

Department of Fish and Game

Massachusetts Division of Marine Fisheries

2011 Annual Report

Commonwealth of Massachusetts

Governor Deval Patrick

Executive Office of Energy and Environmental Affairs

Secretary Richard K. Sullivan, Jr.

Department of Fish and Game

Commissioner Mary B. Griffin

Division of Marine Fisheries

Director Paul J. Diodati

Daniel J. McKiernan

Deputy Director

David Pierce

Deputy Director

Kevin Creighton

Chief Financial Officer

www.mass.gov/marinefisheries

January 1 - December 31, 2011





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Introduction

The Massachusetts Division of Marine Fisheries (*MarineFisheries*) of the Department of Fish and Game is the Commonwealth's chief fisheries management agency. *MarineFisheries* is responsible for the development and promulgation of the Commonwealth's laws governing commercial and recreational fishing activity conducted in the marine environment. The Division promotes and develops commercial and recreational fisheries through research, technical assistance, and the collection of statistics. Guidelines for managing marine fisheries come through Chapter 130 of Massachusetts General Law, the Atlantic Coastal Fisheries Cooperative Management Act, the Interjurisdictional Fisheries Management Act, and the Magnuson-Stevens Fishery Conservation and Management Act.

To successfully fulfill its responsibilities, the Division has established the following mission, vision, and goals.

Mission

To manage the Commonwealth's living marine resources in balance with the environment resulting in sustainable fisheries and contributions to our economy, stable availability of diverse, healthy seafood and enriched opportunities that support our coastal culture.

Vision

Sustainable fisheries and a healthy marine ecosystem achieved through innovation, collaboration, and leadership enriching the public's way of life.

Goals

Improve fisheries sustainability, promote responsible harvest and optimize production of our living marine resources.

Promote and support our commercial and recreational fisheries.

Promote and support industry and community involvement in the fisheries management process.

Foster partnerships that help accomplish the Division's mission.

Support continued development of an ecologically sustainable marine aquaculture industry.

Promote a high level of staff commitment and professionalism.

Ensure that marine spatial planning activities are compatible with fisheries management.

Frequently Used Acronyms

ACCSP Atlantic Coastal Cooperative Statistics Program

ACE Annual Catch Entitlement

ACL Annual Catch Limit
AM Accountability Measure

ASMFC Atlantic States Marine Fisheries Commission

CCB Cape Cod Bay

CE Conservation Engineering

DAS Days-at-sea

EOEEA Executive Office of Energy and Environmental Affairs

FMP Fishery Management Plan
GIS Geospatial Information System

ICCAT International Commission on the Conservation of Atlantic Tunas

ISSC Interstate Shellfish Sanitation Conference

LMA Lobster Management Area

MassDARMassachusetts Department of Agricultural ResourcesMassDCRMassachusetts Department of Conservation and RecreationMassDEPMassachusetts Department of Environmental Protection

MassDOT Massachusetts Department of Transportation

MassDPH Massachusetts Department of Public Health

MassGIS Massachusetts Office of Geographic Information

Massachusetts Port Authority

MassWildlife Massachusetts Division of Fisheries and Wildlife MAFMC Mid-Atlantic Fishery Management Council MFAC Marine Fisheries Advisory Commission MRIP Marine Recreational Information Program NEFMC New England Fishery Management Council

NMFS National Marine Fisheries Service

NOAA National Oceanic and Atmospheric Administration

NRCS Natural Resources Conservation Service
NSSP National Shellfish Sanitation Program
PCCS Provincetown Center for Coastal Studies

PDT Plan Development Team
PSP Paralytic Shellfish Poisoning

SAFIS Standard Atlantic Fisheries Information System

SMAST School for Marine Science and Technology (at UMass Dartmouth)

SNE Southern New England
TAC Total Allowable Catch
USCG United States Coast Guard

USFDA United States Food and Drug Administration
USFWS United States Fish and Wildlife Service

VTR Vessel Trip Report YOY Young-of-year

FISHERIES MANAGEMENT AND POLICY SECTION

Policy and Fisheries Management Program

Personnel

Paul Diodati, Director
Dr. David Pierce, Deputy Director
Daniel McKiernan, Deputy Director
Kevin Creighton, Chief Financial Officer
Kerry Allard, Program Coordinator II
Steve Correia, Senior Marine Fisheries Biologist
Dave Borden, Senior Fisheries Management Specialist
Melanie Griffin, Fisheries Management Specialist
Nichola Meserve, Fisheries Policy Analyst
Jared Silva, Program Coordinator
Shannon Davis, Program Coordinator

Overview

MarineFisheries is responsible for managing the Commonwealth's commercial and recreational fisheries. Management of marine resources unique to state waters and that cross state/federal marine boundaries is a constant, ongoing endeavor. A core of fisheries management professionals, with many years of practical experience and knowledge of Massachusetts recreational and commercial fisheries, composes the team that initiates, evaluates, and selects fisheries management policy and strategies to implement rules and regulations. These rules and regulations frequently result from participation on, and in support of, federal fisheries management through the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC), and interstate fisheries management through the Atlantic States Marine Fisheries Commission (ASMFC).

Our fisheries policy and management staff gathers and analyzes biological and economic data, communicates with the media and public on state, interstate, and federal fisheries management issues, and ensures adherence to administrative and regulatory protocols and procedures. This process also relies on our technical staff to provide biological analyses and other technical reviews of management options to ensure sustainable fisheries and fisheries habitat protection.

Frequent communications with commercial and recreational fishery participants is another important element of policy and management development. This effort directly involves a diverse array of fishermen, dealers, processors, and many other stakeholders. Public hearings to propose regulation changes are held by the Commonwealth's Marine Fisheries Advisory Commission (MFAC) established by the Legislature in 1961. The MFAC and the Commissioner of the Department of Fish and Game must approve regulatory changes that *MarineFisheries* proposes in order for them to be implemented.

State Fisheries Management

Following below are actions taken and issues confronted by *MarineFisheries* in 2011 unilateral of interstate or federal fisheries management actions.

Marine Fisheries Advisory Commission

The MFAC met six times during 2011. The Commission approved regulatory changes for: the Massachusetts Recreational Saltwater Fishing Permit (322 CMR 7.01 & 7.10); seasons, fishing days, trip or bag limits, and minimum sizes for commercial and recreational summer flounder (fluke), scup, and black sea bass (322 CMR 6.22 & 6.28); a renewal of the Spring and Winter Cod Conservation Zones (CCZs) with amendments to their spatial and temporal limits (322 CMR 8.15); and clarifications to several sections of the Code of Massachusetts Regulations pertaining to the taking of lobsters with collapsible traps (322 CMR 6.00), the application of trip limits for quota managed species (322 CMR 6.00), and out-dated references to the location of the agency's headquarters. Regulatory changes to align state and federal rules for several groundfish species that were approved by the Commission in 2010 also became effective in 2011 (322 CMR 6.03, 6.41, & 7.01), as did a regulatory revision lowering the minimum size for oysters and quahogs raised by aquaculturists and sold to authorized wholesale dealers for use outside of the Commonwealth (322 CMR 6.20(3)). The MFAC also approved annual specifications and mid-season adjustments for spiny dogfish trip limits and Atlantic herring days out, the Winter II commercial scup fishery trip limit, and northern shrimp landing days for the 2011/2012 season.

MarineFisheries and the MFAC conducted a total of six public hearings and two comment periods on the above changes plus a proposal to implement gear restrictions on the hook and line striped bass fishery pertaining to circle hooks and so-called "yo-yo rigs". Additionally, four public scoping meetings were conducted on commercial and recreational fluke, scup, and black sea bass management; the CCZs; and state-waters sea scallop management. MarineFisheries also held six public hearings for the ASMFC on the interstate management of Atlantic herring, tautog, northern shrimp, Atlantic menhaden, and American lobster.

An ad hoc subcommittee of the MFAC was formed in 2011 to discuss enforcement issues and practices and bring back recommendations for the full Commission's consideration. The July meeting of the Enforcement Panel with representative of the Massachusetts Environmental Police resulted in the identification of several issues deemed worthy of further consideration including a mandatory fish/lobster pot haul out period(s), clarification on the retention of recreational bag limits during commercial trips, elimination of the fluke landings window, and clarification on the applicability of the lobster management area declaration requirement to non-trap offshore lobster permit holders. The MFAC supported taking to public comment a proposed rule change regarding the lobster management area declaration issue (under administrative review at year's end), while the remaining issues were still under consideration at the end of the year.

In September 2011, the MFAC selected Martha's Vineyard native Mr. John T. Hughes to receive the Dr. David L. Belding Award for his work in marine resource conservation. Mr. Hughes managed the DMF lobster hatchery on the Vineyard for over 30 years,

conducting lobster life history studies and rearing research, and hosting many visiting researchers. An award ceremony was being planned for 2012.

In November 2011, the MFAC met with a special ad hoc committee of the ASMFC during the ASMFC's 70th Annual Meeting, held in Boston. The purpose of the meeting was to discuss issues of mutual concern and areas for future collaboration and cooperation. *MarineFisheries* acted as host for the 70th Annual Meeting.

Recreational Saltwater Fishing Permit

In November 2010, the Director used his emergency authority to file regulations implementing the Commonwealth's recreational saltwater fishing permit in order to comply with a state law ("An Act Instituting Saltwater Fishing Licenses") prompted by a federal mandate. A public comment period and two hearings were held in December 2010 on the emergency rule, and the MFAC voted to codify the rule in the Code of Massachusetts Regulations (CMR) in January 2011.

As of January 1, 2011, recreational saltwater anglers in Massachusetts are required to obtain a Massachusetts saltwater fishing permit, unless they are: 1) less than 16 years old; 2) fishing on a permitted charterboat or headboat; 3) severely disabled and thus dependent on others to meet their daily living needs; or 4) possess a saltwater recreational fishing permit from New Hampshire, Rhode Island, or Connecticut (and are not Massachusetts residents). The reason for permitting is to improve estimates of saltwater fishing effort and catch data. The law also ensured a "user-pays, user-benefits" system by establishing a dedicated saltwater recreational fishing fund for the deposition of fees collected from the sale of permits; money from the fund can only be used to improve recreational fisheries or recreational fishery research in the Commonwealth. Additionally, 1/3 of the annual appropriations from the fund are required to be used for saltwater fishing infrastructure projects in Massachusetts, ensuring better access to coastal fishing.

The fee for the permit was set at \$10 for resident and non-resident anglers, although free for those fishermen 60 years of age and older. Fees for for-hire vessels were: \$65 for resident charter boats, \$130 for non-resident charter boats, \$130 for resident head boats, and \$260 for non-resident head boats. *MarineFisheries* began the year issuing permits at its three permitting offices, by mail, and through *MassFishHunt*, the Commonwealth's online permit purchasing system. A phone option was added next, followed by the addition of authorized permitting agents (e.g., bait and tackle shops, town halls, retail outlets). Permits were also made available at many of the area sportsmen's shows during the year.

For the year, *MarineFisheries* issued over 125,000 private angler permits and 911 for-hire permits; 87% of angler permits were issued to residents of the Commonwealth, and 25% were issued free of charge to seniors. The total revenue added to the Marine Recreational Fisheries Development Fund was \$1,051,271, which includes almost \$40,000 in donations from 3,600 individuals.

Marine Recreational Fisheries Development Panel

Pursuant to provisions of "An Act Instituting Saltwater Fishing Licenses", *MarineFisheries* created a Marine Recreational Fisheries Development Panel to recommend how annual allocations from the Marine Recreational Fisheries Development Fund should be spent. The panel consists of two members of the MFAC and three members of the public at large, all of whom have specific expertise and background in the Commonwealth's marine recreational fisheries.

During 2011, the Panel met once to discuss and make recommendations for spending of the expected FY12 fund appropriation. The approved spending plan included, but was not limited to: construction of a sport fishing pier in the Bass River, Yarmouth; expanded and enhanced sampling of the recreational fishery; additional public informational and educational materials; and stocking and monitoring of diadromous fish populations. The Panel also selected the first Saturday and Sunday in June as the two free saltwater fishing days in Massachusetts authorized by the saltwater fishing license act. The decision aligned the saltwater free fishing days with the state's inland free fishing days.

Fluke, Scup, and Black Sea Bass

Commercial Fluke Winter Fishery: In 2010, a contingent of offshore trawl vessel owners and operators petitioned *MarineFisheries* for alternative winter fishery regulations to assist the fleet in achieving its seasonal allocation (30%) of the annual quota. They sought to replace the wintertime 500-pound trip limit with a 2,000-pound weekly limit. They successfully argued that the 500-pound limit was excessively restrictive for a multiday offshore trip and resulted in high levels of discarding. *MarineFisheries* created a pilot program whereby interested operators could apply for a vessel authorization to land at the higher weekly limit beginning January 1, 2011, provided the fluke were sold to dealers who reported on a nightly basis. (Those not interested would be restricted to the normal 500-pound trip limit.) The reporting requirement would allow *MarineFisheries* to monitor the landing rate in real-time to prevent an overage that would impact the summer inshore fishery.

Fifty-four fluke endorsement holders received Letters of Authorization to participate in the program. The program ended (that is, the possession limit was dropped to 100 pounds) on March 16, 2011 when 25% of the annual quota was projected to be caught. In total, 41 vessels landed fluke during the Winter 1 season. The result was that vessels landed the winter quota for the first time since 2007.

Later in the year, projections indicated that it was unlikely that the summer fishery would harvest its 70% allocation of the annual quota. Consequently, members of the offshore fleet requested that *MarineFisheries* consider increasing the 300-pound trip limit to allow the remaining 5% of the annual quota to be harvested. In response, *MarineFisheries* reinstated the 2,000-pound weekly limit for authorized vessels beginning December 18 for the final two weeks of the 2011 season. Based on the success of the pilot program in 2011, the Division also carried it into 2012, and may permanently codify the weekly limit in the future.

Fluke Endorsement Transfers: In April 2011, *MarineFisheries* issued a licensing policy establishing guidelines for transfer of fluke endorsements to immediate family

members. Prior to the policy, transfers had only been permitted in the trawl fishery when attached to the sale or transfer of a business to avoid creating unnecessary discarding. The new policy provides current participants who are not endorsement holders a mechanism to remain in the fishery when the endorsement they fish under would otherwise be retired. The impetus for the policy came from two requests for endorsement transfers from father to son.

The policy allows for the one-time transfer of eligible fluke endorsements between immediate family members (defined as the legal father, mother, wife, husband, sister, brother, son, daughter, or grandchild of the permit holder in the direct line). Eligibility is based on the endorsement having been fished "actively" in four of the last five years, with the definition of active fishing at the discretion of the Director based on landing reports. After such a transfer is made, the endorsement becomes non-transferable unless the policy is subsequently amended.

Groundfish

Cod Conservation Zones: Massachusetts has become a leader in promoting the conservation and protection of discrete spawning cod aggregations. In 2003, with the understanding that Gulf of Maine cod is a mosaic of remnant stocks that spawn seasonally in specific geographic locations, Massachusetts began to implement seasonal closures in isolated areas of Massachusetts Bay. Two closures, one in winter and one in spring, became known as Cod Conservation Zones (CCZs). These closures facilitated groundbreaking research demonstrating the disruptive effects of fishing activity on spawning cod. Further, at the encouragement of *MarineFisheries*, the NEFMC and the National Marine Fisheries Service (NMFS) approved a similar spawning closure off the New Hampshire coast in an area known as Whaleback. Because the CCZs' implementing regulations were scheduled to sunset in 2011, *MarineFisheries* and the MFAC took action to renew in perpetuity the CCZs.

Based on growing knowledge on the timing and location of the spawning aggregations, the renewal of the CCZs also included spatial and temporal adjustments to the closures. The Spring CCZ was expanded to the east and west, and both closures' effective dates were moved up two weeks. Industry requests for greater groundfishing access were also incorporated where supported by data, with the Winter CCZ being reduced by 48% through three boundary revisions. Overall, the revisions decreased the area closed but lengthened the closure periods.

