

Green Acres

Testing the Waters

Talking Lobsters

UMaine Today

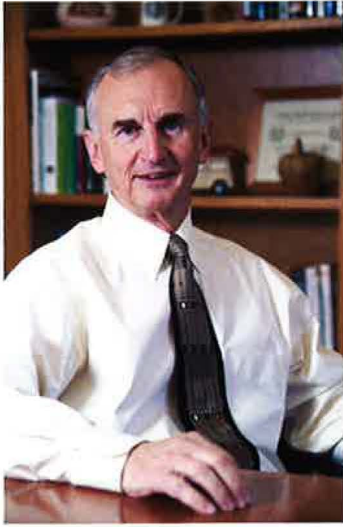
CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE NOVEMBER/DECEMBER 2007



Sensing security

Can new technology
make us feel safer on bridges?

President's Message



WITH RECORD ENROLLMENT, significant progress in our fundraising campaign and a sparkling new recreation center now online, this is an exciting time at the University of Maine. These developments give us reason to feel good about the current state of the university, and they inspire us to look toward the future with great anticipation.

For the past several months, I have been involved in helping lead "Fighting for Maine's Future," an advocacy group that, among other things, is promoting passage of Question 2 and Question 3, two bond measures that will appear on Maine's Nov. 6 ballot. Question 2 would create a \$55 million R&D funding pool and a mechanism through which UMaine researchers could compete for funds to support research projects that will drive statewide economic development. State investment in UMaine research has paid off in a big way over the past several years, with our researchers bringing in five dollars of outside funding for every dollar of state R&D funding. Question 3 is a capital infrastructure bond, with \$11.3 million to fund classroom and laboratory upgrades on our campus in Orono.

While I recognize that many *UMaine Today* readers live outside our state, I believe that initiatives like these are critical to helping UMaine fulfill its unique and vital role.

As we have seen many times in recent history, UMaine uses voter-approved bond funding to enhance the university's role in improving Maine's economy and quality of life. In partnership with people and organizations all around Maine, UMaine uses opportunities like these to strengthen Maine educationally, economically and culturally. I know of nothing on the horizon that is more important to our state and our university than the opportunity that lies before us on Nov. 6.


Robert A. Kennedy
President



ON THE COVER: Associate Professor of Civil Engineering Roberto Lopez-Anido is an expert in structural health monitoring using embedded fiber optic sensors. As a member of the Penobscot Narrows Bridge Team, he led the University of Maine research group that implemented a comprehensive monitoring system that will allow engineers to gather data regarding temperature, tension forces and strand strains throughout the cable-stayed structure. Lopez-Anido and his team, which included UMaine students, spent hours in the underbelly of the new bridge in Prospect, Maine, where the latest in sensor technology is now part of the infrastructure. See related story on page 2.

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University of Maine profile

Located in Orono, Maine, the University of Maine is the state's land-grant and sea-grant institution. UMaine serves its home state through its explicit statewide teaching, research, and public service outreach mission. Offering 86 bachelor's, 92 master's and 29 doctoral degree programs, UMaine provides the most varied and advanced selection of programs available in Maine. The Carnegie Foundation for the Advancement of Teaching classifies UMaine as a Doctoral Research Extensive University, the highest classification.

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November/December 2007

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UMaine multimedia producer Ron Lisnet describes his adventures on the high seas during his first research cruise, led by oceanographer Mark Wells to study the effects of iron on phytoplankton growth in the subarctic Pacific.

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To strengthen the fishery, the Lobster Institute has spent two decades ensuring that the lines of communication remain open among those in the industry.

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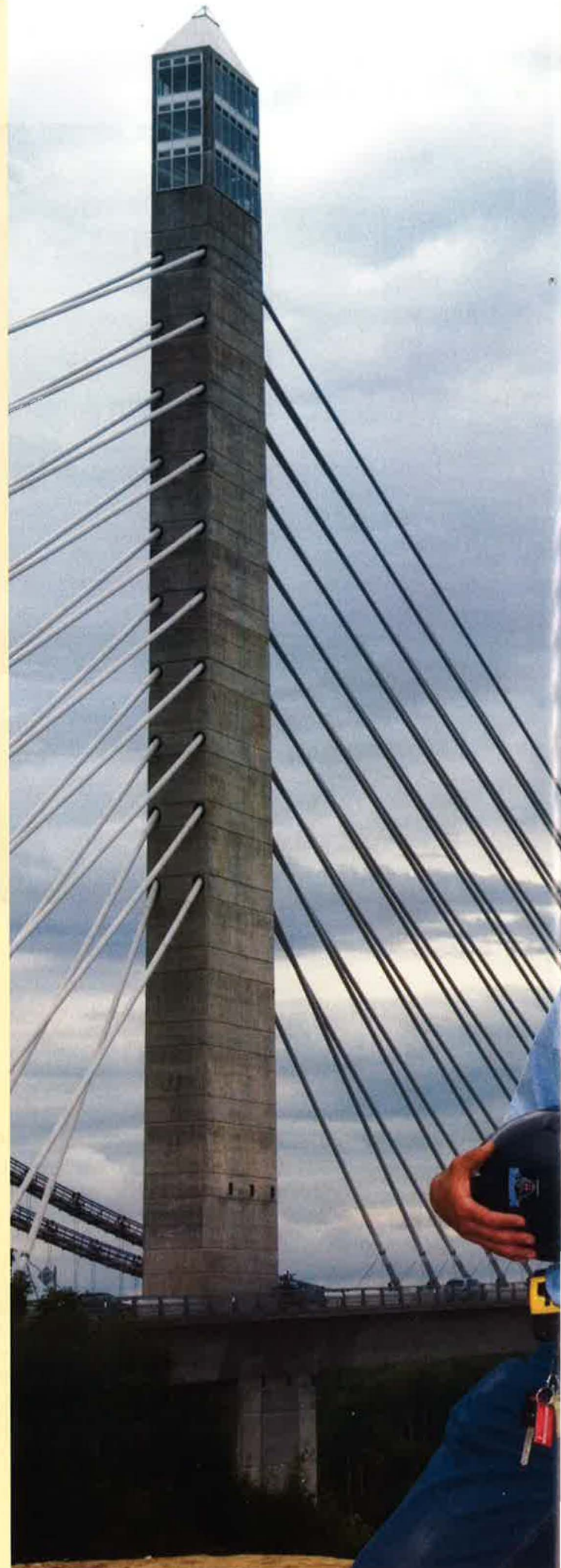
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Visit us on the Web (www.umainetoday.umaine.edu) for *UMaine Today* magazine's online presence, which includes video and audio clips, and a full editorial archive.





Penobscot Narrows is only the second major cable-stayed bridge of its kind in the country. Its continuous cable stays, each containing 50–70 epoxy-coated steel strands, stretches from one span of the bridge deck, through a cradle on the 400-foot concrete pylon and down to the other bridge deck. Six steel strands in three of the cable stays were replaced by high-strength, noncorrosive carbon fiber composite strands. UMaine researchers, led by Roberto Lopez-Anido, right, then implemented a comprehensive structural health monitoring system.



Healthy bridges

A SENSOR-BASED STRUCTURAL MONITORING SYSTEM
COULD BE A KEY TO IMPROVING HIGHWAY SAFETY

By David Munson

THE CATASTROPHIC COLLAPSE of the I-35W steel deck truss bridge over the Mississippi River in Minneapolis Aug. 1 focused national attention on the safety and security of aging bridges across the country. The tragedy that claimed more than a dozen lives emphasized the need for safer, more reliable designs for new bridges, and more comprehensive and reliable monitoring and maintenance programs for existing spans.

The new Penobscot Narrows Bridge in Maine, which opened to the public last Dec. 30, is a shining example of what new designs and technologies have to offer. Working in cooperation with the Bridge Team — the Maine Department of Transportation (MaineDOT), Federal Highway Administration, Figg Engineering Group (the Florida-based company that designed the bridge), CTL Group, Cianbro-Reed & Reed LLC (the bridge contractor), Dywidag Systems International (DSI), Lawrence Technological University, and Tokyo Rope of Japan — University of Maine researchers have been instrumental in making the bridge something more than just a new way to get from Prospect to Verona Island. They've given it a voice.

In late June, six epoxy-coated steel strands in three of the bridge cable stays were replaced by high-strength, noncorrosive carbon fiber composite strands, developed and installed by the Bridge Team. UMaine researchers then implemented a comprehensive structural health monitoring system.



Healthy bridges

UMaine civil and environmental engineering professor Roberto Lopez-Anido, mechanical engineering professor Vince Caccese, Ph.D. student Keith Berube and a small team of undergraduate engineering students have taken advantage of the 2,120-foot-long structure's unique design to help install a sensor-based structural health monitoring system. The system, in effect, allows the bridge to communicate with its maintenance team, providing such information as tension levels in the structure's carbon composite and epoxy-coated steel strands, and any temperature fluctuations in the surrounding environment. The sensors help inspectors determine whether the bridge is safe, and provide an unprecedented opportunity to measure the reliability of new materials.

"The design of this cable-stayed bridge allowed us, working in partnership with the Maine Department of Transportation, the Federal Highway Administration, Figg Engineering Group and other collaborators, to monitor the recently installed carbon fiber-reinforced composite strands, which has never been done in this type of bridge," says Lopez-Anido.

