A Message from President Don Perkins

Ocean Century

My view is that the 21st century is going to end up being recognized as the Ocean Century. The incoming challenge of climate change, the growing challenge of our energy needs and the shift over to renewable energy and then how do we feed a growing world are going to cause us to recalibrate with the ocean. It's a source of solace, recreation and enjoyment as well as a source of protein, employment and energy; it draws us to the water in the morning to watch the sunrise and it draws us there in the evening, at the end of the day, because it nourishes our soul. It is going to be a century of growing public interest in, dependence on, awareness of the ocean. It is a very precious part of our gifts that we have here in New England.

Looking back over 2009, for the Gulf of Maine Research Institute, as well as for everybody else in the world, it was an incredibly challenging, difficult year. We started the year laying off about 15% of our staff and cutting back on expenses aggressively, which is a terribly painful thing to do. Then we found ourselves confronted with enormous needs in the fishing industry, in the ocean energy arena, and in the education arena and so we stretched to try and serve those needs. Our scientists are playing key roles on the technical committees that drive the entire fishery management process. Our education team is playing a key role in Maine's emergence as a remarkably scientifically literate state and that's going to provide all kinds of economic opportunity and education opportunity in a place that has often thought of itself as being isolated. And on the community front we really deepened our leadership role in our work with sectors up and down the New England coast.

One of the interesting things that happened over the course of the year is that we found our science and our education and our community capabilities start to
integrate and blend. We launched the Sustainable Seafood Program which really brings together our interest in educating the public, our interest in science and our interest in the fishing community. We got involved in the whole ocean energy question with our role co-chairing the Governor's Ocean Energy Taskforce. And again that was really a question of “How do you educate the public about a complicated issue?” “How do you deal with the science of a complicated issue?” and “How do you do this in the context of very complicated interests and needs of a coastal community?”

One of the unexpected developments and wonderful developments of 2009 in terms of the resources that GMRI has to bring to bear is that the Gulf of Maine Ocean Observing System decided to look for a partner to merge with and ultimately we merged with GoMoos and we’ve provided them with a sophisticated business platform; they’ve brought to us an unbelievable array of expertise in terms of “How do you collect data virtually from high tech sensors?” to “How do you make that data available over the internet to recreational boaters, to lobsterman to mariners that are navigating large ships?”, “How do you collect that data to study things like climate change?”

We’ve got this extraordinary Gulf of Maine that is very dynamic; that if understood and managed well can be prolific in terms of producing fish, in terms of aquaculture, in terms of ocean energy, but we have to understand it well enough to take care of it and to use it responsibly and that is what we are all about. We have emerged as a very unusual independent entity that brings independent science, that brings innovation on the education front and brings an unusual ability to bring all the complicated stakeholders from communities up and down the New England coast together to really grapple with and solve problems.
Holly Sargeant, President & Founder, HTSargent

“GMRI to me is the best that we have to offer in terms of our practices. We are taking what Maine has, as assets: the great Gulf, also a wonderful and important economic force in the fishing industry, as well as the innovative force of thinking about what the oceans can provide in terms of energy and GMRI uses its particular skills of facilitating discussion, underlying it by great research of scientists from around the world and then a powerful connection to the community with the education initiatives and really, in a sense, harnesses this great asset.

The individuals who have been innovative in leading the education program; the Cohen Lab Center that brings students from all over the state to come here and really have a chance to practice science literacy and learn and do. I am delighted to see that this is really a treasure for Maine educators and Maine students. But GMRI didn't just leave it with just training the majority of Maine 5th and 6th graders. No. They linked up with the grant from Hewlett, really one of the most exacting and forward looking foundations in the country, linked it up with our laptop initiative, which again, sets Maine apart.

GMRI, its vision, its discipline, the quality of its employees, the passion of all of the employees to what is going on is truly outstanding, not just for our corner of the northeast of this country but well beyond our borders.”

Thomas S. Hanson, Partner, Bernstein, Shur, Sawyer and Nelson

“GMRI’s work matters because it operates at the confluence of several forces that will determine the long-term vitality of Maine and coastal New England generally. It provides research that will inform the changing use of riparian, coastal and ocean resources. It helps mediate the conflicts that arise between interest groups as a result of those changes. It facilitates the needed shift to a knowledge and technology-based economy. And it promotes innovation in science education to accommodate that shift.”

J.B. Sullivan, Portland Global Advisors, LLC

My wish for the communities along the coast of Maine, and my wish for all communities in Maine, not just along the coast, is that we have, you know, vibrant communities where people can live, work and raise their families. We are at risk of losing that in a lot of places. What hooks me, in general, about GMRI is that I love Maine and I have a vested interest: I grew up here, I have a business here and I want my kids to be able to stay here. So a thriving Maine economy is very important to me. I see GMRI as a catalyst for that. One of the best catalysts that I have ever found really in the state of
Perspectives Continued

Maine in terms of something that we can do really well here in Maine; we can do this better than anyone else in the world, and I think that is realistic.

The evolution of the organization already has created a world class institution. I am not sure that many people in Maine, or in New England are aware of this. We have already accomplished that, and so, I just look at the next step - all the things that can happen. I mean we are getting recognition from National funders, I mean very serious players in marine science and marine science education want to partner with GMRI. That's incredibly important to the state of Maine. GMRI can leverage funding from national funders to bring money into the state of Maine to do the science; to work on collaboration with the fishing community and to do science education - We are already doing those things! It's not too far fetched, I think, to believe that at some point all of this hard work and all of this science will pay off in terms of incubating companies, for-profit companies, that may come out of this research or some of the work that we are doing around science education. You can imagine how you can have a business community developing; a thriving business community developing around marine science and marine education. All of the pieces are in place for GMRI to be a catalyst for economic development in the state of Maine. So that's what gets me excited.”

Marion Freeman, Director, Kepware Technologies

“Serving on the board of GMRI has been one of my most interesting and exciting non-profit experiences. The organization is like a puppy pulling on its leash, and the board's role is to harness and channel this amazing energy and talent. The issues we examine are all so worthwhile that it is difficult to say which parts of the mission engage me the most. The sound of excited children's voices from LabVenture! is hard to ignore, but the knowledge that world class marine science is going on at the same time or that GMRI is in the forefront of the sustainable seafood movement just add to my sense of appreciation for all that goes on under this roof.”

Elizabeth Butler, Partner, Pierce Atwood, LLP

“GMRI is an extraordinary place where talented scientists and skilled staff successfully tackle the most intractable of our natural resources challenges. GMRI has a demonstrated record of success in convening interested stakeholders to find common ground and to develop pragmatic solutions - in projects ranging from helping to implement sector based fishery management to developing a sustainable seafood sourcing system. GMRI is a rare and wonderful resource center that has the capacity to innovate and implement sustainable solutions for the Gulf of Maine and its users.”

John N. Kelly, Partner, Kelly, Remmel & Zimmerman, PA

“The Gulf of Maine is a vital resource to Maine and beyond. GMRI concerns itself with the wellbeing of all that is significant about the Gulf - its ecology, its economic and
Perspectives Continued

energy potential, and its dynamic role globally.”

**Suzanne E. Hamlin, President, Transformative Knowledge Group**

“My father's family founded Milo, Maine over two centuries ago, but I grew up knowing he had to move away to build a career. I am now back in Maine working to strengthen our innovation economy so the next generation can thrive and prosper wherever they choose to live. This is part of why I am so pleased to see how GMRI touches the lives of children from all over the state. Sparking an interest in science—whether inspiring the child who never imagined they could become a research scientist to make it a career, or simply to help all citizens make better informed decisions about the world around them—is vital to our future prosperity.”

**Marjorie Dawson, President, Portland Pipe Line Corporation**

“What I am most passionate about is the education side of things because that just means so much to me. We are starting in middle school which is where kids really are at that point where they are making decisions about, "Oh I think this is really fun." Or "this is really boring." It gives them an opportunity to see and have a really fun experience with science, see real life scientists and to see what you can do with it, and to me that is so important for our young people. We were sitting up in a board meeting, and a group of the school kids came in, and they got off the bus and they let them come in and blow off a bit of steam. One of the things that they have them shout in that atrium is: "I LOVE SCIENCE!" and there we were, up in the board meeting, and you could hear that through the whole building. To me, just the opportunity to have kids say that; maybe they don't love science, but it lets them see - You know what? Science is something they could love.

