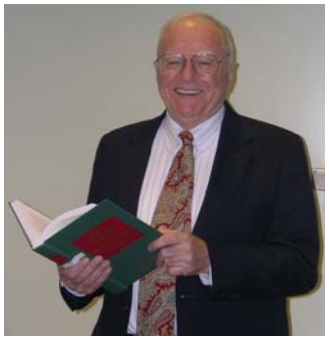
The Massachusetts Marine Fisheries Institute

Message from the Co-Chairs of the Massachusetts Marine Fisheries Institute

The marine economy supports one of the largest and most historic industries in the Commonwealth. Predating the birth of the nation, the Massachusetts fishing industry contributes in excess of $2 billion annually to the state's economy in harvested products and in expenditures made by recreational anglers. While the value of commercial fishing in our state has historically led the nation, the economic significance of the Massachusetts marine recreational fishery has grown in recent years, and it now ranks as the third most valuable in the country. Substantial government resources are needed to gather the information that will guide the protection of the marine ecosystem that supports these industries.



Dr. Brian Rothschild

Dean of the
School for Marine Science
and Technology

The demand on the Commonwealth to improve our knowledge of fisheries, to develop and implement innovative fisheries policies, and to provide recommendations for strategic environmental protection has never been greater. Creation of the Massachusetts Marine Fisheries Institute in 2002 demonstrates our determination to overcome the challenges facing our fishing industry.

Paul Diodati

Director of the
Massachusetts Division
of Marine Fisheries

The Massachusetts Marine Fisheries Institute links the Massachusetts Division of Marine Fisheries and the Department of Fisheries Oceanography at the University of Massachusetts School for Marine Science and Technology to enhance the Commonwealth's ability to positively affect marine fisheries management in the state and throughout the Northeast.

Although still in its infancy, the Massachusetts Marine Fisheries Institute will serve as a national model for consolidating and focusing regional assets and expertise to tackle important marine fisheries questions.

Marine Fisheries Institute

The Massachusetts Marine Fisheries Institute is a cooperative venture between the Massachusetts Division of Marine Fisheries and the Department of Fisheries Oceanography at the University of Massachusetts Dartmouth School for Marine Science and Technology.

A local trawler seen out at sea during a cooperative tagging cruise.

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The Massachusetts Marine Fisheries Institute exists to promote sustainable fisheries by providing timely information needed to protect, conserve, and manage Massachusetts marine and coastal resources. This information is gathered through interdisciplinary research that examines the interactions between marine organisms and their environments. Although the Massachusetts Marine Fisheries Institute programs are application-oriented, these studies enable scientists to understand the underlying processes, in addition to finding immediate solutions.

The federal government recognizes the strength of the Massachusetts Marine Fisheries Institute. Through the efforts of the Massachusetts congressional delegation, it has awarded funding via NOAA Fisheries. From 2005 to 2007, the Massachusetts Marine Fisheries Institute received $5 million per year for scallop and multispecies research. These funds have allowed the Institute to continue to be a leader in cooperative fisheries research. One example of this is the partnership between the scallop industry and Massachusetts Marine Fisheries Institute scientists, who have joined to conduct the world's largest video survey of the U.S. sea scallop resource covering one third of the continental shelf.

With this funding, we move one step closer to making the SouthCoast an internationally renowned center for fisheries research.
- Senator Edward Kennedy

Commercial Fisheries News
February 2006

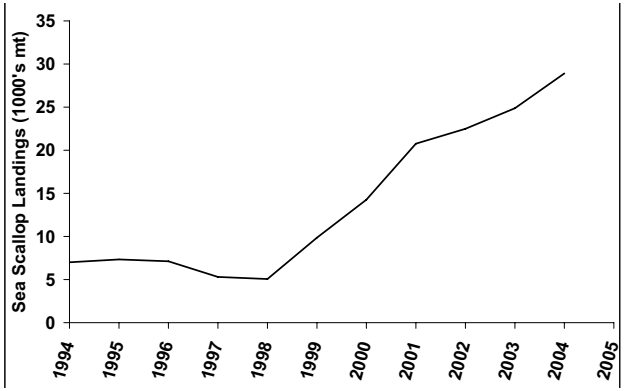
Photo Courtesy of: Peter K. Pryhot - Commercial Fisheries News

History of the Program

Scallop catch on the *F/V Venture* from two ten-minute tows in the Nantucket Lightship Closed Area during February of 2005.

