

The Salmon Times

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Revisiting the Past

Just as the 1800's was a period of hope and opportunity for people in New England, so it was a catastrophic period for the Atlantic salmon. As dams were raised to tame the rivers, salmon returning from the ocean were unable to reach their spawning grounds to reproduce. Water pollution from thriving mills and growing cities took its toll. The salmon, a tasty fish to say the least, was overfished. These factors caused wild salmon populations in many of New England's rivers, including the Connecticut and Merrimack, to disappear by the turn of the century.

In the middle to late 1800's many New England states joined forces to restore Atlantic salmon. Biologists did many of the same things that are done today. Fish were raised in hatcheries for release into rivers. Ladders were built to provide migrating salmon with passage over dams on their way up and downstream.

Using a variety of designs, fish ladders were generally constructed from wood. They all amounted to watery "staircases" and were surprisingly effective. Attracted

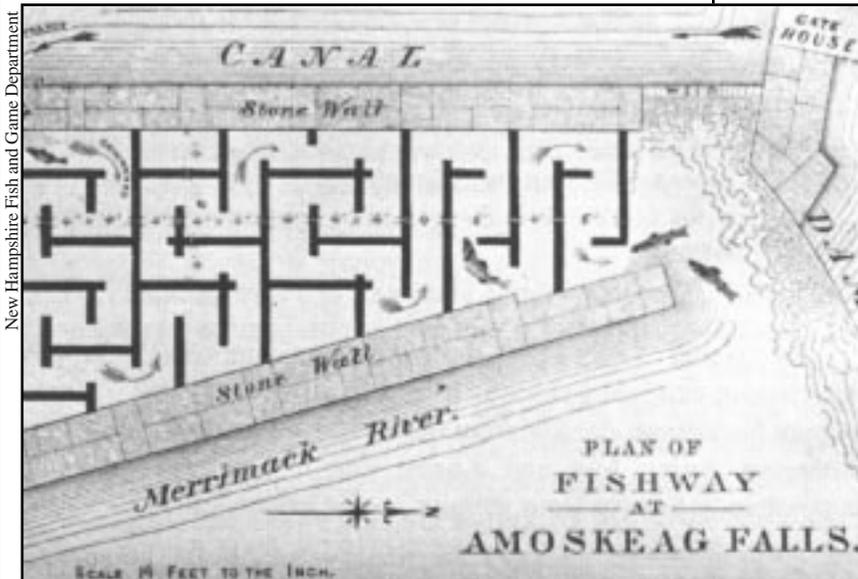


A hatchery worker from the 1800's removes dead salmon eggs from an incubation tray. This technique is still used at today's hatcheries.

to a ladder by the fast moving water spilling from its base, salmon or other fish gradually leaped their way to the top of the dam, one step at a time.

Hatcheries were built in a variety of New England locations. Salmon eggs were initially obtained from Canada, and later, from the Penobscot River in Maine. Incubated and raised to the fry stage, young salmon were released by the thousands into tributaries from the Connecticut to Penobscot River watersheds.

Some of the restoration programs were successful. 3,600 salmon returned from the sea to the Merrimack River in the spring of 1893. Misfortune struck in that same watershed in the spring of 1896 when a flood destroyed the fish ladder at the river's lowermost dam. Except in Maine, where efforts continued well into this century, interest in salmon restoration waned as state fish and game agencies turned their attention to other resource issues. Salmon would not again appear in many of New England's rivers for more than 75 years.



A plan for a fish ladder from the 1800's.

New Hampshire Fish and Game Department

Rivers in New England

Flowing Through Human History

Rivers have always played an important role in human life. In this edition of "*The Salmon Times*" we will explore some of the important uses of rivers - both historically and today.

Long Before Columbus...

To look at human history in New England, we must travel back in time thousands of years, before settlers first arrived from Europe and began building their towns and cities. As long as 17,000 years ago, Native Americans (or native people), inhabited the region.



**Passaconaway,
leader of the
Pennacooks**

Theirs was a challenging way of life, for much of the landscape was covered with ice - in some places up to one mile thick!