The first time I saw these stations was actually with a group of school children that were going through and stuff, and just watching them and seeing them interact with the things, and be interested and excited and that was just, to me, really wonderful because some of those kids, you know, that's going to impact on them, that will be an experience that they remember.

As I look out over the next few years, I think that what we are seeing now is a broadening of that from the grade five and six, single experience sort of thing into now, we are moving into seventh and eighth, giving them, the teachers, an opportunities to work with that, and I think that that is really key: this new focus. Not just on the students but also on the teachers; giving them the tools, because they are the people that are there,
day to day. I really believe from the studies that we have seen, the engagement in the children when they are in here that you just don't see this anywhere else.”

**Karl Turner, Former Maine Legislator**

“I have continued to be very impressed with the talents of the team that has been amassed by GMRI over the last several years. It’s often an over used phrase, but world class comes to mind and I think GMRI embodies that in the people that it has working on its missions. We have a vibrant fishing community today that has been under threat, and my hope for the future is that that community is sustained and grows in both capacity and stature. The other thing that I think is incredibly important about the resource is not the fishery, but the offshore wind potential that it provides. The research institute has been very instrumental in helping catalyze the thinking around how do we properly, and I underline properly, exploit the ocean energy potential of the Gulf and I think that is one of the great promises that will come to push here in the next five to ten years as we move away from carbon based energy and begin to replace it with renewables.

One of the things I want people to know is that GMRI is not for profit; it relies on philanthropy and grants in order to sustain its mission. From my perspective, this is a great place to put your money, if you are interested in creating economic benefit for Maine. I think providing sustainable stewardship for the Gulf of Maine is the most important thing to me and I think is a very key ingredient to GMRI’s mission and ongoing success.”

**Joan Smith, Principal, Baker Newman Noyes**

“I am inspired by the passion and dedication the GMRI team brings to each effort in which they are involved. They work diligently to create collaborations among stakeholders; they inspire our children to think in new ways; they do world class research and they help build a vibrant community. Their enthusiasm is contagious - you can't help leave GMRI with a smile on your face and a 'can do' attitude.

**Derek S. Pierce, Principal, Portland Expeditionary Learning High School**

“While dedicated to sustaining and strengthening the Gulf’s ecosystem, GMRI is itself a healthy ecosystem, cultivating the collaborative, interdependent culture, the informed citizenry and the next edge innovative thinking necessary to keep the Gulf - and Maine - vibrant.”

**Daniel Hildreth, Director and Shareholder, Diversified Communications**

“GMRI has a unique approach to addressing difficult issues in the Gulf of Maine particularly around the management of fishery stocks. It brings first class science and technical
Perspectives Continued

expertise together; bringing people together and informing them in order to solve difficult problems. We are going through a very difficult process right now with the transition to sectors and the commercial fishing environment has been extremely difficult in New England for a long time. I am hoping that GMRI can assist communities and commercial fishing with the process of making this difficult transition to sectors. We have great people spending a lot of time and thinking about how we can make that transition easier and how we can make it work for the commercial fisherman. I am very hopeful that it will have a big payoff over time for the health of the stock and for the commercial fisherman and for our communities. It is the consistency of the quality and the impact and the strategic integration of all those programs that is very powerful.”

Henry L. P. Schmelzer, Civic Leader
“The extent of GMRI’s reach into the heart of Maine’s economy and communities is hard to imagine. Whether it is busing students from across the state to delve into its high tech science labs, studying offshore wind power, bringing fisherman and scientists together to evaluate Gulf of Maine fish stocks, developing markets for Maine’s seafood products or engaging in one or more of its other diverse projects, GMRI has become a real asset to enhancing the quality of life in Maine. GMRI is still a young organization; its potential impact in Maine and beyond is almost limitless.”

Roger L. Martin, Senior Vice President and Chief Financial Officer, Unum
“GMRI has a unique mission focused on science, education and community, providing students with a unique opportunity for hands-on learning experiences that are perhaps unlike any other in the world. These programs challenge young people to think and act like world-class scientists working in small teams to investigate the wonders of marine science. I am a firm believer that engaging students in their middle school years in such unique programs will ultimately result in a stronger pipeline of graduates to enter Maine’s workforce.”

Kimberly Gorton, CEO, Slade Gorton & Co.
“As someone whose family has depended on the seafood industry for its livelihood for five generations, I am wholly impressed by the extraordinary impact GMRI continues to make on science education and fisheries research in support of the long-term sustainability of the oceans’ resources. GMRI’s integrated and collaborative approach sets it apart and will help to ensure its vision of a vibrant marine ecosystem in the Gulf of Maine. I am proud to be associated with such an innovative and pioneering organization.”

Peter Vail, Director of Fresh Foods, Hannaford Bros. Co.
“GMRI holds a useful and unique position in that they are science based with an eye on
Perspectives Continued

protecting the resource at the same time being even handed in protecting the harvesting and shore side business. They are well respected on both sides of the fence. They have credibility. I believe it is an organization of experts that share common values to the betterment of the community and industry. Their values mesh well with Hannaford values.”

**Gerald C. Knecht, CEO, North Atlantic, Inc., President, PT Bali Seafood International**

“I believe that GMRI is unique in many ways. In the world of NGO’s it occupies a hybrid space. The organization has broken new ground by combining science, a pervasive understanding of the fishing industry worldwide, and sharp eye for the issues that have regional, national, and global impact. GMRI is a nonpartisan doer in a space where large amounts of money are spent to study and recommend, but create no permanent change. Challenging issues need workable solutions and GMRI is focused on developing and implementing those solutions.”

**Bill Burke, Media Executive and Author**

“When I first came through the building here after it was constructed one of the things that got me most excited about GMRI was the education center. My wife is a school teacher and works with middle grade students and knows the challenges of keeping kids at that age interested in math and science. Watching students come through this building from all over the state and watching them walk into the Cohen Center and just light up and go right to the stations and get their hands dirty, literally, while learning a ton about math, science, oceans, rivers and the whole water system, it’s a pretty incredible experience.

I’ve been lucky enough to be involved on the board for several years now and I’ve seen how it’s all grown and developed and I’ve watched as plans to replicate the Cohen Center, not only around the state but potentially around the country. It’s been a really exciting thing. The fact that we have served as many Maine students that we have, free of charge to all of the schools, over the years has been a pretty tremendous thing. So, of all of the things that we are doing here at GMRI that is probably the one that gets me the most excited every time I come into the building.

For me, I wish more people could get inside these doors and into this building. I participate in a fair number of tours and because of where we sit, next to Becky’s and in this high traffic area, a lot of people have seen this big imposing building on Commercial Street and have no idea what is going on until they step inside. I wish there was a way to just have busloads walking through day after day because I think the more people who
Perspectives Continued

have a chance to get inside here and see what is going on everyday, whether it's the education or the science or the community work, I think they would get pretty turned on and as charged up as we all are as volunteers. That would be my hope, to get more people exposed to what is going on here.

I would like to thank all of contributors, donors, volunteers and the great staff here at GMRI for another great year. It has been a privilege to be the board chair here and I wish everybody nothing but continued success and I thank you all for your support”.

C. Anthony McDonald, Partner, CB Richard Ellis/The Boulos Company
“Having grown up on the Scarborough beaches, lobstered commercially for a decade, built ships at BIW, sailed on and dove under the Gulf of Maine for 40 years and worked in the commercial real estate and economic development sector for the past 25 years, I have seen clearly how interconnected Maine and her people are with the Gulf of Maine. The Gulf does not stop at the shoreline, its reach extends throughout the State. The very fabric of Maine is woven with its connections to the ocean. Those connections change over time and as the ocean's ongoing bounty is demonstrated through wind energy and sustainable fishing, all of us in Maine will continue to stay connected to the Gulf of Maine. GMRI helps facilitate those connections through education and science and serves as a steward of this remarkable resource.”

Robert H. Suva, Black Point Group
“The marine science expertise at GMRI provides a great foundation for working in a credible way with the commercial marine community. Our interactions in this area have contributed to the both the economic health of the industry, and to the sustainability of the ecosystems.”

