

Quest #105: Water Ways

(Christine Young, Program Host) Coming up on "Quest" ... Maine has more lakes and more miles of rivers than most other states. Geologically speaking, our inland waters are young, but there's an aging process for all lakes and rivers and it's accelerating in some Maine lakes. That worries some scientists. Maine's many miles of rivers and lakes have had thousands of dams built for hydro-power and flood control, yet how helpful are all these dams when major floods occur? And we'll see how being able to turn water on and off like a faucet at the dams affects sport fishing, and how dams have created a whole new industry in Maine. Our diverse inland waters ... that's what this "Quest" is all about.

Promo and Music

(Christine Young, Program Host) This is not only a magnificent lake, it is also the fountainhead of one of the mightiest rivers in Maine. Right here at this storage dam in Moosehead Lake is where the Kennebec River begins. Water running through dams like this can turn huge turbines in papermills and hydroelectric dams. It can cascade into class four, hang-on-for-dear-life white water rapids. And these waters are home to thousands of fish and other aquatic life. Maine is unique because we have so many outstanding rivers and lakes, but like everywhere else, some of our inland waters have problems. We've done much to clean up our rivers, but now some of our lakes are in trouble.

Dana Hutchins explains why vigilance is needed to watch over our many inland waters.

(Dana Hutchins, Segment Host) If it weren't for the allure of our coastline, Maine could have been best known for its lakes. There are only 3 other states in the country that can match the quality and number of Maine lakes and rivers. At last count we have nearly 6,000 lakes. Maine also has 32,000 miles of picturesque rivers and streams, 17 gorges, 61 waterfalls, and 31 white water rapids.

Unless you spend all your time on the coast, you're likely to have an attachment to a certain lake or stretch of river. But as much as we may be attached to a favorite lake or river, these inland waters are not as isolated as they may appear. They all belong to watersheds that include other lakes and rivers as well. There are six major watersheds in Maine. Most of the land in the watersheds is forested and many miles of the rivers are undammed and undeveloped. These watersheds are vital players in the hydrologic cycle.

David Firmage of Colby College studies Maine watersheds.

(David Firmage, Biologist, Colby College) We're standing here on Messalonskee Lake which is one of the Belgrade Lakes and all of those lakes are interconnected, one flows into another and flows into another. So you can look at this whole area as one watershed where the water flows towards one of these lakes but eventually into another. This happens to be the last in a chain and the water then will flow out the Messalonskee Stream into the Kennebec River and out to the coast. So the watershed means that all that water is funneling down through those and every one of them is connected in some way.

(Dana Hutchins, Segment Host) With all these inland waters, Maine is a vortex of hydrolics. Because of glaciers, the geology in Maine is young. During the last ice age, the glaciers spread through the northeastern states, but not much farther than that. The sheets of ice gouged out basins that later became lakes. Since the glaciers were headed in a southeasterly direction when they scoured the Maine landscape, most of our lakes today are slanted to the southeast. The ice sheets also disrupted the patterns of Maine rivers. When they retreated, huge piles of debris were left behind, blocking valleys and damming rivers.

Hal Borns teaches Geology at the University of Maine.

(Hal Borns, Geology, University of Maine) We have a bit of this with the Androscoggin River system, which now runs sort of west to the east out of New Hampshire into Maine. There is some suggestion that that really ran north and south, but it is prevented by the glacial deposits from doing that for a while, so it runs to the east and then turns south.

(Dana Hutchins, Segment Host) Where glaciers followed existing river valleys, they deepened and widened them. After the glaciers retreated, river systems developed where water could most easily flow. Many river rapids in Maine were created when water had to flow over glacial boulders that were too large to be swept downstream. Rapids and waterfalls also were formed when glaciers plucked rocks away from the landscape leaving ledges or drop-offs for water.

(Dana Hutchins, Segment Host) Our youthful rivers and lakes are 12,000 years old. That doesn't sound very young, but there is still much more growing up to do geologically for our inland waters.

(Hal Borns, Geology, University of Maine) Lakes are ephemeral on the landscape and the natural tendency for rivers is to reduce the landscape to sea level by erosion eventually, rivers, and in the process the lakes get destroyed.

(Dana Hutchins, Segment Host) There is a natural aging process for all lakes or rivers. As a river ages, it becomes less steep and slower. Its channel tends to widen into a U shape. Lakes are even more transient. Their lives are quite short compared to most other geological features, such as mountains. From the moment they form they start aging by gradually filling in. The fate of most lakes, particularly the shallower ones, is to fill up and become wetlands, streams, or dry land. Most Maine lakes have already accumulated 15 to 45 feet of sediment since the last ice age.

There are other signs of aging for lakes. Silting at the bottom from erosion is one, so is the accumulation of decomposed organic material. As with people, this aging process can be sped up. Lakes need nutrients to support plant and animal life. On the other hand, it's possible for lakes to have too many nutrients. This advances the aging process and can deteriorate water quality. Phosphorous, a fertilizer, is the number one nutrient problem for Maine's inland waters.