Experimental Groundfish Fishery: During the discussions to renew the CCZs, a number of state water groundfish fishermen requested *MarineFisheries* consider allowing access to the groundfish rolling closures because of underuse of the state waters annual catch limit (ACL) sub-component for Gulf of Maine cod. The state waters rolling closures were established in 1998 to compliment closures in adjacent federal waters that were implemented to reduce fishing mortality on groundfish, particularly Gulf of Maine cod. Federal vessels participating in fishing cooperatives known as "sectors" are no longer prohibited from the rolling closures in federal waters; however, unlike state water groundfish fishermen, federal groundfish fishermen are held accountable for all fish caught (including discards) and controlled by hard quotas.

MarineFisheries agreed to allow an experimental fishery for non-federal groundfish permit holders in the May and June rolling closures. This decision was contingent upon placing at-sea observers aboard participation vessels to monitor catch and harvest such that the experimental fishery could be amended or ended if discarding was problematic and in order to identify any new cod spawning aggregations that could need protection.

In late April, an open enrollment period for the fishery was announced to all commercial fishermen with permits endorsed for state waters groundfish. Participation conditions and monitoring requirements were established by a Letter of Authorization issued by the Director to those interested. Over 60 authorizations were issued, with about half being active in the experimental fishery, leading to an increase in GOM cod landings compared to fishing year 2011. The success of the experimental fishery led some of the participants to ask for additional access in November and December, which was not granted. Whether the experimental fishery would be opened again in May and June 2012 would depend on the results of the monitoring that took place during the 2011 experimental fishery.

Sea Scallops

Response to Increased Inshore Participation: An influx of scallop vessels into state waters (caused primarily by federal plan revisions) led the Division to consider additional restrictions. Existing state waters effort was constrained by limited access to mobile gear Coastal Access Permits (CAPs), a prohibition on fishing mobile gear at night, a 72-foot maximum vessel size, a 10-foot maximum dredge width, a 3.5-inch minimum dredge ring standard and a 3.5-inch minimum scallop shell size. The lack of a state waters trip limit enticed vessels to state waters. In response, the Division held scoping meetings in October 2011 on a new state waters sea scallop endorsement that would only be available to non-federally permitted scallop vessels and would be conditioned with a 200-pound trip limit. Additionally, to align state gear requirements with federal gear requirements that reduce bycatch, also scoped were permit conditions to require twine top net mesh no less than 10 inches and dredge rings no less than 4 inches in diameter.

Based on public input and with the support of the MFAC, the Division made effective by permit condition on November 1, 2011, a 200-pound state waters sea scallop (shucked) trip limit (or 2,000 pounds whole). Federally permitted scallop vessels holding a CAP may still fish in state waters but must adhere to the state trip limit while fishing there. They are also allowed to transit state waters and land larger amounts of scallops in state ports provided they comply with the federal plan and their gear is stowed. Both of the scoped gear restrictions were applied as permit conditions as of January 1, 2012 in order to allow the fleet sufficient time to make adjustments.

Striped Bass

Circle Hooks and Yo-Yo Fishing: In November 2011, *MarineFisheries* opened a public comment period and held public hearings on the use of circle hooks and so-called "yo-yo rigs" in the striped bass fishery. The proposals would require fishermen to use circle hooks when using natural bait and prohibit the use of yo-yo fishing. The proposed regulations aimed to reduce discard mortality.

The circle hook proposal originated from the Cape Cod Charter Boat Association. Circle hooks have a point that is turned perpendicularly back towards the shank to form a generally circular or oval shape. Studies show that this design (especially when non-offset) reduces the incidence of deep hooking in comparison to "J" hooks, and thus significantly increases post-release survival. *MarineFisheries* already recommended the use of circle hooks as a component of responsible angler practices. The MFC agreed to take the issue to public comment in 2011.

Yo-yo rigging is the practice of embedding artificial materials, often lead or other metals, in whole baits (usually menhaden) used to target predatory fish. The problem with weighting and stiffening the bait in this manner is that these objects are not themselves attached to the terminal tackle. Media coverage of the landing of a striped bass with nearly two pounds of gear in its stomach led a number of citizens to contact the Division about the use of yo-yo rigs. The MFAC agreed to take this issue to public comment along with the circle hook proposal.

Based on the public comment received, the Director determined that the Division should examine the rules in other states before making a final recommendation to the MFAC. This was expected to take place in early 2012.

Commercial Management: Upon request, Division staff met with representatives of the Massachusetts Commercial Striped Bass Association in December 2011 to discuss the Commonwealth's management of the commercial striped bass fishery. The Association was concerned about excessive fishery participation levels resulting in curtailment of the season's length, market glut, and reduced ex-vessel value. The Association asked that the Division consider mechanisms to alleviate its members' concerns; *MarineFisheries* agreed to bring the Association's concerns to the attention of the MFAC in 2012.

American Lobster

Collapsible Traps: In 2011, Massachusetts Environmental Police requested *MarineFisheries* clarify whether or not collapsible fishing traps, commonly referred to as "star traps", were a gear type authorized to catch and retain lobster. Massachusetts laws do not provide a legal definition of a lobster trap or pot, but collapsible traps, which are actively tended and fished in an open configuration, do not meet the common knowledge definition of a lobster trap. *MarineFisheries* deemed use of the gear to be tantamount to "dipping", which is a prohibited activity for the harvest of lobsters. Therefore, with MFC support, the Division took to public hearing in May 2011, a rule change to clarify that the taking of lobster by open and collapsible traps is prohibited. The MFAC approved the final rule to adopt the revision in June 2011.

Whelk

Insufficient Management: In late 2011, *MarineFisheries* staff brought to the attention of the MFAC developing issues in the state's channeled and knobbed whelk fishery. With increases in effort (especially in Nantucket Sound) and the price per pound, the value of landings reached an all-time high. In the meantime, the fishery lacked a standard method or certified gauge for measuring whelk against its minimum size, size limits

varied between states, allegations of excessive harvest over the Commonwealth's 5% tolerance for undersized conch were common, and staff biologists had expressed concern about sustainability of the current fishery. *MarineFisheries* staff indicated plans to continue field studies and identify appropriate management measures in collaboration with neighboring states and work with industry members to develop a reliable method for measuring conch.

Research Set-Aside

For-Hire Fishery Concerns: Research set-asides (RSAs) were authorized by federal regulation over 10 years ago. The federal rule modifies the federal quota-setting process to allow the MAFMC to set aside up to 3% of total allowable landings for fluke, scup, black sea bass, squid (*Loligo* and *Illex* genera), Atlantic mackerel, butterfish, and bluefish to be used for research purposes. The RSAs provide a mechanism to fund research and compensate vessels through the sale of harvested fish and thereby establish an incentive for vessels to participate in research activities. The program also allows vessel owners not participating in research studies to purchase RSA set-aside through an auction. Winning bidders request letters of authorization from state and federal entities to fish for the purchased quota outside of current regulations (e.g., outside the open season, above the trip limit). At first only commercial fishermen bought the RSA, but by 2009 there was a significant influx of for-hire sector participants.

The participation of the for-hire fleet in the RSA program raised multiple concerns for *MarineFisheries* including increased administrative burden, compliance with and enforcement of RSA quota, introduction of bias to recreational fishing statistics, and perception of an inequitable system. These concerns led the Division to indicate in April 2011 its intent not to issue LOAs for RSA quota use by for-hire vessels in 2012 and beyond.

Interstate and Federal Fisheries Management

Following below are actions taken and issues confronted by *MarineFisheries* in 2011 in direct relation to interstate or federal fisheries management actions.

River Herring

Harvest Moratorium: In 2008, the MFAC approved continuing the moratorium on the directed harvest of river herring for another three years (through 2011) with a 5% bycatch tolerance for bait fisheries. This action was necessitated by a lack of recovery of river herring runs in the region; an additional three years of closure would protect another generation of river herring. In May 2009, the ASMFC approved Amendment 2 to the Shad and River Herring Fishery Management Plan, requiring states to develop sustainable fishery plans for any recreational and/or commercial river herring fisheries they intended to keep open after January 1, 2012.

Based on continued low levels, Massachusetts had not submitted a sustainable fishery plan for any run by August 2011. Consequently, *MarineFisheries* proposed, and the MFAC agreed, to take to public hearing a proposal that would strike the January 1, 2012 moratorium expiration. Massachusetts regulations already provided the Director with

the authority to open runs when sustainability can be demonstrated. Clarification of the bait fishery tolerance was also included in the proposed rule change. The proposed language was under administrative review at the end of 2011.

Spiny Dogfish

2011/2012 Fishery Specifications: Once declared overfished (1998), NMFS announced in November 2010 that Atlantic spiny dogfish was rebuilt and overfishing no longer occurring. In response, NMFS and the ASMFC raised the quota for the 2011/2012 fishery to 20 million pounds, up from 15 million pounds the previous year. *MarineFisheries* supported this quota increase, as well as the maintenance of the 3,000-lb trip limit to preserve market stability and season length. After a public comment period in Massachusetts on the trip limit, the MFAC voted to approve the 3,000-lb trip limit in April for the 2011 fishery starting May 1, 2011 until the quota allocation was taken.

The 2011 commercial spiny dogfish fishery in Massachusetts was open from May 1 through most of August. Landings in Massachusetts consumed 45% of the coastwide quota and 78% of the Northern Region quota for the 2011/2012 fishing year, reconfirming Massachusetts as having the preeminent spiny dogfish fishery.

Striped Bass

ASMFC Draft Addendum: In March 2011, the ASMFC initiated the development of an addendum with goals of reducing striped bass fishing mortality up to 40% and further protecting spawning stock when it is concentrated and vulnerable. The motion to do so was made by *MarineFisheries'* Director in response to recent declining trends in population abundance, recreational catch, and juvenile recruitment, and in order to position the Management Board to respond quickly to results of the stock assessment update due in the fall, if necessary.

In November, the awaited assessment indicated that striped bass continued to be not overfished nor subject to overfishing. Based on this information, in addition to the ASMFC's Striped Bass Technical Committee's input that recent poor juvenile survival was not related to fishery rules and reports of strong 2011 juvenile recruitment from the Chesapeake Bay, the Management Board postponed any further action on the addendum until the 2013 benchmark stock assessment. *MarineFisheries'* Director opposed the delay in action based on projections that status quo fishing mortality levels would result in spawning stock biomass dipping below the target and threshold levels before the end of the decade triggering mandatory management measures.

Fluke, Scup, and Black Sea Bass

Annual Measures: MarineFisheries revised the regulations for the harvest of scup, black sea bass, and summer flounder (fluke) pursuant to adjustments made by ASMFC for the 2011 commercial quotas and recreational harvest limits. With the 2011 commercial scup quota increased, plus a harvest underage in 2010, MarineFisheries increased the weir fishery's allocation and doubled the trip limits for all other authorized gears. The summer directed fishery was also opened one-month earlier, with the addition of Sunday as an open fishing day for the fish pot and hook and line fisheries. The same low

quota for commercial black sea bass harvest, coupled with high catch rates, led *MarineFisheries* to reduce the spring and summer fisheries' trip limits by 60% with an extension of the spring fishery by seven days. Based on an industry request, Thursday was also replaced with Wednesday as an open fishing day for the scup May fish pot and hook and line fisheries as well as the black sea bass spring fisheries. The Massachusetts Pot and Trap Fishermen's Association had brought forward an alternative black sea bass proposal for the MFAC's consideration which included split seasons and allocations of the quota based on gear type; however, the MFAC did not support the proposal because of the mixed public comment and the onus it put on real-time accurate and verifiable reporting to ensure no single gear type or season took more than its allocation of fish. Commercial fluke regulations remained the same as in 2010.

A required reduction in recreational black sea bass harvest prompted the elimination of November and December from the season, a halving of the possession limit to 10 fish, and a 1.5 inch increase to the minimum size limit. These reductions, while not ideal, were preferred to the alternative coastwide measures that would prohibit Massachusetts from keeping the fishery open during the popular black sea bass fishing months of May and June. An increase in the recreational fluke harvest limit allowed for lengthening the season by 24 days in September and decreasing the minimum size limit one inch. Recreational scup regulations remained the same as in 2010.

Fluke Winter Period II Scup Trip Limits: With 3.3 million pounds of unused Winter I quota being rolled into the Winter II fishery in 2011, NMFS increased the Winter II trip limit to 8,000 pounds (the maximum). So as to avoid disparate and more conservative rules in Massachusetts, *MarineFisheries* took public comment on also increasing the state trip limit. The MFAC subsequently voted to adopt the higher trip limit, which was put into effect on November 1 by declaration.

Northern Shrimp

2011/2012 Fishery Specifications: The ASMFC Northern Shrimp Section approved management measures for the 2011/2012 fishery including a 2,000 metric ton total allowable catch (TAC); landings days of Monday, Wednesday, and Friday for the trawl fishery starting on January 2, 2012; a 1,000-lb/vessel/day limit for the trap fishery opening February 1, 2012; and a fishery closure when landings are projected to reach 95% of the TAC. The use of landing days and different gear regulations was made possible by the implementation of Amendment 2 to the interstate plan in 2011. The 2,000 mt TAC represents a substantial reduction from the 4,000 mt target harvest level for the 2010/2011 fishery, necessitated by the 2011 stock assessment finding that the stock is overfished with overfishing occurring. *MarineFisheries* accepted comment on the proposed regulation, which was followed by approval of the specifications by the MFAC and implementation by the Director.

Atlantic Herring

Annual Specifications: As required by the interstate management plan and state regulations, *MarineFisheries* opened and closed the Atlantic herring fishery in accordance with ASMFC specifications and instituted a seasonal spawning closure based on catch monitoring.

ASMFC Draft Addendum IV: In January 2011, the Division hosted an ASMFC hearing on Draft Addendum IV to the Atlantic Herring Fishery Management Plan (FMP). The draft addendum proposed to allow small mesh bottom trawl and small purse seine vessels an additional landing day or two per week, when landing is restricted through days out measures. In March, the ASMFC Atlantic Herring Section voted against implementing any of the proposed measures.

American Lobster

ASMFC Addendum XVII: In November 2010, the ASMFC initiated development of a plan addendum to respond to the population decline in Southern New England (SNE) likely a product of poor juvenile lobster survival related to warmer ocean temperature. Data support a shift in adult lobster distribution in SNE to cooler, more offshore locations; lobster larvae born in these areas have a lesser chance of making it to their inshore prime nursery habitat.

Although more restrictive measures were first considered for inclusion, Draft Addendum XVII, upon its release for public comment in August 2011, presented a suite of management options to reduce fishing exploitation on the SNE stock of American lobster by 10% starting in July 2013. The proposed 10% reduction would come from management area specific changes in the minimum size limit, maximum size limit, and/or closed seasons. *MarineFisheries* hosted an ASMFC hearing on the draft addendum in late September. In November, the ASMFC adopted the addendum with a 10% reduction in exploitation as a first phase of a rebuilding program, initiating at the same time two draft addenda to be the second phase that is to scale the scope of the SNE fishery to the size of the resource (i.e., reduce traps). *MarineFisheries* co-organized, with Rhode Island, a meeting of the Lobster Conservation Management Team 2 to develop a 10% reduction strategy in December; no consensus was reached at that time and another meeting was planned for early 2012.

Atlantic Large Whale Take Reduction Plan: During the summer, NMFS held scoping meetings to solicit public comments on ways to reduce the risk of serious injury or mortality of right, humpback, and finback whales as a result of entanglement in vertical lines associated with commercial trap/pot and gillnet fisheries off the U.S. East Coast. NMFS intends to publish a final rule to address vertical line entanglement by 2014. *MarineFisheries* staff participated in the Massachusetts scoping meetings and submitted written comment opposing a vertical line reduction strategy that would prohibit single trap fishing, requesting that NMFS consider a strategy that addresses latent effort, and expressing concern with the proposals under consideration to manage risk.