In 1994, the establishment of three large marine protected areas, created to protect groundfish stocks, resulted in the closing of historic scallop grounds, even though scallop densities were believed to be very high within these areas. By 1997, the sea scallop fishery of New England was facing bankruptcy.

Bobby Bruno and Malvin Kvilhaug, scallop fishermen from New Bedford and Fisheries Survival Fund leaders, approached the School for Marine Science and Technology Dean Dr. Brian Rothschild, to request help from the University of Massachusetts. Together, the School for Marine Science and Technology, the Fisheries Survival Fund, the National Marine Fisheries Service, and the Virginia Institute of Marine Science launched a commercial dredge survey of Closed Area II and found a huge abundance of scallops. However, scientific debate raged over what percentage of scallops the dredge collected from the sea floor. Managers require an estimate of the scallop biomass on the sea floor to set the allowable harvest. Concerns were also raised about the environmental impact of scallop dredging.



The yearly sea scallop landings at New Bedford Harbor from 1994 to 2004.

To address these concerns, Dr. Kevin Stokesbury of the School for Marine Science and Technology and New Bedford fishermen developed a video survey system to count and measure the scallops on the seafloor; map the marine habitat; and track changes in areas open to fishing, all without disturbing the sea floor. In the first year, the cooperative video survey found a surprisingly large scallop biomass. The three marine protected areas were open to short-term limited fishing in 1999 and 2000. A catch worth over $55 million rejuvenated the fishing industry and gave the hard-fished open areas a reprieve. A lawsuit against the Fisheries Service in response to the openings was unsuccessful, due in part to the strong evidence provided by the video surveys.

Incorporating the principles of cooperative research and scientific inquiry, the Marine Fisheries Institute is addressing the current critical issues in the scallop, lobster, and groundfish fisheries.

In 2004, New Bedford maintained its ranking as the most valuable fishing port in the country by landing $206.5 million in fish and shellfish. UMass Dartmouth economist Dr. Daniel Georgianna said he believed "[the total value of the New Bedford seafood industry] was close to $800 million in 2004."

New Bedford Standard-Times
27 November 2005

Atlantic Sea Scallop Research

The Massachusetts Marine Fisheries Institute Atlantic sea scallop research program focuses on abundance, distribution, life history, and the impacts of fishing on habitat.

The steel pyramid used in the cooperative sea scallop survey is fitted with three cameras, nine lights, a conductivity/temperature/depth meter, and a high resolution digital still camera. It can be deployed from any commercial fishing vessel.

Cooperative Video Survey: Abundance and Distribution

High-resolution digital camera image from Georges Bank showing a small aggregation of sea scallops over a gravel and pebble bottom.

In concert with the commercial sea scallop industry, scientists have completed 62 video cruises surveying Georges Bank and the Mid-Atlantic since 1999. The survey coverage encompassed the entire scallop resource (approximately 60,000 km^2) in 2003, 2004, and 2005. This is the world's largest video survey of the sea floor, containing a library of over 100,000 samples. Since 1999, these data have brought a new level of accuracy and precision to abundance estimates of scallops and other benthic invertebrates, and to habitat maps for the closed and open areas of Georges Bank and the Mid-Atlantic.

"Dr. Stokesbury decided to mount an underwater camera on an oversize tripod to drop onto the ocean floor. He photographed portions of Georges Bank, counted the number of scallops, and extrapolated the results. . . . Persuaded by the photographs, the regulatory agency agreed to open two of the three closed areas."

The New York Times
21 June 2000

Life History

Sea scallop life history research examines growth, predation, and reproduction. Fishermen say that scallops grow at different rates in different areas.

Together, fishermen, scientists, and students pick the pile of scallops during the 2005 tagging cruise aboard the *F/V Liberty*.

The sea scallop tagging studies estimate growth rates of scallops in particular regions of Georges Bank and the Mid-Atlantic Bight to enhance rotational fisheries management strategies. The dissection study examines sea scallop meat yield across both space and time. Recent work shows that in the closed areas, scallops are dying from predation (starfish, crustaceans) and old age. Exploration of the Georges Bank marine protected areas with the video survey produces a data set for the analysis of reproductive success in unfished vs. fished populations of sea scallops. Marine protected areas may foster the production of more offspring, but may be limiting settlement due to high densities of old scallops.

A haddock on the northern edge of Georges Bank during the 2004 cooperative video sea scallop survey.

Complex habitat on the sea floor, including many different species of marine invertebrates.

