimack River." http://www.fws.gov/northeast/cnefro/returns.html. Accessed: January 4, 2014.

fisheries by dams and fishers strongly affects our appreciation for the good work that has been done. Moratoria on river herring, and previously on striped bass, afforded those populations the opportunity to rebound. The royal fish, the vaunted Atlantic salmon, was late to work and held up before dinner. The American shad, that bony standby, came into its own because the cruel experience of Atlantic salmon restoration – more than four decades of partnerships – had paid its way with the knowledge of how some fish could return if others would not.

The legacy ecosystem of the Merrimack River embraces the contradiction of an industrialized stream and a more natural one. Dams have put hard limits on the propagation of the fisheries of the Merrimack, especially above the Amoskeag Dam in Manchester. But for certain marine fisheries, the improvement in water quality was enough to bring back the marine life of the estuary. Clam flats in the Merrimack had been closed during the Twenties due to fears of contracting cholera and typhus. In October of 2013, the clam flats in Newburyport were reopened. Some 251 acres of Joppa Flat in Newburyport were reopened to licensed commercial diggers of soft-shell clams. Interest had come almost as the flats were reopened. Newburyport shellfish constable Paul Hogg had sold twelve permits in only a few days, and eight other people had also contacted him about getting a permit. "This is vital to us right now, because other areas are depleted," said Bob Stanley, of the family-run Stanley Seafood Company which is a Revere-based wholesale distributor to restaurants and seafood retailers in New England. "They need dozens and dozens of good tests before they can classify a flat as open. Hopefully they'll open some other local areas, too." Dave Roach, Merrimack River biologist for the Massachusetts DMF, explained that monitoring of bacterial levels and pollution remediation had done enough to return some flats to commercial digging. "It's really begun to pay off," he said.[503]

503. David Rattigan, "Clam Flats Reopen After 80 Years," *Boston Globe*, October 27, 2013, REG1.

Reopening the flats was subject to certain conditions that no one could really avoid. Clams would still have to be cleaned at the DMF plant in Newburyport, a process that takes two-to-three days. Bacterial contamination follows rainstorms, which means that any rainfall of more than a quarter-inch would close the flats for five-to-seven days. If the rain were heavier, then the closure would be longer, and reopening the flats would be subject to further testing. Dave Roach said that it takes a minimum of thirty clean samples, and perhaps many more, to establish the effects of pollution. But the Joppa Flat was at least open, joining three other areas – Salisbury Flat, Black Rock Creek in Salisbury, and the Old Point Flat in Newburyport – that comprise about 801 acres of clam flats that were reopened in 2006.[504]

With the reopening of Joppa Flat, there would be more than a thousand acres of clam flats opened to commercial digging for the first time in decades. Other places – in Revere and Saugus, and in Essex, where a part of the town was linked to Gloucester's sewer system, were now slowly reopening. Commercial diggers like Bob Stanley hoped to see more expansion of available spaces in the future. "Lynn would be nice," he said. "There are quite a few flats in Lynn Harbor." Public officials were a little more cautious. "They are forever optimists," said Jeff Kennedy, a Gloucester regional shellfish supervisor, "but when you are talking about fecal coliform levels or rain events, you can never predict reopenings."[505]

The Conditionally Restricted rating issued by the Massachusetts Department of Marine Fisheries means that the digging and depuration – removal of bacterial pollution at the DMF plant on Plum Island – are closely regulated. "Longstanding" regulations limit the digging of Conditionally Restricted areas to weekdays, and only by either licensed Master Diggers or their

504. David Rattigan, "Clam Flats Reopen After 80 Years," REG1.

505. David Rattigan, "Clam Flats Reopen After 80 Years," REG1.

employees, known as Subordinate Diggers. Master Diggers buy clams from subordinates at the site, puts them in plastic boxes, and then loads them into the Master Digger's truck for transit to the DMF plant "by a prescribed route." When the clams arrive at the Shellfish Purification Plant, they are placed on pallets and lowered into one of nine 3,500-gallon tanks that are filled with salt water from one of two wells that are each 130 feet deep. Depuration is "actually a self-cleaning process." The shellfish "purge their digestive system of particulates" as seawater is continuously recirculated and sterilized by ultraviolet lamps. Clams and tank seawater are tested daily for bacteria at the in-house laboratory. "Typically," after two-and-a-half-to-three days, "the shellfish are clean." The clams are then returned to the Master Diggers, who sell them to Massachusetts wholesale shellfish dealers for processing, resale, or both.[506]

In its summary of the recent history of the Merrimack River and its estuary, the restored Merrimack, even with some of its clam flats now conditionally reopened, is a contested place.