Coastal Sharks

De Minimis Request: In 2008, the ASMFC approved the first interstate FMP for coastal sharks. It was determined in 2011 that *MarineFisheries* had implemented all required elements of the plan, with the exception of a 33-fish commercial possession limit for non-sandbar large coastal sharks (LCS). These sharks are not landed in any significant quantity in Massachusetts. Consequently, *MarineFisheries* requested and was granted an exemption from this requirement because we determined that implementation of the possession limit (as well as any future modification of the limit resulting from the annual specification

process) would constitute a regulatory burden that was unnecessary for the attainment of the FMP's objectives and the conservation of the resource.

Groundfish

Amendment 16 Complimentary Measures: In October 2011, state regulations were enacted aligning state management of several groundfish species with Amendment 16 to the federal Northeast Multispecies Fishery Management Plan (FMP). The recreational seasons were adjusted for Gulf of Maine; the recreational and commercial minimum size limit for halibut was increased to 41 inches; commercial prohibitions on wolffish, ocean pout, and windowpane flounder and a recreational prohibition on wolffish were enacted; landing filets of groundfish by recreational fishermen was allowed provided filets have at least a two inch squared section of skin attached and the number of filets does not exceed two times the bag limit; and landing of filets and parts of groundfish by commercial fishermen was allowed provided their weight be multiplied by three to determine compliance with trip limits.

Framework Adjustment 46 (FW46): Through FW46, the NEFMC increased the haddock incidental catch cap for the Atlantic herring fishery, revised accountability measures to protect haddock once that cap is obtained, and revised reporting requirements for herring fishing vessels. These actions were taken to a) maximize the chance for the Georges Bank (Area 3) herring TAC to be caught; (b) provide incentives to fish offshore; (c) provide incentives to fish in a manner, at times, and in areas when and where haddock bycatch is none to low; and (d) reduce the impact of a haddock cap on the entire herring fishery.

Throughout the debate leading up to adopting FW46, *MarineFisheries* continued to support the sea herring industry's attempts to secure a place in the mackerel fishery and continued to contribute to the understanding of mid-water trawling activities and its impacts on non-target species like haddock and river herring.

Framework Adjustment 47 (FW47): In November 2011, the NEFMC approved FW47 which includes: revisions to status determination criteria, including updated winter flounder assessments; revision to the rebuilding strategy for Georges Bank yellowtail flounder; measures to adopt ACLs, including relevant sub-ACLs and incidental catch TACs; measures to adopt TACs for U.S./Canada area; modified management measures in order to ensure that overfishing does not occur consistent with the status of stocks, the National Standard guidelines, and the requirements of the Magnuson Stevens Act of 2006; modification of management measures for SNE/Mid-Atlantic winter flounder; modification of restrictions on the catch of yellowtail flounder in Georges Bank access areas; and modification of accountability measures for certain stocks.

Amendment 17: As approved by the NEFMC, this action would amend the Northeast Multispecies Fishery Management Plan to explicitly define and facilitate the effective operation of state-operated permit banks. DMF provided comments on an initial working draft of the document. NMFS published the proposed rule in December 2011.

Fleet Diversity: *MarineFisheries* staff continued to support, and at times lead, the discussion of measures to protect fleet diversity, including attendance at a June 9th

Council Workshop on Groundfish Accumulation Limits. By the end of the calendar year, scoping hearings for Amendment 18 had been held.

Data Confidentiality: *MarineFisheries* staff spent considerable time during the first half of 2011 confronting concerns about sector data confidentiality and the hindrance that placed on government's ability to effectively manage the groundfish fisheries. NMFS deemed any information not used for a determination under a limited access program (versus an analysis) as confidential.

Following several communications between the NEFMC, NMFS, the Commonwealth, and others, *MarineFisheries* and NMFS addressed the concerns about confidential data access by entering into a Memorandum of Understanding (MOU). The MOU grants approved employees access to confidential NMFS' data to promote effective management of the Commonwealth's commercial and recreational fisheries – data provided to and generated by NMFS with respect to catch shares in the Northeast region, including but not limited to multispecies sector rosters, effort, landings, and economic data.

Economic Reports & Disaster Request: *MarineFisheries* staff participated in two cooperative economic studies of the groundfish fishery and independently authored a focused economic impact study of Northeast Fishery Sector 10, a fleet composed of mostly south shore vessels. Together these reports formed the basis for a disaster assistance request by Governor Patrick for the groundfish fishery. At the close of 2011, the Commonwealth still awaited a response from NMFS on the \$21-million request.

MFI Report — After communication between the Obama and Patrick administrations on the justification for amended catch limits and economic assistance for the New England groundfish fishery, the Massachusetts Marine Fisheries Institute (MFI), a collaboration between MarineFisheries and the University of Massachusetts School for Marine Science and Technology (SMAST), submitted the "Report on Scientific and Economic Information that Supports Increases in Multispecies Groundfish Annual Catch Limits" to the NEFMC for review by its Scientific and Statistical Committee (SSC).

The SSC concluded that the information in the MFI report did not justify revision of the catch limits. However, the MFI report raised important issues, and the SSC concluded that additional research on the following topics would be valuable: characteristics of biological reference point proxies with respect to risk; causes of retrospective patterns and the performance of alternative methods for mitigation of these; performance of alternative risk tolerance in the face of scientific and management uncertainty; and options for managing mixed stock fisheries that address trade-offs between net benefits for the nation and protection of "weak" stocks.

Although not explicitly included in the SSC's Terms of Reference, the SSC also discussed the economic analyses in the MFI report.

NMFS/Commonwealth Report – MarineFisheries worked collaboratively with NOAA Fisheries and relied on the expertise of its Statistics Program staff, SMAST, and NOAA's Office of Science and Technology, Economics and Social Analysis Division to complete the "Break-Even Analysis of the New England Groundfish Fishery for Fishing Years 2009 and 2010."

The uncertainty in the break-even results, particularly related to sector costs, made definitive conclusions regarding financial performance during FY2009 as compared to FY2010 challenging. Nevertheless, it was clear that fewer vessels participated in the groundfish fishery during FY2010 than did so during FY2009. Results showed large numbers and percentages of vessels of all sizes not breaking even during either FY2009 or FY2010. The report concluded that to accurately determine the financial condition of the groundfish fishery, data must be more reliable and of better quality, especially overhead cost data. The report also noted that the NEFMC and other interested management bodies should pay greater attention to this critical need.

Sector 10 Report – Simultaneous to the federal-state collaborative report, MarineFisheries undertook a "Comparative Economic Survey and Analysis of Northeast Fishery Sector 10 (South Shore, Massachusetts) between 2009 (Days-at-Sea) and 2010 (Sector Catch Share)." The report required the cooperation of Sector 10 fishermen who provided access to confidential landings and revenue information.

The report concluded severe economic losses occurred in Sector 10, largely due to the difficult transition to catch shares. Between 2009 and 2010, the sector's groundfish landings declined 61 percent and groundfish gross revenue declined by 52 percent. Sector 10's total revenue loss of \$1,567,000 would have been significantly higher if not for a shift in effort by fishermen to non-groundfish species (lobster, dogfish, skate, etc). This shift in effort to non-groundfish species did not come without costs, and likely had negative conservation and management implications for other fisheries, as well as potential adverse economic impacts on other non-groundfish fishermen.

Although generalities were difficult to conclude, we did see evidence of a fisheries disaster caused by the transition to catch shares, with a disproportionate impact on small boat (30 - 50') owners, which have been hampered by their limited range and limited access to quota.

Sector Workshops: *MarineFisheries* staff participated at the NEFMC's "Sector 'Lessons Learned' Workshop" and the Gulf of Maine Research Institute's "Innovative Strategies for Success under Catch Shares" conference. Both of these regional workshops occurred in Portland, Maine in October 2011, and included review of the first year of groundfish management under a sector system.

Gulf of Maine Cod Status: Preliminary scientific findings indicated Gulf of Maine (GOM) cod is overfished and overfishing is occurring – a sudden and drastic change in stock status with implications for the state of the fishery and fishermen. Although final peer-reviewed results weren't expected until January 2012, *MarineFisheries* participated on a GOM Cod Working Group convened by NMFS and NEFMC. At the close of the 2011 calendar year, the working group continued to explore possible options to maintain progress under the new sector management system and mitigate impacts on the fishing industry of lower cod catch limits in 2012 and beyond.

Revolving Loan Fund: After consulting with several existing fishing industry-related revolving loan fund managers during the month of January, *MarineFisheries* determined that repurposing its \$1-million federal grant for a state-operated permit bank to fund a revolving, short-term loan fund would better assist small-scale fishing businesses. After receiving a letter of support for such an amendment from NMFS Director Eric Schwaab, Division staff developed a revised statement of work for the grant. With the assistance

of a newly formed workgroup of fishing and lending industry representatives, we crafted and submitted a proposal for a Revolving Loan Fund (RLF) program aimed at mitigating the socio-economic impacts of the Amendment 16 sector system on the Commonwealth's local, small-scale fishermen and fishing communities.

Based on NMFS' response, *MarineFisheries* resubmitted the proposal as a change in scope, responded to outstanding concerns and questions, and submitted a Memorandum of Agreement (MOA) for operation of the RLF. With both the grant and MOA approved in late December, *MarineFisheries* began the process to solicit bids from financial lending institutions who would eventually administer loans. At the close of the 2011 calendar year, staff were finalizing all necessary documents.

Amendment 16 Litigation: The Commonwealth entered into an Amendment 16/Framework 44 legal challenge as *amicus curiae*. The suit brought by the city of New Bedford against the Secretary of Commerce, NOAA Administrator, and NMFS, consolidated with a similar industry suit, argued that the Agency misinterpreted the law, relied on inaccurate facts, and acted in an arbitrary and capricious manner in implementing Amendment 16 to the Northeast Multispecies Fishery Management Plan. In the end, summary judgment was ruled in favor of the defendants in part due to deference owed to federal rule-making in general.

Monkfish

Catch Share Scoping: *MarineFisheries* provided comments on the NEFMC's Monkfish Catch Share Scoping Document. Of particular concern was the purpose of the proposed action solely to reallocate monkfish access, not to address overfishing given the status of monkfish as rebuilt.

Scallops

Framework Adjustment 23: As Chair of the NEFMC Scallop Oversight Committee, Dr. Pierce led development and approval of FW23 to the Atlantic Sea Scallop FMP. The NEFMC initiated FW23 to address several priorities identified at its November 2010 meeting. Most pertinent to the Division were possible modifications to the limited access general category management program for the Northern Gulf of Maine Area, which includes a portion of state waters from Massachusetts Bay northward.

At its September 2011 meeting in Danvers, the NEFMC approved FW23 and with it a modification to the Northern Gulf of Maine sea scallop program. This modification allows vessels holding a federal scallop permit to fish in state waters on a trip-by-trip basis without those catches counting against the total allowable catch for the federal area. Although the measure was adopted to make the federal Northern Gulf of Maine scallop management program more consistent with state management programs, the Commonwealth does not allow the splitting of federal and state operations. Therefore, the Commonwealth took simultaneous action to condition Coastal Access Permits to more formally restrict the operation of federally-permitted scallop operations in state waters outside the federal management program. See State Fisheries Management Project for details.

Publications

DMF News: *MarineFisheries'* newsletter was published twice in 2011. Volumes 32 (1st & 2nd Quarter) and 33 (3rd & 4th Quarter) are available at: http://www.mass.gov/dfwele/dmf/publications/newslttr.htm

MarineFisheries Technical Report Series: *MarineFisheries* published two reports in its technical report (TR) series. They are at: http://www.mass.gov/dfwele/dmf/publications/technical.htm

"An assessment of river herring stocks in Massachusetts." TR-46, by G. A. Nelson, P. D. Brady, J. J. Sheppard, and M. P. Armstrong.

"Recommended time of year restrictions (TOYs) for coastal alteration projects to protect marine fisheries resources in Massachusetts." TR-47, by N. T. Evans, K. H. Ford, B. C. Chase, and J. J. Sheppard.

Massachusetts Saltwater Magazine: *MarineFisheries* contracted J.F. Griffin Media to assist in the development of a revamped recreational saltwater fishing guide in 2011. Unlike prior years, the guide is all-inclusive to recreational saltwater fishing, including information on both finfish and crustaceans. The end product is a glossy magazine-like annual guide with increased consumer appeal. The online version can also be updated to account for regulatory changes.

Coordination of NEFMC Nominations

As in years past, *MarineFisheries* coordinated the process of gubernatorial nominations to vacant seats on the NEFMC, including solicitation of potential candidates and submission of nominations by the Governor's office.

Leadership Positions

In November 2011, Director Diodati was elected Chair of the ASMFC. Deputy Director Pierce served out the last eight months of his term as Chair of the NEFMC Scallop Committee.

Conservation Engineering Program

Personnel

Michael Pol, Program Leader David Chosid, Marine Fisheries Biologist Mark Szymanski, Assistant Marine Fisheries Biologist

Overview

Conservation Engineering (CE) collaborates with industry and others to reduce impacts of commercial fishing gear on non-target species. During 2011, innovative, scientifically-designed investigations of fishing technology and fish behavior in otter trawls, longlines, and fish pots were conducted.

Projects

Determining the Seasonality of Cod Pots

This two-year project, funded by the Northeast Consortium (NEC), to determine the seasonal vulnerability of Atlantic cod to two types of fish pots was completed in 2011. We concluded that both pot types tested (static, large mesh, Newfoundland-style and dynamic, off-bottom, small mesh, Norwegian-style) may be effective for further development and that seasonality plays an important role in catch efficiency. The final report, complete with photographs, captions, and database, was delivered to the NEC. Mark Szymanski gave a presentation about the project at the "Static Gears for Survey Purposes" workshop in Rhode Island.

Development of a Spiny Dogfish Excluder in a Raised Footrope Whiting Trawl

Following the successful completion of this NEC-funded project in 2011, CE focused on outreach activities in 2011. The project was aimed at, and achieved, a reduction in dogfish catch in the fall whiting trawl fishery along the coast of Massachusetts using an angled grate in the extension of the net. The project was a collaboration with fishermen Frank and Andrew Mirarchi (F/V Barbara L. Peters) of Scituate and relied primarily on underwater video to assess the effectiveness of the grate.

CE collaborated with New Hampshire Sea Grant to perform outreach about the grates to fishermen. Seven fishermen, primarily from Gloucester, expressed interest. Sea Grant purchased four grates and created data sheets for fishermen to self-report results. Sea Grant and CE teamed to hold a workshop to demonstrate grate rigging and usage. Plans for a smaller grate were discussed with some fishermen. A lack of dogfish on the whiting fishery grounds meant that fishermen did not use the grate much in 2011.

A manuscript co-authored by David Chosid, Michael Pol, Mark Szymanski, and Frank and Andrew Mirarchi entitled "Development and observations of a spiny dogfish *Squalus acanthias* reduction device in a raised footrope silver hake *Merluccius bilinearis* trawl", previously submitted to the journal *Fisheries Research*, was finalized and published.

A Network to Redevelop a Sustainable Redfish Trawl Fishery in the Gulf of Maine

This project is a multi-year, NMFS-funded network of gear researchers, net makers, fishermen, NMFS Regional Office and Science Center members, Council staff, fish processors, and others working to re-establish the redfish (*Sebastes fasciatus*) trawl fishery in the Gulf of Maine. CE's role in the network includes network coordination, financial administration, contract management, equipment purchase, sharing and maintenance, and logistical support for field work.