The last glaciation ended 10,000 to 12,000 years ago. At one point the glaciers held up to twenty percent of the earth's water and the level of the Atlantic Ocean was 400 feet lower than it is today. As the climate gradually grew warmer and the ice melted, the sea began to rise. The retreating glacier left behind the mountains, valleys, rivers,

and lakes we see today - features in the landscape which had been carved by the glacier as it moved forward thousands of years before.

Chasing The Woolly Mammoth!

The Native Americans that inhabited the region during the glacial period were nomadic, living wherever they could find food. This usually meant following the migrations of large animals. They were a carnivorous people, feeding mostly on caribou, moose, bear - even the woolly mammoth!

As the climate warmed, the variety of plants growing in the region increased. Tundra gradually gave way to forest. In addition to hunting, the natives now gathered nuts, berries, and other edible plants. They were no longer strictly dependent upon animals for food.

"Their mode of dressing fish was to boil it with beans and maize. In this pottage they boiled fish and flesh of all sorts either green, or dried, cutting it in small pieces. They also mixed with this pottage several sorts of roots, groundnuts, pompions, squashes, acorns, walnuts, and chestnuts."

By Wilkes Allen
in *History of Chelmsford*, 1820

It was during this period, 10,000 to 3,000 years ago, that the native people were becoming less nomadic, spending more time at specific campsites. Many of these sites were located along rivers and streams to take advantage of the spring spawning runs of salmon, shad, and herring. Because the natives left behind artifacts like spear points and stone tools at many of these sites, archeologists have been able to piece together their life stories.



Corn, Beans, Squash, And Pumpkins

The most recent period of Native American life we will talk about took place during the Woodland Period, beginning about 3,000 years ago. Many Indian groups, especially in southern New England, established permanent settlements and farmed the land. Corn, beans, squash, and pumpkins were the most common crops. Northern groups remained more dependent on hunting, fishing, and gathering - frequently moving with the seasons.

Family was at the center of Native American life. Native groups, or tribes, generally began with members from the extended family, then grew from there. Eventually a tribe might have had from 50 to 300 members. Tribal leaders were called sachems. A sachem was chosen for his ability to hunt, because of family connections, or other reasons. As a sachem got older, tribal leadership often passed to his son.

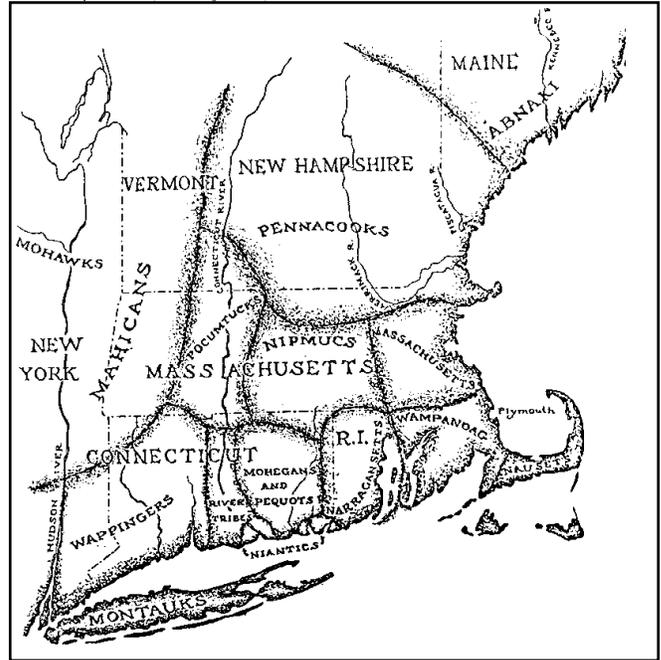
Individual tribes often formed larger groups - sometimes called confederations. Each confederation had an overall leader. Such groups or confederations included the Penacook, Abenaki, Wampanoag, Pequots and others. Many of the groups shared the same language and traded with each other.

First Contact

English settlers first moved into the New England region and made contact with Native Americans in the early 1600's. Early relations between the Indians and settlers were generally friendly. Settlers traded with the natives for furs.



Reprinted from *New England Indians*, c.1978, by Keith Wilbur. Permission granted by Globe Pequot Press, Old Saybrook, Ct.



This map illustrates the various tribal groups that existed in New England in the early 1600's.