Habitat Mapping

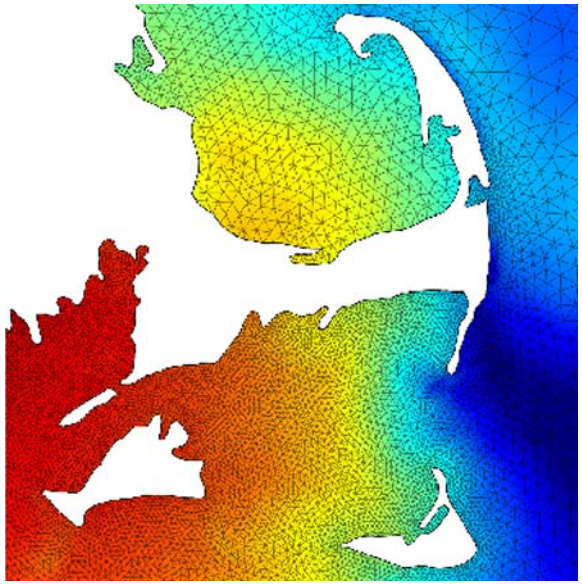
For the continental shelf, habitat data are presently so sparse that a map resolution of 100 nautical miles squared is not reliable. The scallop video survey, which has a much higher resolution of four samples per nine nautical miles squared, will revolutionize our understanding of the continental shelf marine habitat.

"The scallop population from Virginia to the Canadian border is twice what the government estimated, according to a new survey which, if accepted by regulators, could expand fishing for the lucrative shellfish. Researchers found an estimated 550 million pounds of scallops after a three-month survey of about 1,850 sites over 16,000 square nautical miles. Researchers said the survey was more precise than earlier sampling. The project, led by scientists at the School for Marine Science and Technology at the University of Massachusetts Dartmouth, aimed to bring certainty to scallop regulation, which fishermen charge involves too much guesswork."

The Associated Press
The Boston Globe, The New York Times,
The Washington Post, and over 70 additional
print and online news outlets
13 November 2003

Effects of Fishing on Marine Habitat

Portions of the Nantucket Lightship Closed Area and Closed Area I that had been closed to sea scallop fishing since 1994 were opened for a limited harvest from August 2000 to February 2001. Using the video survey, changes in the marine invertebrate and fish communities were closely monitored. This study determined that the dynamic environment caused greater changes in the marine habitat than these short-term fisheries, suggesting that rotational management may be more environmentally sound than other management strategies.



Sea surface temperature and model grid for the Cape Cod region of the Finite Volume Coastal Ocean Model of the Gulf of Maine.

After being hauled along the sea floor, a New Bedford-style scallop dredge empties its catch on deck.

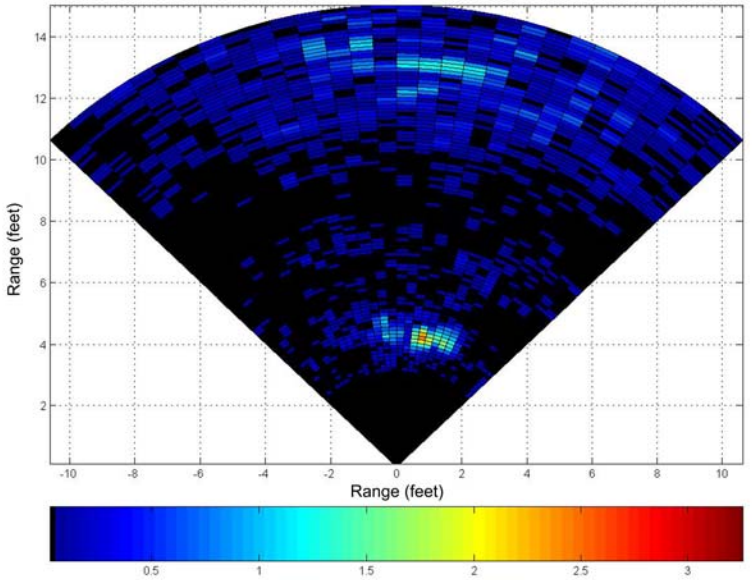
Marine Ecosystem Dynamics Modeling

Modeling can predict marine ecosystem changes based on environmental data. The Marine Ecosystem Dynamics Modeling Group conducts research in the development and application of the Finite Volume Coastal Ocean Model. Researchers work on a wide range of model applications, from water quality studies in estuaries to basin-scale circulation simulations. The Finite Volume Coastal Ocean Model is world renowned and a freely available model that is utilized by numerous researchers and institutions.