Samuel A. Ladd III, President, Maine Bank & Trust
“GMRI can be, and is, part of the waterfront and fishing industry's revitalization. We can return to 25 years ago with a healthy fishing industry and a busy, healthy waterfront.”
Program Update: Science

The National Oceanic and Atmospheric Administration’s creation of the Institute for the North Atlantic Region in mid 2009 sent a strong signal for the importance of understanding the impacts of climate change and fishing on the world’s oceans as well as the caliber of the research happening in the region. GMRI was proud to be recognized as a key partner in this landmark collaborative.

Our merger with the Gulf of Maine Ocean Observing System (GoMOOS) was another important milestone, enhancing capacity to manage, synthesize and share ocean data with a wide array of audiences from schools to coastal management bodies to fishing cooperatives. The former GoMOOS buoys are now operated by our partner the University of Maine as part of the Northeastern Regional Association of Coastal Ocean Observing Systems.

Our research results helped stock the toolkit used to make decisions about sustainable uses of our ocean resources. Several projects focused on monkfish, now the region’s most valuable groundfish species. Work continued on a major initiative to unravel the complex tapestry of natural and human systems connecting groundfish, herring, and lobsters. Two new projects expanded our research up the watershed. Working with the University of Southern Maine and The Nature Conservancy, we documented key predator-prey interactions in the Penobscot River and Bay in advance of future dam removals. We also launched a study to differentiate alewives from more than 20 river systems along the coast of Maine.

We played a key role in organizing the Gulf of Maine Symposium which brought together the science community to review research and policy developments from the last decade. In this forum, our team shared valuable perspectives on what is needed to move forward with an ecosystem approach to management in the Gulf of Maine.
Science Continued

GMRI engaged thoughtfully with a variety of marine spatial planning and renewable energy initiatives around the region. We convened a two day workshop to throw light on seafloor mapping needs in the region. Our scientists served on committees tasked with understanding potential impacts of climate change and ocean acidification.

Deepening Our Impact

One of the core values that distinguishes GMRI’s science team is a deep commitment to collaboration. We regularly partner with the fishing community, academic and scientific institutions, other nonprofits and government agencies.

One exceptional example of this approach is our longstanding relationship with the University of Maine’s School of Marine Sciences (SMS). As a young, independent science institution, GMRI benefits from working with a highly respected research university, while SMS benefits from an increased presence in southern Maine.

Two of the senior scientist positions at GMRI’s lab in Portland are joint appointments with SMS. Having Jeff Runge, Andy Pershing and their respective teams in our lab expands the breadth of scientific disciplines that we can bring to bear on the challenge of taking an ecosystem approach to fisheries. Reciprocally, access to GMRI scientists with applied fisheries focus and strong links to fisheries science and management agencies broadens and deepens the expertise available to SMS. The combination has proven attractive to numerous funding agencies (e.g. National Science Foundation, National Oceanic and Atmospheric Administration) and was an important foundation for the participation of SMS and GMRI in the newly created NOAA Cooperative Institute for the North Atlantic Region.

The granting of adjunct and research faculty status to GMRI scientists has enabled us to develop a robust graduate student program in our lab. GMRI scientists supervise SMS graduate students, support their work through grants, and connect them to a broader mix of marine related community and education initiatives. The alternative of working in Portland (vs. Orono) is highly attractive for some graduate students, as is the opportunity to explore applied science.

Both SMS and GMRI look forward to growing the depth and breadth of future joint efforts. We recognize a growing number of opportunities for collaboration as a result of emerging marine spatial planning and ocean wind development initiatives.

Spotlight on Science: Monkfish Tagging

Transcript of Interview with GMRI Ecologist, Jonathan Grabowski: We are trying to address whether or not Monkfish are being managed appropriately. Our research is designed
Monkfish Spotlight Continued

around the fact that there are two management areas, the northern and southern management areas for Monkfish that are divided at the southern edge of George's Bank.

So the goals of the study are to determine the amount of migration that occurs between the northern and southern management areas using a variety of tagging techniques from conventional tags to more sophisticated data storage tags that actually tell you not only where you caught the fish and where it was re-captured, but what it was doing in between. We actually work collaboratively with the fishing industry to do the tagging and so what we do is, we send out people or we go out ourselves onto the commercial Monkfish fishing vessel and while they are hauling in their gillnets, they are handing us the fish and we are depositing two anchor tags, or t-bar tags into the tail of these Monkfish.

Research Technician Curt Brown explains how to tag a monkfish: I'm going to bring him over to the measuring table and lay him right down flat, stretch his jaw out and measure him... 62.5. So we get the measurement of his total length. Then we take the tagging gun, just like this and stick it right by the fin, to the side of it, between those spines, right in, pull the trigger, twist, then out, then do another tag right behind it. Trigger, twist then pull it right out, then we got both tags: 24259, 24260. Then just as quick as we can we put him right back, let him go.

Jon Grabowski (Continues): One really wonderful experience is that in the last couple of months two of the fisherman that we have worked with have reported these high reward tags, where we have actually put a data storage tag in the fish and provide a $500 reward for the recovery of these fish and its been really exciting to get them back because we only put 150 of those out there and they tell us a lot of information both about fish movement, but potentially about their migratory behavior, their movement off the bottom and then also we are using these fish to try to do a better job of learning how to age Monkfish.

GMRI has historically worked very well with industry but the Monkfish fishing industry has been particularly good to work with. They have been very supportive of the research both through participating in the research set aside programs that funds the research but then also providing a lot of insights into the types of questions we should be asking and also giving us a platform to do this research on, by taking us out on charter days or bringing us fish for other types of studies. It has been really instrumental to the success of these projects.
Spotlight on Science: Modifying Trawl Gear

Transcript of Interview with GMRI Gear Technologist, Steve Eayrs: The project with Port Clyde is an ongoing project. We have been working on it for about three years now. This year we are focusing on the front end of the trawl. The purpose of the project is to replace all this netting in the front part (from the very front of the trawl all the way down to this part here) to replace this with; traditionally, the fisherman use six and a half inch mesh, and we are going to increase it to seven. We are also going to reduce the diameter of the twine as well. What that means is there is going to be less material that makes up this part of the trawl so that should make it easier to tow through the water and therefore we reduce fuel consumption.

The other part of the project of course is to deal with the cod end which is the bag at the end of the trawl. So this is the cod end here and for the past three years we have been testing various sizes of mesh in this part of the trawl and different orientations of the mesh as well. You can see here this material here is the diamond mesh that fisherman commonly use and if you imagine that this is our simulated catch, you can see what happens when catch builds up in the cod end, it actually pulls these meshes tight in this region of the cod end and these meshes here are relatively open. That means that it is very difficult for fish to escape the netting, smaller fish to escape and swim away, and unfortunately you end up catching a lot of the smaller fish in here as well. So what we have been doing is we have been testing with the fisherman ways to modify this cod end and allow the escape of a lot of these small fish. W can do that by increasing the mesh size or we can actually turn the material sideways so that we have what’s called a square mesh cod end and square mesh cod ends remain open all the time and it allows small fish to escape.

We have had to do our work on their boats, of course. They have been very generous in offering their boats and participating in this work. There is a lot of interest in this work as well from them. They realize that by testing this net there is an opportunity for them to save money and providing catches the same as the traditional net by using less fuel with the new one then that should improve the profitability of their operation.

Additional Reflections by Gary Libby: Well, the seven inch worked really well with the grey sole. I was retaining most of my larger grey sole and I was losing a lot of my smalls and the pee-wees. So what we ended up doing was leaving fish on the bottom, which is more sustainable and then retaining the higher value fish. I think with this research and things that GMRI’s doing and the Island Institute and TNC, they want to see us succeed and I’m glad that they are working with us. It feels positive, everything that’s happened.
Spotlight on Science: Alewife Stock Structure

Video Transcript Interview with GMRI Ecologist Jason Stockwell:
The life history of alewife is that they do run up every spring to spawn in these fresh water streams and lakes and then the adults leave soon after. The juveniles will stay in the lake for the summer and grow and then sometimes between the middle of summer and late fall they'll move out of the lakes and go downstream and go out to the ocean where they will live for another three to four years, grow up to adults, mature and then return back to their natal places where they grew up.

