

QUEST #104: Gulf of Maine

(Christine Young, Program Host) Coming up on "Quest": The Gulf of Maine is legendary for its bountiful fish. We'll show you why the sea within a sea is one of the most fertile oceans in North America. Yet even prolific waters can be over-fished. Maine's traditional ground fish are disappearing and scientists say they are part of the problem. Yet, some Maine fisheries stay healthy even when scientists predict trouble. Maine lobstering is a prime example of a fishery that keeps beating the odds. The Gulf of Maine. That's what this Quest is all about.

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)

(Christine Young, Program Host) When you stand on the Maine coast looking out to sea, like from here on Monhegan Island, you'd be mistaken to think you're overlooking the Atlantic Ocean. Hi! I'm Christine Young. From anywhere along Maine's nearly 7,000 miles of coastline, it's the Gulf of Maine for as far as you can see. It is a much younger sea than its neighbor, the Atlantic Ocean. The Atlantic is hundreds of millions of years old, while the Gulf is a mere 4,000 years old. The Gulf is also a fertile sea whose bounties have astonished us for centuries, and there's much more about our ocean that we're just beginning to appreciate. Kate Arno has more.

(Kate Arno, Segment Host) This may look like the Atlantic Ocean, but it's not. The Gulf of Maine is a semi-enclosed sea that's oftentimes confused with the Atlantic Ocean, but for those who know these waters well there's a big difference.

(Tom Balzano, Fisherman, Portland) The ocean covers a lot of the earth, but not everywhere in the part of the ocean is there, there fish to be caught, and there are certain areas you can catch the fish and certain areas there's just nothing there, just water. I think our fishery's probably one of the cleanest fisheries, and one of the best fisheries there is on the East Coast

(Kate Arno, Segment Host) For generations people have harvested this sea within a sea because it is one of the most productive in North America. Along its shores the Gulf crosses political boundaries. It extends from Cape Cod to the Bay of Fundy, washing up along the coast of Massachusetts, New Hampshire, Maine, New Brunswick, and Nova Scotia. Out of the water its size is impressive for it covers over 36,000 square miles. Along the rest of the eastern seaboard there's a coastal plain just offshore that slopes gradually away from land's end, but in the Gulf of Maine there are several prominent underwater banks, or ledges, that serve as a barrier to the waters of the Atlantic Ocean. Philip Conkling heads the Island Institute, a group that works to preserve Maine islands and coastal areas.

(Philip Conkling, President, Island Institute) Unique in defining features of the Gulf of Maine are first, the Outer Banks which were dry land 13,000 years ago. They were plateaus and the rising sea level flooded those plateaus and then emptied into the complex geography of the basins of the Gulf of Maine, and then flooded far inland and way up the rivers to create a huge tidal estuary: kind of a sea within a sea, which is the Gulf of Maine.

(Kate Arno, Segment Host) Because only 30% of the Gulf of Maine's perimeter is open to the deep waters of the Atlantic Ocean nutrients become trapped in the Gulf, providing ideal conditions for productivity. Knowing how the Gulf of Maine was formed can help us understand why it is so productive. During the last Ice Age glaciers covered much of the Gulf of Maine. The weight of these massive ice sheets depressed the Gulf region and much of the mainland. Even after the glaciers started melting and the Gulf began filling up with melted glacial water, it remained

weighted down. Only the mainland dried out and sprung back. Marine biologist and former fisheries manager, Spencer Apollonio explains:

(Spencer Apollonio, Former Commissioner, Department of Marine Resources) There wasn't any Gulf of Maine prior to the Ice Ages. The glaciers which ended about 15,000 years ago really acted as a bulldozer. The glaciation scooped out and drove away all of the sediments that had previously filled in this basin that we now call the Gulf of Maine. In the process of scooping that material out of the basin, they really dumped a lot of it on the edge of the shelf and much of that material is what formed Georges Bank, so both the Gulf of Maine and Georges Bank are the result of glaciation.

(Kate Arno, Segment Host) The Gulf's productivity is enhanced by its shape, which is like a pear. It has a wide bottom in the Cape Cod area and at the Bay of Fundy, a narrow and tapered stem with fast-flushing tides. Maureen Keller is a research scientist with Bigelow Lab in Boothbay Harbor.

(Maureen Keller, Research Scientist, Bigelow Laboratory, Boothbay Harbor) There are several unique things about the Gulf of Maine that make it so productive, and most of those have to do with physical energy. Anybody who's spent any time out in the Gulf of Maine knows what an energetic system it is in terms of its tides, its currents, its storms. It's a very energetic system and what that energy means is it provides the conditions that plants need to grow. What plants need, oceanic plants need just as terrestrial plants need, are light and nutrients, and in the surface, in the oceans the only way they can get the right conditions for growth are to be in the surface sunlit layer of the ocean. So that means they have to be in the surface water. Unfortunately, nutrients are usually deeper down in the water column, so there has to be some physical mechanism to get those nutrients up into the surface waters where the plants can use them, and that's what the Gulf of Maine is really good at.

(Kate Arno, Segment Host) The Gulf of Maine also is unique because it has five significant river systems feeding into it. The Merrimack, Saco, Kennebec, Penobscot, and St. John Rivers empty massive amounts of fresh water and nutrients into the Gulf. Collectively these rivers supply about 100 billion gallons of fresh water annually to this partially enclosed sea reducing salinity and, in turn, increasing fish eggs survival. Stewart Fefer is a biologist with the U.S. Fish and Wildlife Service.