PENOBSCOT NARROWS is only the second major cable-stayed bridge of its kind in the country. Its continuous cable stays, each containing 50–70 epoxy-coated steel strands, stretches from one span of the bridge deck, through a cradle on the 400-foot concrete tower (pylon) and down to the other bridge deck. In the cradle

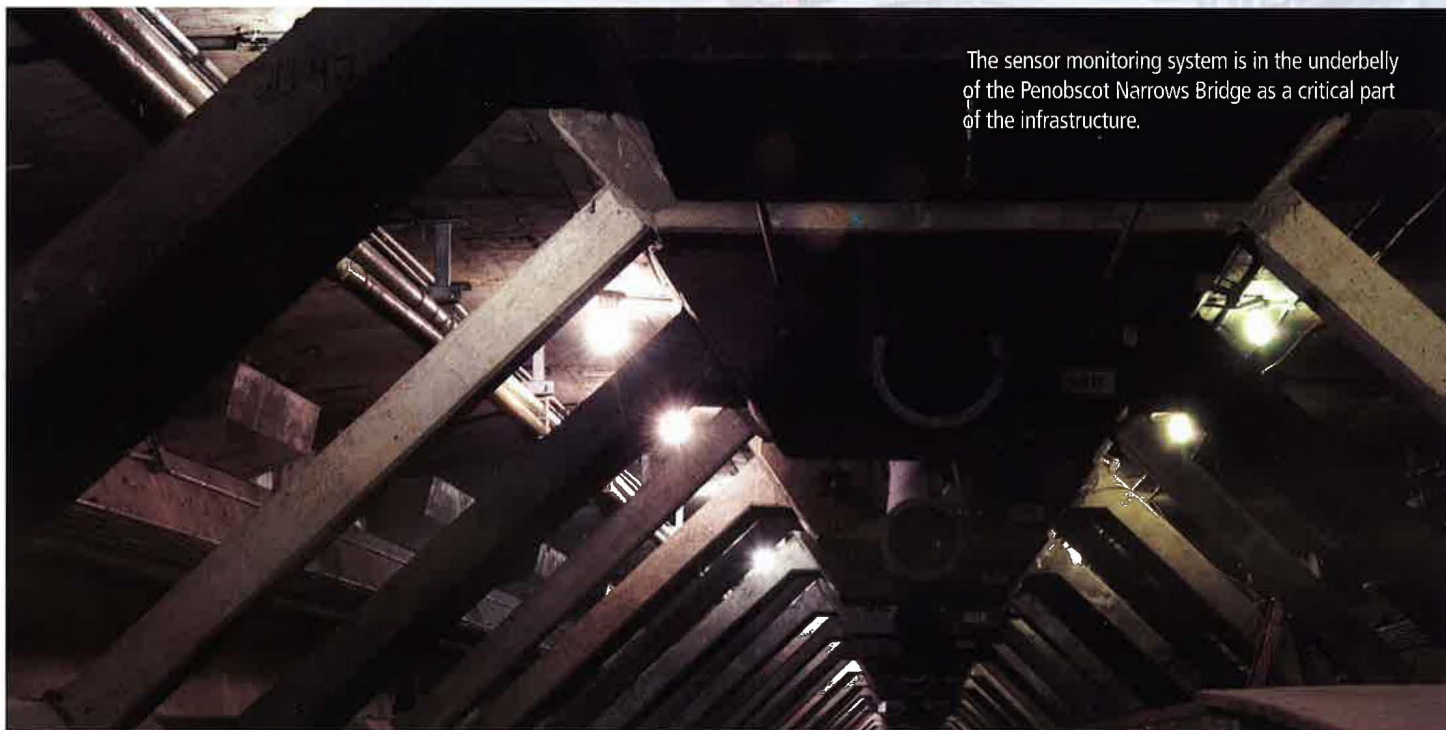
system assembly, developed by Figg Engineering Group, each strand passes through its own stainless steel sleeve. The cradle system separating each strand facilitates individual inspection, adjustment and replacement.

A pair of strands can be detensioned and replaced in each stay without compromising the structural safety of the bridge. At different heights through the pylon supporting the observation tower, crews replaced two strands at three stays with experimental strands of carbon fiber composite, a material that could greatly improve the strength and durability of bridges around the world. Each carbon fiber strand was tensioned between 20,000–26,000 pounds, as indicated by the load cells monitored by UMaine researchers.

Working with Caccese and a team of student research assistants, Lopez-Anido and Berube designed a novel sensor monitoring system for the carbon fiber composite strands, manufactured by Tokyo Rope. By building and testing a support structure (anchorage chair) for the carbon fiber strands equipped with displacement sensors and load cells, they developed a unique system for measuring changes in the strands' tension performance.

In addition, the team developed an effective new method for measuring strain within the cables. By embedding existing fiber optic strain sensors in E-glass/vinyl ester composites, Lopez-Anido created a tube-like sheath for the composite strands to provide additional data on changes in the tension force.

The Penobscot Narrows Bridge gave Roberto Lopez-Anido and his collaborators the ability to test the performance of carbon composite strands in a real-world environment.



The sensor monitoring system is in the underbelly of the Penobscot Narrows Bridge as a critical part of the infrastructure.

The Penobscot Narrows Bridge gave Lopez-Anido and collaborators the ability to test the performance of carbon composite strands in a real-world environment, generating invaluable data that will allow researchers to compare the carbon composite test strands to the more traditional epoxy-coated steel strands that currently support the bridge. Using a battery of sensors, including their own devices as well as sensors installed by the Bridge Team and construction crews, the UMaine researchers will be able to gather data regarding temperature, tension forces and strand strains from throughout the cable-stayed structure.

TO SIMPLIFY the monitoring process and to assist the MaineDOT in making the bridge a kind of “living laboratory,” where trends can be measured and new technologies tested, Lopez-Anido’s team is helping to coordinate the sensors in a way that would allow remote access to the sensor data. Once completed, the complex system of multiplexers, data loggers and fiber optic cables will allow researchers on campus or MaineDOT officials in Augusta to look at performance indicators in real time over the Internet, complementing on-site safety inspections and other research.

UMaine’s Advanced Engineered Wood Composites (AEWC) Center is widely recognized as a leader in the development of sensor technologies and novel materials for use in bridges. Lopez-Anido has been involved in a number of AEWC projects. Materials and techniques developed at the center, incorporating the latest in cutting-edge sensor technologies, are helping to extend the life and improve the safety of a broad range of civil engineering projects.

Currently, Lopez-Anido is fine-tuning a long-term monitoring program for the bridge. Recording data at one minute intervals 24 hours a day, 365 days a year, the comprehensive program will provide the kind of information that engineers and bridge maintenance crews need to prevent tragedies like the Minneapolis collapse.

“We are developing a proposal for a long-term monitoring plan for the MaineDOT that would not only coordinate the use of the existing sensors in the system, but also explore new technologies, including wireless systems, that could ultimately be used in a variety of projects,” says Lopez-Anido. “This is a unique structure with very innovative technologies. (Coupled with) the cooperative approach that has been taken, (it) has allowed us to go from the lab to the field with important new technologies.

“When you look at an old steel truss bridge, you can easily see the challenges involved in making an accurate inspection. There are so many members and joints, it’s like looking through a jungle. Today when we build a bridge, we have to think about monitoring and maintenance, and sensor technologies help us test new materials and monitor safety issues so that repairs and renovations can be made,” he says. “We’re creating bridges that are a lot different from those that were built 40 or 50 years ago.” ■



Keith Berube and Kate Wheeler

Student Engineers Making Connections

DEVELOPMENT AND IMPLEMENTATION of a sensor-based systems monitoring network for the Penobscot Narrows Bridge involved University of Maine mechanical engineering Ph.D. student Keith Berube and undergraduate mechanical engineering major Kate Wheeler. They worked with engineering students Anthony Fessenden and Maurizio Chiamonte under the guidance of civil engineering professor Roberto Lopez-Anido.

Berube and Wheeler were instrumental in making the bridge’s sensor system operational, putting in long days to ensure that the project was completed on time.

Berube, who also earned his undergraduate and master’s degrees at UMaine, and worked for five years as a research engineer in the Department of Mechanical Engineering, says the Penobscot Narrows Bridge has been one of the most demanding and rewarding projects in which he has been involved.

In addition to attaching load cells and soldering hundreds of connections, Berube also designed a specialized egress box to allow the Maine Department of Transportation to perform any required maintenance at the support cable anchorage locations, without compromising the corrosion protection or the sensor systems.

Testing the waters

By Ron Lisnet

LIKE A LOT OF KIDS who grew up in the '60s and '70s, I watched the exciting exploits of famed French scientist Jacques Cousteau on television and imagined how cool it would be aboard the *Calypso*, exploring ocean depths, filming whales and dolphins.

By the time I hit my 40s, it was pretty evident that opportunities for such high seas research and adventure passed me by. All I could do was vicariously experience what such exploration must be like by interviewing University of Maine scientists doing that kind of work. In my job as a UMaine multimedia producer, I was constantly fascinated by their descriptions of research trips to the

polar regions, the jungles of the Caribbean or the wilds of Maine. But that's as close as I thought I would ever get.

One of those researchers is Mark Wells, an associate professor of marine sciences at UMaine. Through the years, he and I came to know each other through our daughters, who take dance classes together. Our families got together on occasion when, more often than not, he had just returned from a research cruise or a trip to Antarctica.

I loved hearing his stories about battling the elements to do his work. Half-jokingly, we related how great it would be to document one of these trips on film.

About a year ago, wishful thinking became reality when Mark Wells invited me to join him on a summer 2007 research cruise to the subarctic Pacific. He was lead-

ing a team of 22 researchers and students from three universities on a month-long cruise to investigate plant life in that region of the ocean.

Specifically, he was studying why phytoplankton aren't growing as they should.

After discussing it with my colleagues, the decision was made. I would join the cruise and spend about two weeks at sea.

It was enough to make me start humming a few bars of John Denver's *Calypso*.

We're going where?

Video production in the field is challenging enough when you're on land. But at least on shore, you can find a store where you can buy batteries when you run out or you can have a replacement part shipped in if something breaks. Preparing for this trip gave the term field production a whole new meaning.