Conservation Engineering Marine Fisheries Initiative

The intent of this project is to identify vital, immediate gear research that could assist fishermen in their transition to sectors and under new catch limits. The projects provide some personnel support to CE as a means of creating capacity for the anticipated research projects and activities. As a network coordinator, CE arranged meetings, purchased equipment, contracted with vendors, and provided substantial budgetary and administrative leadership.

During 2011, sixteen proposed projects for gear demonstration or testing were approved. Several of these proposals were written by staff following meetings with fishing Sectors 6, 10 and 13. Staff handled budgeting, bid solicitation, contracting and general oversight for seven of the projects. Proposals were finalized for Sector 6's testing of a Ruhle trawl designed to target haddock while excluding cod, and Sector 10's testing of an alternative codend. Equipment from the CE inventory was shared with project partners, and repaired when necessary. Staff also conferred with the Sustainable Harvest Sector on a cod potting project.

Under this project, staff are investigating a fisherman's idea to develop an inexpensive codend that when full is triggered to breakaway (and stop fishing) by an integrated signaling device. Following literature review and industry consultation, various trigger mechanisms were purchased to develop prototypes of the detaching mechanism. A prototype was tested on land for two days in May and June at Superior Trawl (Point Judith, RI). In preparation for field tests, authorization was obtained from NMFS, camera equipment prepared and staff trained in its use, and database constructed. Additional work included contract administration, scheduling, and budgeting.

The first field tests were performed during summer on a Gloucester-based trawl. Underwater video was captured using a *MarineFisheries* underwater recording and low-light camera unit. Modifications were made to the prototype, mainly including an adjusted trigger device and additional parachute to act as an indicator that the codend has separated. Three more field days were conducted in June and July. All video and catch data were entered, audited, and basic analyses conducted.

Outreach activities for BREAKBAG included assemblage and distribution of a compilation video to project participants, collaboration on a *Commercial Fisheries News* article, presentation and poster session at the Northeast Regional Collaborative Research Conference, live demonstration of the codend at the New Bedford 2011 Working Waterfront Festival, article submission to *MarineFisheries'* newsletter, and video upload

to the GEARNET website. The project was submitted to the World Wildlife Fund's SmartGear competition.

Design and Test of a Squid Trawl with Raised Footrope Rigging and a Grid Device to Reduce Bycatch

For this NMFS proposal, staff partnered with Pingguo He of SMAST (project lead), net maker Tor Bendiksen (Reidar's Manufacturing, Inc.) and draggerman Mike Walsh (Integrity Fishing Corp.) to reduce bycatch of winter flounder, scup and butterfish in the Nantucket Sound squid fishery using a grid and a raised footrope net design.

Prior to field work, staff met with partners to view the grid under construction, and obtained authorization to access a closure area and retain small fish for measurement. Program Leader, Michael Pol, traveled to Newfoundland, Canada with He and Walsh to test the design in the Memorial University flume tank.

Field work was conducted aboard the F/V Atlantic Prince in May in Nantucket Sound. Video was collected and the catch sampled over 10 field days. Work will continue in 2012.

Investigation of Haddock and Flounder Behavior Near Standard and Floating Bridles

Funded by NMFS through the MFI, this project examines the effect of floating bridles compared to standard bottom contact bridles in a groundfish trawl net using underwater video and paired testing. Planning for the project, including equipment selection, was conducted in collaboration with Pingguo He of SMAST, and Captain Pedro Cura (F/V Fisherman), our industry partner. Vessel contracting and other budgetary management was conducted through CE.

During a nine-day experimental trip in June to Georges Bank, staff collected approximately 70 hours of video over more than 40 tows. Data analysis will continue into 2012.

Other Activities

Appointments

Michael Pol was appointed chair of the ICES-FAO Working Group on Fishing Technology and Fish Behaviour, with a three-year term beginning in January 2011. Pol also continued serving on the NEFMC Research Steering Committee.

Publications

In addition to the publications listed under specific projects above, staff authored (or-co-authored) the following:

Michael Pol co-authored "Hooked on longline", the proceedings from a longlining workshop held in Reykjavik, in 2010

Michael Pol, Mark Szymanski, and David Chosid were co-authors to "Fork length—total length conversions for haddock and Pollock" published in the *North American Journal of Fisheries Management*.

Presentations

In addition to the talks listed under specific projects above, CE staff gave the following presentations:

Michael Pol was invited to present at a Cusk Workshop held in December 2011 in Portland, Maine. The workshop was sponsored by NMFS in anticipation of a request to list cusk under the Endangered Species Act. Pol's talk described a conservation engineering approach to avoiding cusk catch.

Michael Pol gave a talk entitled "Old Dogs and New Tricks: A Year of Conservation Engineering in a Network" at the Northeast Regional Collaborative Research Conference in October in New Hampshire.

David Chosid coordinated and prepared the Division's booth for the 2011 New Bedford Working Waterfront Festival and solicited ideas from other Division personnel. Both the self-closing codend demonstration and the booth attracted a great deal of attention.

All CE personnel attended the Collaborative Research Project Partners Conference in Portsmouth, New Hampshire in October 2011. Mark Szymanski was invited to participate in a panel discussion, David Chosid presented results from the BreakBag project, and Michael Pol gave a talk on CE's experiences with cooperative research networks.

Management Information Systems and Fisheries Statistics Program

Personnel

Thomas Hoopes, Program Coordination Story Reed, Fisheries Data Collection Lead, Web Site Coordination Kim Lundy, Dealer Reporting Coordination, Quota Monitoring Brant McAfee, Fisheries Data and GIS Analysis Mary Ann Fletcher, Fisheries Data Entry

Overview

The Management Information Systems (MIS) Project provides many services to *MarineFisheries* under the umbrella of information systems/technology including: local area network maintenance; PC and server maintenance; Internet and Intranet website development and maintenance; Oracle database development and maintenance and geographic information systems (GIS) data development and assistance.

The **Fisheries Statistics Project** collects fisheries dependent data from both commercial harvesters (catch and effort) and dealers designated as primary buyers (landings). Both data sets are collected in a standardized trip-level format from all permit holders. These data are used in many ways, both within *MarineFisheries* and to fulfill requests made from outside the agency. Project personnel also participate in the planning and development of the Atlantic Coastal Cooperative Statistics Program (ACCSP) and provide support to administrative staff for policy and law enforcement purposes, as well as permitting staff to issue permits from the Gloucester facility.

Management Information Systems Project

Website Development & Maintenance

The MarineFisheries website (www.mass.gov/marinefisheries) continued to be an extremely useful means of distributing information as does an internal Intranet site using Wiki technology, which provides both agency-wide as well as project-specific functionality to agency personnel. A Statistics Project Intranet site is also maintained for display of quota information, reporting compliance, and both harvester and dealer reporting information.

Oracle Database / Application Development & Maintenance

There are currently four production databases that *MarineFisheries* uses: Commercial Permits and Statistics; Lobster Sampling; Shellfish Sampling & Area Management; and Time Tracking for Federal Grants. During the second half of 2011, EOEEA IT took over the primary programming tasks for these applications, beginning the process of upgrading the EOEEA Oracle application and database servers to provide separate Development, Test and Production environments. This work was ongoing through the end of the year and into 2012.

GIS Technical Assistance & Data Development

With the loss of the GIS Analyst in the *MarineFisheries* New Bedford office, most directed large project efforts were discontinued in 2011. Individual programs and projects took it upon themselves to continue to develop their own GIS data layers, and support was provided in specific cases.

Fisheries Statistics Project

Dealer Landings Data Collection

Landings or purchases of all marine species by seafood buyers from commercial fishermen were collected as part of the dealer reporting program. Starting January 1, 2005, all primary buyers not required by federal law to report electronically began reporting under state regulations. All data from these state-reporting dealers were entered electronically by dealers or submitted to *MarineFisheries* via paper forms and entered into the ACCSP Standard Atlantic Fisheries Information System (SAFIS) database by project personnel. All quota-based fisheries are monitored using these dealer data stored in the SAFIS database.

As of December 31, 2011, 1,710 businesses obtained a 2011 MA dealer permit of one kind or another. Of those, 485 (28%) were categorized as primary buyers, purchasing marine species directly from fishermen. These dealers were required to report their primary purchases, including products retailed themselves. Of the 485 dealers, 214 had a federal dealer permit which required reporting electronically to the SAFIS database. These dealers were categorized as "federal-reporting". The remaining 271 dealers were categorized as "state-reporting".

Even though many of the primary buyers in 2011 had been primary buyers in years past, all were required to complete paperwork to confirm their buying intentions and their commitment to the dealer reporting requirements. This registration process not only provided a signed statement for enforcement purposes, if necessary, but also provided the means to monitor reporting compliance and track quotas.

For 2011, 154,293 transactions (not including negative reports) were entered into the SAFIS database, covering over 371,061 individual species landings, or 2.4 species per transaction. Of those, 6,113 transactions were keypunched by project staff directly into the SAFIS database, and 16,443 transactions were uploaded by project staff using the SAFIS file upload module. These transactions were submitted either via paper or spreadsheet form by dealers who elected not to enter their reports electronically, the number of which has been trending downward. The file upload option is preferred particularly by dealers submitting data in spreadsheet form for its efficiency.

Total landings (live weight) in Massachusetts amounted to 595.6 million pounds, valued at \$570.7 million. The top five species in order of value were sea scallop, American lobster, Atlantic cod, haddock, and goosefish, totaling \$442.6 million, or 78% of the total. When grouped together, inshore and intertidal landings of shellfish such as soft shell clam, northern quahog, blue mussel, and oyster amounted to 22.1 million pounds, valued at \$27.3 million, whereas offshore shellfish amounted to 368.7 million pounds, valued at \$341.7 million. Landings of crustaceans (lobster, crabs, and shrimp) amounted to 23.6 million

pounds, valued at \$62.7 million. Landed species with a total gross value over \$1 million are shown in Table 1.

Table 1. 2010 Massachusetts Landed Species with Value Greater than \$1 Million

Species	Pounds (Whole)	Value	
Scallop, Sea	275,026,347	\$330,907,384	
Lobster, American	13,717,139	\$54,858,837	
Cod, Atlantic	15,009,232	\$27,580,562	
Haddock	12,150,853	\$15,812,566	
Goosefish	10,022,106	\$13,434,286	
Tuna, Bluefin	1,621,365	\$12,145,182	
Oyster, Eastern	3,484,420	\$9,069,805	
Pollock, Atlantic	11,791,271	\$9,000,150	
Herring, Atlantic, Sea	66,514,743	\$8,719,270	
Flounder, Winter	4,474,274	\$7,767,385	
Clam, Surf	45,899,159	\$6,785,409	
Whelk, Channeled	2,996,745	\$5,943,549	
Hake, Silver (Whiting)	8,261,514	\$5,012,763	
Hake, Atlantic, White	5,283,973	\$4,809,217	
Clam, Soft	6,503,328	\$4,690,017	
Flounder, Yellowtail	3,515,993	\$4,125,787	
Clam, Ocean Quahog	47,821,868	\$4,042,400	
Flounder, Plaice, America (Dab)	2,842,949	\$3,981,600	
Clam, Northern Quahog	6,664,071	\$3,961,196	
Crab, Jonah	5,379,792	\$3,648,497	
Flounder, Witch (Gray Sole)	1,720,943	\$3,580,991	
Crab, Red Atlantic	3,595,103	\$3,485,954	
Striped Bass	1,163,865	\$3,188,337	
Perch, Ocean (Redfish)	4,293,746	\$2,636,823	
Flounder, Summer (Fluke)	1,130,991	\$2,558,087	
Swordfish	682,602	\$2,060,230	
Scallop, Bay	894,137	\$1,957,424	
Dogfish, Spiny	9,053,694	\$1,927,923	
Skate, Winter	7,657,126	\$1,883,779	
Squid, Long Finned (Loligo)	1,408,548	\$1,810,074	
Skates	5,404,368	\$1,636,351	

Several fisheries were managed by quota in Massachusetts in 2011 and were monitored using the dealer reported landings in the SAFIS database. Automated scripts ran on a nightly basis and were displayed on the *MarineFisheries* website (Figure 1). On a weekly basis during the open season, staff reviewed compliance, by species, from dealers which had already purchased during the year, or in past years, and accounted for potential landings if the dealer did not yet report. A regression analysis was run at least once per week for each fishery still open, the results of which were used to estimate a closure date. Overages were applied to the following year's total harvest, where required.

QUOTA MANAGED SPECIES 2011 Landings and Quota Information as of Jan 20, 2012 - 05:00 A.M.					
Species	2011 MA Landings*	2011 Quota	Quota Type	Percent Landed	
Black Sea Bass	264,165	222,440	MA	118.8%	
Bluefish	579,504	629,704	MA	92.0%	
<u>Dogfish</u>	9,048,607	11,145,452	CW	to NMFS	
<u>Fluke</u>	1,134,080	1,156,952	MA	98.0%	
Illex Squid	3,619	51,429,436	CW	to NMFS	
Loligo Squid	1,404,688	TBA	CW	to NMFS	
Scup (Summer)	1,044,854	1,285,325	MA	81.3%	
Striped Bass	1,163,865	1,061,898	MA	109.6%	
Tautog	57,762	54,189	MA	106.6%	

MA = Massachusetts-specific quota
CW = Coast-wide quota shared between MA and other Atlantic states

Figure 1. 2011 Landings of Quota Managed Species

Fisherman Catch and Effort Data Collection

Starting in 2010, all commercial fishermen began submitting, on a monthly basis, comprehensive, standardized trip-level data for all commercial trips conducted under the authority of their MA commercial permits. Those individuals holding a federal permit with reporting requirements to NMFS (e.g., Vessel Trip Report (VTR)), were exempt from reporting to *MarineFisheries* for those activities occurring on their federally-permitted vessel. All other individuals were required to report to *MarineFisheries*.

This change eliminated the suite of species and gear-specific annual catch reports that were collected for years, some since the late 1960s, and has greatly enhanced the agency's capabilities to monitor catch and effort information in all commercial fisheries conducted by Massachusetts commercial fishermen. It also meets the interstate standards promoted by ASMFC through ACCSP.

All reports were processed and entered by project personnel at the Annisquam River Marine Fisheries Station in Gloucester. Some data entry support was provided by permitting staff in other *MarineFisheries* offices during the latter portion of the year, when permitting activities were reduced.

Fishermen either submitted their trip-level reports in paper form or entered their fishing activities themselves on-line using the SAFIS eTrips application, a web-based program developed jointly by ACCSP staff and program partners. Project staff used the same application to enter data submitted on paper forms. Thus, the primary repository for all trip-level data, except those reported to NOAA fisheries, was the SAFIS database.

Grant support has been provided by ACCSP to help fund the cost of the increase in data entry services brought on by the new trip-level program. The grant stipulates that ACCSP receive all trip-level data submitted to *MarineFisheries*. Making SAFIS the primary repository fulfills this requirement and meets the needs of the Fisheries Statistics Project as

data can easily be downloaded from the SAFIS database to be used for compliance and fisheries analysis.

In 2011, *MarineFisheries* issued 7,601 commercial harvester permits. Sixteen of theses permits (1,185) were for federal reporting vessels, with the remaining 84% (6,416 permits) being designated at state reporting. Roughly 65% of permit holders reported landing via paper reports to *MarineFisheries*.

Of the 106,151 commercial trips that occurred in 2011 that were entered in the SAFIS database, approximately 82% were entered by *MarineFisheries* staff, and the remaining 18% by the permit holders using the SAFIS eTrips application. As in 2010, a large percentage of reports were submitted late, often not until the end of the year when permits were renewed for 2012 (Figure 2). Consequently, staff were inundated with reports at year's end and were still entering 2011 data throughout a good portion of 2012.