Alewives are a species of concern. Their populations have gone down drastically in the past 20 years. One of the questions is: "Is there too much catch going on at sea, by catch, where they are caught in other fisheries?" When Alewife are at sea, we don't know how they mix so if a population of juveniles or adults comes out of the fresh water system we don't know if they stay together in isolation of other populations or if they all come out and mix together. We are using genetics and we are using something called morphometrics which is basically looking at body shape and we are also looking at the otoliths, also known as ear bones, to look at different growth rates and different shapes to see if they can tell us that these populations are different from each other.

The goals of the projects are to actually quantify and define population structure by sampling; I think we sampled nearly 20 river systems and multiple lakes within those systems. By actually going there and sampling as adults and doing these metrics on the fish we will be able to hopefully quantify and define differences in the population and once we do that we can use the results to develop classification models to say, "Ok if a fish has these characteristics or metrics then it has X percent probability of being from this population."

Spotlight on Science: Oil Movements
GMRI Studies Movement of Natural Oil Slicks to Help Spill Mitigation

Research questions are often inspired by a new idea, a way to improve, fix, or prevent something. Sometimes, a major disaster or new technology jumpstarts investigations. For Dr. Andrew Pershing, Research Scientist at the Gulf of Maine Research Institute (GMRI) and Assistant Professor at the University of Maine's School of Marine
Oil Spotlight Continued

Sciences, and his research associate Nick Record experimenting with photography has lead to a novel approach minimizing impacts from possible future oil spills.

In 1996, the tanker ship Julie N tore a hole in her hull as she collided with the Portland Harbor Bridge, more popularly known as the "Million Dollar Bridge." Over 179,000 gallons of petroleum fuel was released into Portland Harbor and the Fore River. The quick reaction of cleanup crews contributed to the removal of almost 78% of the fuel. Despite their best efforts, some of the wetlands remained contaminated for a short time. Portland's lobster fleet had to remove all gear within a 16-mile radius of the spill - a hard hit to the industry and local economy.

"When oil is spilled in a body of water, it moves mostly at the mercy of the tides, currents, and winds," said Record. The oil slicks are visible at the surface and can be tracked as they move.

Pershing and Record are working on a tool that could predict where future oil spills are most likely travel given certain environmental conditions. Since it wouldn't be a good idea to dump a barrel of oil overboard and track its movement, they came up with a strategy to build their model based on the visible sheen that comes from harmless natural slicks produced by algae. These are the lighter streaks of color that you see in most near-shore areas.

Record set up a digital camera on the Casco Bay Bridge - the replacement bridge for the Million Dollar - in the control tower of the drawbridge. It aimed northeast, toward the mouth of the Fore River, and snapped a photo of the seascape every minute for a year - over a half million photos. Record performed monthly checks on the camera to ensure everything was working properly. Nighttime, sea smoke, sea ice, poor weather, and large ships moving through all presented problems when observing the photos, rendering some of them useless for the analysis. Record had to go through the photos and perform a technique called georectification.

Georectification is a method of taking a photo of a landscape, or in this case seascape, and turning it into a top-down view. This is done through "stretching" the pixels of the photo based on distance from an anchor point. The two photos that follow show what happens in the process of georectification. The left is the raw photo from the control tower on the bridge. Visible natural oil slicks appear as lighter, snake-like features at the surface. On the right, the photo has been georectified, and the oil slicks can be seen more clearly.
Oil Spotlight Continued

The slicks close to the camera are quite visible. A series of images over the course of a day would form an animation as the tide, wind, and current flows move the slick. If a model can be created to show the relationship between those environmental conditions and the way the slicks converge, it could be incorporated into oil spill mitigation, says Record.

"If there were a spill, you could contain it better if you know where the oil usually converges," said Record. The model would be available in real-time, so in the event of another spill in Portland Harbor, you plug in the parameters of the equation - where the spill originated, wind, current and tide direction - and it would identify locations to deploy booms in the area. "We wouldn't have to waste oil booms where they aren't needed," he explained. For now, the team is still analyzing the photos and building the model. With over a half million photos, a lot of work is yet to be done. "With so much data, pulling patterns is a major challenge," said Record. If successful, the team hopes to replicate the project in other areas.

Spotlight on Science: E-LogBooks
GMRI Offers High Tech Solutions to Improve Trip Reporting.

Somewhere in the Gulf of Maine, a fisherman steams home after a long trip. He grits his teeth as he digs his pen into another Vessel Trip Report (VTR), pressing hard enough to reach the numerous carbon copies. The boat pitches and rolls while he attempts a steady hand. Every trip is recorded, and reports are sent in each month to be manually entered into a database at the National Marine Fisheries Service (NMFS).
E-LogBooks Spotlight Continued

Somewhere at the NMFS offices, a worker sits in front of a pile of VTRs. She struggles to read a fisherman's writing as she sifts through seemingly endless reports, some dated weeks ago.

Dr. Steve Eayrs, Gear Technologist for the Gulf of Maine Research Institute (GMRI) and his team are developing an Electronic Vessel Trip Report (eVTR) to replace the current paper logbook system. Their goal is to offer a faster and more accurate means of reporting catches.

Jon Loehrke, Collaborative Research Technician for the project, has been working to deploy prototype electronic logbooks to determine what an effective eVTR would look like for both fishermen and managers.

Currently, many commercial fishermen are required to possess a vessel monitoring system (VMS)—more commonly known as a “black box” that constantly logs their position. Fishermen are also required to report prior to a trip, to let NMFS know that they will be fishing, what they are fishing for, and their estimated time of arrival to offload. Messages are relayed via the satellite modem within the VMS system, such as SkyMate, Boatracs, or Thrane & Thrane. They send an email-type message through the satellite, and receive an approval notification that the message has been logged. This satellite then tracks the vessel's position throughout the trip.

An eVTR would interface with the current system. A fisherman could report activity quickly and easily while he's fishing, with the click of a button. The screen-shot shows an example of what the interface would look like at sea using the FishTrax Onboard logbook. The window in the upper left allows the fisherman to choose gear type and target species. Location, date, and time are loaded directly from a GPS.
E-LogBooks Spotlight Continued

Clicking “OK” would bring up another window where the fisherman quickly types in poundage of each species retained and discarded, and clicks save. The information is stored on an electronic log that builds over the duration of the trip. When the trip is over the log is double-checked and submitted.

With the current VTR fishermen often wait until the trip is over to fill out their logs. Landed poundage is usually quite accurate, but discards may be loosely estimated. With an eVTR, all retained and discarded fish could be recorded soon after their catch. This would greatly improve accuracy and give managers a better idea of what is coming out of the ocean.

The exchange of information would be fast, accurate, and in a form that managers can easily analyze. If data from a specific area is needed to determine a new management strategy, it’s at their fingertips and not in a filing cabinet—and it’s current.

“An eVTR would provide real-time data directly to managers,” said Loehrke. Managers could then allocate to different areas based on effort. It would enable them to track possible environmental effects, based on what gear type is being used in certain areas.

In an age of high tech fishing electronics, an eVTR has been a long time coming. Eayrs and Loehrke have been working closely with a handful of New England fishermen from Port Clyde, Maine to Gloucester, Massachusetts to test different versions new software to find the best and easiest-to-use interface.

Spotlight on Science: NERACOOS
Providing Real-time Ocean Data to Just About Anyone

Mariners here in New England need accurate weather forecasts. Whether it’s a surfer on a 7 ft. board, a commercial lobsterman on a 30 ft. boat or an oil tanker captain on a 500 ft. ship, they rely on up-to-date ocean condition reports in order to make crucial decisions about their day. Many fishermen, on their steam out to sea, listen to the all-familiar robot-like voice of the weather forecasts on VHF Channel 2, spooling information about tide, wave action, seawater and air temperature, and wind speed.