Research cruise to the subarctic Pacific is a high seas adventure that adds to our understanding of how iron works in the oceans

A rosette package with 24 sample bottles is deployed to measure the structure of the water column. The goal of the research is to better understand how natural fluctuations of iron and other nutrients affect phytoplankton. Research expeditions like this one are constantly breaking new ground and adding to a rapidly growing body of knowledge about how oceans really work.

Photos by Ron Lisnet



Testing the waters

I spent months going over equipment lists and talking online to colleagues who had done similar assignments. I packed two of everything (except for the camera), preparing for any conceivable contingency.

Where I was going, FedEx doesn't deliver.

May 17, I caught a flight to Ketchikan, Alaska, where I boarded the R/V *Thomas G. Thompson*, a 274-foot research vessel owned by the national Office of Naval Research. After hugging the coast for a day, the ship headed to open water, 1,000 miles west of Seattle.

Our destination was an area literally in the middle of nowhere called Ocean Station PAPA. For oceanographers, this is an important region because it has the longest record of offshore oceanographic observations, initiated by the Canadian weather ship sampling program in December 1949.

It wasn't the Bahamas, but, hey, I was game.

Death wish

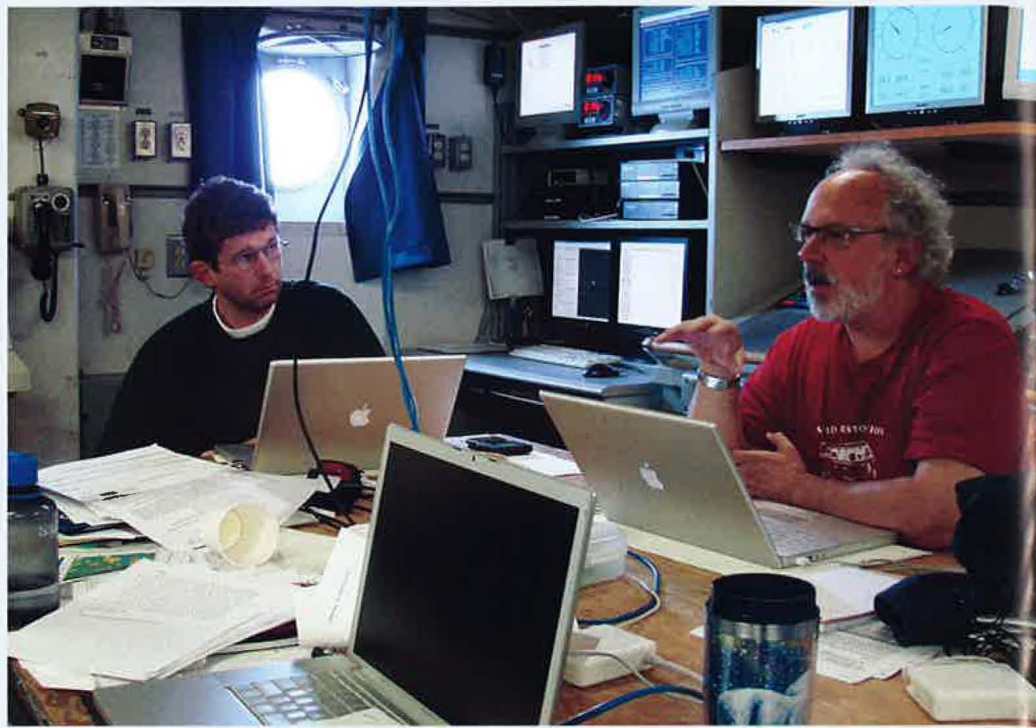
One of the first items on my packing list was a seasickness remedy. With my long history of motion sickness in cars and on airplanes and short boat trips, I dreaded the inevitable.

"Everyone gets seasick for at least a few days," Wells told me, "but you'll recover. Just rest in your bunk and work when you can."

I wasn't taking any chances; I packed just about every cure I could think of — patches, over-the-counter pills, powdered ginger. I also made a mental note of what to do once seasickness hits: Keep eating no matter how bad you feel. Stay hydrated. Stand at the back of the boat and look at the horizon. Get plenty of fresh air.

I thought I was ready. But by the second day, seasickness had me in a strangle hold.

According to seasickness.co.uk on the Web, "seasickness happens when your body,



Mark Wells of the University of Maine and Charles Trick of the University of Western Ontario, two of the three principal investigators on the research cruise, meet daily in the control room to review the latest data and determine which of the more than 50 experiments to conduct that day.

inner ear and eyes all send different signals to the brain, resulting in confusion and queasiness." My description is less scientific. At first, I was afraid I was going to die. Then I feared I wasn't going to die. I spent at least two days incapacitated — weak and nauseous, with cold sweats. Getting in and out of my bunk was a major effort.

My savior was Peggy Hughes, a lab technician from the University of California — Santa Cruz. She shared her remedy with the caveat that it may cause drowsiness.

I took one pill and promptly slept for a straight 18 hours. But, I was not seasick.

After that, I took a small piece of a pill each day and was fine. I even listened to the horror stories of some research cruise veterans who told of their battles with seasickness. Imagine being so nauseous you can barely stand, yet you're working 16- to 20-hour days in a laboratory while 20-foot waves pound your ship.

My respect for the work these scientists do grew exponentially.

The science

What was the point of going through all this effort to essentially bring a floating chemistry lab, complete with a clean room, to the middle of the Pacific Ocean? It turns out that Ocean Station PAPA is one of three areas in the world with a lot of nutrients in the water, but not nearly as much ocean plant life as you would expect. It's important to find out why, because these single-celled ocean plants — phytoplankton — are the basis for most life in the ocean and, by extension, life on our planet. These plants are eaten by tiny critters that turn into bait, which ultimately feed everything from shrimp and fish to walrus and whales — and, of course, humans.

In addition, phytoplankton play a major role in controlling global climate. Trees and plants take in carbon dioxide during photosynthesis, absorbing huge amounts of this greenhouse gas. In turn, these plants provide the oxygen that sustains life on Earth. At least half of all the photosynthesis

on our planet is done by phytoplankton, even though the largest of these plants is about the width of a human hair.

It turns out that a lack of iron, a micronutrient for plant and animals, is a major limitation in phytoplankton growth. Here in the subarctic Pacific, unlike most ocean regions, there's not enough iron and, in some cases, copper, for the plants to use up the plentiful macronutrients of nitrogen and phosphate.

It's as if you threw a bunch of fertilizer on your lawn, but the grass just wasn't growing any better, says Wells.

Looking for answers

With funding from the National Science Foundation, Mark Wells and the other scientists came to conduct experiments. But it's not just a matter of putting samples of ocean water into a bunch of test tubes and beakers on a bench. The very ship on which we sailed is made out of iron, which can quickly change the chemistry of the water. Samples had to be pumped in special ways to avoid being contaminated by the metal "halo" around the ship.

Once on board, the water was carried in plastic tubing directly into a clean room, much like those used in the semiconductor industry. There, water chemistry was analyzed. Scientists then added tiny amounts of iron, copper and other nutrients to see the effects on phytoplankton growth.

The research goal is to better understand how natural fluctuations of iron and other nutrients affect phytoplankton.

The work is exceedingly precise. UMaine Ph.D. student Eric Roy described the measurements they were making as equivalent to trying to detect a single drop of water in an Olympic-size swimming pool. It's labor-intensive work that can go on 24/7.

In the spirit of college all-nighters, the

work often is fueled by coffee and chocolate.

While some data were analyzed on board, the number crunching continued once the scientists came ashore. Oceanographic research of this type is more a marathon than a sprint. Mark Wells likens it to working on a very large puzzle without a clue what the final picture will look like. Scientists keep putting together pieces and pushing the knowledge forward.

It can be a frustrating process in a world that looks for easy, quick answers to complex problems.

Serious exploration of the role of iron in this whole process has been going on for two decades. Experiments on the role of iron were proposed as far back as the 1930s, but it was the application of clean room-type techniques that first showed in 1988 that iron limitation existed.

Research expeditions like this are breaking new ground and adding to a rapidly growing body of knowledge about how oceans really work. I heard more than one scientist say that we know far more about

planets in our solar system than we do about oceans covering three-fourths of our planet.

Life aboard ship

The ship I called home for two weeks, the R/V *Thomas G. Thompson*, is one of the newest vessels in the national oceanographic fleet. According to the University of Washington School of Oceanography, where it is operated as part of the University-National Oceanographic Laboratory System, the *Thompson* carries a crew of 21 and as many as 37 scientists. Its features include a more than 4,000-square-foot laboratory.

I wasn't sure what living on a ship would be like, but I had a sneaking suspicion it wasn't going to be like a Carnival cruise.

My first clue about what I was in for was the high-decibel noise. It's everywhere. Wind, engines, fans, scientific instruments being lowered into the water, pumps. There's no quiet, even in your bunk, where the water about 4 feet from our heads



Undergraduates Natalie McCulligh of the University of Western Ontario and Morgan Brunbauer of the University of Maine work in the 4,000-square-foot onboard laboratory, preparing the ocean water samples for use by the other researchers on the cruise.

Testing the waters

sounded like a huge waterfall. Big waves hitting the hull sounded like cannons, and the motion tossed you into the bulkhead, making a full night's sleep impossible.

I shared a cabin with Bill Caddigan, a middle school science teacher from Bethel, Maine, who provided lessons for his students 4,000 miles away via the Web.

Life was reduced to the basics. There were no bills to pay, phones to answer or any other distractions. Half-hour breakfasts and lunches were at 7:30 and 11:30; the dinner hour started at 5. The food — amazing. How the chefs went about preparing three meals a day for 50 people with the ship rocking and rolling, and sauce pans sliding around on a stove was one of the more impressive feats I've ever witnessed.