Roy Bouchard monitors nutrient levels for the Department of Environmental Protection.

(Roy Bouchard, Department of Environmental Protection) In lakes in Maine there's usually enough of most nutrients, with the exception of phosphorous, so by increasing the amount of phosphorous that gets into a lake by changing the landscape of the watershed we basically increase the availability of nutrients, increase the productivity and thus, the amount of algae that can grow over a year's time.

(Dana Hutchins, Segment Host) Phosphorous is a natural element that clings to soil and organic matter. It gets into lakes and streams when runoff carries eroded soil downhill. Since it is a nutrient, an abundance of phosphorous triggers increased growth, mostly of algae. Algae create multiple problems for lakes. An abundance of algae blocks sunlight to deeper levels of the water. As algae crowd the upper part of lakes, they die and drop to the bottom. The algae are then decomposed by bacteria. This decomposition process can exhaust the oxygen supply in water at the bottom.

(Roy Bouchard, Department of Environmental Protection) ... and what that means is that if any of that phosphorous is able to migrate from the deep waters to the surface lighted zone in the lake, where the light penetrates,

that's phosphorous which is very available to fuel algal growth and increase the productivity dramatically, and that is one of the things that these lakes are suffering from. Not only the external load of phosphorous from the watershed that happens on an annual basis, but also this seasonal, late summer increase in phosphorous which is driven by sediment release during the last summer months.

(Dana Hutchins, Segment Host) Too much algae also cause lakes to turn green and give the water a foul smell and taste. At this point fish, plants, and wildlife are in danger. Lakes heavy with nutrients such as phosphorous and lacking in oxygen are called eutrophic. Once a body of water becomes eutrophic it's an extremely slow road to recovery. All lakes will eventually experience these algae blooms. It usually takes a long period of time, thousands of years, before a lake will have repeated algae blooms, but there are a handful of lakes in Maine where a process that typically takes thousands of years has been greatly condensed to about 50 years.

(David Firmage, Biologist, Colby College) China Lake was a very popular lake in this area. A lot of homes built around it. As you go around China Lake instead of seeing an occasional cottage, you have the whole lake, at least one basin, completely ringed with those homes and lawns going right down to the lake. Therefore, there's been a lot of flow of nutrients into the lake, like phosphorous.

(Dana Hutchins, Segment Host) More than a third of all Maine lakes are either experiencing algae blooms or are close to experiencing them, but a very small fraction of all Maine lakes, less than 1%, are considered endangered. Most Maine lakes though a little murky because of biological activity are aging normally. They don't stink or taste funny. They're full of life.

(Music)

(Dana Hutchins, Segment Host) In both rivers and lakes plant and animal life begins with microscopic plankton. Tiny plankton tend to be swept away in rivers or found clinging to rocks or other surfaces, but in the still waters of the lakes plankton are diverse and numerous and are found from the top to the bottom of the water. This is one of the most important biological differences between lakes and rivers.

(David Firmage, Biologist, Colby College) You're gonna get a completely different group of animals, fish, and so forth, in a pond than you're going to find in a stream. They're working on insects that are feeding along the surface. The insects are on the surface. The fish have to get them off the surface, so it's just a different group of organisms, really.

(Dana Hutchins, Segment Host) Most Maine lakes have distinct temperature zones in the summer, freeze at the surface in the winter, and are completely mixed twice a year. The mixing ensures oxygen is distributed throughout the water. In Maine, this blending is aided by the orientation of our lakes. Earlier we mentioned that most of our lakes run in a southeasterly direction. That puts them right in the path of the prevailing winds from the west. The water has different temperature layers in the summer, because the top is warmed by the sun. When the air cools down in the fall, the water also cools. When there is less of a difference in temperature there also is less difference in the density of the water. This enables the first strong wind to mix the layers of water. That is called "overturning."

(David Firmage, Biologist, Colby College) Movement of water in the spring and the fall where we get a mixing brings the nutrients up from those bottom layers and that allows the algae to grow, which in the natural system is a good thing. It provides the food, the base of this whole chain of life in the lake. That happens again in the spring, so instead of locking away the nutrients on the bottom they are brought up and we get algal growth, then insects that are feeding on the plankton, and so forth.

(Dana Hutchins, Segment Host) The basis for plant life in lakes consists mostly of microscopic algae and phytoplankton, which can be found right here in my hand. The small animals that feed on these plants, and then are

eaten by larger animals, are zooplankton. The animal plankton world is a strange looking one. Under a microscope most of these animals are shrimp-like with antennae, bristles, and forked tails. They are difficult to watch because of their jerky movements.

Whereas the life span of lakes is thousands of years, rivers last much longer. Rivers last for millions of years, although they constantly change as well. Rivers change by adjusting their courses. Like lakes, rivers get their water from precipitation, either directly from rain, snow, and runoff or indirectly from underground accumulations. Lakes are often the headwaters of many rivers. Moosehead Lake is the headwaters for the huge Kennebec River. In turn, lakes are often fed by other rivers or streams.