The data used for these reports comes from the Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS). NERACOOS uses a network of buoys (locations shown at right) to collect real-time data and put it online for public use. Anyone that needs access to ocean conditions from Long Island Sound to the Canadian Maritimes can visit www.neracoos.org and quickly obtain the information they need.
The NERACOOS website provides other services for mariners outside of simple observations. A model forecast viewer (below left) allows the user to generate predictions about water level and wave height over the course of the following two days. The user can select the region and the closest observing station, and the model will generate a chart that shows predictions against actual observations for that area.

High Frequency Surface Current Radar does just as the name suggests. It maps surface currents around the area of the observation buoy and the direction in which they flow. This is an important application for recreational boaters, commercial fishers, researchers, and rescue personnel.

Another service of the NERACOOS website is Coastal Flooding and Erosion Forecasts.
NERACOOS Spotlight Continued

The tool predicts flooding and splash-over events based on the relationship between wave height and water level using real-time data and animates it on a graph over time (below right). This information is helpful for managers, coastal homeowners, and others concerned about erosion from large storms.

“The NERACOOS website is a great portal for people to get to these products,” says Shyka. “We’ve been getting great feedback from our clients and its users.”

The launch of the NERACOOS website led to an opportunity for GMRI to develop a similar website in the southeast with the Southeast Coastal Ocean Observing Regional Association (SECOORA). SECOORA serves areas from North Carolina to the Georgia Coast, and has been providing updates and information on the recent BP oil spill.

NERACOOS and SECOORA are both part of the U.S. Integrated Ocean Observing System (IOOS). IOOS coordinates the nation’s regional ocean observing systems from the East and West coasts to Alaska, Hawaii, and the Great Lakes. All are dedicated to providing maritime users with streaming ocean information.

Having up-to-date ocean data is important for many, from natural resource managers and fishermen to the owners of beachfront cottages. It is Shyka’s hope to someday see a global observing network where every region’s data is in the same format and is accessible all over the world. “The philosophy is to bring everything together under the same standards,” he explained. “So if someone needs access to ocean data from another part of the world, they can obtain it easily.”

Check out the NERACOOS online database at www.neracoos.org.
Spotlight on Science: Understanding Calanus
A Tiny Organism with a Big Role in the Food Web

Stories about ocean life often focus on large, well-known fish and mammals, but researchers at the Gulf of Maine Research Institute (GMRI) and the University of Maine (UMaine) know that understanding microscopic organisms is key to understanding the ecosystem as a whole.

Herring, mackerel, northern right whales, and other species in the Gulf of Maine rely on a type of zooplankton called Calanus finmarchicus as a major food source. Any changes in abundance of Calanus over time could have significant effects on the ecosystem as a whole. Scientists Jeffrey Runge and Andrew Pershing, who are both jointly appointed by GMRI and UMaine, are leading an effort to study the abundance of Calanus in coastal waters, how climate change might impact the population, and the subsequent potential impact on the Gulf of Maine food web.

Two unique research projects are advancing knowledge toward these questions.

UMaine and GMRI have been conducting a zooplankton survey every summer for the past three years with support from the Maine Department of Marine Resources and the National Science Foundation. The survey is an effort to characterize the transition between near-shore and off-shore oceanic conditions. High abundance of zooplankton is mostly found at least three miles off-shore, where whales are most often sighted. Understanding where the dynamic transition line is between these near- and off-shore conditions—and what factors may cause it to shift—can provide insight into where whales are likely to be found. This is of particular interest to the lobster industry, which is making efforts to avoid whale entanglements in their traps in near-shore waters.

Nick Record, Research Associate in Pershing’s Ecosystem Modeling lab, and Rebecca Jones, Research Associate in Runge’s Biological Oceanography lab, are working on the survey.

“Some near-shore coastal areas such as Cape Cod Bay and the Bay of Fundy provide seasonal habitat for whales,” said Record. “This project will provide insight into how those areas differ from the coast of Maine. It will also identify physical influences that could shift the boundary line between near- and off-shore conditions.”
Record and Jones are looking at locations where the concentrations of zooplankton are high enough to be a potential feeding area for whales. For three summers, they spent 10-14 days at sea, collecting data from Portsmouth to just beyond Mount Desert Island. First, Jones lowers a ring net to the seafloor to collect a sample of plankton that she brings back to the lab to count (shown in first photo on right). In the same location, Record lowers down a laser optical plankton counter, which measures every object that passes through (center image on right). This data is combined to determine whether the plankton is evenly distributed or concentrated in layers at different depths (third image on right). Updates from these survey trips are posted at www.seascapemodeling.org.

A second project Jones worked on was a five-year cooperative partnership with fishermen focused on coastal ecosystem monitoring in the Gulf of Maine. Funded by the Northeast Consortium, she worked with fishermen to monitor seasonal changes in the zooplankton community. For the first phase of the project, she went with Portsmouth fishermen every two weeks to two sites—one near-shore, one off-shore—to take zooplankton samples with a mesh ring net and analyze them back in the lab. The second phase included five sites, and for this portion, fishermen from both Portsmouth and Gloucester were trained to collect samples on their own. The chart below shows zooplankton species composition over time at Jeffreys Ledge. This fine-scale research is being used by ecosystem modelers and other researchers to analyze the zooplankton community in the Gulf of Maine ecosystem and how it differs from other regions.

“One of the most interesting parts of the study was looking at the changes in the Calanus community during periods of flooding,” said Jones. “The influx of fresh water seemed to have a significant impact. But the most important outcome of this research is providing baseline data on seasonal patterns of zooplankton, and opening the door to new research questions on Calanus abundance and the potential impacts of climate change.”
Spotlight on Science: PenBay
Innovative Diet Study Promises Clues to Impact of Penobscot River Dam Removal

Two dams in Maine’s Penobscot River are expected to be removed in the near future and a new fish passage will be constructed at a third site. These conservation efforts will restore sea-run fish to nearly 1,000 miles of river habitat and could aid the recovery of a number of key fish species.

With funding from The Nature Conservancy and the Penobscot River Restoration Trust, GMRI scientist Graham Sherwood has teamed up with Karen Wilson from the University of Southern Maine to capture a snapshot of food web dynamics in the region before this major restoration effort gets underway.

Over the past two summers, Sherwood and a team of technicians and interns have spent countless hours angling for large predators such as cod and striped bass and snorkeling for invertebrates such as mussels, crabs, and lobsters at numerous sites throughout Penobscot Bay. They caught few large fish in the upper reaches of the bay, even with the assistance of a recreational fishing guide, suggesting that this area may no longer be home to many large predator species. It is hoped that the removal of the dams may reverse this trend by encouraging more prey species that must spend part of their lives in fresh water (such as alewives) to return to the bay. GMRI also worked with the Maine/New Hampshire Inshore Trawl Survey (DMR) to collect cod, haddock, herring, pollock, redfish, flounders, among other fish species and invertebrates. In parallel, USM scientists collected fish (e.g., smallmouth bass and chain pickerel) and invertebrates in the river and its tributaries.

Back at the lab, a small sample of muscle tissue from each specimen is dissected and preserved for future analysis. Using a novel scientific technique call stable isotope analysis, the researchers will be able to identify carbon and nitrogen signatures to determine the major components of each fish’s diet over the course of its life. In the future, we will be able to compare these isotope signatures to samples collected several years after the dams are removed. This will tell us if and how the relationships between major predator and prey species are changing.
PenBay Spotlight Continued

While the primary job of the project to date has been to create an archive of pre-dam removal samples, Sherwood has been able to move ahead with some initial analyses. He has identified an isotope signature that tells us that most fish caught in the bay eat other marine species. Mackerel are the exception with an isotope signature that reflects a diet of more freshwater prey. We suspect that as this highly mobile species feeds it way along the coastline, it carries a freshwater signature into the bay from areas where there are more juvenile alewives leaving the rivers.