Veteran crew members make the ship operate smoothly. Many have worked together a long time. They lead a life that is very different from most, spending months at sea followed by long stretches of time off.

Seeding the ocean

Many people wonder about the value of doing the type of basic research conducted on this cruise. What I learned is that understanding the way our planet works is crucial. Oceans are incredibly complex environments that we ask to do astounding tasks — provide food, travel and recreation, process waste. Fifty percent of the people on our planet live within 50 miles of an ocean.

A seemingly small event like a change in the amount of iron available to phytoplankton can be a tipping point leading to major changes, such as fisheries collapsing or toxic algal blooms killing sea life and people. Even global warming or cooling.

It's the latter possibilities that recently thrust this research into the news. Scientists have conducted a handful of large-scale iron fertilization experiments to better understand how past ecosystems in these regions



UMaine Ph.D. student Lisa Pickell collects samples of phytoplankton growing in a flowing seawater incubator on the deck of the research vessel.

would have responded to natural changes in iron inputs. And now private companies are trying to get into the game.

The goal of these companies, backed by venture capitalists, is to use iron fertilization to grow certain types of larger phytoplankton. While all phytoplankton grow by turning carbon dioxide into organic matter, heavier plankton sink when they die, essentially sequestering that CO₂ in the deep ocean. Because carbon dioxide at the ocean surface stays near equilibrium with the atmosphere, these private companies propose to seed vast ocean regions with iron and sell carbon reduction credits.

The scientific community has come together to condemn such geoengineering as a means to address global warming. We know so little about these ocean ecosystems that scientists warn iron fertilization may have unintended and damaging consequences. It might stimulate deadly toxic algal blooms similar to those that occur regularly closer to shore. Iron seeding can increase the growth of some phytoplankton species that produce greenhouse gases more potent than carbon dioxide.

Even without these outcomes, there is little evidence that dumping iron will do

much of anything to reduce the amount of atmospheric CO₂ produced by human activities; it essentially shifts the problem without dealing with its root causes.

Going to sea again?

I returned from my high seas adventure with a large volume of video and photographs to help tell the story of the groundbreaking work of UMaine scientists. I was grateful for the experience and impressed with the passion of these modern scientific explorers to understand the role of a tiny plant that is such an essential building block in Earth's circle of life.

When most people think of marine science, they think of work with whales and dolphins. These researchers argue that the smaller the creatures, the more interesting and important they become.

The question asked by many since I came ashore: Would I do it again? Trips are planned to the Bering Sea, a region chronicled in the Discovery Channel's white-knuckle series *Deadliest Catch*, about the lives of Alaskan crab fishermen.

I'll skip that one, but I could envision going back to sea some day, now that I have the seasickness thing figured out. ■

student focus

Love of physics



Katie McCann not only wants to teach science, she is committed to teaching it in a rural Maine high school like the one she attended. She'll do that with the help of a prestigious five-year fellowship she was awarded this past spring from the Knowles Science Teaching Foundation. "I feel rural districts don't get as much attention as urban ones," she says. "There's still a pretty big need for good teachers and educational development." Above all, McCann wants to share her love of science — physics, in particular — when she's in the classroom. She'll do that by making sure to connect the concepts and the students.

Photo by Michael Mardosa

KATIE MCCANN was 5 when she fell in love with science. Inspired by each edition of *Your Big Backyard*, then *Ranger Rick*, she headed outdoors and "checked stuff out."

That thrill of discovery stayed with her through middle school, when astrophysics became her passion. But in high school, McCann hit a self-described rough patch. Classes in chemistry and physics were uninteresting, mostly because they didn't seem to have real-world applications.

The experience left her uncertain about her course of study at Northeastern University. Ultimately, she found biomedical physics and collaborated on research at Brigham and Women's Hospital focused on neurodevelopment of the preterm infant brain. In particular, she studied cerebral fluid flow as a possible indicator of brain injury or defect.

McCann's rediscovery of her love of science occurred because her coursework was driven more by concepts and theory than by formulas and prescribed experimental outcomes.

"I began thinking more deeply about the huge underlying concepts that are so amazing and beautiful," she says. "And I like that there may be more than one way to solve a problem. You may

not remember the equations, but if you know the basics, you can solve the problem. That's where the beauty comes in."

McCann's undergraduate experience could have led her to pursue graduate work and a job in industry or research. But that was not an option, she says.

"I wanted a career, so I'm going into teaching," McCann says. "For me, it's the difference between a job and fulfillment."

Last year, McCann enrolled in the University of Maine's Center for Science and Mathematics Education Research, which supports scientists and mathematicians committed to teaching. As a master's student, she's studying how students learn physics in an inquiry-based curriculum.

"An inquiry-based curriculum is so much more effective than lecturing to students," she says. "When the lab precedes what the teacher talks about, the discussion is more dynamic and students have more input."

McCann not only wants to teach science, she is committed to teaching it in a rural Maine high school like the one she attended. She'll do that after she finishes her graduate work with the help of a prestigious five-year fellowship she was awarded this past spring from the Knowles Science Teaching Foundation.

SHEAR SHEEP MADNESS CAN EWE GET T

THE TREWORGY FAMILY'S
2007 CORN MAZE



Green

ROUGH?

Treworgy Family Orchards farm manager Chuck Bailey shows off this year's sheep-shaped corn maze. For Bailey and the many other Treworgy family members who work on the farm, helping get the public — especially youngsters — in touch with agriculture is what agritourism is all about.

By David Munson

Research shows Maine farms are tapping into agritourism's direct-to-consumer appeal

Farming in Maine can be a tough row to hoe. Pressured by huge national and international agribusinesses supplying giant grocery chains, family farms in Maine have been marginalized even within their own state, struggling to compete with hormone-enhanced beef and gas-ripened tomatoes trucked in from corporate-owned megafarms. Without a strong local connection, food quickly becomes just another packaged and processed commodity. As economic forces widen the gap between consumers and producers, the connection between farmers and their communities deteriorates as well, completing a socioeconomic one-two punch for the farming lifestyle.

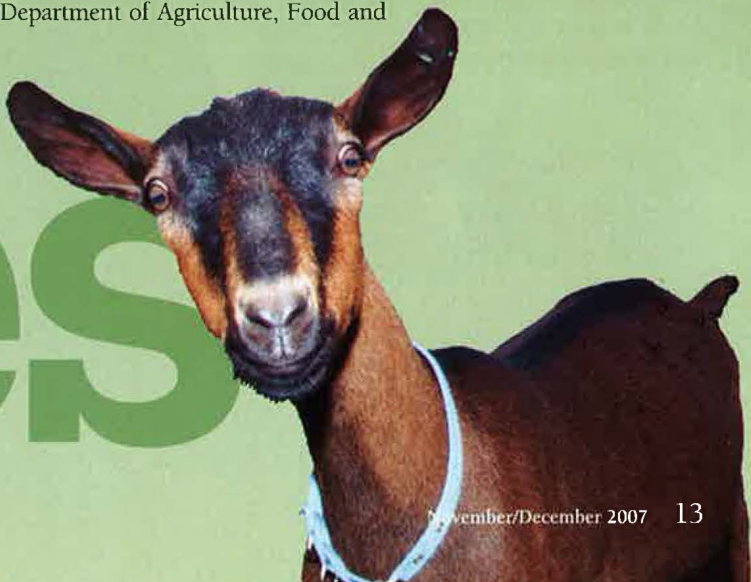
But Maine farmers are a tough breed, and their successes are evidence of the power of determination and adaptability.

SINCE THE FIRST SETTLERS carved field from forest more than 300 years ago, farming in Maine has required hard work, long hours and more than a little luck. Farmers learned to hedge their bets against dry summers, killer frosts, plant pests and livestock diseases to ensure that there would be enough food on the table and money in the cupboard to get them through until the next season. Today more than ever, diversification continues to insulate the family farm from disaster, helping farmers to earn a decent income and maintain their connection to the communities in which they live.

"We've got a little bit of everything going on here. There's always a new idea and a new project," says Patty Treworgy of Treworgy Family Orchards in Levant. "Our entire operation is direct-to-consumer, so we really try to keep up with what our customers like or don't like, and what they would like to see in the future."

The Treworgys are not alone. According to a recent study by University of Maine School of Economics researchers Thomas Allen, Todd Gabe and James McConnon, direct-to-consumer enterprise is a critical part of the success of many Maine farms. The trio applied their combined expertise in economics to determine how consumer-oriented activities — from roadside stands to farm-based festivals — contribute to the success of Maine farms. The study was conducted in cooperation with Deanne Hermon of the Maine Department of Agriculture, Food and

acres





Of the hundreds of visitors who join in Brae Maple's Open Farm Day activities every summer, many are customers from the area farmers' markets, where most of the Smiths' produce is sold. Among the stars of Open Farm Day — indeed, every day — are the Smiths' Scottish highland cattle.

Brae Maple beauty

ALLAN AND ANDREA Smith's hilltop farm in Union is as picturesque as it is productive. The Smiths make their living on the plants and produce they sell to their community. Perennial gardens and educational displays on the farm help their visitors connect with the farming lifestyle.

But the real crowd-pleasers, in addition to inquisitive donkeys and a surly goat, are the Scottish highland cattle with their long red locks.

"Andrea does some spinning and makes ornaments from the wool, and they dispose of the surplus from the gardens and give us fertilizer, but this is a retirement community for the animals for the most part," says Allan Smith, describing each member of the herd by name, birth date and personality. "People really look forward to the cows and the sheep and the donkeys when they come out here.

(The animals) keep us busy in the winter and we just like to have them around."