(Stewart Fefer, Biologist, U.S. Fish & Wildlife Service) The enormous amount of fresh water that flows into the Gulf of Maine has tremendous effects on the ecology of the Gulf of Maine. The fresh water brings with it nutrients that drain from the huge land mass, the watershed of the Gulf of Maine, that mix with the salt water in the estuaries. An estuary is a mixing zone and as fresh water mixes with the salt water which provides a unique habitat for a variety of vertebrates and recreationally important things like water fowl, shore birds, and a whole variety of organisms.

(Kate Arno, Segment Host) Since an estuary is a body of sea water into which fresh water mixes, technically the entire Gulf of Maine is an estuary. In scientific—not religious—thinking, life began in the oceans. Scientists believe the first organisms on the planet were micro-organisms that evolved in the seas some four billion years ago, which means bacteria were the evolutionary ancestors of all organisms.

(Spencer Apollonio, Former Commissioner, Department of Marine Resources) Life originated in the sea, so far as we know, because the sea, particularly the shallow in-shore waters of the sea, the margins of the sea, were very favorable for the origin of life. There's a very stable environment. The temperature doesn't change very much and the salt condition and the nutrients don't change. They're very constant and very stable, and because it's a fluid environment sooner or later all of the chemicals which are essential for the formation of life would get mixed together.

(Kate Arno, Segment Host) As it turns out, the Gulf of Maine is a comfortable place to live in. It's a more stable environment than on land. There is some variation in water temperature from one location to another. This is one reason why species prefer different areas of the Gulf.

(Tom Belzano, Fisherman, Portland) December 1st through April 1st the water temperature is in the 40's, 42, 49, and the shrimp like that temperature of water. They'll come in and they will spawn probably twice in the course of six months. One batch will come in, spawn: they'll go off and another batch will come and they'll do their spawning and they'll move off. When they come in to do their thing that's when we start fishing on 'em.

(Kate Arno, Segment Host) Another reason the Gulf is productive is because of the circulation of the water. The Gulf circulates counter-clockwise. It takes about three months for a complete revolution in the Gulf. The flow of this gyre is driven by cold waters that invade the Gulf near Nova Scotia, and through the northeast channel at the stem of the pear-shaped Gulf.

(Kate Arno, Segment Host) The incoming flow from the five major rivers also propels the circulation, but the most dramatic part of the engine pushing this gyre is the lunar pull of the tides. In the Gulf of Maine the tides are semi-diurnal: two lows and two highs every day. They are called lunar tides for good reason.

The moon's gravitational force affects water more than land, because water is liquid and can be reshaped the moon's gravity moves water toward a point directly under the moon. This creates a bulge. At the same time centrifugal force on the opposite side of the earth creates another bulge. As the two bulges are formed an area of low water is forced between the two bulges. Different phases of the moon cause wider ranges in high and low tides. Full or new moons, for instance, create the greatest ranges.

(Spencer Apollonio, Former Commissioner, Department of Marine Resources) We have two tides a day in Maine which we tend to take for granted, but it's not a universal feature of the world's oceans. There are places with one tide a day. There are places with more than two tides a day. The tidal range that we have in the Gulf is remarkable. It goes, now, from ten feet in some places to 50 feet between high and low tide. The tides are important for several reasons as far as the productivity of the Gulf is concerned. They mix nutrients into the surface water where they're needed and can be used by the plants, and they create large intertidal areas.

(Kate Arno, Segment Host) Northern waters like the Gulf of Maine benefit from a phenomenon called "upwellings," areas where deeper nutrient-rich waters are brought to the surface. In many areas of the Gulf as waters cool in the fall and winter, they sink and replace water at the bottom. This convection action brings nutrients to the surface where they can explode in early blooms of phytoplankton or food for fish. Scientists often look to the bottom of the food chain to determine productivity of seas. In this case it's phytoplankton.

(Philip Conkling, President, Island Institute) The real building block of the Gulf of Maine is the phytoplankton bloom. That's the bottom of the food chain on which all of these schools of cod and haddock, and all of the lobsters and urchins and shrimp depend on is that bloom that gets going in March and really pops by, say June, that creates the basic of marine productivity of the whole system.

(Kate Arno, Segment Host) In the last few decades scientists have found new tools to study phytoplankton production. In this NASA satellite photo the red areas show where most of the plankton is growing.

(Maureen Keller, Research Scientist, Bigelow Laboratory, Boothbay Harbor) When you look at a satellite image of the Gulf of Maine you'll see the areas that're currently productive, and those are typically along the coast, along the edges of the banks, but on a seasonal basis you will see different types of patterns occurring. In the spring and the fall, if you looked at a satellite image, the whole Gulf would be covered with phytoplankton bio mass, and that's because during those periods of the year you're getting a lot of vertical mixing over the whole area of the

Gulf and that brings those nutrients up and allows them to bloom.

(Kate Arno, Segment Host) Which brings us to the Gulf's emerald green color:

Over most of the earth, the seas are blue, merely reflecting the color of the sky, but in the rich waters of the Gulf the water is green, a sign that it is teeming with life.

Light rays at higher latitudes like Maine are more slanted when they hit the earth's surface. They don't penetrate the water as deeply. Because light is restricted to the surface there are more plants near the top of the water and with more plants even more light is absorbed at the top. Rarely in the Gulf of Maine is underwater visibility anything like that in the clearer waters of the tropics where marine life is much less concentrated.