Resident cod show no evidence of freshwater influences in Penobscot Bay, but we wonder… how might this change following dam removals? If alewife return in large numbers will cod isotope signatures start to look more like mackerel? Would this signal the beginning of a long-awaited recovery for cod and other groundfish species in Penobscot Bay?
Spotlight on Science: Up the Watershed
Don Perkins, GMRI President Reflects on Spread of GMRI Research

One of the challenges for any small organization, certainly for GMRI, is how do we maximize our impact on the world; how do we maximize our contribution. Our strategy in that arena is: we need to figure out, what are those niches that we can really make a huge difference in? And so, when we started out, in terms of research, there was this crisis going on offshore with groundfish. We started our focus there, but we have always had this bioregional, this ecosystem-wide view that you need to think about the watershed, and the coast, and the Gulf of Maine as this single system. And our theory was that if we started in the niche off-shore addressing these acute fishery problems, that they ecosystem itself, the fact that some of the fish migrate up rivers, would take our science right up into the watershed. Just six years into our existence in our lab, in this past year, we have found ourselves doing research on alewives; we've found NOAA asking us to take on a research project related to salmon, because these fish transport energy up and down the watershed.
Program Update: Education

GMRI has built a remarkable continuum of 5th to 8th grade science education programs that inspires deep learning. Through authentic hands-on science, Maine children gain capacity for critical thinking, problem solving, communication and collaboration. They learn how to learn. Our focus is on the practice of science in all its messiness, rather than memorizing right answers. Students build transferable skills and habits of mind through teamwork, analysis, reasoning, and sharing.

We were excited to introduce 5th and 6th graders participating in LabVenture! to a new science mystery. Lobsters: Untold Tales puts Maine children in the driver's seat to investigate what this iconic species eats, where it lives, how it behaves, and where it is caught.

Thousands of Maine's 7th and 8th grade students and their teachers joined our Vital Signs community. We officially launched the website where they can share their findings of invasive species and native species and habitats most vulnerable to future invasions with top scientists, passionate citizens and a statewide network of their peers. The Vital Signs community of novices and experts has contributed and reviewed over 500 species observations statewide.

Through Vital Venture, we published an extraordinary collection of watershed experiences designed to facilitate in-depth learning over the course of the middle school years. Students construct a more sophisticated understanding of systems, hone investigation skills, and apply and extend their learning into local communities. Vital Venture also provides teachers with learning resources and best-practice case studies, as well a library of classroom-tested activities.

All of GMRI's education programs share a deep commitment to teacher professional
Education Continued

development. In 2009, over 75 teachers participated in multiple days of GMRI workshops or training. We are working closely with the Maine Department of Education and the Maine Mathematics and Science Alliance to maximize the impact of these experiences by providing a consistent approach to how teachers learn about and enhance the teaching of science in Maine classrooms.

Deepening Our Impact

Walk down the fishery ecosystem research wing in our lab and every door is decorated with multiple lobster "tattoos." Every student visiting the Cohen Center for Interactive Learning receives a temporary tattoo depicting the LabVenture! program's signature larval lobster icon. Each time our scientists make a guest presentation they too receive one of the coveted tattoos. Competition is fierce to determine who gets bragging rights for accumulating the most.

On Halloween, our Pelagic Ecologist Jason Stockwell donned a crazy costume and compared photos of some undersea life to monsters and aliens in movies. Curt Brown, a GMRI research technician and commercial lobsterman, brought in lobster traps and captivated students with a demonstration of how lobsters are caught. Research Associate Nick Record regularly makes a point of presenting to visiting students from his hometown in Central Maine. Research Technician Adam Baukus recently got students excited about gear research with a "choose your own adventure" that challenged students to think like a shrimp approaching a net — would they swim up or down? Another special experience was a guest visit by four scientists who were at GMRI for an international conference on zooplankton ecology. They heard that young students were in the lab, and offered to talk with them about their work and how they became interested in marine science.

These stories are endless and the impacts are profound. Students are interacting with real scientists. Sometimes these are senior scientists whose careers have taken them all over the world. Sometimes they are passionate young scientists just starting out. Whether they share research happening along the coast of Maine or breaking science news, they become exciting career role models for young students.

Staff Reflections

Alan Lishness, Chief Innovation Officer

“When GMRI responded to an interesting opportunity to provide design services for an innovative particle-physics experiment located 8,000 feet underground in an abandoned gold mine in South Dakota, we had no idea of the adventure that was in store for us. This large-scale physics experiment, called the Deep Underground Science and Engineering
Laboratory (DUSEL), is designed to study extremely rare nuclear physics processes.

Because GMRI is interested in cultivating a scientifically literate public, and because this project would provide an unprecedented opportunity to share our science engagement approaches with others, we responded to a Request for Proposals. We, along with a firm from Portland, OR, were selected as finalists.

I and four colleagues planned to travel to Rapid City, South Dakota, for an interview. Three of us left Maine the evening before, and ended up stuck in Minneapolis due to snowstorms. We quickly realized that our only option for getting to the morning interview would be to drive all night - 576 miles, in a snowstorm. After a wild night, we arrived two hours before the interview, just in time to grab breakfast and map our interview strategy with our fourth partner, who had flown in the night before. Under the sleep-deprived circumstances, we made it through the interview surprisingly well. Our interviewers commented on our tenacity, noting that any organization that would drive all night to get to an interview on time could probably be relied upon to deliver on their promises.

Ironically, our competitors didn’t make it to Rapid City on the day of the interview, and they got the job, to boot! It was, nonetheless, an outstanding opportunity for us to compete for a large-scale national science project, and to re-live our college days of an all-nighter, as required."

Alexa Dayton, Vital Signs Community Specialist

“A great moment that illustrated the ripple effect of our programs happened while I was prepping for one of our Vital Signs teacher institutes. I went to a local video store to rent the documentary ‘Cane Toads: An Unnatural History’ for the group to watch, and the clerk at the store commented on the interesting choice. The film is about the spread of Hawaiian sugar-cane toads through Queensland and then into the rest of Australia following an attempt to introduce them to counteract other pests. He had recently watched it with his middle school-aged daughter, after a family visit to Mackworth Island where she pointed out all of the invasive species they saw along their stroll. The daughter said she had learned about invasive species in her science class and clearly was excited and wanted to do something about the tangling vines choking the trees. I asked where she went to school - King Middle School, one of the schools we'd worked with on Vital Signs a couple of years ago! It’s so exciting to see the program spread beyond our direct work with teachers, into the community, and hear about how a child’s scientific curiosity was directly impacted by our efforts.”

Blaine Grimes, Director of Development & Community Relations

“When I was leaving the building yesterday, I came across several groups of teachers, loading their cars with their new equipment and workbooks. They were all loitering outside, talking to one another so I stopped to ask them about their experience. The following are verbatim quotes:
'We don't want to leave - seriously. It was amazing.'

'Ve were just all talking about this; it was one of, no - the best workshop I've ever attended.'

'You don't understand... I've been teaching for 30 years and never experienced anything like this!'

'Thank YOU!!!!!'

Justine Glynn, Learning Systems Manager

“2009 was a tough year - we had to make some very difficult decisions in cutting back on our program offerings due to the uncertain economy, and as a result, on staffing as well. In spite of this, our staff maintained our enthusiasm and energy for each and every program we presented to students, and teachers were unanimously grateful that we were still able to operate at the level we did. While we budgeted and planned for reaching 50% of the 5th/6th grade cohort, we actually exceeded that - making the year all the more rewarding.

The highlight of 2009 was unveiling our new LabVenture! program: Lobster: Untold Tales. Teachers confided that they had been nervous that we wouldn't be able to match the success of the Mystery of the X-Fish, but everyone said that the new program was every bit as good, if not better, than the first! Students loved holding live lobsters, experimenting with setting different trap limits, looking at larval lobsters under a microscope, and studying lobster behavior in our new benthic tank. The addition to the tank of sea stars, lumpfish, and other creatures rounded out the richness and diversity of the tank experience.”

Katie Flavin, LabVenture! Presenter

“When kids walk into the Cohen Center for the first time, they mutter to one another or shout, 'This is the coolest place on Earth!' and 'I wish I could live here!' Then, when we tell them they'll be holding a live lobster, there is usually a simultaneous 'Yessssss' in the seats. Many kids have never held a lobster before, so they are just in awe and amazement that they get to take pictures and hold the lobsters.”

Meredyth Eufemia, LabVenture! Presenter

“The hands on part of the program (with the new lobster program) it's even more hands on; more choices for the kids, and that brings the engagement even higher than it was before. And the engagement is such an important part of making the kids learn about science and get excited about science and think that maybe they could be scientists. Every time that you tell the students that they get to handle a live lobster today
there is this awe, this little roar, that kind of goes through the crowd of excitement and that's really fun to have these kids so excited to handle a live animal.