The Smiths also host University of Maine Cooperative Extension's Master Gardener Program, welcoming dozens of area garden enthusiasts to their farm to practice sustainable gardening techniques, test new gardening methods and conduct field trials.

"The master gardeners have been here for 10 years. It's been one of the best things that we've done," says Smith. "We share a lot of great ideas, and they have just been good friends. We get an amazing turnout for Open Farm Day, and we just couldn't do (the event) without them."



Andrea and Allan Smith

Green acres

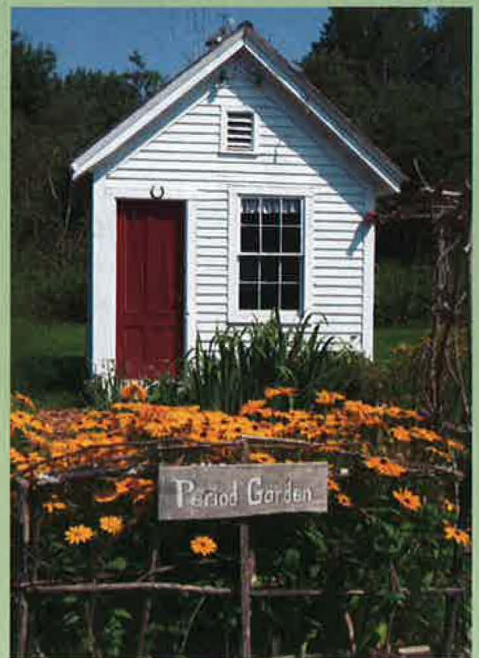
Rural Resources, and funded by the Maine Agricultural Center at UMaine.

Using surveys and statistics from a variety of sources, the group identified a broad range of direct-to-consumer activities as examples of agritourism, and set out to determine how they influence the Maine economy and survival of the family farm.

"Research in a lot of states is looking at some of the same questions, trying to learn more about agritourism and the needs of farms involved in it," says Gabe, an associate professor in the School of Economics. "We wanted to provide some solid information to use as a starting point for people in Maine."

THE RESEARCHERS surveyed nearly 500 Maine farms that self-identified as agritourism businesses in records filed with the Maine Department of Agriculture, Food and Rural Resources. Of those surveyed, the majority depended on agritourism for more than half of their farm revenues.

"The surveys showed that agritourism is a proven economic development strategy for



Brae Maple Farm's natural landscape is highlighted by gardens, grown in cooperation with University of Maine Master Gardeners. Gardens featuring medicinal herbs and period plantings are a popular part of Open Farm Day.

small farms," says McConnon, UMaine Cooperative Extension business and economics specialist, and a professor in the School of Economics. "Trends in wholesale agriculture have made it more challenging for small farms to produce the kind of volume that allows them to continue to be price competitive. Agritourism allows small farms to diversify in ways that capture more consumer dollars, helping them to survive."

For many of the farms, the potential profitability of direct-to-consumer sales began as a way to supplement shrinking profit margins of wholesale production. Diversification has been a key to the survival of Maine's family farms, with income from a farm stand or a farm-based event making up for crop losses or sudden drops in wholesale prices for products.

"We started out making most of our income from the cows, selling them for breeding stock and meat. We did that for years, but it was a lot of work and was really time consuming," says Andrea Smith, who operates the 52-acre Brae Maple Farm in Union with her husband, Allan. "We started to shift to selling more plants and vegetables, and now that's our main focus. We do the farmers' markets in Rockland, Camden and Belfast, and the Common Ground Fair, and we work a lot with the Cooperative Extension's Master Gardeners Program."

Farmers' markets, on-farm events, community classes and other agritourism activities add complexity to their farm business. They have to plan planting and harvesting to jive with market schedules, coordinate farm duties and transportation to ensure products and people get where they need to be, and fill out reams of paperwork for government programs. From small hurdles to massive roadblocks, there are a lot of considerations that can stand in the way of success for an agritourism project, considerations many farmers may not have the time or expertise to handle effectively.

That's where UMaine Cooperative Extension comes in.



Under the watchful eye of one of the feathered inhabitants at Treworgy Family Orchards, Ingrid Whitehouse, a youngster attending summer day camp, participates in the farm chores.

Connecting to farming

THE SOCIAL, PERSONAL and spiritual benefits that a strong connection with the land and community can provide are what inspired the Treworgy family to begin their farming enterprise in Levant. Their direct-to-consumer agritourism business, Treworgy Family Orchards, has grown from a few acres of U-pick apple trees to a dynamic, farm-focused destination, offering day camps, hayrides, farm products, petting zoo, ice cream stand and corn maze.

Having begun the business without a farming background, the Treworgys have worked closely with University of Maine Cooperative Extension on everything from fly control to business planning and marketing.

"I would guess that not a week goes by around here without a call to Cooperative Extension about something. We learned just about everything we know about farming from Cooperative Extension and 4-H," says Patty Treworgy, who founded the family business with her husband, Gary, in the mid-'80s. "We wanted to

create a place where a family could enjoy spending the day, and where they could learn a little something about farming."

Today, more than a dozen family members are directly involved in the operation of the farm, each contributing his or her unique expertise and enthusiasm to different aspects of the multifaceted operation. From learning to drive a team of horses for hayrides to testing new crops for the retail store, the Treworgy team is always on the lookout for new ways to make their farm welcoming and exciting.

Farm manager Chuck Bailey sees the thousands of visitors who visit the orchards for school fieldtrips and weekend recreation as more than just customers; he sees them as thousands of opportunities to reconnect with a generation that is losing touch with its farming heritage.

"More and more, you find that people really don't understand what farming is all about, and we want to do what we can to stem that tide," Bailey says.



Green acres

Extension faculty like Donna Coffin of Piscataquis County provide training and expertise where and when farmers need it, helping to ensure a good crop and a mutually beneficial connection between farmers and their communities.

"Donna has jumped us ahead in many ways. By advising us on grants that are available and helping us put the grants together, she has helped us get new equipment, put bushels and bushels of food into the local food cupboard, and connect with educational programs on everything from storing vegetables to dealing with government regulations," says Sid Stutzman, who runs Douty Hill Farm in Sangerville with his wife, Rainie.

With Coffin's help, the Stutzmans and other area farmers got a Sustainable Agriculture Research and Education Grant to establish Maine Highland Farmers four years ago. Members jointly market their produce, print maps to guide new customers to their farms and organize educational talks on marketing their products and other subjects.

THE CONNECTIONS agritourism fosters in a community have far-reaching implications. By strengthening the sustainability of small farms and creating jobs, agritourism plays an important role in the preservation of Maine's small farms. Family farms, in turn, preserve rural communities and traditional Maine lifestyles that offer direct benefits to the tourism industry.

"We have people from Connecticut and Massachusetts who make our farm stand a seasonal stop. They buy pies and produce, and get their winter storage of potatoes, and we've gotten to know them," says Stutzman. "When we make these connections, we are helping to define what central Maine is for the people who are here for a few weeks and for the people who live here."

Agritourism fits well with the state's tourism strategy to capitalize on the beauty of Maine's natural assets, says Allen, a senior research scientist with UMaine's Center for Tourism, Research and Outreach. "Natural resource-based tourism and ecotourism are two of the fastest growing sectors in the tourism industry. Agritourism is able to provide the authentic experience that many visitors look for in Maine."

Gabe, McConnon and Allen conservatively estimate that agritourism activities currently generate more than \$28 million in sales and support more than 1,700 full- and part-time jobs on Maine farms. In addition to the farm sales, the researchers used a statewide economic model to examine how agritourism activity relates to other businesses and industries across the state. Find-

According to UMaine's survey, a fourth of Maine's agritourism farmers established their businesses in the last five years, and nearly half are interested in adding more activities.

ings show that agritourism activity on Maine farms generates an additional \$13 million of economic activity in non-farm businesses, pushing the total contribution to the Maine economy to approximately \$41 million.

According to UMaine's survey, a fourth of Maine's agritourism farmers established their businesses in the last five years, and nearly half are interested in adding more agritourism activities.

The study also found that agritourism farms in Maine may benefit from establishing strong connections and linkages with tourism-related businesses and organizations in their communities.

Further research by McConnon, Gabe and Allen will include a study of the interactions between agritourism and other tourism-based businesses.

"We discovered a real gap in the research. There was no baseline for direct farm-to-consumer activity in Maine. This research is helping to fill that gap," says McConnon. "Our goal now is to find out how best to support farmers who are pursuing agritourism activities." ■



In July, the Stutzmans sponsor a community Berry Festival, featuring live, down-home music and a feast prepared with fresh produce, like raspberries and strawberries for shortcake. Among the festival entertainers: Sid Stutzman and the Douty Hill Band.



The Stutzmans' customers travel to Sangerville from as far away as Sebec Lake and Greenville for fresh produce, the farm's famous whoopi pies and homemade fruit pies baked by Julie Harrington.

Destination: Douty Hill

IN A LOW-SLUNG building at the crest of a hill in Sangerville, Sid Stutzman eyes bushels of neatly arranged produce, picked that morning in the field below. Tucked away in a corner kitchen behind the cash registers, more than 40 pies a day are mixed, rolled, poured and baked to flaky perfection, offering his customers an even tastier way to enjoy the farm's harvest.

Customers come and go, making their just-picked or fresh-baked selections, pausing to chat with one another about family and friends, the latest news and gossip.

It's a far cry from the impersonal fluorescence of the grocery store, and that's just the way Stutzman likes it. Raised on the same hill where he harvests the day's crops, Stutzman's personal connection with his customers, his workers and his fellow farmers means much more to him than just revenue for the farm.