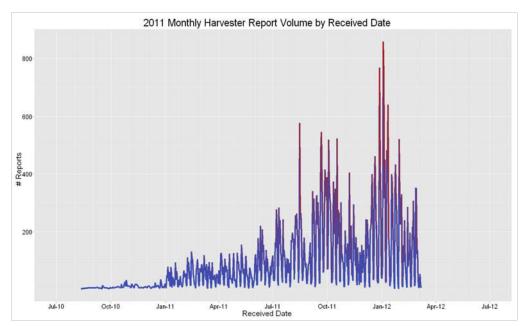


Figure 2. 2011 Daily Reporting Volume for State-Reporting MA Commercial Harvesters

As always, one of the main questions about harvester-reported landings is how well they match dealer-reported landings. Figures 3-5 compare the numbers for lobster, groundfish, and striped bass, respectively in 2011. The results are encouraging as the figures indicate a relatively good match. They also depict the relative contribution between state reported and federal reported (VTR) catch from harvesters.

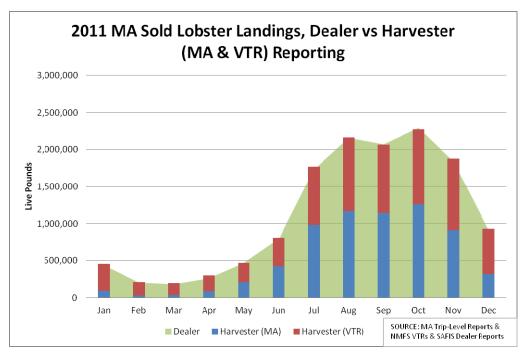


Figure 3. Dealer-Reported Landings and Harvester-Reported Catch of Lobster in 2011

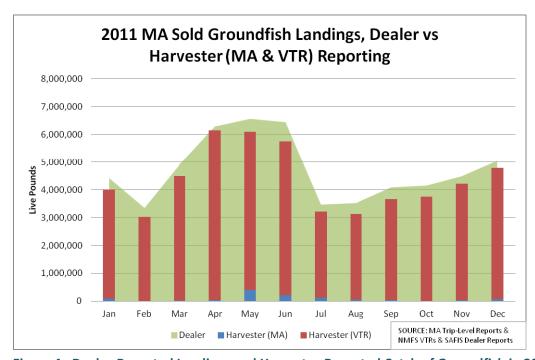


Figure 4. Dealer-Reported Landings and Harvester-Reported Catch of Groundfish in 2011

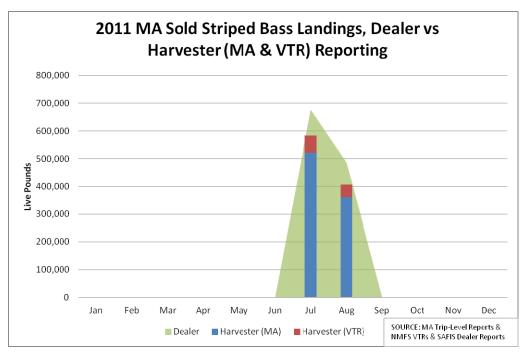


Figure 5. Dealer-Reported Landings and Harvester-Reported Catch of Striped Bass in 2011

Data Analysis and Dissemination

The Commonwealth's ongoing assessment of Sector Management and its impact on the federal groundfishery dominated activities and required significant time expenditures. Two distinct analyses were created through collaboration with the National Marine Fisheries Service (NMFS) and University of Massachusetts School of Marine Science and Technology (SMAST). The assessment produced a comprehensive economic analysis of the entire Northeast groundfish fleet as well as a focused case study analysis of a Northeast Fishery Sector 10 (described more fully under the Policy and Fisheries Management Program subsection). Fisheries Statistics Project staff provided technical input and document drafting assistance for the fleet-wide analysis, and were more heavily involved in the Sector 10 report. For this analysis, Project staff developed a Comparative Economic Survey for distribution to the sector's membership. Staff collected, edited, audited, and keypunched the survey responses, and then developed three economic models to analyze the economic impact of sector management on each permit holder within Sector 10. These models relied on the synthesis of the survey data, existing effort and revenue data, and data collected directly from the Sector 10 Board of Directors. The process required tremendous effort and time expenditures due to the nature of the data, the complexity of the analysis, and constant collaboration with NEFS 10.

Remaining time outside of this project was dedicated towards providing analysis and data support for fisheries data requests, technical and database support, and policy analysis support. Most internal data requests and analyses involved providing data to *MarineFisheries* staff for annual ASMFC compliance reports, while most external data requests to the public pertained to regional landing statistics. Technical support and database development efforts focused on integrating Division fisheries dependent data

sources with federal data sources, enhancing existing data reporting modules, and regulation support to commercial permit holders.

Time and resources were divided between two primary types of activities: (1) standard requests – various small-scale data requests and support endeavors that required short-term time commitments such as landings history verification for permit transfers or data to *MarineFisheries* staff to produce annual ASMFC compliance reports and (2) major projects – several large, time intensive projects requiring significant effort, such as the economic analyses of the groundfish fishery. Two additional major projects are described below.

MarineFisheries and NMFS Database Integration: *MarineFisheries'* transition to monthly trip-level harvester reporting in 2010 changed the agency's fisheries dependent data collection and storage procedures. One major change was the bifurcation of permit holders into two groups: (1) state-reporting permits and (2) federal-reporting permits.

While this system limits duplication between NMFS VTRs and *MarineFisheries* trip-level reports, it presents challenges when accessing and analyzing the data. Data need to be selected from two different databases and merged to create a complete dataset. Differences in formatting and the data fields and codes used between VTR data and our trip-level reports present major integration challenges when these data need to be merged.

To overcome these problems, a database replication routine was developed that provides local access to federal reporting permits' VTR data. The routine utilizes both the NMFS permit number and vessel documentation number attached to each permit to link the records between the federal and state databases. Due to the differing reporting areas used in the state and federal reporting systems, the routine must normalize statistical reporting areas in VTR records to Division statistical reporting areas. The process utilized conversion factors in SAFIS to standardize all weights to live pounds. Duplicate reports filed by permit holders on both VTRs and MA trip-level reports are eliminated by a database procedure that filters out these records according to coincident landing dates.

Linking records in both databases enabled more complex queries because it allowed *MarineFisheries* specific permit information to be joined to records stored in the VTR database. The resulting merged data are comprehensive, yielding all MA landings at the trip level in standardized units and species by statistical reporting area. Integrating both data sources vastly improved data access, analysis, and productivity. Its establishment quartered the time required to monitor state water groundfish landings and has had similar affects on numerous other data requests requiring both data sources.

State Water Groundfish Management: MarineFisheries implemented an experimental fishery for state-waters groundfish fishermen exempting them from all rolling closures in MA state waters during May – June 2011 provided they obtained a letter of authorization (LOA) from the Division. Project staff provided help during the initial scoping process of this fishery as well as its final assessment. During the initial scoping process, MA state-water groundfish allocations were researched under Amendment 16 including the processes used to develop these allocations. These allocations were compared to 5-year historical MA state-water groundfish catches and input was provided on possible effects of the experimental fishery. During the fishery, LOA eligibility was verified for permit holders, landings monitored, and data support provided to managers. Upon completion of the experimental fishery, final landings statistics were presented to Division management and

compared to prior year trends. This information was used to evaluate the experimental fishery and its impacts on overall MA groundfish management goals.

ACCSP Participation and Planning

With the transition to trip-level reporting for all MA harvesters in 2010, continued procedural development occurred during the year, including the preparation, submittal, and acceptance for future funding support from ACCSP. *MarineFisheries* staff continued to provide feed-back to ACCSP with regard to web-based reporting applications. With both dealers and harvesters using these applications, this feed-back is a valuable part of the continued improvement of these applications. Fisherman permit and vessel information was routinely uploaded to the SAFIS database. Both the state boat registration database and the coast guard registration database were used to verify registration or documentation numbers for all vessels before adding the vessels to the SAFIS database.

Law Enforcement, Permitting, and Industry Interaction

Project staff routinely worked with *MarineFisheries* administrators and state law enforcement personnel on enforcement and regulatory issues. Staff provided data, support, and outreach to industry when needed. Support was also provided for the issuance of *MarineFisheries* commercial permits from the Gloucester facility, in addition to working with a contractor, Active Outdoors, to continue to fine-tune the new recreational permitting system for both *MarineFisheries* and the Division of Fisheries and Wildlife.

Project staff worked with industry, law enforcement, and *MarineFisheries* administrators to implement the Winter Fluke Fishery Pilot Program. Accurate and timely electronic reporting by dealers made the quota-monitoring piece of this program a success. Other industry support was provided by phone, individually at Division facilities, and at meetings such as at the Massachusetts Lobstermen's Association annual meeting.

Project staff collaborated with law enforcement on a lengthy investigation into unreported spiny dogfish purchases by an unpermitted dealer during the 2011 spiny dogfish season. This involved a lengthy records analysis which carried over into 2012. Trip-level reports were critical to this investigation.

The Gloucester facility began issuing commercial permits in 2008 and only issued about 1% of the total issued for that year. As more permit holders became aware of the option to get their permit at this facility, a greater number have been issued from this location. In 2011, 8.6% of the commercial permits were issued from Gloucester, up from 5% in 2010. In addition, *MarineFisheries* began requiring and issuing Recreational Saltwater Fishing Permits in 2011. Gloucester staff, primarily from the Statistics Project, issued 5,178 recreational permits through the *MassFishHunt* application in 2011. Project staff has provided support for both permitting and regulatory questions as well as technical issues.

SHELLFISH AND HABITAT SECTION

J. Michael Hickey, Section Leader

Shellfish Sanitation and Management Program

Personnel

J. Michael Hickey, Program Manager

South Shore

Thomas Shields, Senior Biologist, Section Leader

Jerry Moles, Biologist

Neil Churchill, Biologist

John Mendes, Biologist

Terry O'Neil, Biologist

Gregory Sawyer, Biologist

Jim Rossignol, Lobster Culturist

Mike Syslo, Senior Biologist, Martha's Vineyard

Ross Kessler, Biologist

Susan Boehler, Laboratory Supervisor

North Shore

Jeff Kennedy, Senior Biologist, Section Leader, Depuration Plant Manager

Dr. Jack Schwartz, Environmental Analyst

Gregory Bettencourt, Biologist

Glenn Casey, Biologist

David A. Roach Jr., Biologist

Paul Somerville, Biologist

Devon Winkler, Biologist

Florence Cenci, Laboratory Supervisor

Ashley Silberzweig, Laboratory Assistant

Christopher Schillaci, Contract Field Coordinator

Melissa Campbell, Contract Fisheries Technician

Newburyport Shellfish Purification Plant

Diane Regan, Laboratory Supervisor

Natalie Berthiaume, Bacteriologist

Vivian Lasnier, Bacteriologist

Ralph A. Stevens Jr., Plant Foreman

Richard Hardy, Laborer

Peter Kimball, Laborer

Albert Thistlewood, Assistant Plant Foreman

Paul Thistlewood, Laborer

Overview

The Shellfish Sanitation and Management Program (Shellfish Program) has two primary missions: public health protection, and both direct and indirect management of the Commonwealth's molluscan shellfish resources. Public health protection is afforded through the sanitary classification and biotoxin monitoring of all 1,744,041 acres of overlying waters within the states territorial sea and Nantucket Sound. The National Shellfish Sanitation Program (NSSP) is a federal/state cooperative program recognized by the United States Food and Drug Administration (USFDA) and the Interstate Shellfish Sanitation Conference (ISSC) for the sanitary control of shellfish produced and sold in interstate commerce for human consumption.

Shellfisheries management is accomplished by direct *MarineFisheries* regulation of the commercial surf clam, ocean quahog, and quahog dredge boat fisheries, harvest of contaminated shellfish for depuration and relaying, and setting size and maximum harvest limits for other shellfish and seasons in the case of bay scallops and conchs. *MarineFisheries* also regulates shellfish aquaculture and is required to certify that operation of private shellfish aquaculture projects at sites licensed by coastal municipalities will not have an adverse impact on shellfish or other natural resources of the city or town. Indirectly, *MarineFisheries* manages through its partnership with the coastal communities by providing technical assistance in consultation with local management authorities (elected officials and shellfish constables) in the development of management plans and regulations to protect and conserve shellfish and by providing information pertaining to increasing the supply of shellfish and protection from predators and shellfish diseases.

Sanitation - Public Health Protection Project

Shellfish Sanitation

Surveys: Public health protection is achieved as a result of sanitary surveys of shellfish growing areas to determine their suitability as sources of shellfish for human consumption. Sanitary surveys include: 1) evaluation of all pollution sources that may affect an area, 2) evaluation of hydrographic and meteorological characteristics that may affect distribution of pollutants, and 3) assessment of water quality. Each shellfish growing area must have a complete sanitary survey every 12 years, a triennial evaluation, and an annual review in order to maintain a classification which allows shellfish harvesting. Minimum requirements for each of the evaluations noted above and annual water quality monitoring are established by the ISSC and set forth in the NSSP.

The Shellfish Program collects samples from 1,494 stations in 278 shellfish growing areas in 57 communities, coastwide. In 2011, 11,209 water samples were collected and analyzed at either the *MarineFisheries* New Bedford or Gloucester laboratory. This represents an increase of 3.6% (405 more water samples) than in 2010.

Shellfish program biologists completed 313 annual evaluation reports for growing areas or classification sub-units of growing areas, 64 triennials, 15 sanitary surveys, and 37 additional annual conditional rainfall management plan evaluations.

Shellfish are also tested for bacterial quality and various contaminants based on assessment of pollution sources impacting growing areas as determined by the sanitary survey and also

as a result of pollution events such as oil spills and chemical spills or discharges. In 2011, 77 shellfish samples from growing waters were analyzed for bacterial quality. For the 2011 PSP sampling season, 1,789 shellfish samples were analyzed, up from 904 in 2010 for an increase of 49%. Of these samples, 557 were from state waters and 1,232 for the Dockside Protocol Pilot Study.

Notification: Every time a shellfish growing area undergoes a change in either an NSSP classification or in an "Open" or "Closed" status for areas classified as "Approved", "Conditionally Approved", "Restricted" or "Conditionally Restricted", a legal notice is required by *MarineFisheries*. These notices reflect the type of opening or closure, the dates, the reason, and other pertinent descriptive information and are sent to municipal managers, the state Office of Law Enforcement, Massachusetts Department of Public Health (*Mass*DPH), USFDA and other interested parties. In 2011, 460 legal notices were written, an increase of 121 notices from the prior year. This increase was largely due to closures and openings related to paralytic shellfish poisoning (PSP) and storms. PSP openings are by individual species and areas over long periods of time rather than a single large opening.

Shellfish Classification Improvements: During 2011, the Shellfish Program was involved in a number of initiatives designed to improve shellfish classifications. Some of these were ongoing at the end of year and four resulted in classification changes.

In February, *MarineFisheries* reclassified 923 acres in Mount Hope Bay (MHB 1) from Prohibited to Conditionally Approved. The reclassification affects 512 acres in Swansea and 411 acres in Somerset that have been closed to shellfishing for about 30 years. The area will be managed under a Conditional Area Management Plan with three conditional components: season, rainfall, and sewage treatment plant performance. The area will be open to harvest from February 1 – November 30 unless closed due to rain above an established threshold or a treatment plant upset. Significant upgrades in sewage collection, separation of storm water, and sewage treatment at the Fall River waste water treatment plant are the main reasons for the water quality improvement.

In March, *MarineFisheries* reclassified a portion of the South River (MB 6.1) consisting of 313 acres from Prohibited to Conditionally Approved with a seasonal opening from December 1-May 31. The South River in Marshfield and Scituate (MB 6) had been closed to shellfishing for 23 years. Both towns have worked to improve water quality over the last two decades. *MarineFisheries* shellfish staff devised a targeted sampling plan and worked with the Marshfield Shellfish Constable and citizens from Scituate and Marshfield to conduct the sampling. The area contains a healthy population of soft-shell clams as well as razor clams and quahogs. Scituate has sold 99 recreational permits while Marshfield has sold 83. The towns do not allow commercial harvesting.