Because of this interrelatedness what affects a lake is bound to impact a river. This certainly is the case with pollutants. The pollution of Maine rivers began with logging. The cleanup continues today. The first pollutants added to our rivers were logging debris, like lumber edgings and sawdust. Soon after came raw sewage from the state's growing towns and cities. We reached a crisis stage when industrial wastes were dumped into our rivers. The heavily industrialized Androscoggin River became the state's worst. Back in 1941 the Androscoggin's entire 135-mile length, from Berlin, New Hampshire, to Brunswick was severely polluted. As the river ran downstream it filled with sludge, garbage, foam, strong odors, and gas bubbles.

(Barry Mower, Department of Environmental Protection) My grandfather used to say that the river here was too thin to cultivate and too thick to navigate, and at one time the Androscoggin was considered one of the ten worst in the entire country.

(Dana Hutchins, Segment Host) This kind of pollution was common throughout the country, but Maine had further to go than most states. Even 30 years ago when most cities in the country had sewage treatment plants for years most Maine towns and cities, including Portland, were still piping sewage directly into rivers and the sea. Wastewater from industry compounded the problem. Much progress has been made with wastewater treatment, yet there are still some rivers that are not classified as fishable or swimmable yet.

(Barry Mower, Department of Environmental Protection) Back in the, before the mid-70's when there was no treatment, one mill might discharge up to 300,000 pounds a day of organic waste and after 1976, when they had secondary treatment, they cut that by about 90%, and since then they've made further reductions so that today some of the mills may be down around to 3,000 to 5,000 pounds a day.

(Dana Hutchins, Segment Host) The biggest pollution problem for Maine waters now appears to be dropping from the sky, if you will. These are pollutants that fall on us as rain, snow, or dust. We've all heard of acid rain. Steve Kahl of the University of Maine at Orono has been out in front on a number of acid rain studies in the U.S. He's conducting one now where artificial acid rain is being applied to lakes. After spending ten years and \$1 billion on acid rain studies scientists like Kahl conclude we were probably crying wolf about the dangers of acid rain.

(Steve Kahl, Water Research Institute, University of Maine) There are a few lakes in Maine that are acidic. Some of these lakes are acidic because of acidic precipitation, yes. Many of them are not.

(Dana Hutchins, Segment Host) Acidity comes from what are called heavy metals in polluted air. What may be more harmful to our lakes than acid are the metals themselves, mercury, lead, zinc, and cadmium.

(Steve Kahl, Water Research Institute, University of Maine) Mercury, for example, is one that's been in the news. We got a state-wide advisory on eating fish because of mercury contamination. It certainly appears that much of it comes from precipitation. There's reasonably good evidence that there's not a lot of it, not enough of it around in the natural environment to cause the concentrations we see.

(Dana Hutchins, Segment Host) The state also is analyzing data to determine whether there should be health advisories on other contaminants, such as PCBs, insecticides, and pesticides. There's a natural buffer for our rivers and lakes that filter out some pollutants. Fresh water wetlands aren't really lakes or rivers. They bridge the gap between water and land and act as sponges.

(David Firmage, Biologist, Colby College) So all that water flow coming down the slopes after the rain, is gonna come down in it to the marsh and they really are like a sponge. They are gonna absorb that water that slows it down and all of the plants that are growing there are gonna take up the fertilizer, the nutrients that are in the water.

(Dana Hutchins, Segment Host) Natural buffers, like wetlands, shouldn't be expected to absorb all pollutants, but what wetlands don't catch some amateur scientists may. Maine relies on a core of citizen volunteers to monitor lakes all around the state. Maine's volunteer monitoring program is one of the oldest and largest citizen projects in the nation. Volunteers in the lake monitoring program come and go, but of the 350 lakes the state wants to keep track of, 220 are covered. Some volunteers have been at this for years, mainly because of personal ties to the lakes.

(Jean Demetracopoulos, Volunteer Lakes Monitoring Program) I grew up in a town in Massachusetts that saw drastic changes while I was growing up, to the point where today I don't recognize the town that I grew up in, and South Berwick has a very strong sense of place and I don't want my children to feel the same way when they grow up. I want them to be able to come back and still see a pristine pond in town, still see the old waterhole the way the old waterhole should be, and be able to use the old waterhole the way the waterhole should be used.

(Dana Hutchins, Segment Host) Measurements for lake clarity or algae growth are taken once a month from May to October. Volunteers use what's called a secchidisc, an instrument which looks like a diving mask.

(Scott Williams, Biologist, Volunteer Lakes Monitoring Program) Once the disc disappears we bring it back up again until we can see it a second time and then lower it down very slowly until it completely disappears. That's our reading. So we're getting 4.7 meters. That is somewhat typical for this lake. It may be a little bit low.

(Dana Hutchins, Segment Host) Volunteers also are being trained to take oxygen, phosphorous, and acidity measurements as well. Their data are sent to the state for processing. The volunteer group hopes to take over that job. Scott Williams, a lake biologist, runs the program.