(Maureen Keller, Research Scientist, Bigelow Laboratory, Boothbay Harbor) You'll probably notice the coastal waters appear to be green, and if you go to the tropics or out in the open ocean the waters appear to be blue, and the reason for that is, is the phytoplankton that are present in the water. In coastal waters there's a lot of phytoplankton: in the open ocean and the tropics there's very little, and what makes the phytoplankton result in that color change is the presence of their main pigment, chlorophyll, which is the same pigment that's present in leaves of terrestrial plants.

(Kate Arno, Segment Host) The Gulf of Maine's 5,000 islands also add to the diversity of marine life. The islands provide a vast expanse of near-shore areas called subtidal zones that are loaded with marine life.

(Philip Conkling, President, Island Institute) The islands are actually hilltops and if you follow the hilltops down to, say, 150 or 200 feet, all of those hillsides are coated in seaweeds and algae and sponges and some of the highest marine biodiversity that exists anywhere in the oceans of the world is found here.

(Kate Arno, Segment Host) Of course, the feature of the Gulf we know best is the shoreline, but however familiar we are with our favorite shorelines and beaches, they are more dynamic than we may think. Waves, beach sand, and the shape of a beach are not static. They migrate, and when one changes the others adjust to reach a balance. When waves get bigger sand is scooped off beaches. We tend to call those adjustments "beach erosion." Shoreline engineering can offer some short term and expensive remedies, but over time jetties and sea walls can destroy beaches.

(Joe Kelley, Maine Geological Survey) The material that makes up the beach is all in motion. All of the sand grains move. The wind blows the sand into the dunes. The currents and waves move the sand along the beach. Sometimes it's hard to know that until somebody puts something on the beach that doesn't move. This rock jetty does not move and it's completely altered the orientation of this beach. It has caused a tremendous amount of erosion here, a tremendous amount of beach growth in other places.

(Kate Arno, Segment Host) It seems whenever we interact with the Gulf of Maine we create even more changes. Changes we don't often expect or like.

(Joe Kelley, Maine Geological Survey) As people have come to a beach they've altered the processes that made a beach what it is, and as a result they're disappointed that the beach isn't as wide as it used to be. The birds don't come back anymore. It just isn't very pretty anymore once we put rocks on it, but for us to live on a beach one has to do that or else the forces that form a beach will destroy our property.

(Kate Arno, Segment Host) Yet more and more of us fancy living by the sea and for all its quaint connotations the Gulf of Maine is no longer rural. The Gulf region is the third most densely populated coastal region in the country, and the population continues to grow. With all these people, can pollution be far behind?

John Sowles, who works for the Maine Department of Environmental Quality, knows where contaminants like PCB's, lead and mercury, are accumulating in the Gulf.

(John Sowles, Aquatic Biologist, Department of Environmental Protection) From a pollution point of view, the Gulf of Maine as a whole is in pretty good shape, but we've found that certain areas, localized areas, have some levels of toxic contaminants, bacterial pollution, and nutrient pollution that is of concern. Any area that has a high concentration of human activity tends to have higher levels of pollution. We are increasing in numbers along the coast. We are using the coast more intensively. As we've cleaned up the ports and the harbors they've become more attractive for us to use. We have more boats than we've had in the past ten years, and in general the demands on the coastal system are just that much greater.

(Kate Arno, Segment Host) We as individuals can have a huge impact on the welfare of the Gulf of Maine. Being aware of that responsibility is one way we can keep the Gulf of Maine productive for future generations.

One new project called "Gaia Crossroads" provides students in Wiscasset access to satellite imagery. It's helping a new generation of citizens learn the power of individual action at a young age.

(Clarice Yentsch, Co-founder, Bigelow Laboratory, Boothbay Harbor) Students can use this information and can use this technology as well as we can, even though we've gone through lots and lots of years of training. It's quite fun to see what great questions that they will come up with, and sometimes they're far better than we can do because they don't have these preconceived notions on how things are supposed to work. I'm a firm believer that everyone can contribute to science. If you're willing to be trained and just learn a few skills and willing to ask questions and be a keen observer, you can contribute in a major way.

(Christine Young, Program Host) There are still some challenges to face if we want the Gulf of Maine to remain as vital as it has been to us. Even though they've had several oil spills in the Gulf of Maine, none has posed a serious threat to marine life. At least 200,000 gallons of oil have spilled into Gulf waters. Yet, it seems the biggest threat to the Gulf of Maine comes not from oil tankers, but from our oldest industry, fishing.

Dana Hutchins explains ... "Loss at sea" ...

(Dana Hutchins, Segment Host) It's 5:00 a.m. and the sun's about to come up. The new day looks like it has the makings for good fishing, but these fishermen never know anymore. Sometimes the only fish they bring back to shore, what they call trash fish. These fishermen are searching for fish that can be in a different location from one day to the next. They have thousands of square miles to cover to find the fish. Fishing never was an easy way to make a living. Ronnie Shepard of Deer Isle knows that: he's been fishing most of his life.

(Ronnie Shepard, Fisherman, Deer Isle) Oh, you're brought up into it and you don't know nothing else but fishing, and it seems so's there's good days and there's bad days.

Some days are easy and some days are hard, but most of the days are, like today is nice, but when you got the windy days it's hard.

(Dana Hutchins, Segment Host) It's hard to believe that even under conditions like these we have become so efficient that whole species of fish can be threatened. But it's happening in the Gulf of Maine to ground fish like yellow tail flounder and haddock, and cod is threatened as well.

(Robin Alden, Commissioner, Department of Marine Resources) It's possible to find a body of fish by stepping in

an area, stay on it, continue to stay on it, and or follow it as it moves to the point where they can't get away.