> The Merrimack River was once considered one of the nation's ten most polluted rivers. This reopening is due to concerted clean-up efforts begun over twenty years ago by local, state and federal programs and an aggressive re-sampling initiative by *MarineFisheries*. The reopening encompasses over 251 acres of the southeastern portion of the Joppa Flat, while the northwest section remains CLOSED and classified Prohibited as part of a closed safety zone around the Newburyport Wastewater Treatment Plant discharge. Joppa Flat will join some 534 acres of Merrimack River estuary clam flats in Newburyport and Salisbury, reopened in 2006.[507]

Four decades of Clean Water made a much better milieu for the drama of aquatic life in the Merrimack River. The performance did rather less about physical access to habitat.

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506. Massachusetts Department of Marine Fisheries, "10/18/13 250 Acres of Joppa Flat in the Merrimack River Estuary Reopened for Conditionally Restricted Commercial Soft Shell Clam Harvest," October 18, 2013. http://www.mass.gov/eea/agencies/dfg/dmf/marine-fisheries-notices/commercial-softshell-clam-reopening.html Accessed: January 24, 2014.

507. Massachusetts Department of Marine Fisheries, "10/18/13 250 Acres of Joppa Flat in the Merrimack River Estuary Reopened for Conditionally Restricted Commercial Soft Shell Clam Harvest," October 18, 2013. http://www.mass.gov/eea/agencies/dfg/dmf/marine-fisheries-notices/commercial-softshell-clam-reopening.html Accessed: January 24, 2014.

Blockage of the good places in New Hampshire shifted the landscape against the possibility of a self-sustaining anadromous fishery north of Lowell. This is not to say that there was no expansion or improvement of riparian habitat, or that habitat could not coexist with human walkways and boat landings. People could now come and go without constantly stressing the environs for birds and fish. But the riverine ecosystem is a legacy ecosystem. The mills have closed. Some of the malls have closed and reopened. For wastewater treatment, the big construction projects are over. The big social transformations of the latter half of the twentieth century have largely run their course, and the river is a cleaner one. In the absence of a regional natural disaster, a nuclear exchange, or a pandemic, most of whatever is in the Merrimack Valley is largely in place. Ecologists and environmental proponents have to be selective.

A river is a blurry place, one that defies a final settlement or even a satisfactory result for any given length of time within the life of a human being or even a strident generation. The conditional restrictions of the clam flats adduce a common truth: that a river, whatever its daily vagaries, can never be restored once-for-all, even by the purest intentions brought to mind by men and women of decent purpose. But what stands the test of time, in the early twenty-first century, is certainly not all bad.

Now there are green places, even among the gray places. The Merrimack River watershed is a contested place, a site of continual readjustments and occasional reassessments. It is not whether people have given up or taken up a new fight, so much as whether people engage or retreat, that shapes the landscape of the post-industrial (and yet still industrial) world. After four decades of public policy and private interests, the story is far from over, but perhaps it has only begun. With science as the guiding principle, there are settled answers only for those who will not endure the questions that arise from the truly testable, the truly repeatable, and the truly

falsifiable. Science eludes the easy comfort of human morality, even the self-induced transposition of the imaginable to the tune of the possible, let alone the celestial tones of the ideal world where value and cost are strangers to the realities of everyday life. The easiest adverb in environmental policy is *enough*. The hardest adverb is the selfsame word.