In May, *MarineFisheries* upgraded Chapin Beach (CCB 23.2), a 442 acre sub-area of Dennis North Coastal (CCB 23) in Cape Cod Bay, from Conditionally Approved with a seasonal opening from October 1 – May 31 to Approved. The seasonal closure was put in place in 1992 because of unacceptable water quality believed to be caused by waterfowl. A reevaluation with extensive water sampling resulted in the reclassification to Approved allowing year-round harvesting of shellfish. The area contains soft-shell clams, razor clams, and surf clams and is harvested recreationally.

On the North Shore, *MarineFisheries* reclassified in early 2011 Malibu Beach (GBH 3.11) in Dorchester, an area with 19 acres of intertidal clam flats, from Prohibited to Conditionally

Restricted for depuration as a result of work conducted in 2010. Project staff also continued extensive testing of outer coastal waters in Rockport and the Weir River and Nantasket Beach in Hull presently classified as Prohibited. The reevaluation of the southeast corner of Joppa Flats in Newburyport continued in order to increase acreage of available conditionally restricted flat in the Merrimack River (N2.1). Other areas under investigation for reclassification include a section of the Ipswich River in Ipswich, Town River and Buckley's Bar in Quincy for depuration and four new areas in Lynn and Revere for depuration.

Vibrio: As a result of USFDA and ISSC concerns about the naturally occurring pathogen *Vibrio parahaemolyticus* associated with consumption of raw or undercooked oysters in the summer months, the water temperature monitoring study using automatic temperature recorders, initiated in 2008, was continued in 2011. Monitors were located at eight sites (June – September) and other data were obtained from additional sources. Temperature data are used to annually assess the risk of Vibrio illness and the need for more stringent requirements, such as time-to-refrigeration, for the harvest of oysters during warm weather as required by the NSSP. To date, average water temperatures have remained below threshold levels that would trigger controls However, during the summer of 2011, two epidemiologically confirmed cases of Vibrio associated with the consumption of raw oysters were reported from Eastern Cape Cod Bay. Two or more cases in one year from the same area automatically require a Vibrio Control Plan that will be implemented in 2012.

Pollution Discharge: Program biologists also comment and make recommendations regarding U. S. Environmental Protection Agency (EPA) National Pollution Discharge Elimination Permits. In 2010, 20 permits required review including 12 point source discharges from waste water treatment plants, industrial discharges, and marine animal holding facilities. The remaining eight permits involved the discharge of non-contact cooling water. Comments on public health consequences and environmental impact on shellfish growing areas were made; or direct consultation with EPA and the Massachusetts Department of Environmental Protection (*Mass*DEP) was provided to resolve issues raised by shellfish staff before final permits were issued. Recommendations and comments involved end-of-pipe fecal coliform bacteria standards and facility chlorination requirements, along with impacts associated with other industrial discharges.

PSP Monitoring

Another major aspect of the shellfish program is monitoring for naturally occurring marine biotoxins produced by microscopic algae that can cause paralytic shellfish poisoning (PSP) or red tides. Consumption of shellfish containing certain levels of PSP toxin can cause severe illness and even death. Shellfish Program personnel collect shellfish from 15 primary stations weekly from March through mid-November. Samples are sent to the *MarineFisheries* Gloucester lab where bioassays determine the levels of toxin in shellfish. If toxin is found, both the frequency of sampling and the number of sample sites are increased. Shellfish areas are closed if toxin levels exceed safe limits. In recent years—2005 and 2008 especially—the intensity, duration, and spatial distribution of toxic algal blooms have increased.

In terms of magnitude of toxicity, duration and spatial extent of species closures, 2011 ranks fairly average among recent years, with 2006 and 2009 being especially similar. These North Shore and South Shore area closures are due to PSP toxins arriving in Massachusetts after

climatic and hydrographic conditions (rain, wind, and currents) force the causative organism *Alexandrium fundyense* south from waters off the Maine and New Hampshire coasts. Figure 6 illustrates the extent of PSP closures within Massachusetts during 2011.

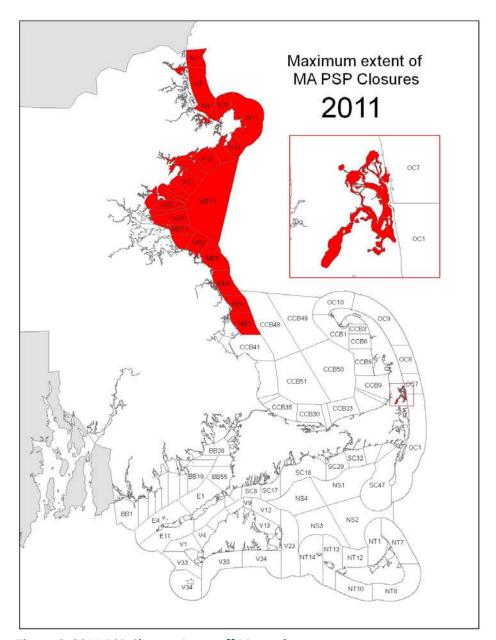


Figure 6. 2011 PSP Closure Areas off Massachusetts

The 2011 PSP monitoring season began on March 20 with three samples taken from the primary stations within the Nauset Estuarine System in the towns of Orleans and Eastham. Statewide sampling in the remaining primary stations commenced on April 5. The first closure was on April 21 to all species in growing area OC3 Mill Pond and a portion of area OC2 Nauset Harbor. On May 2, the closure was extended to include the rest of OC2 and OC4 Town Cove. The entire Nauset system was closed to all shellfishing just four days afterward, on May 6. These closures were in place until June 29, when all of OC2–OC6 was opened to

all species but moon snails. These closures represent a typical annual occurrence of PSP toxin within the Nauset Estuarine System. This event is considered separate and unrelated to the larger Gulf of Maine blooms.

The first closure outside the Nauset system in 2011 was for all species in North Shore areas N1–N14, from the New Hampshire border south to Manchester-by-the-Sea, except N2 the Merrimack River, N4 and N5 Plum Island Sound and the Ipswich River in Ipswich. This closure occurred on May 19 and four days later was extended to include all shellfish except softshell clams in N2. On May 25, all species were closed in North Shore areas N15–N28 and in South Shore areas MB1–MB14, except classification area N26.1 Pines River in Revere and Saugus. Piecemeal-style openings began with N9 Annisquam River opening to softshell clam harvest on June 25. N7 Essex Bay followed with its softshell clam opening on July 6. One month later on August 6, areas N1–N14 were opened to all species except carnivorous snails, ocean quahogs, and whole sea scallops. South Shore areas MB1–MB14 were opened to all species except carnivorous snails and ocean quahogs on August 17. The remaining North Shore areas N15–N28 were opened to blue mussels and surf clams on November 14.

A total of 1,789 shellfish samples were processed through our Gloucester lab for PSP during 2011. The samples support two activities: monitoring of in state waters (496 blue mussels, 47 softshell clams, 10 surf clams, two razor clams, and two moon snails) and a dockside monitoring program (1,232 surf clam samples, both whole animal and homogenate). The PSP season for state samples concluded on November 15, after an eighteen-week period without any detectable toxicity in blue mussels.

In addition, during this same time period, a total of 270 phytoplankton samples (individual tows) were collected and analyzed by several area biologists. This type of monitoring is based on relative abundance of phytoplankton using plankton nets and field microscopes and is directed at identifying the organisms that produce various biotoxins that cause PSP, Diarrheic Shellfish Poisoning, and Amnesic Shellfish Poisoning.

In early October, after numerous seal deaths were reported up and down the New England coast, *MarineFisheries* biologists joined a multi-state, multi-agency effort to determine the cause. Shellfish Program personnel collected two rounds of blue mussel samples from the primary PSP stations to be analyzed for domoic acid by *Mass*DPH staff at their Jamaica Plain lab. Sampling was conducted on October 4, 5, 11 and 12 with all tests negative for domoic acid. Additional phytoplankton sampling was also conducted.

During 2011, there were no reported illnesses due to red tide in Massachusetts or attributed to Massachusetts shellfish in interstate commerce.

Shellfisheries Management Project

Contaminated Shellfish Resources

MarineFisheries directly manages the contaminated shellfish resources for relaying, depuration, and commercial bait harvest.

Relaying: MarineFisheries permits municipalities to relocate bacterially contaminated shellfish to clean waters for natural purification and propagation. Relays are conducted under stringent NSSP guidelines and are heavily supervised by state and local enforcement authorities. Contaminated shellfish must remain at the recipient site for a minimum of three

months and also for the duration of one spawning season. Shellfish are tested prior to relay and again before harvest for human consumption. Quahogs are most often transplanted, but oysters and soft-shell clams are also moved. During the previous six years, between 6,400 and 8,600 bushels of quahogs have been moved annually from the Taunton River.

In 2011, seventeen towns participated in the program. A total of 13,260 bushels of quahogs were relayed; 12,840 bushels from the Taunton River to various towns on the South Shore and Cape Cod, and 420 bushels from the Centerville River to other locations within the Town of Barnstable. Also, 140 bushels of oysters were relayed from North Bay in Barnstable to other locations within the town. This method of shellfish propagation affords participating municipalities a relatively inexpensive source of shellfish to use as parent stock and reduces the temptation of illegal harvesting by reducing the standing stock in contaminated areas.

Despite the benefits, the amount of shellfish being relayed has decreased in recent years due mostly to reductions in municipal shellfish department budgets and not from the lack of available shellfish stock or interest in relaying. However, 2011 saw increases over 2010 with one more town participating and 4,265 bushels of quahogs more relayed from the Taunton River. In total, 13,400 bushels of shellfish were relayed in 2011 compared to 9,020 bushels in 2010 for an overall all increase of nearly 33%.

Depuration: The management and oversight of mildly contaminated soft-shell clams, *Mya arenaria*, is a substantial activity for *MarineFisheries*. Clams are harvested from specially designated "Conditionally Restricted" areas in Boston Harbor, Pines River, and the Merrimack River and transported by *MarineFisheries* licensed and bonded Master Diggers under strict enforcement to the Shellfish Purification Plant located on Plum Island in Newburyport. Once at the plant, the clams are treated in a controlled aquatic environment.

The Shellfish Purification Plant is a state of the art facility containing nine depuration raceways. Pure seawater is obtained from two deep salt water wells and is continuously disinfected using ultraviolet light. Depuration is a complex biological process requiring constant validation, during and upon completion of the treatment, through testing of shellfish and tank water. This is accomplished by daily testing in an on-site certified laboratory. The depuration process occurs for a minimum of three days and upon completion, the clams are returned to the harvesters, who pay a depuration fee. The purified clams are sold in commerce.

In 2011, the Shellfish Purification Plant processed 11,995 racks from 33 areas. This is a 19% decrease from 2010 when 14,829 racks were processed. Seven Master Diggers delivered clams to the Purification Plant with an average of 32 Subordinate Diggers harvesting daily. The maximum number of Subordinate Diggers working a single tide was 50. In total, 79 Subordinate Digger permits were issued in 2011. One new area was harvested: GBH3.11 Malibu Beach in Dorchester, harvested twice for 83 racks total.

The plant received shellfish on 167 dates (runs), down from 173 runs in 2010. A total of 513 lots of shellfish were processed in 2011; 512 lots were processed in 2010. In 2011, diggers harvested an average of 2.45 racks per tide, down 6% from 2010. This decrease is statistically significant, representing a continuing downward trend in harvests from all depuration areas due to resource decline, primarily in Boston Harbor from the disease neoplasia.

Shellfish Plant

The laboratory tested a total of 1,119 shellfish samples, an increase of 3% from 2010. The laboratory also analyzed 1,204 water samples for fecal coliform – no change from the previous year.

The laboratory participated in the annual USFDA laboratory compliance evaluation. This was the inaugural year of revised testing which included for the first time shellfish samples and depuration water samples. Water samples were tested using two methods, and shellfish samples using three methods. The laboratory was found to be within acceptable limits. In December, the lab supervisor participated in a separate laboratory proficiency exercise measuring fecal coliform in water samples.

Plant maintenance continued with replacement of the overhead door on the loading dock, floor resurfacing, wall repair, and painting. *Mass*DPH inspectors continued monthly inspections throughout the year. No critical issues were identified and all minor problems were addressed immediately by maintenance staff.

The plant hosted numerous tours throughout the year for a variety of individuals including the department head, several media outlets, interns and schoolchildren, and a few private shellfish companies. An open house was held on August 6 as part of a larger local event in which over 200 people toured the lab, viewed tanks of clams depurating, read plant posters, watched a 15 minute slide show on the depuration process, and investigated clams in a separate touch tank. In addition, the plant provided instructional tours for 25 kids from a local summer camp every Friday afternoon during the summer. On July 20 the plant welcomed USFDA and *Mass*DPH shellfish inspectors for a national training session. As the only publicly owned facility in the country the Plant was chosen as the depuration training facility for USFDA's Plant Standards Officer.

As the only USFDA certified Laboratory Evaluation Officer in Massachusetts, Susan Boehler was responsible for evaluating all laboratories involved in bacteriological analysis of water or shellfish acceptable to the NSSP and ISSC. This involved two *MarineFisheries* labs, a Massachusetts Water Resources Authority lab, a City of New Bedford lab, and a single industry lab. In this capacity she also provides technical assistance to these labs upon request.

Boston Harbor Soft-Shell Clam Enhancement

During spring 2011, *MarineFisheries* and its partners committed to a sixth year of enhancement and monitoring of softshell clams (*Mya arenaria*) in Boston Harbor. From June 16 through October 31, approximately 1.25 million clams, purchased from the Northeastern Massachusetts Aquaculture Center hatchery, were stocked within 80 plots at seven sites in Boston, Hingham, Hull, Quincy and Weymouth (Figure 7, Table 2). The seed clams averaged about ½ inch in shell length and were planted 25 to 30 per square foot.

Enhancement efforts were concentrated in Winthrop areas in 2011 (34% of planted clams) because of the dramatic population die-off observed on those flats. While the cause of the die-off is yet to be determined, there has been an increased prevalence of terminal-stage hemic neoplasia (a disease) found in Boston Harbor shellfish areas.

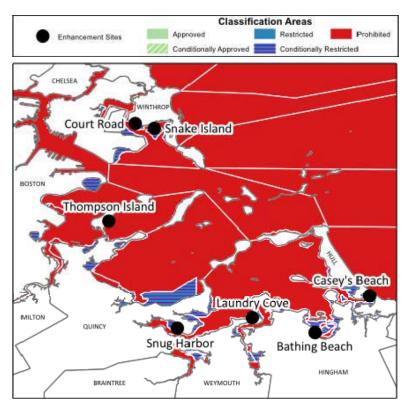


Figure 7. Location of 2011 enhancement sites

Table 2. Dates, locations and size attributes of 2011 clam seeding events

Date	Town	Site	Seed Quantity	Plots
July 12	Quincy	Snug Harbor	54,000	3
July 14	Quincy	Snug Harbor	54,000	3
July 29	Quincy	Snug Harbor	108,000	6
August 30	Quincy	Snug Harbor	90,000	5
July 20	Hull	Casey's Beach	36,000	2
June 16	Hingham	Bathing Beach	45,000	3
July 19	Hingham	Bathing Beach	36,000	2
July 5	Boston	Thompson Island	18,000	3
August 1	Boston	Thompson Island	18,000	3
August 8	Boston	Thompson Island	54,000	9
October 1	Boston	Thompson Island	6,000	1
July 7	Winthrop	Court Road	54,000	3
August 5	Winthrop	Court Road	72,000	4
September 9	Winthrop	Snake Island	54,000	3
September 12	Winthrop	Snake Island	72,000	4
September 30	Winthrop	Snake Island	54,000	3
October 31	Winthrop	Snake Island	116,000	6
July 15	Weymouth	Laundry Cove	90,000	5
July 15	Weymouth	Laundry Cove	18,000	1
August 17	Weymouth	Laundry Cove	108,000	6
September 9	Weymouth	Laundry Cove	90,000	5

The project is a cooperative effort with area diggers contracted to construct, install, and later remove predator-exclusion nets designed to protect the planted clams. *MarineFisheries* personnel monitored the enhancement plots regularly throughout the growing season to inspect for net fouling, tears, over-siltation or other impediments to clam growth and survival. All nets were extracted from the enhancement site starting in mid-December and continuing into January. Those with minor damage were repaired for reuse the subsequent year.