Word of unlimited land and natural resources in the New World quickly reached across the Atlantic to the shores of Europe. Colonial settlements spread inland along New England's rivers, the very places where Native Americans had set up many of their own villages. The settlers cleared forests to build their homes and plant crops. The rapidly spreading settlements drove the native people off their lands. In some cases they were paid for their land; sometimes they were simply driven off. Eventually the natives were left with little more land than the reservations several of the tribes occupy today.

European settlement of New England had other disastrous impacts on Native Americans. Having little or no natural resistance to diseases brought over from Europe, native people died by the thousands. A deeply spiritual people, their religion was gradually replaced by Christianity. Their land gone, numbers greatly diminished, and beliefs diluted by European influence, the native way of life became a memory.

The New England of today is a patchwork of cultures from across the world. Native Americans remain a strong and important part of this diversity. Scattered throughout New England in various tribes such as the Penobscots, Passamaquoddy, and Wampanoags, these native people are beginning to re-discover and celebrate their rich cultural heritage.

The Industrial Revolution:

From Farm to Factory

Farming was a way of life for many early European settlers. But as the population grew and farmland became increasingly scarce, industry was the machine that drove the regional economy. Rivers were at the center of the Industrial Revolution during the early to mid-1800's. We will take a look at this "revolution" in the Merrimack River watershed. Much of what happened there occurred in watersheds throughout New England.

Turning Logs Into Ships

The 1700's marked the beginning of trade and industry in New England. With its expansive forests, New England became an important source of lumber for the shipbuilding industry. Newburyport, located at the mouth of the Merrimack River, was an important shipbuilding city. The most efficient way to get the logs to the factory was to float them down the river. However, getting the logs over the Pawtucket Falls near Lowell, MA proved to be a problem. In 1796, completion of the 1.5 mile Pawtucket Canal provided a way around the Falls.

On A Slow Boat To Boston

Canals soon became an important method of transporting goods and materials throughout the watershed. By 1815, it was possible to travel the 85 miles between Boston and Concord, New Hampshire by canal boat. Owners of the locks and canals made money by collecting a toll as each boat passed through a lock. The boats were odd looking, 9

USFWS photo



The construction of a dam at the Pawtucket Falls in Lowell during the early 1800's gave the mill owners more water to power their machinery.

feet wide and 75 feet long, and could carry substantial loads. They were propelled up and downstream using a combination of oars, poles, and sails. Canal boats were towed by horses through the Middlesex Canal between Lowell and Boston. Canal use was limited to the period from spring ice-out to the late fall.

The heyday of the canals came to an end during the 1840's with the establishment of a railroad line between Boston and Concord. The railroad ran year round and was much faster than the 4 to 5 days that it took to travel by boat between the two cities. Canals would yet play another important role during the industrial development of cities within the watershed.



Not only were logs floated downstream in "log rafts," they were sawn into lumber at water-powered mills built along the streams and rivers in the watershed.

source: "The Valley and Its Peoples" by Paul Hudson



source: "The Valley and Its Peoples" by Paul Hudson

A typical view of a mill and its boarding houses built along a canal.

A New Way Of Life

In the early 1820's, Lowell and his company, The Boston Manufacturing Company, built the first large scale textile mills in the watershed. The mills were totally self-contained, meaning they could process cotton, wool, and flax from "bale to bolt." Located in East Chelmsford (now Lowell), MA, these first mills were built along canals that provided the power necessary to run the machinery. Soon similar mills sprouted up in places like Lawrence, Nashua, and Manchester. The regional economy rapidly switched from agriculture to industry.

In many cases, cities were actually created by the mills. Company owners built churches, stores, and boarding houses for their employees. The first mill workers were women.

These "mill girls" brought with them a knowledge of cloth making to their mill jobs. When

they went to work at a mill, they had to sign a one year contract and were usually required to live in a boarding house. Twelve hour, six day work weeks were common. Later, as other better paying jobs became available, women began to leave the mills and were replaced by immigrant laborers.