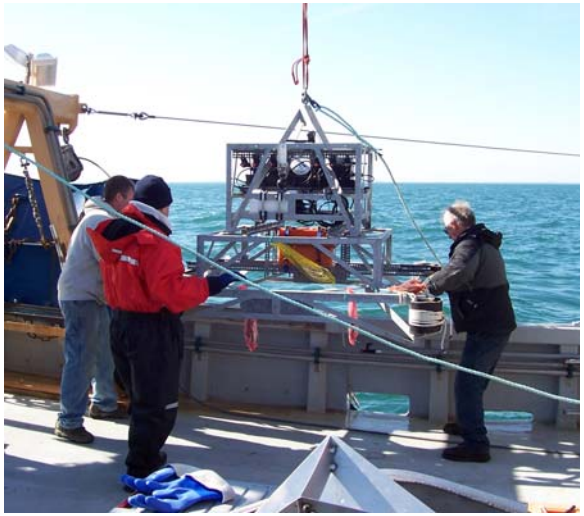
> Scientists from the University's Marine Science and Technology Center were instrumental in working with the industry in research surveys to increase the data and assessment information on scallops . . . Sen. Kennedy said the research UMass Dartmouth has conducted "made believers out of many cynical, skeptical and questioning individuals" who undervalued the worth of good science.
>
> The New Bedford Standard-Times
> 10 July 2001

Multispecies Research

The Massachusetts Marine Fisheries Institute multispecies program includes the Ocean Groundfish Observatory, cooperative cod and yellowtail tagging, a trawl study fleet program, lobster surveys and water quality assessment in Buzzards Bay, and the development of a fisheries management decision support system.



This sonar scan shows one individual fish seen using the stationary acoustic-optic platform at a range of 4 to 5 feet, and one at a range of 12 to 13 feet.



Deployment of acoustic-optic platform element in the Cod Conservation Zone of Massachusetts Bay from a commercial fisherman's vessel.

Ocean Groundfish Observatory

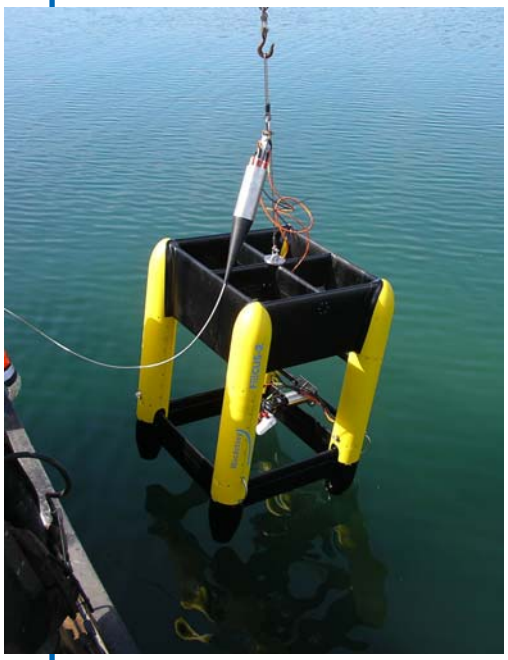
The Ocean Groundfish Observatory is a two-component system using acoustical and optical sampling techniques to assess groundfish stocks. The first component is a stationary acoustic-optic platform mounted on the sea floor. The acoustic-optic platform uses a combination of active sonar, low-light video cameras, and a suite of sensors to monitor fish activity and environmental conditions near the platform. The second component is an autonomous underwater vehicle called FINTAN, fitted with five low-light deep sea cameras, being developed in conjunction with Lockheed Martin Sippican. Prototypes of both the acoustic-optic platform and FINTAN are being tested under various conditions for increasingly longer periods of time and in successively remote locations.

Seen in the Mid-Atlantic, this large school of mackerel is just one of several fish species the Ocean Groundfish Observatory is targeting.

Habitat Conservation

The Commonwealth's commitment to achieving the Massachusetts Marine Fisheries Institute objectives has led to the investment of state funds in state-of-the-art technology for multi-purpose research in coastal waters. Strategic outlay of state funds will leverage federal resources made available to the Massachusetts Marine Fisheries Institute.

The towed underwater vehicle Focus-2, equipped with the Kongsberg EM3002 sonar head, sits on deck of the *R/V Gloria Michelle* during the second sea acceptance trial in June 2006.