(Dana Hutchins, Segment Host) It's a huge heartache for New England, of all places, to watch the ground fish industry suffer. Fishing has always been pre-eminent here. It's what brought settlers here 350 years ago.

Because there was bountiful cod to sell to Europe as far back as the 1630's the Massachusetts Bay Colony, which included Maine, prospered. Ever since then the economy of nearly every coastal town along the Gulf of Maine has counted on fishing for its survival, but after four centuries of pulling untold millions of nets of fish from our waters we may have exhausted one of the most prolific fisheries in the world.

Virtually every major U.S. commercial fishing region outside of Alaska is in trouble. However, the devastation of New England's fishing grounds is considered to be the most serious in the country. Our fishing crisis is analogous to one next door to us in the Canadian Maritimes where stocks of cod and haddock are at all-time lows and fishing is banned in many areas. There is no consensus among scientists whether Canada's approach will work. For all that we know about the Gulf of Maine and other seas, there's a lot we don't seem to know about marine ecosystems.

(Robin Alden, Commissioner, Department of Marine Resources) The marine environment is very hard to understand. It's hard to study because it's so obscure. You can't go and count the trees, you know, and it's a very dynamic environment. There are lots of factors working on it which are at this point poorly understood as a whole system.

(Dana Hutchins, Segment Host) It used to be a much more even match between fish and fishermen. Fishing on the high seas is much more like harvesting than hunting. In fact, fishing is increasingly being compared to farming today.

(Charlie Saunders, Fisherman, Cundy's Harbor) Over here on this side is that gray lobster boat, and then there's a whole series of boats down through here.

(Dana Hutchins, Segment Host) Expensive, hi-tech fishing boats are part of the problem with dwindling stocks of ground fish. Charlie Saunders of Cundy's Harbor has the latest in hi-tech gear on his boat. Saunders uses this electronic gadgetry to help him navigate with more accuracy and to fish with more efficiency. Aboard his boat Saunders uses the radar as his eyes. It helps him see in bad weather and at night. Using satellites in the global positioning system and the Loran Sea Navigational System, Saunders can pinpoint his exact location anywhere on the water, so if there's an area where the fishing is good he can easily find that spot again. He also can autopilot his boat while trawling or navigating along a specific path.

(Charlie Saunders, Fisherman, Cundy's Harbor) This body of blue, here, is probably a body of fish, perhaps herring.

(Dana Hutchins, Segment Host) The latest sonar equipment will let Saunders see what fish are milling about his boat. It's clear enough to make out what species of fish are going by. All this means there's less room for fish to hide anymore.

(Charlie Saunders, Fisherman, Cundy's Harbor) I'm gonna be able to see this rock pile and follow along the edge of the rock pile, so that if I keep my net on the soft bottom I can stay right close to the rocks and play cowboys and indians with the fish, and that's what the game's all about. Find out where the fish are and try to catch them.

(Song)

(Dana Hutchins, Segment Host) Nets dragged along the ocean bottom are more efficient now, too, because of

new designs and materials to prevent them from getting hung up on rocks. For a long time dragging was thought to be disastrous to habitats at the bottom of the sea, but some think it may be beneficial to some habitats. The scientific debate over dragging continues.

(Bob Steneck, Ecologist, University of Maine) The habitat can be at risk due to dragging and certain organisms, because they require longer periods of time left undisturbed than dragging allows, are at particular risk.

(Ronnie Shepard, Fisherman, Deer Isle) Dragger tows that line is just like mowing your lawn: you might make one pass down through the middle of the lawn on both sides, but there's no fish there, they're not gonna bother, so it isn't like you're going out and mowing up boodles and the whole bottom down. The gear, you don't want the rocks. You don't want the mud. What it's doing is just bumping along the bottom.

(Dana Hutchins, Segment Host) The size of fishing vessels has changed too. There's the enormous trawling factories that can literally vacuum up vast amounts of ground fish, like these American vessels on the Bering Sea off Alaska. These boats process fish right on board, store them in huge freezers and stay out for months at a time, far from their home ports.

(Spencer Apollonio, Former Commissioner, Department of Marine Resources) Big trawling factory ships could have a very substantial impact. They have had a substantial impact on a lot of fisheries around the world, and they took a lot of fish, there's no question about it, and they took fish indiscriminately, but they're no longer a serious factor in the Gulf of Maine. They've been gone for a number of years and we really are not dealing with factory vessels, the big 300-foot factory vessels, as we used to be dealing with.

(Dana Hutchins, Segment Host) Before 1976 foreign trawlers often caught more ground fish than our own boats did in the Gulf of Maine. The big takers were mostly Russian, but Polish, German, and Spanish vessels took many fish as well. In 1976 the federal government stepped in to help American fishermen. Eight regional councils also were set up to manage each of the nation's major fishing regions. The government also offered attractive loan guarantees and tax shelters for buying boats. Fishing then became more of a business. Before long, non-fishermen were buying big fishing boats and sending them out to sea with hired crews. In order to make loan payments and payrolls, fish catches had to increase.

By the end of the 1980's there were twice as many boats as were needed to catch the available fish off New England, and what happened? The numbers of ground fish plummeted.

Landings of haddock, flounder and cod declined by about 85% since the 1970's. In the 20 years since the Magnuson Act, instead of over fishing by foreign vessels we have American over fishing our own waters.

(Jennifer Atkinson, Attorney, Conservation Law Foundation) I think it was a slow, relatively slow process. I don't think at the time anybody thought that our smaller boats, our American boats, could do the damage of these large foreign fleets, but we proved that we could do a great job harvesting fish.