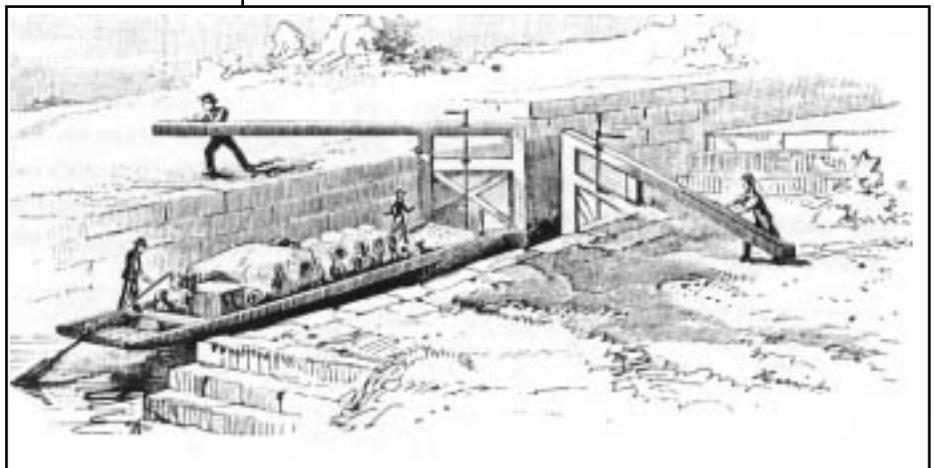
A Southern Migration

The golden age of New England's mills came to an end in the early 1900's. Because of the discovery of electricity, mills no longer had to be located along rivers and

In addition to farming, logging, and shipbuilding, spinning and weaving cloth was an important part of the regional economy. Women would get yarn from local spinning mills and weave cloth on a loom at home. The finished cloth was then sold to the mill owners. Though a relatively inefficient way of producing cloth, it did provide local people with much needed jobs for quite a period of time.

During the early 1800's, New Englanders were buying many of their products, including textiles, from Great Britain. It was cheaper to buy the British products than to manufacture them in America.

In order to compete with the British, cheaper and more efficient ways of producing goods had to be devised. In 1810, Francis Cabot Lowell, a Boston businessman, toured a number of textile mills during a visit to England. Upon returning to the United States, he set about to duplicate the power looms he had seen overseas. The Industrial Revolution was about to begin.



source: The Massachusetts Magazine, 1886.

Long before the days of gasoline engines and hydraulic machinery, propelling a canal boat and moving lock gates required brute force. Based on the weight of its freight, a canal boat had to pay a toll as it floated through each lock.

canals. Many textile mills were moved to the southern United States because of cheaper labor and fuel. Since cotton was grown in the south, expensive transportation costs disappeared. As mills closed, high unemployment and urban decay were often left behind.

In recent years, cities like Lowell and Manchester have rebounded. New industries have brought jobs back to New England. Perhaps more importantly, people have re-discovered their cultural heritage and have taken great pride in where they live.

New England as a Melting Pot



A French-Canadian couple from about 1875.

America has always been a special country in which to live because of the diverse cultural backgrounds of its citizens. This "melting pot" has its origins in the Industrial Revolution. When the "mill girls" left the mills to move west with their families

or take better paying jobs, someone had to replace them. Irish immigrants were the first group of people to take these positions. French-Canadians, Greeks, Poles, Portugese, and Russian Jews were among the later ethnic groups to work in the mills. Immigrant laborers became the backbone of the mill workforce. More often than not, these people left their homes in other countries in hope of finding a better way of life in America.

Rivers of Today

Rivers continue to play a central role in all of our lives. By the mid-1960's the relationship between people and rivers was strained. Many New England rivers were extremely polluted, among the dirtiest in the United States. They were being used to death. After an aggressive 25 year effort to clean them up, our rivers are much cleaner (though far from perfect) and are once again providing countless benefits to the wildlife and people that live in or near them.

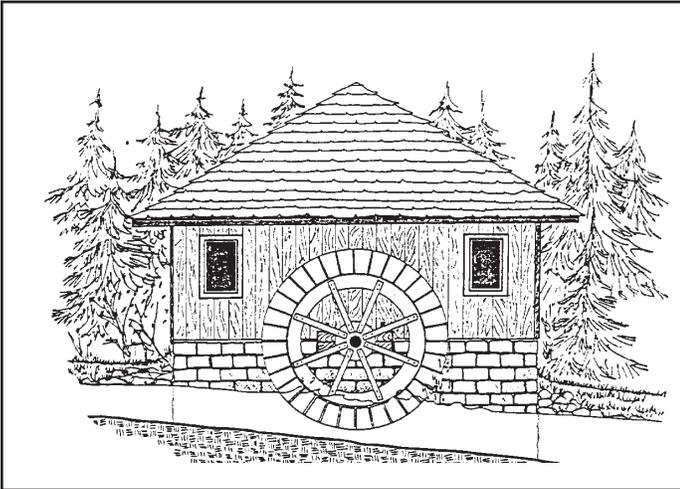
Rivers supply water to households across New England. 300,000 people drink Merrimack River water. Farmers depend upon rivers and streams for crop irrigation. Some factories use river water to produce the products that improve the quality of our lives. The paper this *Salmon Times* is printed on may have been processed with river water!