The towed underwater vehicle Focus-2 was launched from the side of the *R/V Gloria Michelle* during a sea acceptance trial.

The new instrumentation includes a MacArtney Focus-2 towed underwater vehicle and a Kongsberg EM3002 multibeam. The Focus-2 has unique stabilization properties, and can maintain a constant height off the seafloor. It is ideal for trawl imaging, high resolution photo or video imaging of the seafloor, and can be coupled with sidescan and multibeam instruments for habitat mapping research. It provides one of the most stable platforms available at tow speeds of four to eight knots. The Kongsberg EM3002 couples high resolution multibeam backscatter imaging with water column imaging. This tool allows simultaneous seafloor mapping and imaging of groundfish and pelagics.

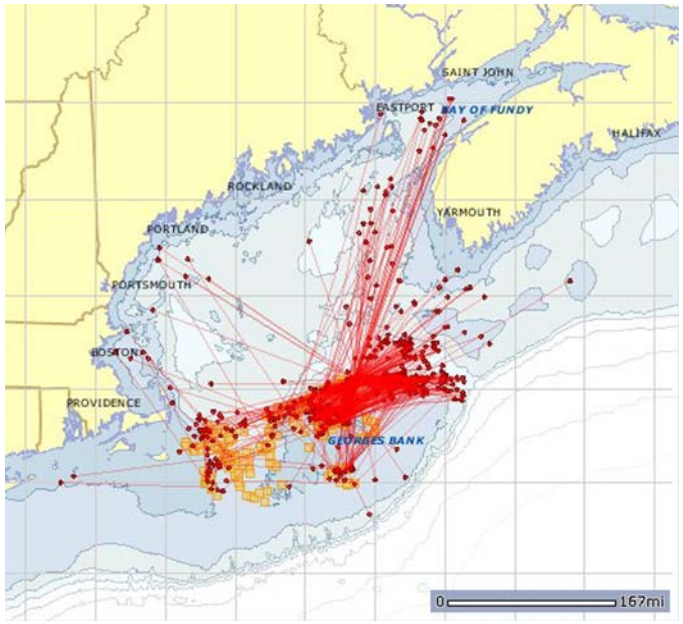
Dr. Kathryn Ford checks the silicon lubricant level of one of the motors of the towed underwater vehicle Focus-2 after a dive during the first sea acceptance trial in March of 2006.

Research is currently underway examining dynamics of sand waves, the impacts of the Hubline pipeline, and the capabilities of the EM3002 with respect to imaging groundfish. The ultimate goals of these research projects include identifying habitats essential to managed species, devising measures to conserve and enhance this habitat, and improving fishing techniques to minimize habitat impact.

Fisheries technician Ross Kessler holds up an Atlantic cod, tagged during a cooperative trip with local fishermen.

Groundfish Tagging

Fish migrations, long-term growth, and environmental preferences of cod and other groundfish in the Gulf of Maine, Georges Bank, and southern New England are being examined through tagging studies.



This figure shows the release of 21,462 (yellow square) and recapture of 903 (red diamond) Atlantic cod tagged on Georges Bank.

Since August 2000, more than 24,000 fish (mostly cod) have been tagged in cooperation with more than 80 commercial fishermen from Maine to Long Island. When a tagged fish is recaptured, commercial fishermen contact the School for Marine Science and Technology and describe the size, location, and condition of the fish. From this information, distance traveled and growth are calculated for each animal. This movement and growth information will play an important role in the highly anticipated upcoming cod benchmark stock assessment of 2008. These movement results may contribute to our understanding of fish stocks.

A fisheries technician attaches a disk tag to a yellowtail flounder, caught on Georges Bank by a local vessel.

This tagging study is part of the Northeast Regional Cod Tagging Program, which includes the Canadian Division of Fisheries and Oceans, the Maine Division of Marine Resources, the University of New Hampshire, and the Gulf of Maine Research Institute.

Trawl Study Fleet

The High-Resolution Trawl Study Fleet project was established in 2000 with a grant from the NOAA Cooperative Research Partners Initiative Program as a collaboration between the commercial fishing industry of New Bedford, Massachusetts, and the School for Marine Science and Technology. It created an industry-based program for the collection of trawl catch and environmental data.

A large catch of Atlantic cod was hauled during a cooperative tagging cruise on Georges Bank.