(Dana Hutchins, Segment Host) Although the Magnuson Act helped other U.S. fishing regions it backfired in New England. More so that in the other regions, here in the northeast short term solutions for saving the fishing industry took precedence over conservation of the fisheries themselves.

(Robin Alden, Commissioner, Department of Marine Resources) Under Magnuson you were allowed to have ... you are, in fact, obligated to have directed foreign fishing if you are not able to use a resource, and I think that's something we've forgotten in the northeast because we are able to use all of our resources.

(Dana Hutchins, Segment Host) All along the coastline of the Gulf of Maine there are communities that expect

the sea to provide them with jobs. It was good politics for regulators to try to please all those fishing communities. Ten years after it had become apparent that stocks of ground fish were dropping precipitously, the federal government stepped in. Late last year the U.S. Commerce Department, for the first time ever, banned fishing on Georges Bank and the waters off southern New England to protect ground fish spawning areas. Until regulators develop a long term plan for restoring fish stocks Georges Bank will likely remain closed. The Gulf of Maine, which is still open to fishing, but has dwindling numbers of ground fish, will be included in the restoration plan, but how will we get the fish back? Even if we could push all the political and economic concerns aside, do scientists know what to do to rescue these fish? The collapse of the Atlantic Cod, reknowned for its rapid growth, took many by surprise, even scientists.

(Bob Steneck, Ecologist, University of Maine) It's really hard to determine how many fish are out there, and it's also difficult to know what the relationship is between the stocks that you're assessing and their potential to regenerate and grow. Fisheries models are the state of the science and maybe the state of the science doesn't have the resolution that we might need to really put our fingers on the pulse of the fishery.

(Dana Hutchins, Segment Host) Federal Regulators have been accused of working blindly to save the fish, but one of the biggest problems from regulators is that science is not able to give them the information they need. Until recently most scientists couldn't see the importance of patterns in ocean ecosystems.

All they saw was chaos.

(Bob Steneck, Ecologist, University of Maine) It's very simple. If something is destroying acorns, oak trees won't be there, and if something is destroying nursery grounds, whether it's environmental things, whether it's dragging, then we're going to have problems with the subsequent population.

(Dana Hutchins, Segment Host) Predator-prey relationships among fish are a pivotal part of how ecosystems work. Scientists know very little about predators in the sea. This leaves them with a huge information gap. Jim Wilson is an economist at the University of Maine who studies fisheries.

(Jim Wilson, Economist, University of Maine) From a purely objective point of view, may this ecosystem is functioning just as well the way it is now as it was before, but from the human prospective, it's a much worse situation.

(Dana Hutchins, Segment Host) Norway also overfished its cod. To remedy the situation, the Norwegians who already had limits or quotas on fishing made them more severe. The quotas were cut in half. In just 4 years cod landings nearly tripled and the stocks appear to be on the rise. Some scientists think New England fisheries take years to bounce back. For more than a decade, Georges Bank was fished to all time lows, with fishermen taking more than 70% of all the ground fish swimming on the Bank each year. That altered our marine ecosystems dramatically. Even with the fishing ban on Georges Bank the cod are not coming back. Quite the opposite.

(Spencer Apollonio, Former Commissioner, Department of Marine Resources) It's like taking a governor off a diesel engine. The diesel engine without the governor will race and slow down and relace, and sooner or later it will self-destruct. This system works by series of governors. We've taken the governors away, so our system is racing and idling and racing and it may collapse.

(Dana Hutchins, Segment Host) Biologists are not sure how long it will take to restore depleted populations of ground fish. Estimates range widely, from three to twenty years, even with strict conservation measures. Fishing has always been a boom and bust business, but 20 years will be too long for many fishermen to wait.

(Charlie Saunders, Fisherman, Cundy's Harbor) Up here along this coast you gotta be versatile, but if you get compartmentalized and pigeon holed and you can't go over to the other pigeon hole what're you gonna do? Starve

to death?

(Dana Hutchins, Segment Host) There's evidence that fish species can simply come and go in ocean waters. In the late 1800's on Georges Bank both haddock and halibut disappeared for a while and then came back strong. Marine mammals are another example. Right now the seal population is exploding. Sometimes marine animals will migrate to other waters because of climatic changes. We're just beginning to learn how fish are dispersed throughout the Gulf. The cod has many relatives, including haddock, pollock, cusk, and hake. Members of the cod family can be found in pockets all over the Gulf and they will spawn at different times of the year. It's as if nature wanted to ensure the cod family always survived.

(Spencer Apollonio, Former Commissioner, Department of Marine Resources) We would call it redundancy in engineering. All engineering systems have redundancy built into them to make sure that the systems as a whole function. Species diversity basically serves the same purpose: redundancy to make sure the system operates properly.

(Dana Hutchins, Segment Host) The fate of many fishermen and ground fish will be decided by how well we understand the balance of this ecosystem. Right now we may be taking too many older large fish and not leaving enough in the water for spawning. Spencer Apollonio thinks that's shortsighted.

(Spencer Apollonio, Former Commissioner, Department of Marine Resources) Young fish don't spawn very well. They don't know how to spawn very well. Their success at spawning is not very good. It is apparent that older fish have to learn and if they're not there they're not gonna learn and, therefore, the spawning isn't going to be very successful or very efficient.

(Dana Hutchins, Segment Host) We've been doing this all along with lobsters. Lobster traps are designed to keep larger crustaceans out and let smaller ones escape. Only medium size lobsters get caught.