(Scott Williams, Biologist, Volunteer Lakes Monitoring Program) I think it's important that the DEP continues to provide technical support and analysis and evaluation of the data. I see that as a role that they'll continue to play in the future. We may be able to deal with some of the logistic problems of collecting and organizing and entering the data, to sort of assist them in that process. Okay, here we go.

(Dana Hutchins, Segment Host) The well being of Maine rivers also appeals to citizens. The Penobscot Riverkeepers is a prime example in Maine. It got its start three years ago as a celebration of how much river pollution had been cleaned up. The celebration took the form of an expedition down the entire river, beginning at a spring at the source of one of the Penobscot's tributaries. Penobscot Riverkeepers is now a resource for area schools and citizens who want to learn about the river.

(Jo Eaton, Penobscot Riverkeepers) We've been able to bring people together to celebrate this resource and get people to say we're glad it's here and we'll pay attention to it. We'll think about the decisions. One of the things that is an ongoing issue is how to find a balance between the economy and the environment and we need both of those things, and so, we talk about that and we don't say 'this is what you need to decide,' we say 'this is something that you need to be as informed as you can about.'

(Dana Hutchins, Segment Host) About 40 schools conduct Riverkeeper projects. Some do water quality tests, others have built whole curriculums around the Penobscot. Two years ago Medway Middle School in East Millinocket devoted an entire week to studying the Penobscot and its surrounding environment.

(Judy Danforth, Medway Middle School) I think the one thing they learned is that something that was in their backyard they took it for granted had a lot of action, a lot of life, and presented a lot of meaning for them.

(Dana Hutchins, Segment Host) Even by focusing in on very specific bodies of water, groups like the Penobscot Riverkeepers and the Lakes Volunteer Monitoring Program can help improve the overall quality of Maine's inland waters.

(Music)

(Christine Young, Program Host) It's been only recently that Maine citizens could get involved in maintaining the health of our lakes and rivers. For many years industry had the upper hand on our inland waters. Electric companies, paper mills, and tanneries controlled the waters. To make their work easier, thousands of dams were built in Maine. Controlling the flow of water through these dams has become a science in itself, but every once in a while when flood waters build we are reminded that we're at the mercy of nature. Kate Arno reports:

(Paul Thibodeau, Erroll Dam, Union Water Power Company) Yesterday's average, 288, one in 400. On the lake, 51890.

(Male Voice on Two-way Speaker) That is correct...???

(Kate Arno, Segment Host) As enchanting as they are, Maine rivers and lakes have been working waters for as long as people have been here. Paul Thibodeau oversees the operation of the five dams on Rangeley Lakes. Some of these dams have been around for well over 100 years.

Beginning with Native Americans our inland waters were used as means of getting around and finding game, such as caribou and moose. Early settlers, particularly trappers, also used lakes and rivers as part of their transportation networks. The connections between our inland waters also was important to the timber industry when it began establishing itself in Maine in the early 1800s. The timber industry was launched in Maine when the forests could be linked with an inland waterway system to move logs downstream to mills and ports. Lakes were used to stockpile logs before they were sent downriver. Many ponds and lakes were enlarged to more easily store and move logs around. Dams were built to raise the level of lake water so driving logs would be easier.

(Sherman Hasbrouk, Sawyer Environmental Center, University of Maine) Rivers have quite a cycle and when the water is running very strongly some parts of the year, other parts they become very low, so the dams enable a more continual flow, particularly in those seasons when the logs were being driven.

(Kate Arno, Segment Host) Dams have an even more profound impact on Maine inland waters. Beginning in the early 1600s most Maine towns and cities evolved around a small dam and watermill to grind grain and saw logs. The very first dam in the United States was built in South Berwick. By the early 1800s much larger dams were built to run textile mills at Brunswick, Biddeford, Augusta, and Lewiston. Thousands of dams have been built in Maine from the colonial period to the present. Many have washed away, but there are about 600 left. Those left are all different sizes and ages. Some have been ignored for years.

Because of all the dams, salmon stopped running up Maine rivers as early as the 1830s. Salmon losses were first noticed in the Kennebec and, not long afterward, in the Androscoggin. There would be no doubt that industry was

in control of the rivers when the next era of dam building came along in the late 1800s.

The modern paper industry expanded by using massive amounts of water to run its operations. The early 1900s saw the advent of large hydropowered dams on Maine rivers. Even back then when a dam was built there was bound to be controversy. Courts and legislatures usually ruled in favor of industry whenever flooded farmers or others disputed the need for dams.

(Sherman Hasbrouk, Sawyer Environmental Center, University of Maine) In the first place, the struggle did not take place at the dam, 'cause somebody would build a dam, it would affect somebody 20 miles downstream, so we had this traditional legal ... law, if you owned land along a river the river is yours. If you owned both sides of the river, you have the ownership of that river.

(Kate Arno, Segment Host) Today there are about 100 hydroelectric dams in Maine. They provide about 1/5 of our electrical needs. Even though industry and energy are still in control, since they own the dams, the various different users of our lakes and rivers are now more balanced. There's an effort to balance all conflicting needs, including environment and recreation.