"We try to do a lot with the community. We're big into the Senior Farm Share Program, we give a lot of local kids their first job, we do the Berry Festival. It really gives you a good feel-

ing," says Stutzman, a third-generation farmer and talented musician. "We used to do a lot of wholesale, but we expanded the farm stand and now we sell most of what we grow to our own customers."

Stutzman and his wife, Rainie, work closely with University of Maine Cooperative Extension specialists to improve their farming and marketing practices. The result is a successful, multifaceted agritourism business built on the Stutzmans' reputation for supplying the freshest, most flavorful food available.

"People want to buy local because they want to know where their food is coming from," says Stutzman. "They can go to the store and get week-old produce anywhere, but they come here and they know what they're buying was picked the same day."

Rainie and Sid Stutzman

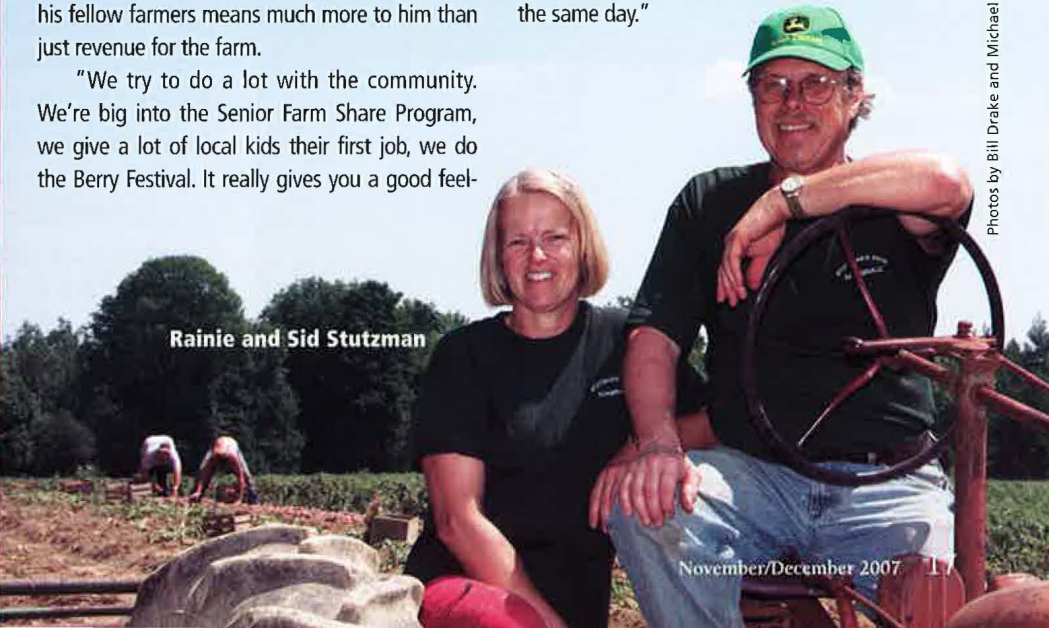




Photo by Mitchell Merrick

"The people are what keep me involved with the lobster fishery and industry. The science is great, but the fact is it also directly affects the lives of people in the U.S. and Canada that rely on this industry for a living. It's an interesting community, the way they rely on each other and present their problems to us. Some of it has to do with their history and with the joy of getting out and doing a day's hard work. Most tell you there's nothing they'd rather do."

Bob Bayer

By Margaret Nagle

Talk



Dana Rice's family

has been lobstering in Maine waters for generations. He was 7 when he first accompanied his grandfather as he checked his traps in Birch Harbor.

Now his 7-year-old grandson has started donning his oilskins to go out with his father on occasion.

That cultural heritage, the opportunity afforded young people and the abundant natural resource are critical, Rice says, for maintaining an industry — and a way of life.

Key to the whole process is the Lobster Institute at the University of Maine, he contends.

"The institute brings people together and gives them a forum in which to discuss these things," says Rice, owner of D.B. Rice Fisheries in Birch Harbor and a member of the New England Fishery Management Council. "If it wasn't there, there basically would be no other place for us to discuss what's on our minds and find common ground to work toward common goals."

It seems almost too simplistic to think that open, regular dialogue between Canadian and American lobstermen, pound owners, scientists, processors and distributors can yield far-reaching results. But ask those in the state's lobster industry what difference the institute makes and they'll inevitably cite the communication it has facilitated in the past two decades.

"Prior to the formation of the institute, there was real mistrust between fishermen and scientists, says Cathy Billings, an assistant director at the Lobster Institute. "Lobstermen saw researchers as trying to control the industry without even being on the boats, seeing what the fishermen see day in and out. The institute built a bridge between them."

Bridge building was achieved by fostering relationships, says Bob

To strengthen the fishery,
the Lobster Institute has spent
two decades keeping the
lines of communication open

ing lobsters

Bayer, the institute's executive director since 1995. "There were many splinter groups from Newfoundland to New York, but we were able to get them in the same room, talking together, and represented on our board of advisers."

At the fourth annual Canadian/U.S. Lobstermen's Town Meeting, held last April in New Brunswick, Nova Scotia, fisherman Ashton Spinney reminded the audience of 60 what brought them together to discuss topics ranging from the rising costs of lobster fishing, including fuel and bait; price structuring that occurs between fisherman and consumer; and reconciliation of environmental needs with economic realities.

"We may come from different geographic areas," he said, "but we all share and rely on the same natural resource. Sustaining a shared resource calls for constructive sharing of information. Our knowledge grows by this sharing of observations and experiences. The greater our knowledge, the better our decisionmaking will be."

The Lobster Institute is both a conduit and catalyst for research to meet industry needs. Working with a network of experts and scientists, many of whom are at the University of Maine, the institute has tackled a number of issues related to lobsters, starting in 1988 with research on lobster shell disease in tidal pounds and stock assessment. That research was followed by studies on alternative lobster baits, a patented technique for improving yield and shelf life of processed lobster, and development of a test for law enforcement to determine if female lobsters were illegally scrubbed of their eggs.

Scientists now affiliated with the Lobster Institute have been studying shell disease since the mid-1980s. Most recently, research

by a UMaine graduate student is exploring the correlation of the disease to environmental health using GIS and maps indicating heavy metal deposits. Also under development is a low-cost hatchery to be used as a rearing facility for stock enhancement.

In addition, the institute has focused on research to create value-added lobster products like extruded snack foods for people and dog biscuits made from processing by-products, such as mince and shell.

In 2006–07, the institute helped channel awards totaling more than \$1 million in state and federal funding into lobster-related research. The institute is now planning a study on the impact of the lobster culture on tourism.

And the institute has launched a \$4.8 million capital campaign to ensure future funding for research and administration. Organizers hope the campaign will help establish a regional lobster health coalition of researchers and fund an annual lobster health survey.

"In Maine, the lobster industry and the state didn't realize for a long time how important lobstering is to the economy and the culture," says Rice. "When you're competing to make a living, you take for granted what you're doing, but the reality is there's no other fisheries like ours left. Without this culture, this would be just another place to live."

Bayer came to UMaine in 1972 as a poultry expert, teaching courses in animal nutrition and physiology. He worked with a master's student who wanted to pursue research on the nutritional requirements of lobsters in tidal pounds. In another project, Bayer and a graduate student developed and patented a vaccine to control gaffkemia or red tail disease that afflicts lobsters in captivity.

"The lobster industry is the best managed in the world and the fishery is stable. Fishermen tell us there are tons of small lobsters out there, which means the future is strong."

Bob Bayer

By 1974, Bayer turned his research attention to crustaceans.

“No one on campus at that time was doing anything with lobsters,” Bayer says. Talking with fishermen, it was clear they were not getting the help they needed.

“The people are what keep me involved with the lobster fishery and industry. The science is great, but the fact is it also directly affects the lives of people in the U.S. and Canada who rely on this industry for a living. It’s an interesting community, the way they rely on each other and present their problems to us. Some of it has to do with their history and the joy of getting out and doing a day’s hard work. Most tell you there’s nothing they’d rather do.”

The institute has become a trusted resource for the lobster industry, a place to turn for the most accurate, up-to-date information, Billings says.

“I’ve always described the institute as industry driven,” she says. “Lobstermen came to us (UMaine) saying they wanted this. They were very proactive in wanting to secure their fishery because it’s a very generational endeavor. They’re bringing their grandchildren in, just like they came in with their grandfathers. They have a personal stake in it beyond the paycheck.”

As part of Maine Sea Grant at the university, the institute was established 20 years ago with the help of the Maine Lobstermen’s Association, the Maine Lobster Pound Association and the Maine Import/Export Lobster Dealers. By that time, Herb Hodgkins of Hancock, head of the Maine Lobster Pound Association, was already tapping the research expertise of UMaine to study nutrition and disease control in crustaceans in captivity.

“The Maine Lobster Pound Association got off the ground with research the university did on lobsters in storage and red tail disease,” Hodgkins says. “We founded the association to support (further) research, then became one of the cornerstones for developing the Lobster Institute.”

While the Lobster Institute does not advocate for the lobster industry, it does serve as an information clearinghouse for crus-



“My basic concern is whether the resource will be there and whether there will continue to be open access to the industry so there will always be a way for a young person to get into the industry. Any regulation should consider the impact on a community. We need to make sure we’re not selling the fishery out from under the next generation by putting a big price tag on a lobster license. I hope we don’t give away my grandsons’ heritage.”

Dana Rice

tean enthusiasts worldwide. The phone calls and e-mail come not just from people in the industry, but also from the public.

The zaniest question for the lobster experts: How do I grow lobsters in my basement? (The answer: It’s not economically feasible; in the wild, it takes five to seven years for a lobster to grow to a legally marketable size.)

An example of a more serious phone call: News that a shipment of U.S. lobsters has been turned back in Italy on grounds that lead levels are too high. In response, the Lobster Institute put Italian authorities in touch with researchers whose work has clearly shown that lead levels

in American lobsters are well below minimums set by the Food and Drug Administration.