(Spencer Apollonio, Former Commissioner, Department of Marine Resources) The reasons for that have to do with spawning, but the real benefit that may come from that has to do with all of these other reasons that I mentioned for preserving larger and older fish, and I think we should look at that quite carefully. Maine's the only area that has that law, by the way, and it may be that we're benefitting from that law for reasons we don't understand.

(Dana Hutchins, Segment Host) Survival is more difficult for cod because of the exploding number of trash fish that eat juvenile cod. Some think a predator control program is needed. Spiny dogfish, skates, and other trash fish appear to be dominating other fish on Georges Bank. There's an explosion of trash fish in the Gulf of Maine as well.

(Bob Steneck, Ecologist, University of Maine) Let's say in a perfect world the codfish would be dominant over the dogfish, but in that they are being removed this competitively subordinate species is able to increase its numbers and preempt the reestablishment, possibly preempt the reestablishment, of codfish.

(Dana Hutchins, Segment Host) These fish used to be automatically thrown overboard if caught. They were ugly and too bony to sell. Today we see more and more of them sold at the Portland Fish Exchange. This one used to be called "goosefish." It's shaped like a saucer with half of its body ringed by sharp teeth, but its tail meat has a flavor and consistency of lobster. Renamed "monkfish" it's now a popular item in restaurants. Wolf fish also is indescribably ugly, but great for fish and chips, and pollock, once rejected because it didn't keep well, is now a staple in fish chowder. McDonald's switched from cod to pollock for its fish sandwiches. There are some other unlikely fish which may help keep Maine fishermen afloat. Barbara Stevenson is a member of the New England Regional Fisheries Council. Stevenson also owns fishing boats. She's been given federal money to fish in deep waters beyond Georges Bank for new kinds of fish, fish we've never heard of before like grenadier and chimaera.

(Barbara Stevenson, Fisherwoman, Portland) Ha, ha, ha, they may be ugly as sin but they taste good. The chimaeras are half way between a shark and a fish and they have these big long fins, but they taste somewhere between haddock and cusk, which means that would be a great fish for the consumer and they appear to be very widespread and there appears to be enough of 'em for commercial fisheries, so you might see one in your local fish market sometime in the future.

(Dana Hutchins, Segment Host) In the last five years as ground fish landings nosedived fishermen have rediscovered markets for sea urchins, sea cucumber, periwinkles, and seaweed. Thousand of tons of Maine seaweed are harvested each year for fertilizer and animal feed. There's a red algae called "porphyra" that one company grows in downeast Maine. This lettuce-like algae is actually more dark purple than red. It's known as nori in sushi bars, where it's used to wrap rolled up fish and rice. In Eastport, Maine, there are no sushi bars, but there is plenty of nori. It grows in these nets at Coastal Plantations. Scientific researchers are increasingly turning to the sea in their search for medical cures and pharmaceuticals. One of their big finds has been nori. Maine-grown nori is used in medical diagnostic materials, for it glows in the dark under ultraviolet light. It's also being studied as a cure for cancer and ulcers in Japan. Coastal Plantations is hoping to improve native Maine nori by genetic modification. Research is under way to combine native strains of nori to make a new multipurpose strain. Sea urchins is another hot market. Urchins are now second only to lobster in fish sales in Maine. It's hard to believe these prickly-looking creatures are chic. Just in the last few years green sea urchin has become one of Maine's most valuable resources.

(Robin Alden, Commissioner, Department of Marine Resources) Nobody would have dreamed that ten years ago sea urchins were going to be this valuable.

(Dana Hutchins, Segment Host) Urchin eggs, or roe, are a delicacy in Europe, Japan, and in ethnic markets of east coast cities. There is some concern we may be over-harvesting urchins and seasons have been established for urchin harvesting.

(Robin Alden, Commissioner, Department of Marine Resources) Probably the yield that we've had in the last few years is unsupportable. Probably we need to be harvesting at a lower level, but we may be at the point right now where we're driving it so low so that it won't be economically viable and that would be a great waste for the state.

(Dana Hutchins, Segment Host) To reverse what overfishing has done to ground fish in the Gulf of Maine there is talk of restocking waters with hatchery ground fish. Maine has received a federal grant to raise cod and haddock. If that's successful the state will try restocking some traditional fishing grounds with the hatchery fish.

(Monica Cease, Island Aquaculture) We started out with about 10,000 eggs and we ended up with six live fish from that and we consider this to be a great success compared to a lot of the other hatcheries.

(Dana Hutchins, Segment Host) Aquaculture is an industry on the fast track in Maine. We're seeing commercial success with salmon, trout, mussels, and oyster hatchlings. Besides ground fish we're now experimenting with clams as well. The only soft shell clam hatchery in the world is on Beal's Island in downeast Maine, but there are lessons to learn about every new species we try to grow ourselves. It took more than 20 years to work out the snags in salmon aquaculture. Although there have been cod hatcheries in Maine since 1885, there's been only limited success with restocking the hatchling cod and haddock.

Island aquaculture on Swan's Island is one of two Maine hatcheries experimenting with ground fish. It's borrowing techniques from Norway and Newfoundland.

(Monica Cease, Island Aquaculture) From Norway we learned a lot of the techniques on what we needed for filtration systems and what we needed for food to raise the cod.

A major threat to all hatcheries is disease and viruses. Last summer an unknown virus wiped out the largest shrimp farming area in the U.S. Its destruction was so quick and complete that it's compared to the dreaded Ebola virus that has killed many Africans. One of the country's leading institutions for research and the prevention of diseases in aquaculture is here at the University of Maine. Using DNA processes this Orono lab has developed techniques to help recognize fish viruses in aquaculture.