Waste has to go somewhere. Every household and factory in New England produces some form of waste. Water disappears down a drain - but where does it go after that? Sewage treatment plants in towns and cities across the region release treated waste into many of our rivers.

Rivers serve other important purposes. People and products travel by ship and barge along many of America's rivers. Clean rivers provide us with a variety of recreational opportunities: fishing, boating, swimming, or simply enjoying nature. As you will learn on the next page, electricity can be made from river water!



THE POWER OF WATER



Small mills with waterwheels were once common in New England.

Long before Thomas Edison invented the electric light bulb, people built dams to harness the energy of moving water. This is one reason why many cities developed along rivers. Factories used moving water to power machinery. Spinning waterwheels provided energy to saw lumber and mill grains. As the demand for electricity increased, people looked for inexpensive ways to produce it. Hydroelectric generation provided one of the answers.

Making Electricity

Falling water contains a certain amount of mechanical energy or hydrostatic pressure. Water flows or “falls” from the high to low side of a dam because of gravity. The greater the distance the water falls, the faster it moves and the more energy it has. A hydropower plant transforms some of this mechanical energy into electrical energy.

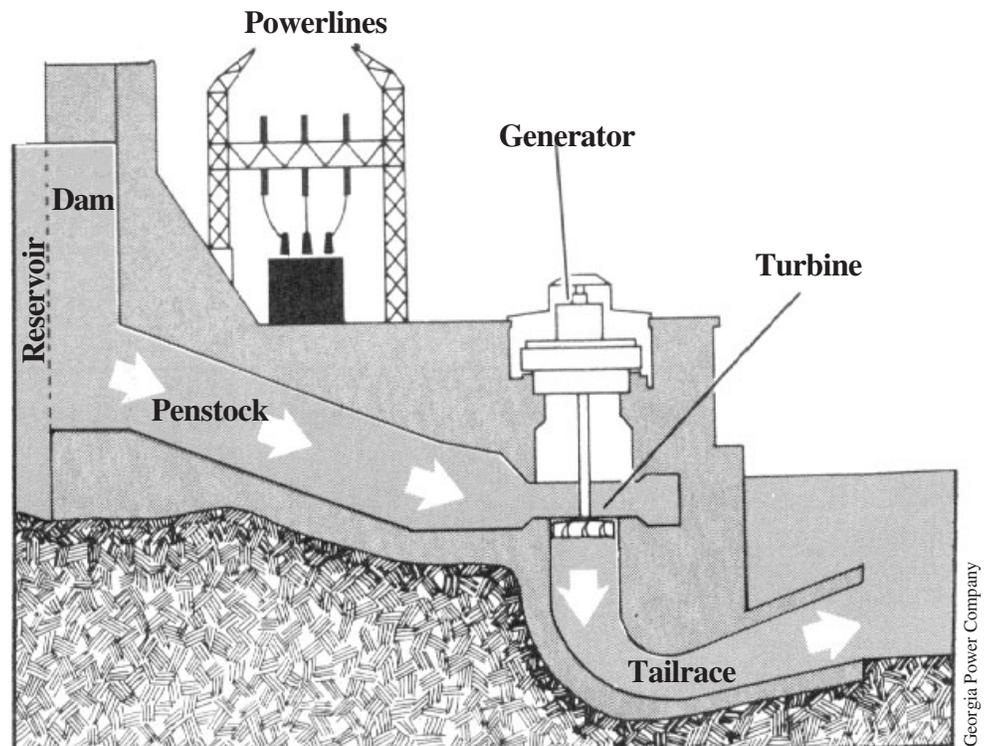
A dam backs up water and creates a deep pool called a reservoir. Water from the reservoir flows down through a penstock and rotates a turbine. The spinning turbine is attached

to a generator that produces electricity. The electricity is transferred through powerlines to the consumer (you and me). The water then flows out through a tailrace to the base of the dam and continues its downstream journey.