The fishermen who are involved in these tagging projects, however, believe that it is important to undertake the science and learn. "Science is not sleight of hand. It is not a conspiracy to get rid of fishermen," said New Hampshire fisherman Dave Goethel. "Besides, we who complained the loudest (about management) have to be willing to be part of the solution."

Commercial Fisheries News
October 2003

Decision Support System for Fisheries Management

The Decision Support System for Fisheries Management was created by Dr. Brian Rothschild in 1996. It applies mathematical approaches and management science techniques to fisheries in order to maximize ecosystem sustainability and increase economic and social benefits. The System uses the data from other Massachusetts Marine Fisheries Institute programs and NOAA to estimate the status of fish stocks.

It is a powerful tool that government agencies and the fishing industry can use to evaluate the outcomes of their management policies prior to implementation.

An American lobster on Georges Bank, captured by the high-resolution digital still camera used in the cooperative video sea scallop survey.

Fisheries technician Missie Allard and Massachusetts Marine Fisheries Institute divers Rhonda Moniz and Vinny Malkoski tag lobsters aboard the *R/V Lucky Lady* in Buzzards Bay.

Buzzards Bay Lobster Program

The American lobster fishery is the most valuable fishery in the Northeast. Although the lobster fishery is strong in some areas, in Buzzards Bay landings have declined by 50 percent since 1998.

Why did the lobster population decline, and is it rebuilding? Possible explanations include overfishing; oil spill effects; predation from recovering fish stocks, such as striped bass; and shell disease.

Answering these questions is the focus of the Massachusetts Marine Fisheries Institute Lobster Program. Currently, we are surveying the lobster population using ventless traps, calibrating these traps for the Massachusetts Division of Marine Fisheries, exploring specific habitat relationships with SCUBA diving, and analyzing 18 years of continuous monthly water quality data for Buzzards Bay.

"Local fishermen are encouraged that scientists are studying water quality, shell disease, and other factors that they believe have slowed lobster reproduction in [Buzzards] Bay," said Bill Adler, executive director of the Massachusetts Lobstermen's Association. "These are things fishermen said should be done. It's good news that somebody is listening and trying to do something."

New Bedford Standard-Times
9 January 2005

Photo Courtesy of Senator John Kerry's Office

"UMass Dartmouth is conducting exciting research on fisheries," said Senator Kerry, "which will help contribute to the future economic growth and security of critical Massachusetts industries."

News Release from Senator John Kerry
24 Nov 2004

An American lobster captured in Buzzards Bay using a ventless trap, as part of the Massachusetts Marine Fisheries Institute Lobster Program.

Scientific Diving Program

Creation of a formal scientific diving program for the Massachusetts Marine Fisheries Institute will promote full protection of scientific divers and set standards for training and certification. This collaborative effort to develop and operate a structured scientific diving program joins the practical experience and operational knowledge of the Massachusetts Division of Marine Fisheries with the expertise and educational capabilities of the School for Marine Science and Technology.

Massachusetts Marine Fisheries Institute divers suction sample for juvenile American lobsters in Buzzards Bay.

As well as affording protection for both the Massachusetts Marine Fisheries Institute and the divers, a structured scientific diving program will directly benefit graduate students. Those with majors in marine science and technology will gain proficiency in techniques that will better prepare them for their careers and further marine science.

Two Massachusetts Marine Fisheries Institute divers prepare to search for American lobsters along a transect in Clarks Cove.

Additionally, association with the American Academy of Underwater Sciences as an Organizational Member provides avenues for communication, interaction, and reciprocity with diving scientists at many other accredited institutions.

Phase one of this effort, the melding of the School for Marine Science and Technology and Massachusetts Division of Marine Fisheries divers and diving studies, has resulted in the support and management of 26 divers and 11 scientific diving research projects. Future efforts will include the creation of a Research Diver Training Program for the Intercampus Graduate School students and Institute faculty/staff at all UMass campuses.

An American lobster seen by Massachusetts Marine Fisheries Institute divers in Buzzards Bay.

Education and Outreach

The Massachusetts Marine Fisheries Institute provides not only opportunities for research, but also a community presence through school programs, safety training classes, and educational events. In addition, the Massachusetts Marine Fisheries Institute is helping to train the next generation of fisheries scientists through the University of Massachusetts and the Cooperative Marine Education and Research Program.

Two generations of fishermen, Gabe Miranda Sr. and his son Gabe Miranda Jr., stand aboard the *F/V Friendship*, one of the participating vessels in the cooperative video survey.