* * * *

On their second day in the dory, Henry David Thoreau and his brother John made their way past Tyng's Island. Henry called it Wickasuck Island, after the Penacook word Wickasee. He mused as it grew dark over the water near Chelmsford.[508] "The Scene-Shifter saw fit here to close the drama of this day, without regard to any unities which we mortals prize," he wrote. "Whether it might have proved tragedy or comedy, or tragi-comedy or pastoral, we cannot tell. This Sunday ended by the going down of the sun, leaving us still on the waves. But they who are on the water enjoy a longer and brighter twilight than they who are on the land, for here the water, as well as the atmosphere, absorbs and reflects the light, and some of the day seems to have sunk down into the waves."[509]

When they reached a good place to land near Tyngsborough, "where the sloping bank was a sufficient pillow," the two men transferred "such stores as were required from boat to tent, and hung a lantern on the tent-pole, and so our house was ready." They made their beds with a buffalo skin and blankets, and soon made a fire. After they had eaten, they put out the fire and closed the door. With "a semblance of domestic comfort," they sat up "to read the gazetteer, to learn our longitude and latitude, and write the journal of the voyage," or listened to "the wind

508. McPhee 126; National Canals Museum, "The Merrimack River Canals," http://www.canals.org/researchers/Canal_Profiles/United_States/Northeast/The_Merrimack_River_Canals, Accessed: January 25, 2014.

509. Henry David Thoreau, *A Week on the Concord and Merrimack Rivers Unabridged* (Dover Thrift Edition ed. by Kathy Casey. Mineola, NY: Dover, 2001) 71.

and the rippling of the river till sleep overtook us." There were small animals close by, with the Merrimack "sucking and eddying away all night down towards the marts and the seaboard," a "great work and freshet, and no small enterprise to reflect on." But instead of the "Scythian vastness of the Billerica night, and its wild musical sounds," they were kept awake by "the boisterous sport of some Irish laborers on the railroad, wafted over to us by the water, still unwearied and unresting on this seventh day, who would not have done with whirling up and down the track with every increasing velocity and still reviving shouts, till late in the night."[510]

One of the brothers was troubled in his sleep, "visited in his dreams this night by the Evil Destinies, and all those powers that are hostile to human life, which constrain and oppress the minds of men, so that the most innocent and worthy enterprises seem insolent and a tempting of fate, and the gods go not with us.

> But the other happily passed serene and even ambrosial or immortal night, and his sleep was dreamless, or only the atmosphere of pleasant dreams remained, a happy natural sleep until the morning, and his cheerful spirit soothed and reassured his brother, for whenever they meet, Good Genius is sure to prevail.[511]

510. Thoreau, *A Week on the Concord and Merrimack Rivers*, 71 – 72.

511. Thoreau, *A Week on the Concord and Merrimack Rivers*, 72.

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http://www.nefsc.noaa.gov/USASAC/Reports/. Viewed: March 25, 2012.

Other Fish Resources

The Atlantic States Marine Fisheries Commission (ASMFC)

The ASMFC manages twenty-four Atlantic coastal fish populations, some of which occur in the Merrimack River estuary.

http://www.asmfc.org/

Viewed: March 17, 2013.

The United States Geological Service (USGS)

USGS maintains a list of Nonindigenous Aquatic Species websites. The relevant site for the striped bass is:

http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=787

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APPENDIX.

University *of* New Hampshire

Research Integrity Services, Service Building
51 College Road, Durham, NH 03824-3585
Fax: 603-862-3564

11-Apr-2011

Melia, Timothy F.
History, Horton SSC
9 1/2 Eastern Avenue
Rochester, NH 03867

IRB #: 5107
Study: Getting Out of the Hole: Water Quality and Fish Ecology in the Merrimack River, 1965-1995
Approval Date: 11-Apr-2011

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved the protocol for your study as Exempt as described in Title 45, Code of Federal Regulations (CFR), Part 46, Subsection 101(b). Approval is granted to conduct your study as described in your protocol.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the document, *Responsibilities of Directors of Research Studies Involving Human Subjects.* This document is available at http://unh.edu/research/irb-application-resources. Please read this document carefully before commencing your work involving human subjects.

Upon completion of your study, please complete the enclosed Exempt Study Final Report form and return it to this office along with a report of your findings.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or Julie.simpson@unh.edu. Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,

Julie F. Simpson
Director