Hydropower plants are usually located where a river has a steep drop or slope. Natural waterfalls are frequently present at these sites. Tall dams with deep reservoirs can be built at these locations.

There are about 485 hydropower dams along New England's rivers and streams. Because most of the good sites have been developed, it is unlikely that many more dams will be built in the future.

Once a dam is built and paid for, a river provides an almost limitless supply of low cost energy. Hydropower is called renewable energy because the water that has produced it can be used again by other plants downstream. As long as there is water in a river, electricity can be generated. Hydropower generation is a relatively clean process because it does not pollute the air. However, it does have certain negative impacts on rivers and wildlife - impacts that we will discuss in a future edition of *The Salmon Times*.



This Diagram shows how a hydropower plant produces electricity.

Aquaculture:

Down on the Fish Farm!

Ever eaten a salmon from the supermarket? If you have, chances are the fish was an Atlantic salmon that was grown on a fish farm. These fish are part of a relatively new industry called aquaculture, the business of raising fish for the commercial market. Atlantic salmon, oysters, and blue mussels are three important species presently raised in the aquaculture industry.

Commercial fishing has long been an important industry for coastal New England states. After years of overharvesting, certain species of shellfish and finfish were greatly depleted. As a result, a "big chunk" of the regional economy was threatened. Aquaculture stepped in as a promising way to save jobs and meet the demand for fresh seafood. Nowhere is this more true than in the state of Maine - especially with Atlantic salmon.

Atlantic salmon are raised to the smolt stage in private freshwater hatcheries, just like a salmon hatchery you may have visited. From there the young fish are placed into saltwater net pens, usually located in protected bays or harbors. There they spend the next several years while growing to a "marketable size." These are the fish that end up on your plate.

In addition to the species already mentioned, researchers are developing ways to raise other marine species commercially. Clams, lobsters, haddock, cod, and flounder may be important aquaculture species in the near future. One company in Maine is presently growing nori, a type of edible seaweed in great demand by the Japanese.



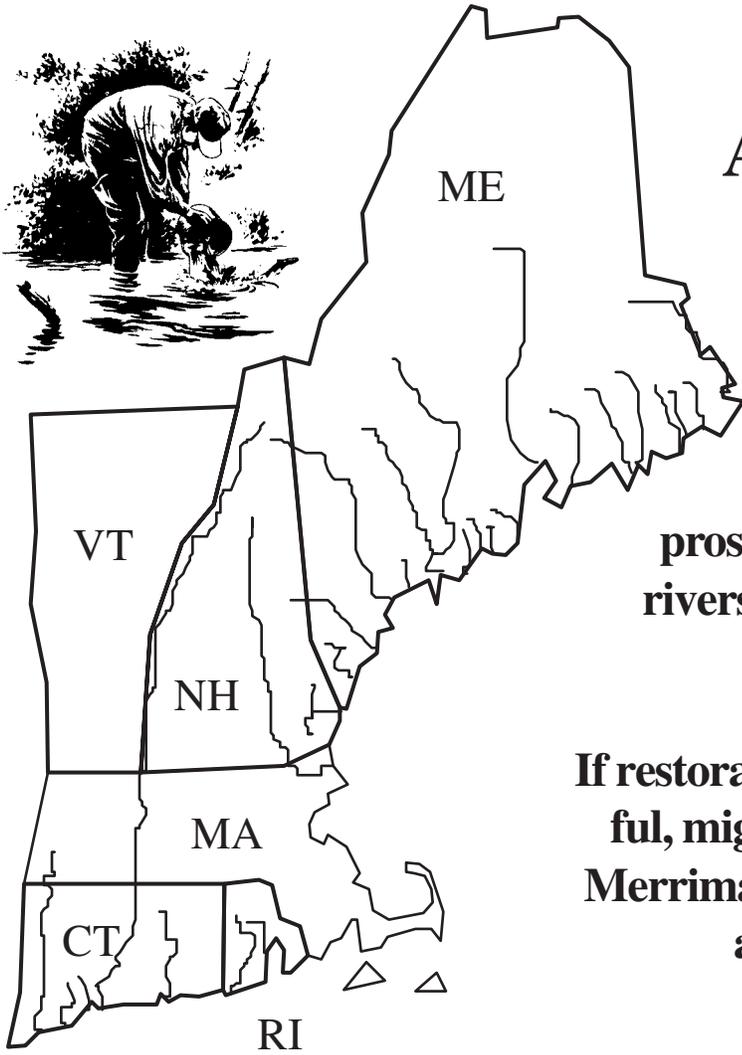
Harvesting cultured blue mussels.