The highlight of all 2011 activities was a new outreach effort aimed at involving volunteers from local communities. Ongoing outreach efforts with researchers, advocacy groups, municipalities, and local commercial shellfishermen were expanded upon with the development and implementation of a multi-year educational initiative based at the Thompson Island Outward Bound Education Center in Boston Harbor. This collaborative effort is aimed at protecting the long-term commercial and biological sustainability of shellfish while educating participants on the role shellfish play in the ecology and economy of Boston Harbor. Additional partners involved in the project include: the City of Boston, Thompson Island Outward Bound Green Corps, the National Park Service, Save the Harbor/Save the Bay, Salem State University, and UMass Boston's Green Harbor Project. Two undergraduates from UMass Boston's Earth, Energy and Ocean Science program also aided the project from May through August.

On August 8, the outreach collaborative organized a soft-shell clam seeding event led by *MarineFisheries*. Over 70 volunteers from local communities assisted the project by planting more than 100,000 clams in the intertidal mudflats of Thompson Island. The seeding methodology was successfully adapted to better utilize so many volunteers. Informative talks and hands-on activities were also open to the public, which served to educate on the larger ecological picture. In the summer of 2012, Outward Bound campers and visitors to the island will have the opportunity to join in monitoring the progress of the seeded clams.

All *MarineFisheries* enhancement plots are closed to harvest for three years after clams are planted. Starting in the 2010 season, yellow buoys were deployed at enhancement sites to delineate them as closed areas and protect the validity of the plots. Buoys were placed and maintained at all 2008, 2009, 2010 and 2011 sites. In the spring, all four of the 2008 sites—Winthrop Snake Island, Weymouth Laundry Cove, Hingham Beals Cove and Rotary—were opened to commercial harvest.

Technical Assistance Project

In Massachusetts, the cities and towns manage the shellfisheries in all waters within their boundaries that are not closed by *MarineFisheries* for public health reasons, with the exception of commercial harvest of surf clams and ocean quahogs that remain under state control. The Shellfish Program assists municipalities concerning a wide variety of shellfisheries management issues by providing technical and regulatory information as well as recommendations to local shellfish managers. Assistance is furnished regarding shellfish propagation techniques, predator controls, shellfish survey methods, management openings and closures, habitat improvements, shellfish management plans, aquaculture development and regulation, water quality, sanitation and public health, and permitting. Each shellfish biologist and the program supervisor provide technical assistance to municipal managers

and boards, state and federal agencies, academia and non-governmental research and management organizations, and individuals. It is estimated that throughout 2011, staff rendered technical assistance on over 4,000 separate occasions to more than 2,000 entities.

Environmental Protection Project

Shellfish Program personnel respond to pollution events in coastal waters in order to assess possible damage to shellfish resources and to determine the need for public health closures. These events include sewage discharges, boat sinkings, petrochemical spills, and other discharges of hazardous chemicals. Several events in 2011 are detailed below.

- An incident involving a sunken local quahog dredge boat at the New Bedford state pier was investigated on September 22. No closures were required as the boat was boomed and the small amount of fuel that leaked was contained.
- On April 4, the sewer force main near Trunk River (SC 5) in Falmouth failed, discharging 200 gallons of raw sewage along the water's edge. The area was not closed because the only shellfish in the area are bay scallops which are exempt from bacteriological closures and the site was treated with chlorine. A larger discharge from the same sewer main in 2010 caused a 14 day closure of 3,510 acres.
- Two small discharges at the Massachusetts Maritime Academy treatment plant that did not require closures beyond the existing closed safety zone around the out fall in the Cape Cod Canal were investigated on March 29 and December 12.
- A major sewer line break in Braintree resulted in the closure of areas in Quincy, Weymouth, and Hingham in Weymouth Fore River and parts of Quincy Bay for over a month between September 8 and October 13. This line had periodically been a problem; this break resulted in more permanent repairs to the line.

In addition, the Shellfish Program co-reviews with other *MarineFisheries* staff various proposed coastal alteration projects with regard to impacts on water quality, shellfish resources, and shellfish habitat. Recommendations are made through the *MarineFisheries* environmental review process to the permitting agencies concerning the effects of proposed structures, and filling or discharges into the marine environment. In 2011, approximately 219 proposed projects in coastal communities were sent to the Shellfish Program for some level of review and comment. Projects ranged in size from private docks to large projects such as the South Terminal in New Bedford, the Cape Wind Proposal in Nantucket Sound, and runway safety area improvements at Logan Airport in Boston.

Program staff, principally Neil Churchill and the Program Chief, also participated in periodic meetings with the United States Coast Guard (USCG), NOAA, and *Mass*DEP relative to oil and hazardous material spill contingency planning and drills. This involved membership on two committees developing Area Contingency Plans and state Geographic Response Plans for oil and hazardous substance discharges in both Massachusetts Coast Guard Sectors. Related activities in 2011 included five planning or training meetings in Boston on January 11, New Bedford on May 11, and Swansea on July 26.

Aquaculture Permitting and Technical Assistance Project

The regulation of shellfish aquaculture is a major management and technical assistance endeavor of the Shellfish Program. This activity involves two areas of concern: licensing of sites by municipalities, and the permitting of aquaculturists to obtain and possess sub-legal shellfish (seed) for transplant and grow-out to legal size. *MarineFisheries* assists the industry and municipalities by certifying (after inspection of the project site as required by Massachusetts General Law, Ch.130, Sec. 57), that license and operation will cause no adverse effect on shellfish or other natural resources of the city or town. The required *MarineFisheries* permit is designed to allow possession of seed and to prevent the introduction of shellfish diseases, non-native species, and other pests or predators that could decimate natural populations and ruin both aquaculture and wild commercial fisheries.

In 2011, 17 new private aquaculture license sites in 8 towns totaling 63.75 acres were surveyed and approved. Provincetown and Truro each licensed abutting 25 acre subtidal aquaculture zones along the town line in Cape Cod Bay located in 25-30 feet of water. The plan is to subdivide these two zones into smaller individually licensed shellfish aquaculture sites. *MarineFisheries* is working with the two towns to mitigate adverse impacts of gear and lines on marine mammals particularly the endangered Right Whale which spends part of the year in adjacent waters.

Falmouth approved a three acre site off Megansett Harbor in Buzzards Bay. The original proposed site had to be reconfigured to exclude eel grass found during the *MarineFisheries* survey. A quarter acre site also in Falmouth, outside Eel Pond in Vineyard Sound, was also approved. Eastham granted three half acre license extensions (adding additional area to existing license sites) off Boat Meadow Creek and one new two acre site off South Sunken Meadow in Cape Cod Bay. Eastham also granted another two small extensions totaling a quarter of an acre in Town Cove. A new half acre site was approved by the Town of Orleans in Cape Cod Bay south of the entrance to Rock Harbor.

A one acre site approved by both the Town of Mashpee and *MarineFisheries* in Popponessett Bay met with resistance from abutting land owners leading to intervention by *Mass*DEP. The applicant was required to file an Environmental Notification Form (ENF) because *Mass*DEP ruled that the proposed site was in a velocity zone. This was the first time *Mass*DEP ever required an ENF from a shellfish aquaculture license site applicant. Ultimately the applicant abandoned the proposed site and is searching for a less controversial location.

Three sites (4.25 acres) in Plum Island Sound, Ipswich were also surveyed late in 2011 for consideration of approval in 2012. Fairhaven approved its first license since the late 1980s, a one acre site off Round Island.

In addition, aquaculture permits (a.k.a. propagation permits) were issued to 335 license site holders operating shellfish aquaculture projects on 406 sites totaling 1,091 acres in 29 coastal municipalities.

The 2011 value of shellfish marketed by growers, as reported in 2012 by dealers, was \$10,217,646 based on average wholesale prices. This is an increase of \$1,666,404 from 2010. Reported production in bushels for 2010 (most recent available) was: quahogs 18,398 (up from 15,983); oysters 71,831 (up from 62,335); soft shell clams 1,815 (down from 2,025); and bay scallops 7,500 (up from 5,218).

Incidences of the quahog disease known as QPX continued to occur in individual aquaculture sites in both Wellfleet and Barnstable although the number of reported cases had declined. This may in part be the result of the shift by growers away from quahogs to oysters because oysters yield a higher price for growers and because they reach marketable size quicker than quahogs due to the availability of larger seed in the spring. Additionally, *MarineFisheries* relaxed the 3" size limit on cultured oysters to 2½" longest diameter in 2011. The purpose of the size reduction was to allow growers to market a smaller "petite" oyster before they succumbed to the oyster diseases MSX and DERMO which usually occurs when oysters are between 2½" and 3" in length. At the same time, the quahog size limit was also eased for aquaculture from 1" diameter (hinge width) to $^{7}/_{8}$ " diameter as a strategy to minimize losses to QPX. Significant oyster mortalities continued to occur particularly in Buzzards Bay in oysters just under 3". About 106 aquaculture permits were endorsed for either petite oysters and under sized quahogs in 2011.

Other related activities include: assisting growers in the licensing and permitting process, providing information on aquaculture to interested parties, assisting municipalities with site selection prior to formal site survey in order to avoid *MarineFisheries* denial, assisting growers in finding seed sources, and working with hatcheries to become certified to sell seed in Massachusetts. A list of approved shellfish hatcheries is maintained on the *MarineFisheries* website.

Other Activities

The Shellfish Program continued to participate in the activities of the ISSC, the primary agency involved in setting standards for the NSSP that regulates shellfish at the national level. Shellfish Program Supervisor, J. Michael Hickey, was Chairman of the Executive Board and either chair or member to an additional six committees, including Chair of the Vibrio Management Committee. He was responsible for appointing committee members; coordinating committee and Executive Board activities; and presiding over the Conference's biennial meeting in Seattle, WA, held October 1-7. Jeff Kennedy also attended the biennial meeting as a voting delegate and gave a presentation on draft Massachusetts shellfish planting guidelines.

Program staff participates in professional organizations such as the Northeast Shellfish Sanitation Association, the Massachusetts Shellfish Officers Association, and the New England Estuarine Research Society. Michael Hickey and Jeff Kennedy attended and gave presentations at the Northeast Shellfish Sanitation Association annual meeting in Rye, NH in March 2011; additional staff participated via remote connection. In addition, the laboratory staff participates in training and workshops of the Northeast Laboratory Evaluation Officers and Managers, funded by FDA.

Under the direction of Tom Shields, Shellfish Program staff worked throughout the fall of 2011 (and into 2012) with the Massachusetts Shellfish Officers Association, *Mass*DEP, *Mass*DPH, and the Massachusetts Maritime Academy to update a two-week Shellfish Officers Training Course (scheduled for January 24 – February 5 at the Maritime Academy).

MarineFisheries developed shellfish planting guidelines based on six overarching principles that describe allowable practices, statutory and regulatory authority, permit requirements and types of available permits. The intent is to clarify and enumerate considerations for review of shellfish planting projects to benefit project applicants, as well as, local, state and federal resource and permitting agencies. MarineFisheries is interested in balancing the enthusiasm for shellfish restoration with the important goals of protecting human health, protecting wild shellfish stocks, enabling opportunities for commercial and recreational shellfishing, and fostering development of shellfish aquaculture in Massachusetts. MarineFisheries with the assistance of The Nature Conservancy (TNC) held five Public Listening Sessions in September 2011 to solicit public input for the draft guidelines and clearly define the shellfish planting oversight process within the Commonwealth. TNC facilitated the sessions and compiled comments for MarineFisheries review. The final document, Shellfish Planting Guidelines, by Michael Hickey, Tom Shields, Jeff Kennedy, and Kathryn Ford, was published in December 2011.

Shellfish staff also collected mussel samples for the Gulf of Maine Program's Gulf Watch Mussel Sampling Program and for NOAA's Mussel Watch. Samples were analyzed for metals and PCB contamination. Forty soft-shell clam samples were also collected in cooperation with West Chester University in Pennsylvania over the year to determine the extent of the soft clam disease, Hemic Neoplasia, in Massachusetts coastal waters. Neoplasia has been implicated in extensive clam die-offs in Boston Harbor.

In July of 2011, Director Diodati announced that *MarineFisheries* was re-tasking the State Lobster Hatchery in Oak Bluffs to support municipal shellfish propagation programs. To achieve this goal, *MarineFisheries* formed a new partnership with the Martha's Vineyard Shellfish Group (MVSG) to grow shellfish at the hatchery. A two-year agreement was forged allowing MVSG to use portions of the hatchery to culture bay scallops and quahogs. Access to the facility will greatly expand the MVSG's capacity to enhance the public shellfish stocks in the six towns on Martha's Vineyard. During 2011, *MarineFisheries* expended \$130,000 to renovate the existing green house for algae culture, upgrade the seawater and aeration systems, and accomplish general building maintenance. Additional improvements are planned for 2012.

Habitat Program

Personnel

Dr. Kathryn Ford, Program Leader Wesley Dukes, Marine Fisheries Biologist Tay Evans, Marine Fisheries Biologist Eileen Feeney, Marine Fisheries Biologist Dr. John Logan, Marine Fisheries Biologist Mark Rousseau, Marine Fisheries Biologist Steve Voss, Marine Fisheries Biologist Andrew Weinstock, Marine Fisheries Biologist

Overview

The goal of the Habitat Program is to protect and enhance marine fisheries resources by reviewing coastal alteration projects, writing best management policies, and conducting fisheries habitat research and restoration. The objectives of the program are to provide science-based guidance and policies that address potential impacts of coastal alteration activities to fisheries resources and habitats of the Commonwealth, to initiate and perform fisheries habitat research and applied studies, to develop and oversee *MarineFisheries'* climate change program, and to coordinate technical responses to emerging issues. The Habitat Program provides input to the Massachusetts environmental permitting process through review and comment to permitting agencies on a project's potential impact to marine fisheries resources and habitats.

In 2011, Habitat Program staff reviewed 544 projects, representing 104 municipalities. Major project reviews included a variety of energy, dredging, monitoring, and coastal development projects. Two multiple-year technical guidance / policy projects were completed: the "Recommended Time of Year Restrictions (TOYs) For Coastal Alteration Projects to Protect Marine Fisheries Resources in Massachusetts," and the "Summary of Marine Fisheries Resource Recommendations for Municipal Maintenance Hydraulic Dredging Activities on Cape Cod and the Islands." The in lieu fee mitigation program continues in its development toward an expanded statewide program, and a grant was received to aid in planning of restoration projects to be done under that program. Under the five-year HubLine eelgrass restoration program, one biologist and one fisheries supervisor were hired, and half an acre of eelgrass was planted. The Habitat Program conducted video sampling and analysis on two research cruises aboard the Environmental Protection Agency (EPA) vessel, the OSV Bold, to support NEFMC Habitat Plan Development Team (PDT) data needs and Massachusetts Ocean Plan data needs. We completed our first side-scan sonar and single beam sonar mapping of eelgrass beds in Manchester. Program staff also represented MarineFisheries on a variety of committees and supported other Division programs.