Dams have taken their toll, though. Runs of all anadromous fish, including Atlantic salmon, shad, smelt, and alewives, are smaller. Water quality has been sacrificed, too, by slowing some rivers down too much. Rivers can clean themselves of waste only if there's enough flow and turbulence.

(Dana Murch, Department of Environmental Protection) The faster the water, the more it can naturally cleanse itself to degrade the organic matter that's in it. The slower the water, the slower that action, and in fact in lakes you get very slow turnover of the water, so the pollution is there year after year.

(Kate Arno, Segment Host) Yet large water releases from dams can be a problem for fish. In the old days there would be massive releases which would send so much water downriver from a dam that fish habitats would be wiped out.

(Dana Murch, Department of Environmental Protection) What happened sometimes in the past was the dams would release such a large slug of water that the bugs, literally, couldn't hang on to the rocks in the stream and without bugs there's no food for the fish, so the fish would be elsewhere.

(Kate Arno, Segment Host) Dams not only disrupt the flow of water, they also can deprive downstream waters of organic matter and sediment. Sediment can get trapped in dam reservoirs. Without sediment flowing downstream, sandbars and river banks, which are constantly eroding, cannot rebuild. Sandbars and river banks are critical to wildlife because of the plants that grow in them. Many environmentalists think some dams have outlived their usefulness.

(Brownie Carson, Natural Resources Council of Maine) This dam could be taken out and the flowage of the river and 18 miles of very, very valuable spawning habitat up above, toward Waterville, could be restored. The shad, the Atlantic salmon, the sturgeon, some of which will not use a fish ladder or other fish can't survive other fish passage, would be able to get up to traditional spawning grounds and we would have tremendously valuable riverine habitat here.

(Kate Arno, Segment Host) One real tangible benefit of dams is in helping control floods. Although poorly maintained dams can break and cause flooding, properly maintained dams can hold back storm waters in upper sections of rivers.

The most damaging flood in Maine history was just a few years ago. The so-called April Fool's Day flood of 1987

was the state's worst natural disaster, because of all the damage it caused.

A rain storm that went on for two days on the heels of much snow melt, flooded rivers throughout central and western Maine. More than 2,000 homes and 400 businesses were flooded. Two hundred homes were destroyed, and the damage would have been even worse if dams on the Kennebec had not been able to hold back a considerable amount of water.

(Sherman Hasbrouk, Sawyer Environmental Center, University of Maine) So the weather conditions just were bad luck for Maine and for those rivers, so the floods were incredible. I feel the Kennebec, they were the worst, the highest crests that they have ever recorded.

(Dana Murch, Department of Environmental Protection) What was happening, it was raining south of the storage dams and all these major tributary rivers, the Carrabassett, the Sandy, the Sebasticook, all were pouring water into the main stem of the river and caused a great flood in Augusta and areas south of that.

(Kate Arno, Segment Host) However, if we wanted to control flooding better than we do now, we'd have to build even more small storage dams in upstream stretches of water.

Two thirds of Kennebec's watershed has no dams, no flood control at all, but some dams were not even designed for flood control.

(Brownie Carson, Natural Resources Council of Maine) The Kennebec floods fairly regularly, putting portions of downtown Augusta, particularly a parking lot between Water Street and the river, underwater. It puts Gardiner much ... and Hallowell, and portions of Farmingdale, regularly under eight or ten feet of water; the first story of many of the businesses and homes down by the river in both Gardiner and Hallowell gets flooded. So if the dams on this river are supposed to be designed for flood control I would consider them a miserable failure.

(Kate Arno, Segment Host) The Kennebec and Androscoggin Rivers are controlled by companies created for the express purpose of managing the waters and dams on those rivers. It has been said that because of dams those rivers can be turned on and off as easily as a faucet. That's probably an overstatement, but it is true that during the big flood of 1987 the upper Androscoggin River was in its banks, under control. Larry Perkins of Union Water Power Company explains how that happened.

(Larry Perkins, Union Water Power Company) Just as soon as we got word that significant rainfalls were going to occur we could virtually shut the gates down at all the upstream storages and capture the water behind the dams rather than releasing them down through Lake Umbagog and into the Androscoggin, thereby cutting back significantly on the flows that we would ordinarily contribute to the river.

(Kate Arno, Segment Host) Before Rangeley Lakes dams were built log drives were possible only during high water periods. It would take four years to get a pile of logs from northern Maine to Lewiston. It was easier and much faster to drive logs by raising water levels of lakes and rivers with dams, but by the beginning of this century Androscoggin paper and textile mills wanted assurances they would get as much water as they needed downstream. Power companies, manufacturers, and paper mills together created a company to manage the upper Androscoggin and its dams. The Androscoggin is now considered one of the best regulated rivers in the country.

(Larry Perkins, Union Water Power Company) The whole river system operates under what they call a 1909 headwater benefits agreement. That agreement was put into being at the time that Androscoggin Reservoir Co. was formed along with the construction of Liskehaus Dam. That's really the guiding principle, and that guiding principle was wherever possible a minimum of 1,550 cubic feet per second of water will flow by Berlin.