A recent call came from a dealer in Switzerland who wanted to know why the lobsters he recently purchased were not doing well.

“We’ve been called lobster 911,” says Billings. “If there’s a problem or a question, we’re typically the first called. If we can’t give them the answer with Bob’s expertise, we connect them to the person who can.”

Concern about the environment, particularly water quality as it affects lobster health, remains one of the leading topics of discussion among fishermen. That was particularly true in 1999 when lobstermen from Connecticut and New York called Bayer to lend expertise on the lobster die-off in Long Island Sound. While nothing could stem the die-off, Bayer was able to provide research findings that helped the lobstermen better understand the role environmental contaminants, particularly pesticides, can play in lobster mortality.

“We’re primarily here to ensure that problems don’t crop up for the industry by staying proactive in lobster health,” Billings says. “Science is no longer a dirty word with lobstermen. They know they need to have research to keep the fishery going.”

The fishery continues to evolve, says Rice, which makes it even more imperative that all those with a vested interest in the industry constantly keep the resource — and access to it — in mind.

“It’s the same old creature with no brain that keeps us humans on our toes,” he says. ■

connection Kids Can Grow



Mackenzie Rowe of Kennebunk works in one of the raised beds used for demonstration at the Kids Can Grow teaching site in Springvale. She is one of nearly 250 youngsters ages 7–12 who have participated in the Kids Can Grow program since its start in 1999 by University of Maine Cooperative Extension in York County. Photo by Frank Wertheim



IN YORK COUNTY in southern Maine, flower and vegetable seeds are used to grow and nurture self-esteem in children. They are among the supplies distributed to youngsters ages 7–12 in the Kids Can Grow program that, since 1999, has provided the knowledge and mentoring children need to establish their own raised bed gardens.

Kids Can Grow is now a national model that has been adopted in other states.

“I’ve been blown away with how popular it is with kids, parents and

teachers,” says Frank Wertheim, the University of Maine Cooperative Extension educator who started Kids Can Grow. “By getting their hands in the earth when they’re young, we hope to kindle an interest that could turn into a life-long hobby. We also hope to instill excitement and pride in growing their own food.”

Up to 30 children each summer join the program, often hearing about it from their friends and siblings. They gather monthly from April–August to learn how to make and maintain 3-foot by 5-foot raised bed gardens at the teaching site in Springvale. They use the “square-foot gardening” technique

developed by Mel Bartholomew to “grow more in less space.”

With the help of Extension Master Gardener mentors and simple supplies, the aspiring green thumbs start their own gardens in their backyards. For children living in more urban areas, Wertheim and the other adult volunteers help establish garden plots in their communities, close to their homes.

Each child pays \$20 to get the loam, compost, lumber and seeds needed for his or her raised bed garden. York County Master Gardener Association subsidizes the program and local

businesses donate some of the supplies to keep the cost affordable.

Master Gardener mentors work with the young gardeners at their homes, guiding their success and

inspiring confidence. Some of the mentors spend up to 40 hours cultivating a love of gardening.

As the growing season progresses, the Kids Can Grow monthly meetings focus on gardening-related activities, including nutrition. The summer culminates with displays at the county fair, and a harvest dinner. Produce from the teaching garden is harvested by the children and donated to area food pantries as part of Extension’s Plant a Row for the Hungry.

“Kids Can Grow is a powerful community project,” Wertheim says.

Past participants often return as helpers, including one girl who has volunteered every summer since her introduction to gardening. In a couple years, Frank Wertheim expects to see her in the Master Gardener program.



In the winds of war

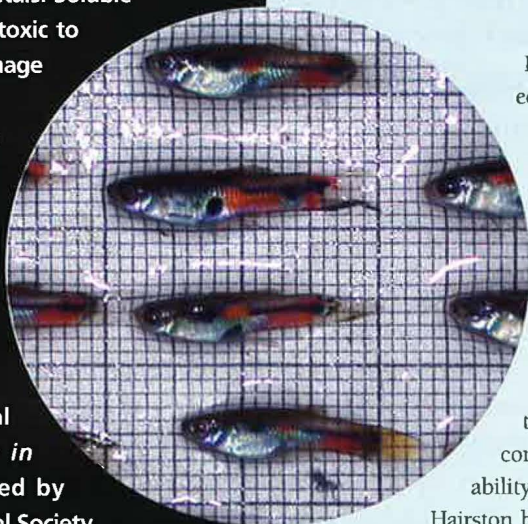
THE HIGH DENSITY of depleted uranium (DU) makes it ideal for the manufacture of military armor plating and armor-piercing munitions. However, the dust that results from explosions and fires involving equipment made with DU is becoming an international health concern for military personnel and civilians.

DU is less radioactive than the natural metal, but it is a suspected human carcinogen, affecting the bronchial cells of the lung through inhalation of particles.

Scientists at the University of Southern Maine and University of Maine recently conducted one of the first studies of the clastogenicity (chromosomal damage) of particulate and soluble DU in human bronchial cells. They found that DU dust particles did cause toxic and DNA-altering effects in human lung cells, comparable to those caused by other carcinogenic metals. Soluble DU was found to be toxic to cells, but did not damage the chromosomes.

Further research will focus on epithelial cells to determine the ability of DU to cause lung disease or tumors.

The researchers' findings were reported in the journal *Chemical Research in Toxicology*, published by the American Chemical Society.



Digital access

THIS FALL, the first copies of Fogler Library's newly digitized out-of-print books are available to patrons throughout Maine via the library's online catalog and to the public through Amazon.com.

In a large-scale project to digitize public domain titles, including rare books, the University of Maine, Toronto Public Library, Cincinnati Public Library and Emory University partnered earlier this year with BookSurge, Amazon.com's print-on-demand service, and Kirtas Technologies, the manufacturer of automated book scanning systems.

The collaboration and cutting-edge technology provide greater access to materials once only available on-site to patrons researching in the libraries' special collections. Digitalization also is a strategic preservation effort for leading libraries nationwide.

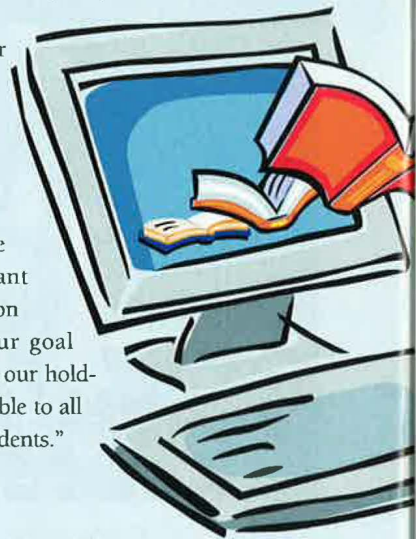
Fogler Library and the Maine State Library are collaborating in the project to digitize such out-of-print and rare materials as UMaine publications, historical Maine town reports, local histories, and

documents relating to Wabanaki peoples.

Ultimately, the scanned titles will be available to be read online (with full text search capability) or downloaded by URSUS users. Low-cost, bound copies will be sold through BookSurge, with a portion of the proceeds being recouped by the libraries to cover the expense of digitalization.

"This project will dramatically enhance our ability to support research in history, the social sciences, the environment, genealogy, and on various public policy

issues," says Fogler Library Dean Joyce Rumery. "It will also make a significant contribution toward our goal of making our holdings available to all Maine residents."



THE eco-EVOLUTION RACE

Michael Kinnison's lab is exploring eco-evolutionary questions using Trinidadian guppies, part of a large NSF Frontiers in Integrative Biological Research (FIBR) project involving 12 universities and the U.S. Geological Survey.

IN AUSTRALIA, snakes have evolved in order to coexist with invasive, toxic cane toads. Elsewhere on the planet, researchers have found plants with an evolved tolerance to heavy metals, and zooplankton that have evolved in order to survive on nutritionally poor cyanobacteria growing in polluted water.

The ability of such populations to evolve in response to environmental pressures threatening their existence is clear. But what determines how and when a population will be rescued from extinction by such contemporary evolution — adaptive changes occurring within a human life span?

The answer can be found in the study of eco-evolutionary dynamics, according to biologists Michael Kinnison of the University of Maine and Nelson Hairston of Cornell University, writing in *Functional Ecology*, the journal of the British Ecological Society.

Historically, evolution has often been considered too slow to be relevant to the ecological processes underlying extinction and conservation biology. Recent recognition of widespread evolution in contemporary time, spear-headed by earlier work by Kinnison, has begun to overturn this perception and open the door to a new synthesis of evolution's role in ecology. Instead of the usual focus on trait evolution that characterizes most studies of evolution, the study of eco-evolutionary dynamics considers how ongoing evolution influences population abundance, the interactions of species, and even the ways that nutrients and energy move through ecosystems.

In conservation biology, human impacts on environments and species that drive population declines also often impose strong selection for adaptations that may help species recover. In this respect, conservation problems may often constitute an eco-evolutionary race between the factors causing declines and the ability of species to sufficiently adapt to those changing conditions. Kinnison and

Hairston believe this perspective encourages a broader scientific focus, going beyond the acute problems of imperiled populations and growing invasions to consider the complex mechanics that allow some populations to succeed while so many others fail.

Theories about the North Woods debate

INSTITUTIONAL CHANGE theories applied to the extensive discussions of the 1994 proposal to create a Maine Woods National Park and Preserve shed light on why the debates were so heated and immovable, according to a University of Maine business professor and an economist.

Associate Professor of Management Stephanie Welcomer and Mark Haggerty,

researchers, sources of debate included conflicting projections for the wood products industry. In addition, local communities and state officials did not believe the economic studies commissioned by RESTORE.