Fisheries technician Michelle Schenk (center) explains the inner working of an Atlantic sea scallop to local high school students.

Primary and Secondary Schools

An important function of the Massachusetts Marine Fisheries Institute involves promotion of marine education in the local community. This outreach ranges from one-day presentations in elementary and middle school classrooms to a semester-long internship program for high school seniors. By giving students the opportunity to explore topics such as scallop growth or marine engineering, an early interest in marine science is fostered.

The Scallop Steering Committee, consisting of local fishermen and SMAST scientists, is a vital forum to exchange ideas between the industry and academia.

Graduate Education

At the university level, the Massachusetts Marine Fisheries Institute is committed to graduate education through the Department of Fisheries Oceanography at the School for Marine Science and Technology. This department provides students with a unique educational experience beyond the "classic" graduate degree and prepares them for a future in the dynamic profession of fisheries science. These graduates will address the growing need for marine scientists in federal (e.g., National Marine Fisheries

Service), and state (e.g., Massachusetts Division of Marine Fisheries) agencies and universities.

The survival suit is an essential life-saving tool for fishermen. During the Fishermen's Safety Trainings held at the School for Marine Science and Technology, all fishermen don a survival suit, enter the water, and practice climbing into an inflatable life raft.

Cooperative Marine Education and Research

The Cooperative Marine Education and Research Program is a partnership between the National Marine Fisheries Service and academic institutions. In 2005, the UMass Cooperative Marine Education and Research Program moved to New Bedford to work with the Massachusetts Marine Fisheries Institute in the number one fishing port in the nation. The Cooperative Marine Education and Research Program research addresses a wide range of issues important in the Northeast, such as winter flounder ecology, seafood shelf life, subsistence fishing, and cod maturation.

Members of the United States Coast Guard demonstrate a water-to-air rescue, as part of the Fishermen's Safety Training held at the School for Marine Science and Technology.

Cooperative Research

Members of the local fishing industry are essential partners in many Massachusetts Marine Fisheries Institute research projects, such as the sea scallop video survey; sea scallop, yellowtail flounder, and cod tagging; and the trawl study fleet program.

Community Outreach

The Massachusetts Marine Fisheries Institute reaches beyond the classroom to educate the public. Recognizing the tragedy of fishing accidents, Massachusetts Marine Fisheries Institute divers and scientists host fishermen safety training workshops, which are televised on local stations to broaden their impact. Another important outreach mechanism is the Working Waterfront Festival, which is now an annual event

''We want there to be zero [deaths and fewer accidents]. We'd like to bring what's happening [in Massachusetts] to the rest of the country. It's a shift in culture." Mike Rosecrans, chief of fishing vessel safety for the Coast Guard, speaking about the ongoing series of safety training workshops that were held at SMAST beginning in 2005.

Boston Globe
26 January 2006

Moving Forward: A Vision for the Future

The goal of the Massachusetts Marine Fisheries Institute is to achieve educational and research success in the interdisciplinary sciences, which relate the interactions between marine organisms and marine environments through cooperative research with the fishing industry of New England.

Our focus continues to be an application-oriented program. Through our research, we seek to understand, to go beyond short-term solutions, and to answer key questions:

1. What is the distribution and abundance of fish?
2. How do fish and other species live in the ecosystem?
3. What species will be caught as bycatch?
4. What is the effect of fishing on the marine environment?

We envision a leading educational and research institute that trains new scientists to examine the questions of stock assessment and ecosystem management using new technologies and insight, but with a strong background in the history of fisheries science. This training, combined with the experience of working in one of the top fishing ports of the United States, will prepare these scientists to address the changing nature of human impacts on the marine environment.