There are some concerns about salmon aquaculture. The possibility that aquaculture salmon could escape from their net pens and intermingle with wild fish,

spreading diseases, is a major concern. Escapees could also compete with wild salmon for food and habitat. Some fear that fish food and waste from net pens could add to the water pollution problems that already exist in some of our coastal waters. Still others, particularly private landowners, object to the net pens they say interfere with their views of the seacoast. Hopefully, these problems will be worked out. It is likely that Aquaculture is here to stay. It takes the fishing pressure off natural fish stocks, provides jobs, and gives people something they like - fresh seafood!



A floating net pen for Atlantic salmon near Swan's Island, Maine.



A Second Chance...

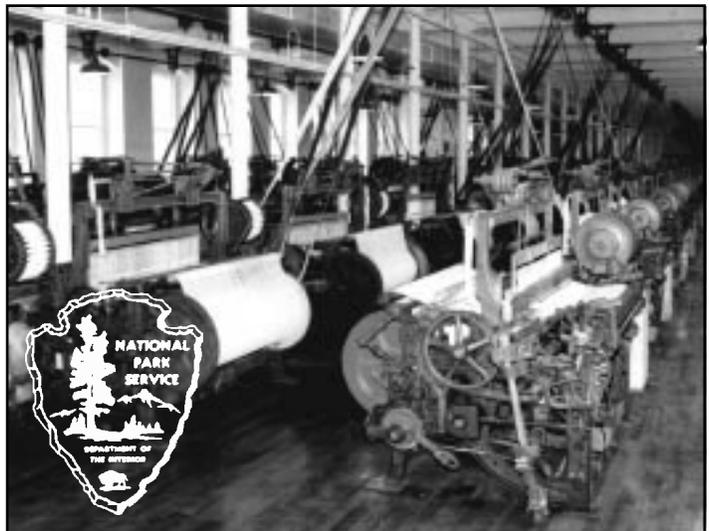
This map shows the New England rivers where populations of wild Atlantic salmon were once thought to prosper. Today just seven of these rivers, located in Downeast Maine, contain wild salmon.

If restoration programs prove successful, mighty rivers like the Penobscot, Merrimack, and Connecticut may yet again play host to the "king of sportfishes!"