(Kate Arno, Segment Host) Normally, water from snow melt would last no more than three months in the Androscoggin River system. With the Rangeley dams on the upper end, that snow melt can last for 6 to 9 months by slowly releasing it through the dams. Here in Maine we receive excess runoff in the spring and usually again in the fall. This reservoir system stores water during periods of high runoff and releases stored water during drier months.

(Larry Perkins, Union Water Power Company) Without the dams the Androscoggin River for nominal seasonal summer flows would be just a trickle. It was with the institution of all these dams that we are now able to provide a relatively uniform flow throughout the year, to benefit not only the hydropower producers but all the mills and waste treatment plants, and so forth, downstream.

(Kate Arno, Segment Host) At each of the Rangeley Lake dams there are official weather stations where temperatures, precipitation, and lake elevation measurements are recorded every day. In the late winter and early spring union employees measure the depth and water content of the snow in the mountains. These data are necessary in order to make the many calculations needed to control the upper Androscoggin. It's not high-tech, but rather a lot of what used to be called "seat-of-the-pants work."

(Larry Perkins, Union Water Power Company) It allows us to manage our water system better. We know what is out there on the watershed in the snow content, in water content, so we can anticipate the type of fill that we're gonna get on our five reservoirs, and can better manage the releases once the snow melt starts.

(Kate Arno, Segment Host) Union Water Power Co. hasn't changed much since 1878. The companies that were the original partners in Union Water Power have come and gone. The former Berlin mills and Rumford Falls power companies were once part of it. In their place are companies like Boise Cascade and Central Maine Power. The Lewiston canal system was built to power the now defunct textile mills. Today overflow from the Androscoggin is still channeled into the canals to generate electricity.

(Larry Perkins, Union Water Power Company) They're only utilized when the flow capacity, the flow in the river, is so large that all the power, all the water cannot be consumed by Monty Hydro. At that time the generators are brought on, one by one, to generate additional power that goes into the grid, and the end user really doesn't know where that power got generated, but yet the water is being beneficially used in the canal as well as at the head works of the falls.

(Kate Arno, Segment Host) In addition to providing 25% of Maine's power needs, dams have a strong visual presence here. There are hydro plants on Maine rivers. Power also is generated at the outlets of some lakes. Other lakes serve as water storage. On an as-needed basis the water is released to downstream hydro plants.

(Brownie Carson, Natural Resources Council of Maine) You'd have to weigh the value of the change in the river system, the river basin, the ecological system, against the benefits that would be provided either by production of electric power or mechanical power. That's the way the world works these days.

(Kate Arno, Segment Host) Maine waterways are now among the most heavily regulated in the country. By law many of Maine's rivers are off limits for new hydro power dams. On what may be the last good available site for a hydro dam in Maine, Bangor Electric is helping to build a new dam on the Penobscot. The controversial Basin Mills project would be located near Old Town. Aside from the Basin Mills proposal the age of dam building is coming to a close in Maine. The legacy of that age is hundreds of dams to either take care of or to discard. Also left behind are some of the prettiest lakes and rivers in Maine most of which we'd never know were being artificially manipulated by dams.

(Music)

(Christine Young, Program Host) Although Maine's lakes and rivers have been worked hard for industry, we are now using our inland waterways to play hard as well. Hydro power and storage dams play a pivotal role in this recreation. Rafting is a sport that depends on dams for its survival. On the other hand, dams can ruin a sport for some by destroying whole species of fish. Yet, as Diana George Chapin tells us, despite dams we are finding many ways to play on our lakes and rivers.

(Diana George Chapin, Segment Host) Garrett and Alexandra Conover are guides. In the spring, summer, and fall they help others explore the Maine wilds by canoe.

(Alexandra Conover, Northwoods Ways Guides) Yeah, paddling into a headwind will tire you out fast.

(Diana George Chapin, Segment Host) The Conovers prefer the less traveled river routes that are deep in the heart of Maine, because they offer glimpses of what much of Maine used to be like.

(Alexandra Conover, Northwoods Ways Guides) Maine is so rich that those wild areas give you a sense of maybe self, and the people who've been here before me mean a lot. Knowing what their lives were like, and thinking about them sometimes, whether they were families living here, or loggers or native peoples traveling en route to somewhere. Maybe it was their winter camp or maybe it was their summer camp. That sense of Maine's rivers and lakes being a highway, I never tire of that.

(Diana George Chapin, Segment Host) Most of Maine's rivers and lakes are for play now, although players are known to collide with one another. Our inland waters can be overcrowded with recreationists. Some of us like the Conovers want to get us as far into the Maine woods as we can go, while others of us are perfectly content to spend our idle hours on rivers and lakes in the company of others.

Maine's lakes and rivers have attracted many people for well over 100 years. At the turn of the century it was the age of lake resorts. Lured by cooler summer weather and legendary sport fishing easterners took trains to get to the lakes and then boarded steamboats to get to the resorts and sport camps. After the depression and two world wars, fewer guests came because of economic hard times. Besides, the prize trophy fish became scarce from over fishing. Yet when the car and motorboat made it possible for tourists to get to the lakes and rivers themselves, private camps began cropping up on shorelines.