Welcomer and Haggerty found that Maine communities experienced more security by maintaining the status quo of

UMaine researchers Stephanie Welcomer and Mark Haggerty found that Maine communities experienced more security by maintaining the status quo of the North Woods than by investigating an alternative “perceived as too much of a threat to the traditional way of life.”

who teaches in the Honors College, examined several hundred public records from newspapers and journal articles on the proposed 3.2 million-acre Maine Woods National Park and Preserve. They studied the extensive data set using principles of institutional adjustment, including those of the 20th-century institutional economic theorist J. Fagg Foster.

In particular, the UMaine researchers found that three of Foster’s principles — technological determination, recognized interdependence and minimal dislocation — made discourse especially difficult on the proposal by the group RESTORE: The North Woods.

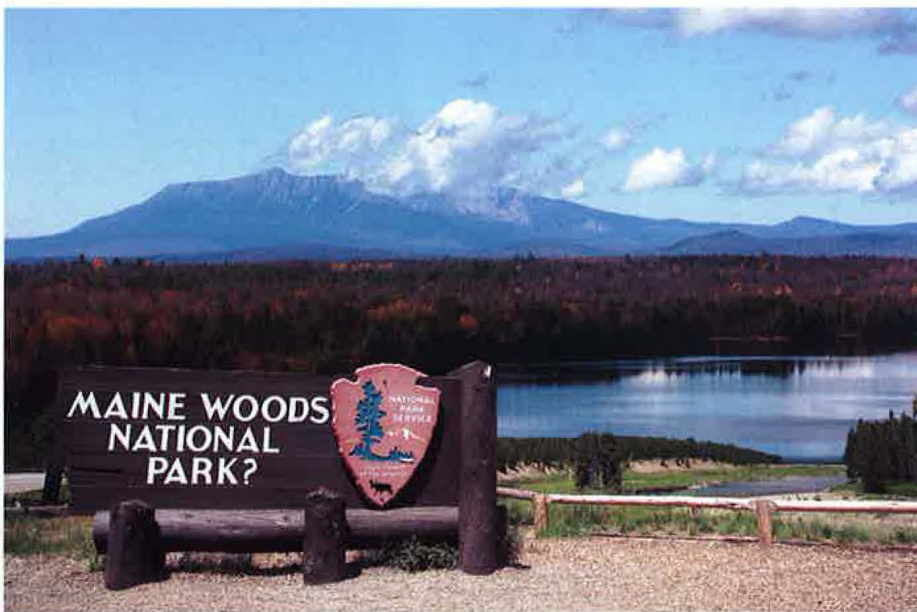
The principle of technological determination hinges on “reliable knowledge” for problem solving. According to the UMaine

the North Woods than by investigating an alternative “perceived as too much of a threat to the traditional way of life.”

The principle of recognized interdependence basically requires a community to agree to alter behavior or attitude. But in the case of the Maine North Woods Park, local communities viewed the proposal as coming from outsiders and involving federal regulation.

Under Foster’s principle of minimal dislocation, widespread change in the institution is perceived as difficult to accomplish.

“In this case, the park is perceived to change a way of life: culture, economic livelihood, community makeup, traditions and recreation,” wrote Welcomer and Haggerty in the *Journal of Economic Issues*. “It is understandable that such fundamental change would be opposed.”



insightlite

lobster dollars

The Lobster Institute at the University of Maine has compiled an economic snapshot of Maine’s lobster industry. Among the facts and figures:

- The estimated overall economic impact of the lobster fishery on the Maine economy is between \$816 million and \$1.36 billion annually.
- In 2006, Maine lobstermen landed more than 66 million pounds of lobster, valued at more than \$272 million. That’s about \$4.12 per pound.
- Maine had 7,259 licensed lobstermen in 2005. Most (1,523 lobstermen) fish in Maine Lobster Management Zone D, from the mouth of the Penobscot River to Pemaquid. The next largest concentration of Maine lobstermen trap in Zone A, from Schoodic Point to the Canadian border.
- Active lobstermen are involved in the industry an average of 31 years, holding a commercial lobster license or permit an average of 28 years, according to the Lobster Socioeconomic Impact Survey, released by the Gulf of Maine Research Institute in 2006.

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PRIMING INEQUALITY

ACCORDING TO the widely held American Dream, anyone can get ahead — attain status and garner rewards — if he or she is talented and works hard. But that same merit-based ideology also can lead people to psychologically justify status inequalities, according to two social psychologists at the University of Maine and University of California - Santa Barbara.

In two studies, researchers Shannon McCoy and Brenda Major found that the pervasive merit-based belief system in American culture can cause individuals to engage in system-justifying responses to personal and group disadvantage when rejected by someone of perceived higher status. As a result, even in the face of clear inequality, members of low status groups may be encouraged to construe personal and group disadvantage as deserved, and to minimize the perception that such disadvantage is due to discrimination.

In one study, women who were primed with merit-based messages (i.e. effort leads to prosperity) blamed themselves more often than discrimination when a man rejected them for a higher-status job in favor of a male. Men in the same study who were similarly primed with meritocracy blamed their rejection by a woman in favor of a female as much on discrimination as on themselves.

In a second experiment of college-age women, those primed with merit-based messages who then read an article about sexism endorsed system-justifying stereotypes (i.e. men on average are more decisive than women) more than those who did not receive meritocracy prompts or who read about prejudice against an ethnic group. They also self-stereotyped, rating themselves significantly higher in traits pertaining to warmth than to competence.

Regulating Invasives

INVASIVE TERRESTRIAL plants are a major issue in Maine and their sales should be regulated, according to two opinion surveys conducted by University of Maine researchers.

Recently compiled results of the surveys, one set from members of the state's green industry and another from University of Maine Cooperative Extension Master Gardeners, found widespread support for collaboration to develop invasive plant regulations.

When asked about the role the green industry should play in the sale of invasives, more than 36 percent of the Master Gardeners who responded to the survey said businesses should not be allowed to sell any plants known to be invasive in Maine. Nearly 38 percent of the green industry members said businesses should



be allowed to sell invasive plants, but should be required to provide customers and clients with information about how to manage them.

The survey, initiated last fall, was followed in May by a mandate from the Maine legislature for the state's Department of Agriculture, Food

and Rural Resources to convene a stakeholder group to assess the danger invasives pose to natural ecosystems.

The mandate is widely viewed as a first step toward the regulation of such plants, according to the authors of the survey — Lois Stack of UMaine Cooperative Extension; Donglin Zhang, Department of Plant, Soil and Environmental Sciences; and Mary Rumpho, Department of Biochemistry, Microbiology and Molecular Biology.

Speaking ESL

A \$1.5 MILLION, FIVE-YEAR GRANT to the University of Maine will better prepare Maine teachers to work with a growing number of students just learning or still perfecting their English language skills.

The U.S. Department of Education Title III grant will enable research and teacher training in English as a Second Language (ESL). The program being created through the grant also is expected to sensitize teachers to the diverse and specific educational needs of a range of students who bring cultural, language and significant religious differences to the classroom.

Maine schools now have more than 3,000 children and young adults who speak Arabic, Chinese, French, Spanish, Cambodian, Vietnamese, Serb-Croatian, Somali, Sudanese, Russian, Penobscot, Passamaquoddy or American Sign languages, according to the Maine Department of Education. To accommodate that growing number of students, the population of ESL-trained teachers in Maine is growing exponentially.

While the classroom focus for multicultural students typically has been on learning English, students should be encouraged to retain their native languages, where so much of their cultural identity is reflected, according to the program's codirectors.

"By allowing them to lose their native language, we're impoverishing the state of Maine and its ability to become a player in a global economy," says Gisela Hoecherl-Alden, an associate professor of German and a codirector of the program with Laura Lindendorf, a research assistant professor in the Department of Communication and Journalism, and in UMaine's Margaret Chase Smith Policy Center.



last impression



ENERGY INDEPENDENCE is the goal of University of Maine research exploring ecologically sustainable alternatives to petroleum. UMaine scientists and engineers are looking to the state's renewable natural resource bases — from its forests and agricultural fields to its tidal pools — to find alternative energy solutions. The largest of these research initiatives focuses on the production of forest-based bioproducts, developing methods for transforming waste products from paper processing and other wood-based enterprises into fuels, chemicals and plastics.



In Susan's memory



Among the Camp Susan Curtis counselors and former campers are Steven Barter, a 2007 UMaine graduate; Rachel Hasty, a sophomore education major; and Bouranee Kim, a first-year business major. The first Camp Susan Curtis Scholarship will be awarded in 2008. Susan Curtis, the daughter of former Gov. Kenneth Curtis and Pauline Curtis, died from cystic fibrosis at the age of 11. The Susan L. Curtis Foundation's mission is to build the individual character, self-confidence and self-esteem of economically disadvantaged Maine children. The top photo shows one of the facilities at Hewnoaks Volk Center.

THE HEWNOAKS Volk Center on Kezar Lake in Lovell, Maine, bequeathed to the **University of Maine Foundation** by Jesse Volk for the benefit of the University of Maine, has entered a partnership with Camp Susan Curtis to operate an art education center. The center will provide educational programs in a summer camp format for disadvantaged Maine teenagers using various forms of art, history and the influence of Maine landscape on the artist. Camp Susan Curtis, nearby on Trout Lake in Maine's White Mountains, provides programming and activities tuition free to disadvantaged and at-risk Maine youth.

Since 1974, more than 12,000 Maine children have attended Camp Susan Curtis.

In 2007, the **University of Maine Foundation** established the **Camp Susan Curtis Scholarship Fund** as a result of the bequest from the Volk Family estate. Income from the fund will be used to provide scholarship assistance to UMaine undergraduate students who attended Camp Susan Curtis as youngsters.

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