So on a few occasions, we get some of the scientists who work here in the building to come down and talk to the students for just a few about what they're doing either here in the lab or out in the field. This year, Adam did a presentation he called it "Choose Your Own Shrimp Adventure." He showed the students how shrimp gear works, went through all the steps of what the fishing industry does to catch the shrimp, and then asked the students, they had three choices, if they were a shrimp: would they swim up, stay put or bury in the mud? The students were able to choose what they thought the shrimp should do and then Adam went through and showed what might happen if they shrimp did that choice.

The general awe and excitement of the students help me to continue to stay excited. The second they walk in the room they are looking at the technology and all the screens and the bright lights and the pretty images gets them excited about science and that continues to keep me excited because they are so happy to be here. I have heard of 8th graders talking about it in their graduation. I've heard of freshman in high school still talking about it; telling their little brother or sister, "Oh you are going to have so much fun when you go there!" So the fact that these kids are remembering this years after being here shows that we are doing something really cool that is staying with them and getting them excited about science, hopefully for the long future to come.”

Pete Stetson, Research Technician
“it’s always exciting presenting in the Cohen Center; you never know if the group is going to ask a million questions about something you happened to mention in passing, or grill you on your presented material, or ask you things unrelated entirely, like ‘where's your lab coat?’ The kids keep you on your toes, and that really makes presenting a lot of fun.”

Ros Goldsbrough, Cohen Center Visit Administrator
“What fun it is having kids in the lab knowing that they are ‘doing’ science. Every time a group yells ‘lobstah’ I smile. I smile when I hear them in the Cohen Center. I smile as they burst out of there. I smile as I'm booking the visits. There's lots to smile about at GMRI.”

Sarah Kirn, Vital Signs Program Manager
“I think it's wonderful whenever we can give a student the opportunity to be successful in science, and especially those students who maybe didn't think that they would be successful in science. We give them those experiences and it really opens up what they may think is possible for themselves.
One of my favorite VitalSigns moments that I witnessed: I was working with a teacher and a couple of her students on a special project, we were at a meeting together, and I got chatting with the students and asked them what species they looked for. One of them said that she looked for Celastrus orbiculatus or bittersweet, which we have some right here. So I said to the student, I said, “Go and look at your observation. Has anyone posted comments?” And she said, “Oh yeah, I looked a little while ago.” I said, “Well, go an look again.” And she scrolled down, and she saw that there was a new comment posted and she read it and it was something about ‘good work’ and ‘well done,’ and ‘yeah you did see what you thought you saw.’ She said, “Well who is this person?” and I said, “Go to the homepage and click on the scientist, that’s who wrote the comment.” You could just see her lift up and she was floating and kind of bubbly for the next 20 minutes. It made a huge impression on her that what she had done in her class work had actually been looked at by a scientist and he bothered to make a comment on her observation.

So for me, it’s all about science literacy and helping students have those experiences and learn things that will serve them throughout their lives as they’re interacting with science questions. We are also really interested in helping students have the skills and knowledge so that they can be productive members of Maine’s future economy.

One of the things that happens in the course of the year for me is that I get the chance to work directly with teachers. Every time I stand up in front of a new group of teachers who are at the Gulf of Maine Research Institute who are here for the Vital Signs Institute, I get a chill. It is so exciting to me that this program that I believe in so strongly is drawing teachers, and they are having such a positive experience with it, and they are coming to institutes and they are telling their friends about it. It’s incredible to me and it is such a privilege to be able to make this contribution to the state.”

Sarah Morrisseau, Vital Signs Program Coordinator

“Three special moments from the past year really stand out for me.

Franklin Sames and his team of 8th grade science students from Portland's Lincoln Middle School were wildly efficient data collectors. They had to be. Their schedule allowed them 15 minutes to walk to their Baxter Woods study site, 15 minutes to collect their data, and 15 minutes to race back with skirts flowing, flip flops flapping, and bones shivering against the October chill. Teams of students took responsibility for different tasks, measurements, and species. They did it, and they did it really well.

The Vital Signs website was brand new. The fall field season was upon us. One afternoon I checked the site and saw that students at York Middle School were having an impromptu online exchange with students at Massabesic Middle School about a species they both had found near their schools. I couldn't help but smile. In that moment, I knew we had built a pretty special learning tool. Kids don't typically chat with other kids about plants.
A Vital Signs citizen scientist was walking on the beach and saw something that 'seemed wrong.' He gathered some photos and written evidence and published what he observed to the Vital Signs website. His finding was confirmed by our species expert who had not heard of the species having spread that far north yet. Both the citizen scientist and scientist were hooked!

Tom Farmer, Interactive Media Producer

“It's been thrilling to bring the next generation of LabVenture! stations into being for Lobster: Untold Tales. Each station starts with a kernel of an idea, usually from our advisors or research staff. Each of these ideas develops into activity ideas that we test and iterate. Mystery of the X-Fish was a fantastic and successful program. We wanted to up our game by adding more engagement and more student choice. This thinking grew into each of the new Lobster: Untold Tales stations.

Some of my best memories of this process were in testing how appropriately students could handle live lobsters. Even with solid ideas or instructions, you never know how students will react. Teacher Rori Crossman's students at Bonny Eagle Middle School were one of our test groups for this and other stations. I'll never forget the smiles and excitement with each lobster tail flip. I love working with students. I love their eagerness, their optimism, and most of all, their ability to rise to expectations.

Lobsters: Untold Tales broke new ground for GMRI in pushing the envelope of how we interact with and communicate complex ideas with students. Working through no less than a dozen well-thought-out interfaces and many sessions of student testing, we were able to create a game station that successfully helps students ask and begin to answer incredibly complex ideas around social and economic theory.”

Rebecca Martin, Environmental Educator, Vital Signs Program

“The thing that makes GMRI's education strategy special is the focus on professional development for teachers. Teachers have such a hugely difficult and important job and so few resources. I think it is wonderful that the Education group is sensitive to Maine teachers' needs, such as training and equipment. The Vital Signs program gives teachers the tools they need to increase the presence and effective use of technology in their classrooms.

One other thing I find exciting about GMRI's education programs is that the staff recognizes that exciting content is important to engage students in science! Some programs get so bogged down in process/skills work that they forget how engaging and fun science topics can be. It is great for kids to learn about science that is relevant to their lives - invasive species, lobsters, where our food comes from... students can
relate to these issues and understand how they impact Mainers.”

**Gayle Bodge, Science Learning Specialist**

“GMRI's Education Team has a grand vision of providing every student in Maine the opportunity to experience science, do science, and ultimately understand science. This idea has so much energy around it, it makes collaborating on projects with fellow GMRI education staff, scientists, teachers, and other organizations really exciting. What we're starting today is really going to impact many tomorrows for students and the communities they live in.”

**Andy Whitaker, Fellow in Interactive Science Learning**

“When I began working for GMRI last February, I was no stranger to the education programs that we offer. I had spent the entire previous year on Monhegan Island as the science teacher for the island's five students and had the opportunity to involve them in both LabVenture! and Vital Signs. I know firsthand how isolated the island can be with its unpredictable 12-mile ferry ride, and the fact that GMRI made such an extraordinary effort to bring our small band of kids to the Cohen Center and visit us personally to help us with Vital Signs was an incredible testament to GMRI's commitment to science literacy for ALL of Maine's students. Now as I see the workings of the education team from the inside, I am no less impressed. It is tremendously rewarding to work for an organization that is constantly striving to serve as many kids and teachers as possible with an ever-growing buffet of innovative programs. It is also amazing to see the kids' excitement day in and day out when they get to pick up and examine a live lobster or use underwater cameras to film them in their habitat. Whether they are from Fort Kent and have never seen the ocean or from Ellsworth and haul their own traps, the kids leave here with a deeper understanding and appreciation for the Gulf of Maine.”