Over-fishing decimated Maine's famous record sized trophy fish, but Maine has lost other fish as well. Whole species of fish have been wiped out of Maine's rivers and lakes. It wasn't over-fishing that did these fish in, it was the 600 dams built all around Maine.

(Diana George Chapin, Segment Host) Anadromous, or migrating fish, like Atlantic salmon, sturgeon, and striped bass began disappearing in the 1800s. The first dams were small and were built on tributaries. Many spawning fish were able to jump over the early dams, but dams got much larger and were placed on the main rivers and lakes. That was the beginning of our troubles with fish. Maine did not even begin efforts to restore migrating fish until our rivers were cleaned up in the last 20 years or so. Now we raise millions of migratory fish from eggs in hatcheries. Dam owners are required to put in fish ladders or pools so the fish can more easily get up and down the rivers. There's even a proposal in the Basin Mills dam project to revive an old method, trucking migratory fish around dams.

(Dana Murch, Department of Environmental Protection) With the Basin Mills proposal what Bangor Hydroelectric has proposed to do is capture the salmon and other migrating fish as they come up to the Veazie dam, put them in trucks, and literally truck them on the highway around the next several dams. The idea is that you'll get more fish to the spawning grounds more quickly and lose fewer fish at each of the dams as they go upstream.

(Diana George Chapin, Segment Host) As Maine and other states learn how to revive their migratory fish species sport fishermen have other gripes. Fishermen want to know why their catches of cold water fish are so poor.

In Maine cold water fish include trout and landlocked salmon. Even though the record size cold water fish are gone, these species are still a favorite for sportsmen.

(George Smith, Sportsman's Alliance of Maine) The old timers can tell you that fishing in the old days was much, much better for cold water species, trout and salmon. I see two big problems. One is that our hatchery facilities have declined to such a state that they can't put out the numbers of fish that we need. The other thing is that we just haven't conserved these fish. We've taken home all of them for the table. We haven't had any real conservation regulations to save those cold water species.

(Diana George Chapin, Segment Host) But sportsmen and fish biologists disagree on just how good the fishing is in Maine's rivers and lakes. The quality varies greatly from one place to another and from one species to another. It has become a very emotional issue in Maine.

Warm water fish do best in shallow lakes that are high in nutrients and older in age. Cold water species are most often found in deep, clear lakes where the lake aging process is not far along. In relatively inaccessible northern and eastern Maine lakes, where there's less fishing, cold water species are in good shape, but in the more accessible lakes cold water species are fished so hard they must be restocked by the state.

There are cases where we can watch lakes shift from cold water to warm water species. This usually indicates that the lake is aging too fast and oxygen is being depleted by algae growth. Cold water fish species can be wiped out if oxygen levels drop too far, but warm water species can handle less oxygen.

(Dana Murch, Department of Environmental Protection) The number one concern now is no longer water quality. The concern now is protecting habitat for fish which is probably the biggest long-term concern and, short term, providing good fish passage so the fish can get over the dams safely.

(Music and lyrics)

(Diana George Chapin, Segment Host) River rapids also are critical for many fish. Cold water species use stretches of fast water for spawning and for nurseries for young fish. Since cold water fish require large amounts of oxygen to survive, rapids are ideal habitats.

(George Smith, Sportsman's Alliance of Maine) These cold water species depend on oxygen and cold temperatures and so that moving water, those cold temperatures, that churning oxygenating process is what a lot of these game, cold water game species depend on.

(Diana George Chapin, Segment Host) There are white water rapids on all of Maine's rivers. The most dramatic rapids are in the more mountainous central and western portions of the state, or near the headwaters of rivers. During the log drive days, rapids were hazardous and unpopular. Unless water was running high rapids invariably meant log jams.

These days rapids are a big draw for an increasingly popular sport, rafting. Few rivers in the eastern part of the United States have as challenging rapids as Maine's rivers.

Maine has both long stretches of white water and sharp falls for the thrills raft riders have come to expect. Sections of the Kennebec and Penobscot are rated five, which is just shy of the unraftable rating. During certain

times of the year rafts also run the Dead River:

(Music)

(Diana George Chapin, Segment Host) But Maine wouldn't have this rafting industry if it weren't for our dams.

(Matt Polstein, New England Whitewater Rafting Company) We raft normally on a flow of between 4,800 cubic feet per second and 6,000, and to put that cubic foot per second in perspective, I like to think of it as being a basketball. At one point you've got 140 basketballs rolling down the river and, you know, 20 seconds later you've got 4,800 or 6,000 basketballs of water rolling down the river every second, passing a given point.

(Diana George Chapin, Segment Host) The gates at Harris Station, a dam at the head of the Kennebec Gorge, are opened up at 10:00 a.m. every day. For three hours water is released. The depth of the river rises from about a foot to around seven feet with the release. Rafting companies time their trips to coincide with these releases. When the water comes, they're off.