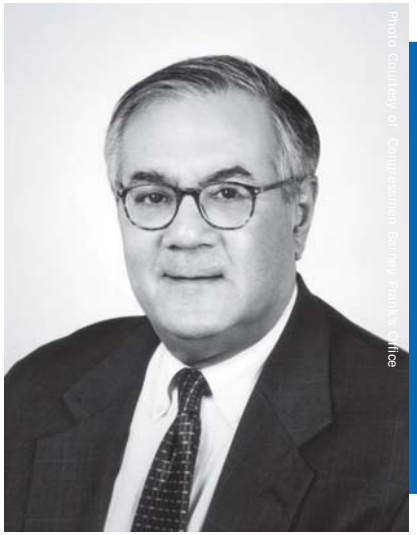
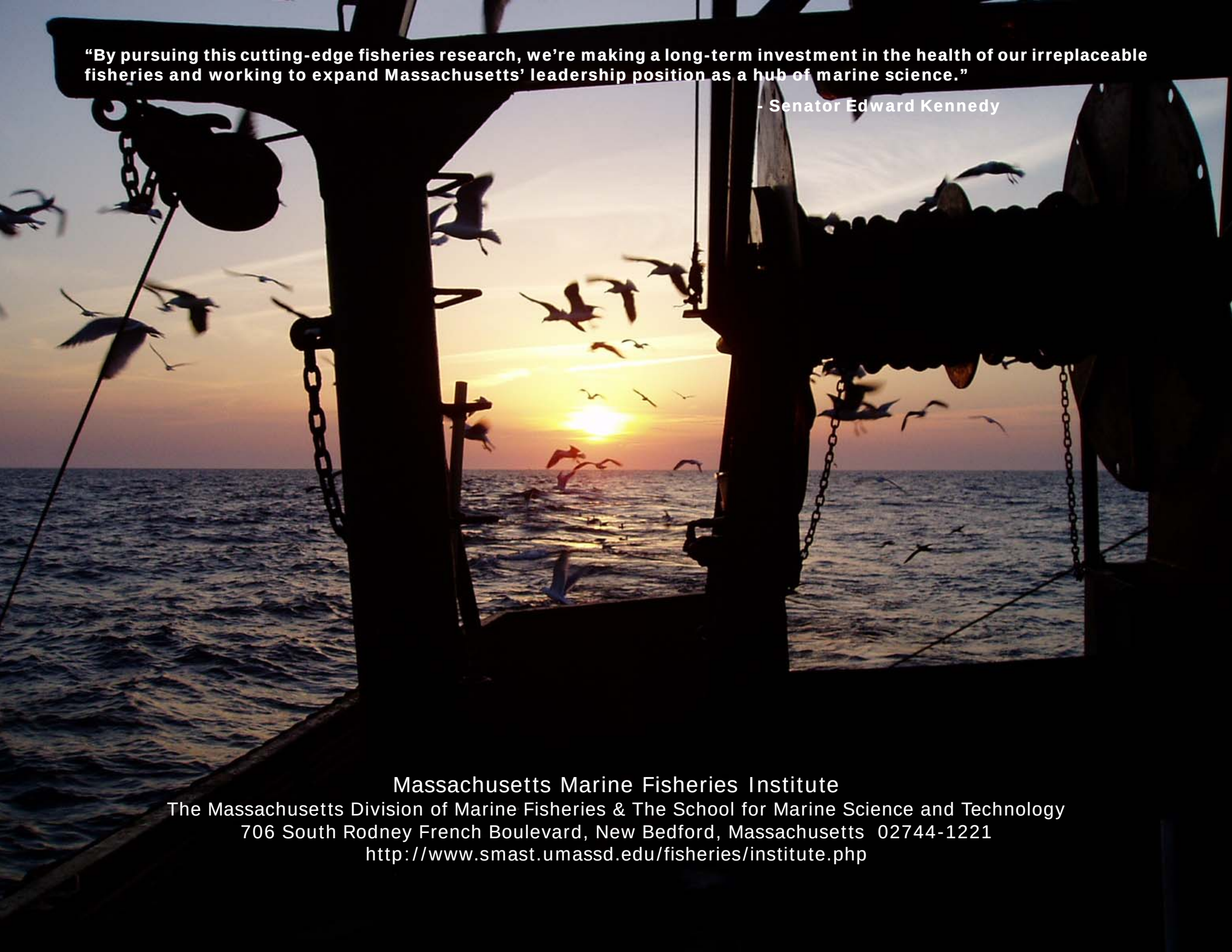


Photo Courtesy of Congressman Barney Frank's Office

"In order to manage our fisheries properly, it is essential that we have high-quality scientific information about fish populations..." Congressman Frank said. "UMass Dartmouth has been playing an increasingly important role in the effort to keep the southeastern Massachusetts fishing industry strong".

News Release from
Congressman Barney Frank
10 Nov 2005



“By pursuing this cutting-edge fisheries research, we’re making a long-term investment in the health of our irreplaceable fisheries and working to expand Massachusetts’ leadership position as a hub of marine science.”

- Senator Edward Kennedy

Massachusetts Marine Fisheries Institute

The Massachusetts Division of Marine Fisheries & The School for Marine Science and Technology

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http://www.smast.umassd.edu/fisheries/institute.php