**Taylor Strout, Fellow in Interactive Science Learning**

“For me this job is filled with rewards every day. I have been very fortunate to grow up here in Maine along the coast. I almost believe that if I counted my days at sea compared to on land, more often than not I would have water under my feet. My unique upbringing put me on a boat hauling my own lobster traps when I was 15. The passion and love for the ocean that I developed at a young age is something I wish every kid could experience. Now this is a pretty impossible task, but if I can spend a couple hours a day showing these kids how incredible our backyards really are, then I might get some of them to fall in love with the ocean just like I did. Giving a child a chance to look at the ocean the way I do is what makes it worth coming to work every day, and it's what I'm most excited about.
Our approach to expose these kids to the world of science is like no other opportunity that I have ever seen. It's not like going to your science class after math or English from down the hall. Coming to the Cohan Center is an experience outside of the classroom that leaves a lasting impression, one that might spark an otherwise hidden interest in science.”

Nick Record, Research Associate, Ecosystem Modeling

“Some of my favorite experiences are when groups come to participate in LabVenture! from schools that I once attended during my childhood. I think it gives the students a direct link between where they are now, and the possibility of doing something bold like oceanography later in life. The teachers also seem to get an extra charge from it. During a special presentation on seabirds, one such group was asking me what each bird sounded like - puffin: mrrrrrp; laughing gull: ahahaha; etc. And my fourth grade teacher from 25 years ago asked me to do an impression of Big Bird. All of my post-graduate training left me at a loss.”
major thrust of our community initiatives in 2009 centered on the difficult transition underway in New England's historic groundfishing industry from a "days-at-sea" management system to harvesting sectors. Our staff was down in the trenches with fishermen and policy makers doing the hard, messy work that comes with implementing a new way of doing business.

We provided training and support for incoming sector managers, grappled with monitoring and reporting challenges, and helped the fishing community think creatively about how to maximize the value of their catch as the first fishing season under the new rules approached. The National Oceanic and Atmospheric Administration partnered with GMRI to provide start-up financial assistance to sectors. Our staff worked through multiple models to help fishermen settle on an equitable plan to disperse these funds. We conducted a series of ethnographic interviews to capture attitudes and perceptions as fishing families grappled with seemingly overwhelming changes.

GMRI's sustainable seafood program also gained significant momentum in 2009. Hannaford, our signature partner, adopted a rigorous sourcing policy for the seafood sold in their grocery stores. We engaged scientists, harvesters, processors, distributors, retailers, and conservation organizations to define a rigorous set of standards to guide responsible harvesting. We laid the groundwork for a new branding program that will make it easy for families to choose Gulf of Maine seafood products that look to the future.

We continued to nurture leadership in the fishing community, adding an advanced course for alumni of our Marine Resources Education Program. We prototyped a new series of Lobster Biz workshops to provide training for lobster families to enhance
Community Continued

skills in basic accounting, financing, and planning for business growth or retirement.

Our SeaState lectures engaged the community with the work of the Census of Marine Life and the Gulf of Maine’s potential to develop renewable ocean energy.

Recognizing the extraordinary growth of our community programs over the past five years, we conducted an extensive international search to find a strategic and entrepreneurial leader to serve as our first Director of Community Initiatives. We were delighted to recruit Kate Burns from Ireland.

Deepening Our Impact

In early 2009, GMRI collaborated with the Penobscot East Resource Center, the Maine Department of Marine Resources, Maine Sea Grant, and the University of Maine to convene a workshop entitled "Exploring Fine Scale Ecology for Groundfish in the Gulf of Maine and Georges Bank."

The groundfish fishery that was once the mainstay of many coastal communities around the Gulf of Maine remains vastly diminished. Some have called for a re-evaluation of the geographic scale at which we manage fisheries. For example, should commercial groundfish species like cod be managed as only two stocks in New England (Gulf of Maine and Georges Bank) or should we be considering alternatives, including finer-scale management for multiple sub-stocks within each region?

The Fine Scale Ecology workshop brought together oceanographers, biologists, social scientists, fishermen, and resource managers to share the research on groundfish migration, abundance, and habitat use in the Gulf of Maine and explore future research priorities.

The day’s discussion led to at least one strong message: management should be tailored to the appropriate ecological scale, but this might require management of multiple scales, not just a finer scale. Our current management system misses a medium and finer scale, but we also need to maintain a picture of the whole system. We should not move to a system that manages many smaller boxes at a smaller scale, but rather should incorporate the approaches of alternate scale to promote ecological and financial sustainability. Any shifts in management will require stewardship.
Merging Tradition and innovation

Kate Burns, Director of Community Initiatives

The community programs are here to engage and serve and facilitate our coastal stake holders and fishing community to address many of the challenges they have and to strive toward a more sustainable future. In the grand scheme of things, that is what we are here to do.

The nice thing about the community program at the moment, it’s a program in the early stages of pretty exciting growth. I think the next few years are going to tell pretty interesting stories about where we are going. It is a challenging landscape, and it’s a challenging fishery management world and a challenging marine environment. The extent of dependence and the interest and engagement in the sea by a very diverse range of interests is huge, and that’s exciting.

I think some seminal moments in the last six months was sitting in on my first Marine Resources Education Program Training. When I saw the fisherman and the science being presented and the depth of interest and enthusiasm and understanding and the quality of the training, that was just a great insight and I was really excited by what I was seeing there. That was one seminal moment. I think another one as being seeing a range of people in the industry and the new ground fish sectors and our wonderful team of staff actually getting a lot of challenging operational issues over the line to allow sectors to start at the beginning of May.

The seafood program is just exciting every day! There is always a lot of interesting information coming out and we have had quite a bit of good press coverage and good stories and good messages. What is really nice is the hunger because people are interested in that, all the time you are seeing, ‘This is right we are doing the right thing here,’ so that is exciting too.

My wish for the coastal communities: I think really important is their sense of ownership and engagement and being a part of the management process. Their sense of confidence in the marine resources; that they know what they can do and what they’re place is and that they have to respect the ocean and resources and look after them and a really good sense of stewardship. So a diversified coastal community with a pride of its heritage and a pride of its past but also innovative, flexible, entrepreneurial. Above all, a sustainable fishing industry that can service our future generations.
Gulf of Maine Research Institute (GMRI) programs operated with a modest shortfall of $31,285 on expenses of $5,563,465. This is a remarkable result given the uncertainties in the investment markets which reduced charitable giving everywhere.

Our programs were funded by a variety of sources, mainly federal grants, foundation grants, and charitable contributions. Additional state grants were received for rebuilding the bulkhead pier on our property, a capital project, which commenced in early 2010.

Fundraising and community relations costs were primarily funded by unrestricted
Financials Continued

ccontributions and investment income. Administrative costs were funded by overhead allocations to programs and by property management income.

In addition to new revenue of $5,108,113, we used contributions received in prior years (more info) for our future operations (part of our net assets) to cover almost all remaining operating costs. Using the prior years' contributions had the overall effect of lowering our net assets by $455,452.

In November of 2009, GMRI merged with the Gulf of Maine Ocean Observing System (GoMOOS), adding an Ocean Data Products group to our Research capacity. The merger involved no debt or fixed assets, and transferred to GMRI a $870,341 restricted grant fund and $235,049 of net assets restricted to the operations of the Ocean Data Products group. After accounting for the merger and use of prior years' contributions, our financial position increased by a net of $650,038.

GMRI continues to receive unqualified opinions and top marks from our external auditors, Runyon Kersteen Ouelette, in our financial and federal compliance audits.

GMRI has a wholly owned subsidiary, Gulf of Maine Properties Inc. (GMPinc), which owns and operates GMRI's facilities. In addition to the above GMRI results, GMPinc was able to reserve $75,000 from operations for future needs and asset reserves.

Our financial evolution from capital campaign (2002-2004) to facility ownership and emerging endowment base (2005-2009) is shown in the eight-year trend chart of the consolidated net assets of GMRI and GMPinc.

GMRI and GMPinc audited financial statements are reported on a consolidated basis. Copies can be downloaded on our website www.gmri.org
Thank You

We deeply appreciate your support – without you the Gulf of Maine Research Institute could not exist. Your donations fuel our efforts to catalyze solutions to the complex challenges of ocean stewardship and economic growth in the Gulf of Maine bioregion.

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The Compass Fund provides critically needed unrestricted operating support to fuel the growth of our mission and accelerate our impact.

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