Central Maine Power owns the Harris Dam. CMP sits down with government agencies, rafters, and other special interest groups to schedule these releases a year in advance.

(Bill Hanson, Central Maine Power Company) We like to think that we do a pretty good job coexisting and sharing this river resource with a multiple number of users, including fishermen, white water rafters, and private kayakers, to name a few, and some of the ways that we do that is that the times that we like to generate electricity in the middle of the day, also those flows turn this river gorge into one of the premier white water segments in the northeast, so the commercial rafting customers come and utilize those same flows for boating, and at the same time our lower flows in the early evening and early morning accommodate the fishermen who like to come in and fish in the river.

(Diana George Chapin, Segment Host) Rafters also make similar agreements with other dam owners like Bowater Paper Company and International Paper. Rafting has become a big business in Maine.

(Matt Polstein, New England Whitewater Rafting Company) We run three different rivers, the Dead River, the Kennebec River, and the west branch of the Penobscot, and we're able to run all of them all summer long based on dams regulating what nature would provide us in a big rush in the spring, or snow melt and spring rains, the dams can regulate that flow and spread it out over the course of a whole summer to meet both hydro power needs and recreation needs on the rivers that we're running.

(Diana George Chapin, Segment Host) Controlled water releases from dams are a boon to sports fishermen as well. Especially during dry periods the extra river flow keeps rivers colder and adds oxygen. Some of the best cold water fishing in Maine is in the west branch of the Penobscot, right below the Ripogenous Dam.

It's ironic that recreationists get along better with dam owners than they do with themselves at times. Some of these conflicts are long-standing. They stem from a major shift from industrial to recreational use of our rivers. Canoeists and those navigating by motorized boats are often at odds, but more recently rafters and sports fishermen have been getting in each other's way.

(George Smith, Sportsman's Alliance of Maine) Fishermen don't like rafters. We have a tremendous conflict, especially in the west branch of the Penobscot, which is our very best wild salmon fishery on the east coast and our most popular rafting river, and the two really don't coexist very well: serious problems there. I think they've done their best to schedule rafting at different times when the anglers are not there, but there's always going to be that conflict.

When the rafters go by they create a lot of disturbance and the fish go down, and you don't catch any for the next 30 minutes or 45 minutes.

(Diana George Chapin, Segment Host) Lakes have seen the most dramatic changes. Historically our lakes have been used seasonally and for low intensity uses. What used to be remote and nearly pristine is now busy, noisy and suburbanized, especially in Southern Maine. It is estimated that currently there are as many as 200,000 year-round homes or summer cottages in Maine. The rate at which we're adding residences and recreation facilities is posing a significant threat to some lakes. With this development comes excess nutrients from runoff and algae blooms.

Maine has come a long way in controlling lake shore development. Maine's efforts are considered one of the great environmental success stories of the last quarter century, comparable to the cleanup of our rivers. Remember the Androscoggin River 20 years ago, one of the foulest in the country? Today it is as clean as it has been in 100 years. The Friends of the Androscoggin, a citizens advocacy group, have been watching its progress.

(Steve Wight, Friends of the Androscoggin) For one thing today as we were out here on the river we're smelling fresh air. Twenty years ago, 1975, we would have had an odor that was too strong to allow us to stay on the river. We would probably see old cars dumped along the banks. We'd see old tires in the river, things floating, just a sign of neglect, but more than that, we would see piles of foam floating on the river.

(Diana George Chapin, Segment Host) A 42-mile stretch from Shelburne, New Hampshire to Rumford, with its seven sites for getting in and out of the river is beginning to lure boaters. Wight thinks the river could even be declared swimmable soon.

(Steve Wight, Friends of the Androscoggin) I'm quite proud. I'm proud of the efforts of the local people, proud of the State of Maine for their achievements in cleaning up the rivers and just proud of the whole notion that people in Maine are really serious about their environment and about the fact that we have a great recreational opportunity and that we need to protect it, not to squander it.

(Alexandra Conover, Northwoods Ways Guides) I think the public is realizing that a vacationland doesn't come for free, you have to protect it. I think that's very important. If Maine loses that the nation loses something incredibly important to the human spirit.

(Music)

(Christine Young, Program Host) It's important to remember that only a fraction of a percentage of Maine lakes are sick and our rivers are making a strong comeback as the Maine Guide Fly Shop here in Greenville knows well. We've learned a lot about the science of controlling these waters through dams, but there are limits. We've seen how our dams can't stop all flooding. Despite industry's heavy hand historically in deciding what goes on on our lakes and rivers, there is now more give and take, and when industry and individual Mainers see the need for clean waters, both aquatic life and recreation stand to gain.

Next time on "Quest" we look into the future of Maine's forests. Until then, I'm Christine Young. Thanks so much for joining us.

(Narrator) Maine Public Television's production of "Quest, Investigating the World We Call Maine" is funded through a television demonstration grant from Rural, Economic and Community Development, part of the USDA.

(Music)