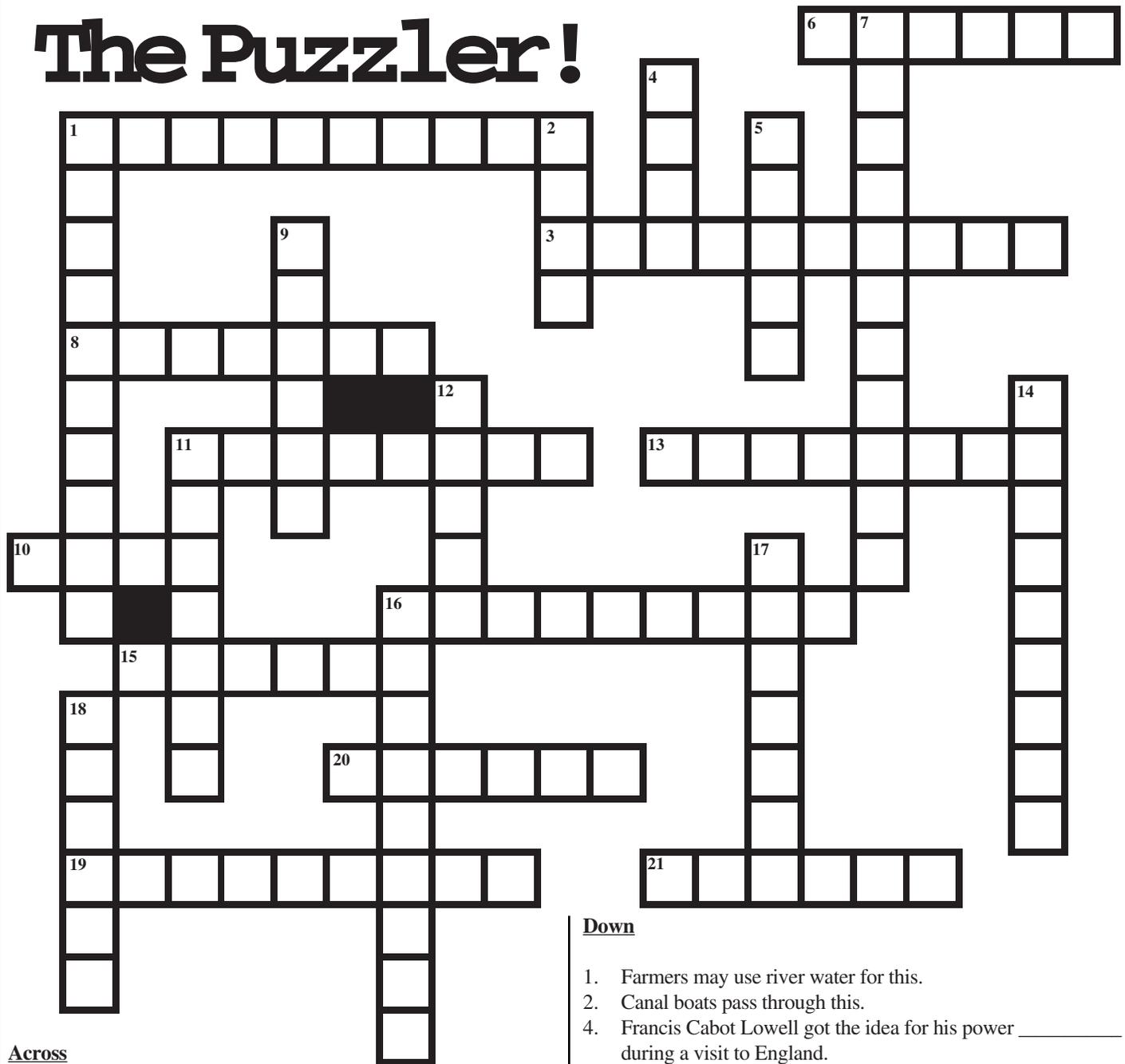
Have you ever passed through a lock on a canal boat? Ridden on a trolley car? Felt the floor shake beneath your feet as power looms churn out yard after yard of cotton cloth? Listened to the whir of a water-driven turbine? You can experience these and other adventures of long ago at Lowell National Historical Park in Massachusetts.

Established in 1978, the park preserves the history and culture of the Industrial Revolution. The park has a number of exhibits, tours, and educational programs that will give you a good understanding of what it was like to live and work in a nineteenth century industrial city in New England. Visiting the park on the weekend is a fun thing to do with friends or family. For more information about the park, call (978) 970-5000.

Stepping Back In Time



The Puzzler!



Across

1. The _____ Revolution
3. Raising farm-raised fish for the _____ market
6. An Indian tribal leader
8. Water flows downhill because of this.
10. A type of seaweed grown commercially in Maine
11. Everyone should be proud of their _____ heritage.
13. Hydropower plants produce electricity for the _____.
15. _____ species live in the ocean.
16. The body of water created by a dam
19. _____ laborers formed the backbone of the workforce in New England's cities during the Industrial Revolution.
20. Aquaculture smolts are placed in a _____, where they reach adulthood.
21. New England is a true "melting pot" because of the variety of _____ groups that live here.

Down

1. Farmers may use river water for this.
2. Canal boats pass through this.
4. Francis Cabot Lowell got the idea for his power _____ during a visit to England.
5. Blue mussels and clams are examples of _____ fish.
7. Fish farming
9. A plant that can be eaten safely is _____.
11. The _____ in New England during the last glaciation was cold.
12. A group of Indians
14. _____ left behind by ancient peoples help archeologists to tell their story.
16. Hydropower is one form of _____ energy.
17. Salmon, haddock, and other fish with fins are all examples of _____.
18. _____ American