(Bruce Nicholson, Zoologist, University of Maine) One of the most critical components in successful aquaculture is to control infectious diseases. An outbreak of certain types of infections could decimate aquaculture populations which would be devastating to the fish farmer. Therefore, it's extremely important to prevent infection with certain kinds of passages.

(Dana Hutchins, Segment Host) There are fears that even if ground fish stocks recover, fishing along the New England coast may be forever changed. There's already intense global competition particularly in aquaculture. Americans now rely on foreign countries to supply more than half of the fish we consume.

(Dana Hutchins, Segment Host) Yet in 1993 Maine fishermen had their largest commercial harvest in 30 years. The declining ground fish was compensated for by strong catches of sea urchin, herring, and lobster.

With all the talk about managing marine ecosystems better, scientists have a hard time agreeing on what that term really means. Meanwhile, many Maine fishermen will continue fishing as they have for years now, by trying different kinds of fisheries and diversifying. That's exactly what Ronnie Shepard has done. He shrimps, drags for ground fish, and beginning last year, goes lobstering too.

(Ronnie Shepard, Fisherman, Deer Isle) But I still think of the good days, you know. I'm still hoping that they'll be coming back. I still think Mother Nature's gonna put 'em back sooner or later, but I don't know if I'm gonna be around to see it. Ha, ha, but, we'll see. Ha, ha ...

(music)

(Christine Young, Program Host) On the waterfront much of the news is grim these days. Ground fish, like cod, haddock, and flounder, have been decimated in the Gulf of Maine and other New England waters. The numbers of shrimp fluctuates so erratically that making a living shrimping is nearly impossible, and statewide clams are hard to find due to over-digging and pollution, but there is one success story that may be used as a model for other fisheries. Paul Leblond tells us why the lobster is on top of the heap in Maine.

(Paul Leblond, Segment Host) Many scientists believe New England fish are doomed because we take them for granted. The scientists list even includes lobsters which for many symbolize the very vitality of Maine fishing.

Title: Lots of Lobster

(Paul Leblond, Segment Host) Are these doomsayers right? There is plenty of bad news about our ground fish. Do we know enough about our fisheries to prevent over-fishing of other species?

(Bob Steneck, Ecologist, University of Maine) There is a lot we still need to know with respect to fishing impacts. The fisheries models and their ability to predict have fallen somewhat short of the mark and I think that we have to work on why that's so.

The Maine lobster fishery should be in trouble. Some say it's been over-fished for more than 100 years. More than 90% of the females are caught before they reach maturity. That means nearly all of the females never get to pro-

duce eggs. The imminent demise of the lobster has been predicted for 25 years now.

(Bob Steneck, Ecologist, University of Maine) Well, right now the lobster industry and lobster landings are doing very well. 1994 was a record year. It was a \$100 million harvest. Far and away the single most important species to the fisheries of New England, let alone Maine.

(Paul Leblond, Segment Host) Jim Wilson of the University of Maine used to think Maine lobsters were a basket case. He and many others are now convinced Maine's lobster fishery is one of the healthiest in the world, and one of the best managed.

(Jim Wilson, Ecologist, University of Maine) Almost every rule, at least since the end of World War II is the result of fishermen kind of arguing amongst themselves for a couple of years, then they walk up to Augusta and there is a grand scene called the Lobster Committee hearing, and if there is not significant objection to the new rule the Legislature adopts it and it goes into effect, but by going through that process what you have out there is consensus that this rule is reasonable and that it serves the interests of the industry over the long run.

(Paul Leblond, Segment Host) Maine lobstermen are known world wide for being successful and shrewd. What many people don't know is the lobstermen here govern themselves with a system that has been compared to gangs.

(Jim Acheson, Anthropologist, University of Maine) What you had here is a group of individuals in the same industry who have found it advantageous and convenient to evolve a set of rules about how they're going to operate.

(Paul Leblond, Segment Host) Maine lobstermen's system of self-governance happened by chance in Maine. It wasn't planned. It slowly developed on its own over the past century.

(Jim Acheson, Anthropologist, University of Maine) There was a time when some of the offshore islands, for example, in the 1930's and the 1940's where, in fact, you had had some outstanding lobster wars. Places like Mettanicus, so long and so forth, where after they got done chopping off each other's traps, people pulled the traps up on docks, and then it's burn, burn the docks where all the traps are, and that was fairly efficient and there have been boat sinkings and there have been some instances of, you know, shootings.

(Paul Leblond, Segment Host) Lobstering is a strong presence in the small harbors along the central coast of the state. This is where there are buoys and traps piled high in nearly every yard. Each lobstering household has a different color scheme for buoys. In some places belonging to a lobster gang was crucial to success. Once you were a member of a gang you could fish only in territory owned by your gang. Some harbors overlapped town lines and there can be several harbors in one township, but each harbor has its own gang. For example, Bristol has three harbors and three harbor gangs. New Harbor, Pemaquid, and Round Pond.

(Edgar Drisko, Fisherman, New Harbor) But these boundary lines aren't really enforced. No one seems to go over them that far. Sometimes we do. I straddled them before. I got a few complaints, but no one bothered me.

(Paul Leblond, Segment Host) Gangs can be very protective of their turf. Retribution for fishing in someone else's spot can be swift and anonymous. Sometimes deliberately destroying fishing gear is one of many methods of sending a message.

(Bob Steneck, Ecologist, University of Maine) That's an extreme case, cutting gear, as a friendly sort of reminder to just simply take a line and loop it so that the top of the buoy isn't sticking up to make it easy to catch. It's sticking down and it can only happen by somebody literally stringing that.

(Paul Leblond, Segment Host) There are actually two kinds of rules for the lobster fishery and both were created by the lobstermen themselves. The territories and gangs are one type of system. The other one is strictly by-the-book legal. Over time the state legislature has passed five major rules for the industry, all advocated by lobstermen. There is a minimum and maximum size requirement for any lobster taken in state waters. This means many young and old lobsters are not legal to catch and if trapped are tossed back into the water. Also, it's illegal to take female lobsters carrying eggs or vee-notched lobsters. V-notching is a way to keep track of the breeding lobsters, and lobstermen can only use traps to catch lobsters.

(Bob Steneck, Ecologist, University of Maine) The lobster trap goes way back and so there's a traditional reason for having the lobster traps be the sole way of fishing. It also serves to conserve the stock. It's environmentally friendly and it's also friendly to the lobsters themselves.

(Paul Leblond, Segment Host) Because of these rules the lobster fishery has been immune to many of the problems other fisheries face. Lobster landings have been stable since 1945 and in the last four years landings hit record levels. An average of 20 million pounds of lobster are caught each year. Last year Maine lobstermen brought back 40 million pounds. So far, Maine lobstermen have been able to control their own fishery, but can they lose their control? More people are getting into lobstering because for fishing it's lucrative. Last year 6,500 Mainers were licensed for lobstering. This year the number may jump to 8,000. It's estimated the number of traps has tripled, or quadrupled, in the last 35 years. In Casco Bay some lobstermen have more than 3,000 traps apiece in the water. There's a "gold rush" mentality in the fishery.

(John Rogers, Maine Lobsterman's Association) Well, Casco Bay is a very unusual place to do business as far as being a lobster harvester. We've jokingly been called the Bay of Pigs, mainly because we probably got the largest gangs of traps per individual of anywhere on the coast.

(Paul Leblond, Segment Host) The old rigid territorial system is still there in downeast Maine. In recent years it has lost some of its authority in Casco Bay because of the large number of people getting into lobstering in Casco Bay gangs lost authority there some time ago.

(Jim Clemons, Lobsterman, South Harpswell) Gang style is very territorial where now the new fishermen seem to have faster boats and can go wherever he wants to. The electronics that we have today, I mean, you can get back to those positions so you can find your gear, so ... with the advancements of technology, it's a whole different fishery than it was 30 years ago.

(Paul Leblond, Segment Host) The extralegal system of territories and gangs may not be a fair one, but it does to have scientific value. The gangs result in lobstermen imposing their own limits on catches in their own individual harbors.

(John Rogers, Maine Lobsterman's Association) If you limit the number of traps that are in the water you can to a certain extent control the rate at which stuff is harvested.

(Paul Leblond, Segment Host) Divvying up territories works well because lobsters are sedentary most of the time and don't often migrate into other territories.

Most lobstering takes place on in-shore waters where fishermen can easily observe one another. If retribution is needed the individualized colors on buoys make it easier to identify offenders. These groups of lobstermen also provide family members with a long standing system of sharing expertise and information about the fishery.

(Jim Wilson, Ecologist, University of Maine) Most commonly it's family groups, father-son, daughter, brothers, cousins, whatever kind of combination you can think of.

(Paul Leblond, Segment Host) The legal rules are well suited to the Maine fishery as well. V-notching and the ability to see undersized and egg-bearing females is much easier with lobster than with other fish. Each rule has been the outgrowth of much discussion by lobstermen before it's approved.

Decision-making for lobster fishing begins with the very people who have the most to gain from the long-term health of the resource. There is a much less democratic process for other fisheries, but one of the best things going for the lobster fishery now has nothing to do with self-governing. It has to do with predators. Lobsters have virtually no predators after the first few years of their lives. The lobster's most worrisome predator is ground fish, but there aren't too many of them left in our waters.

(Bob Steneck, Ecologist, University of Maine) I'm not so sure that that linkage holds for what we're seeing here in Maine. First of all, you have to realize that most of our landings are coastal. They are within three miles of shore. Most of this increase has happened within the last 10 years. Well, there hasn't been significant ground fish stocks in coastal areas in the last 10 years, so that doesn't really ring true.

(Paul Leblond, Segment Host) Despite the apparent lack of predators scientists and lobstermen alike are a little nervous about the unprecedented success of this fishery. Lobstermen have asked for certain new rules such as trap limits, apprenticeships, and the right to regulate themselves. Their worse fear is that they will have little say in future new regulations.

(John Rogers, Maine Lobsterman's Association) For the first time in the history of lobstering this past year the legislature finally granted us a trap limit.

(Paul Leblond, Segment Host) The lobstermen have heard these arguments before.

(Edgar Drisko, Fisherman, New Harbor) The best law they can pass is don't do anything, absolutely nothing.

(Paul Leblond, Segment Host) What's different is there are more and more lobsters coming out of the Gulf of Maine. There are scientists who argue lobstermen have outgrown their old self governing system and the fishery is at risk. Yet, there are still plenty of other scientists who agree with the lobstermen that it's the lobstermen themselves who know what's best.

Music ...

(Christine Young, Program Host) Our sea within a sea is a beautiful and unique place. There are few oceans in the world that are more productive than the Gulf of Maine, but the collapse of our ground fish stock highlights how little we know about the Gulf. Marine ecosystems are a puzzle to us. The only fishery we seem to have mastered is lobsters. Our next "Quest" is to our inland waters. Maine is endowed with many exquisite rivers, lakes and wetlands, but it's a constant battle to keep them productive. Until then, thanks for joining us. I'm Christine Young.

(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.

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