Technical Review Project

The goal of the Technical Review Project is to protect and enhance marine fisheries resources by providing information regarding those resources to regulatory agencies during coastal alteration permit review. This project is also responsible for recommending mitigation and tracking mitigation projects. To meet these goals, the Technical Review team tracks coastal and marine construction projects, solicits specific resource information from *MarineFisheries* biologists, conducts literature reviews and site visits, writes project comment letters, reviews options for compensatory mitigation, and participates in interagency meetings. The Technical Review team also creates programmatic approaches to resource recommendations, improves access to coastal resource information, and supports research specific to review needs. The major tasks and projects are as presented below.

Technical Review

The Project continues to respond to a high volume of requests for technical review for specific construction permits as well as for reviewing state and federal policy documents. In 2011, 544 specific projects in 104 municipalities were reviewed. Three full-time staff members, two in New Bedford and one in Gloucester, dedicate up to 75% of their time on technical review. Two contractors, one full-time and one part-time, continue to play a vital role in maintaining records and assisting with the preparation of our comment letters in both field offices.

Major review projects included Massport safety area expansion at Logan Airport, Muskeget Channel tidal energy, Quincy Town Brook improvement project, New Bedford South Terminal, Manchester dredging, Northeast Gateway 3rd Year Monitoring, Cape Cod Comprehensive monitoring plans, Comcast Fiber Optic Cable, Pappas Commerce Center in Boston, Whittier Bridge, South Coast Rail, and the US Army Corps of Engineers (Army Crops) General Permit Amendment. They all involved multiple meetings, workgroups, and interagency communications due to the complexities of the proposals. There has also been extensive involvement with the Massachusetts Department of Transportation (*Mass*DOT), including several project reviews and on-site meetings, work toward anadromous mapping sponsored by *Mass*DOT and *MarineFisheries'* request for a cofferdam turbidity study to be conducted by *Mass*DOT.

Time of Year Work Windows

Two major projects were finalized in 2011. The first was a comprehensive update of our time of year recommendations. This report includes robust, literature-supported explanations of how the recommendations are established, and involved consultations with many experts both within and external to *MarineFisheries*. The timing of this project coincided with an update of the Army Corps General Permit, so it was tailored to be included as a reference within the General Permit, providing time of year restriction parameters that define the Category I review threshold. The document, "Marine Fisheries Time of Year Restrictions (TOYs) for Coastal Alteration Projects," co-authored by Dr. Kathryn Ford and Tay Evans (with Gary Nelson and John Sheppard), was added to the *MarineFisheries* Technical Report Series (#47).

The second project involved creating a programmatic time of year recommendation for the Barnstable County Dredge. This project involved creating a habitat map for all Cape Cod embayments, linking dredge locations with resource information.

Both of these projects were discussed at length with other resource agencies and town representatives and both were presented at scientific meetings. The shellfish suitability layer was updated to reflect the time of year recommendations for all species represented and provided to the Massachusetts Office of Geographic Information (MassGIS) for posting.

Anadromous Mapping

In the interests of generating a programmatic approach to time of year work windows for the *Mass*DOT Accelerated Bridge Program, a project was initiated to map all streams and spawning habitat for anadromous species. The *Mass*DOT-funded project is utilizing the data and expertise of several *MarineFisheries* biologists, and both *Mass*DOT and *MarineFisheries* will benefit from the spatial database of fish runs. The Habitat Program facilitated the initiation of this project and has provided technical expertise in terms of GIS and mapping needs as well as how to build time of year considerations into the project.

Standard Protocols

In order to achieve improved consistency with our review of projects, the Technical Review Manual was initiated in 2009; it was completed in 2011. A component of this larger vision was a comprehensive document describing the data needs associated with assessment of impacts on marine fisheries resources. A draft titled "Essential data for assessing biological impacts to fisheries resources and habitats from construction activity" is currently under review within the program, and is anticipated to be published in the Technical Report Series.

In Lieu Fee Program

This was the third year of the *MarineFisheries* and Army Corps of Engineers (ACOE) In Lieu Fee program. This program addresses authorized impacts of <1 acre in extent to aquatic resources, in particular Essential Fish Habitat (EFH) and aquatic habitats of managed diadromous fish and marine finfish and shellfish species in Massachusetts' waters, resulting from projects permitted under the Massachusetts General Permit (GP). Fourteen projects impacting 12,193 ft² of aquatic habitats have contributed \$137,098 to the program through 2011.

During 2011, three important programmatic developments occurred: 1) a deadline and monetary benchmark was established for disbursing the first round of collected ILF funds for mitigation projects; 2) restoration areas and potential restoration projects were identified as a priority need in the development of the program prior to funding mitigation projects, and the ILF Program received a \$20,000 grant funded through the Massachusetts Bays Program to address this need; and 3) a conceptual summary was drafted by the Massachusetts Department of Fish and Game (DFG) outlining a new statewide ILF program covering marine and freshwater habitats; Program staff continue to work with DFG staff and the Army Corps in developing a Prospectus and Comprehensive Planning Framework for an expanded ILF Program that will address

impacts for unavoidable impacts under the GP as well as unavoidable impacts associated with Individual Permit projects.

In October 2011, MarineFisheries submitted the ILF Annual Report to the Army Corps.

Fisheries Habitat Research Project

The goal of the Fisheries Habitat Research Project is to conduct research, monitoring, and restoration relevant to the mapping, identification, and quality of marine fisheries habitats (Figure 8). This project also aids in the creation of new data products now viewed as critical in the fisheries management community (e.g., seafloor maps). Research that the Project is currently working on includes eelgrass monitoring, restoration, and conservation; artificial reef siting, construction, and monitoring; and seafloor mapping. Project staff serve on a variety of habitat-related committees, including the ASMFC Habitat and Reef Committees, the Atlantic Coastal Fish Habitat Partnership, the NEFMC Habitat Plan Development Team, and the Coastal and Marine Ecological Classification Standard working group. We also participated in working groups for the Boston Harbor Habitat Atlas.



Figure 8. Clockwise from upper left: *MarineFisheries* booth at the seafloor mapping exposition at the Ocean Explorium; lobster on Jeffrey's Ledge; mooring scar in sidescan sonar record; lobster in eelgrass in Manchester.

Sediment Database

The Habitat Research team assembled sediment data from grab sampling and video sampling to create seafloor substrate maps for the Massachusetts Ocean Management Plan. We completed fully compliant metadata and released the dataset to NOAA's National Geophysical Data Center. We continued to compile additional datasets and develop quality assurance procedures for the dataset. A report, "Seafloor sediment composition in Massachusetts determined using point data," describing the dataset and a quality assessment, co-authored by Dr. Kathryn Ford and Steve Voss, was released in early 2011 in the *MarineFisheries* Technical Report Series (#45). We continue to add to and improve this dataset and it represents a successful collaboration with the Massachusetts Office of Coastal Zone Management (*Mass*CZM), that has contributed greatly to the content and quality control of the dataset.

The Habitat Research team conducted research focused on furthering seafloor mapping. A single-beam sonar study on the SeagrassNet monitoring site in Salem Sound was completed, as was a side-scan sonar map of mooring scars in an eelgrass bed in Manchester Harbor (using an instrument on loan from MIT SeaGrant). In August and September of 2011, the Project team conducted video sampling and analysis on the Ocean Survey Vessel *Bold*, an EPA research vessel. The first cruise supported NEFMC Habitat PDT data needs on Jeffrey's Ledge in the Gulf of Maine. SMAST donated portions of the video system used to collect 506 seafloor images in an area with few existing samples. The second cruise was done in support of *MassCZM* efforts to fill in gaps in seafloor sediment data. We developed and built a nearshore high definition video sampling system that was deployed off of a 17-foot boat that took day trips from the *Bold*, enabling sampling in waters too shallow for the *Bold* to operate. We sampled 116 stations and provided quantification of known hard bottom areas off of Martha's Vineyard, Nantucket, and southern Cape Cod Bay. Funding for the cruises was provided by EPA, the Massachusetts Ocean Waterways Trust Fund, and *MarineFisheries*.

The Project also maintains a blog to promote discussion of seafloor mapping tools and issues. It is online at: seafloormapping.blogspot.com.

Eelgrass

The Habitat Research team provides regional leadership in the field of eelgrass research and restoration. *MarineFisheries* was awarded a contract in 2009 to restore two acres of eelgrass damaged as a result of the construction of the HubLine pipeline. Preliminary site work was completed in 2010 and two employees were hired in 2011 to work on the restoration. Half an acre of eelgrass was planted and ten sites were test-planted in 2011. New planting methods were explored and a method comparison study initiated in collaboration with researchers at Cornell Cooperative Extension. New methods and planting designs will be employed in 2012 to improve the likelihood of success (a hurricane in the fall of 2011 severely damaged the newly planted bed).

We also participated in a Nature Conservancy-funded eelgrass genetics study with the University of New Hampshire, and are collaborators on a NOAA grant to conduct eelgrass research in mooring scars. Associated with the NOAA grant, we are using SCUBA to measure eelgrass parameters within scars created by mooring chain drag on

the seafloor. The in-water data are being used to compare remote-sensing methods of identifying scars.

In addition to research and restoration, the Project team is in its fifth year of monitoring a long term transect in an eelgrass bed in Salem Sound, as part of the international SeagrassNet monitoring program. *MarineFisheries* continues to coordinate the Massachusetts Interagency Seagrass Group, an informal network designed to maintain and improve communications across researchers and managers involved with seagrass. A blog was launched to help address the communication needs of the group: seagrasssoundings.blogspot.com.

Artificial Reefs

The Habitat Research team continued to support efforts involved with establishing artificial reefs in coastal waters of Harwich and Yarmouth consistent with the Artificial Reef Plan. Extensive site selection was completed in 2009 and 2010, culminating in a final siting report with a presentation to involved stakeholders. The groundwork for submitting permit applications in 2012 was accomplished in 2011.

Climate Change Project

The Climate Change Project was created in 2010 with the goal of providing data and analysis regarding the effect climate change is having on fisheries and marine habitats in Massachusetts. In 2011, the Project developed strategies and priorities to address ecosystem changes and fisheries impacts resulting from climate change and ocean acidification. We also created actions for the coming year consistent with the strategies and priorities. They are: 1) meeting with program leaders to assemble climate-related data; 2) examining how to identify optimal locations for a carbon dioxide sensor network; and 3) drafting a policy document regarding the impacts of beach fill activities on marine fisheries resources.

Other Activities

Offshore Wind Energy

There has been considerable focus on the development of offshore wind energy in recent years in Massachusetts. The Habitat Program has provided support and information to the Executive Office of Energy and Environmental Affairs as well as to the Bureau of Offshore Energy Management by participating in the Massachusetts Renewable Energy Task Force and the Joint RI-MA Renewable Energy Task Force. We participated in a Fisheries Summit organized by the Massachusetts Ocean Partnership (now SeaPlan).

Outreach & Peer Review

Habitat Program staff provided scientific peer review for grants and manuscripts submitted to Aquaculture Research, Bulletin of Marine Science, Environmental Biology of Fishes, Fishery Bulletin, ICES Journal of Marine Science, Journal of Experimental Marine Biology and Ecology, Journal of Fish Biology, Journal of Quaternary Science, Limnology

and Oceanography, Limnology and Oceanography Methods, Marine and Freshwater Research, Marine Biology, Marine Ecology Progress Series, Methods in Ecology and Evolution, Maine Aquaculture Innovation Center, MIT SeaGrant, ACFHP, Estuaries and Coasts, and Northeastern Naturalist.

Habitat Program staff continued its tradition of participating in a variety of outreach events. Efforts included manning booths at the Working Waterfront Festival, the Boston Boat Show, the Topsfield Fair, and Salem Sound Coastwatch events. We also organized presentations at Salem State University's Women in Science and Engineering Conference and gave presentations at local schools, including leading a field trip to Gloucester to demonstrate smelt spawning to high school students. The Fisheries Habitat Program coordinated with CZM and USGS to organize a seafloor mapping exposition at the Ocean Explorium in New Bedford in July 2011. For the ASMFC annual meeting in Boston, the Fisheries Habitat Program organized a field trip highlighting fish passage restoration in Massachusetts and provided three posters. Presentations were given at two scientific conferences: the Northeast Estuarine Research Society at their seasonal meeting in Long Island and at the Coastal and Estuarine Research Federation in Florida. Habitat Program staff is also serving on one graduate student thesis committee at Northeastern University and gave two lectures in university courses and seminar series.

Publications

In addition to the publications mentioned previously, Habitat Program staff authored or co-authored a number of publications in 2011. Dr. Kathryn Ford contributed to "Shellfish Planting Guidelines for Massachusetts", part of *MarineFisheries'* Policy Series. John Logan co-authored "Foraging ecology of leatherback sea turtles in the western North Atlantic determined through multi-tissue stable isotope analyses," published in *Marine Biology*. Dr. Ford, Eileen Feeney, and Tay Evans contributed "Summary of Marine Fisheries Resource Recommendations for Municipal Maintenance Hydraulic Dredging Activities on Cape Cod and the Islands" to *MarineFisheries'* Policy Series. John Logan was co-author to "Variability of albacore (*Thunnus alalunga*) diet in the Northeast Atlantic and Mediterranean Sea," and "Diet of young Atlantic bluefin tuna (*Thunnus thynnus*) in eastern and western Atlantic foraging grounds," both published in *Marine Biology*.

FISHERIES BIOLOGY SECTION

Dr. Michael Armstrong, Section Leader

Fish Biology Program

Personnel

Dr. Gary Nelson, Program Manager
William Hoffman, Senior Biologist
Brian Kelly, Biologist
Brad Schondelmeier, Assistant Biologist
Micah Dean, Senior Biologist
Scott Elzey, Biologist
Kimberly Trull, Ageing Technician
Kate L'Heureux, Ageing Technician
Jennifer Stritzel-Thomson, Assistant Biologist
Nicholas Buchan, Assistant Biologist

Overview

The objectives of the Fish Biology Program are to collect, process, and analyze biological data on recreationally- and commercially-important fishes needed for effective, science-based management of Massachusetts' fisheries resources. Biological data collected from harvested and released fishes include age structures (i.e., scales, otoliths, vertebrae), length frequencies, maturity stages, and bycatch levels. All data are used in stock assessments to determine the status of those resources. In addition, information on catch and effort of recreational anglers are collected via volunteer surveys. Special research projects are also conducted to address specific management actions.

Age and Growth Project

In 2011, staff cleaned, processed, and aged hard-part structures from recreational and commercial samples of bluefish, river herring (alewife and blueback herring), American shad, smelt, striped bass, tautog, and white perch. Structures collected from a study of wolffish were also processed and aged. Table 3 shows the number of structures processed and aged.

Much of 2011 was spent ensuring that ages produced in the lab were as accurate as possible. Staff attended an ASMFC-sponsored bluefish ageing workshop, chaired by the Recreational Fisheries Project Coordinator, to ensure consistent ageing methods between states. Structure comparisons were investigated for tautog, river herring, striped bass, shad, and wolffish. Whole otoliths were deemed best for aging river herring and shad. Sectioned otoliths worked better for striped bass and wolffish. Another ASMFC workshop is scheduled for 2012 to discuss ageing methods for tautog. Reference collections were compiled for river

herring and supplemented for smelt. The lab will continue to improve ageing and quality control methods in 2012.

Table 3. Samples processed for age in 2011

Species	Structure	Process	Quantity (Fish)	Sample Dates
Bluefish	Otoliths	Baked, Sectioned, Aged	83	2011
River Herring	Scales	Cleaned, Mounted, Aged	2,240	2011
River Herring	Otoliths	Extracted, Aged	202	2011
River Herring	Scales	Reference collection created	329	2010-2011
Shad	Otoliths, Scales	Otoliths aged, scales checked for repeat spawning	259	2011
Shad	Scales, Otoliths, Vertebrae, Opercula	Structure comparison study	562	2008-2011
Smelt	Scales	Cleaned, Mounted, Aged	930	2011
Striped Bass	Otoliths	Extracted, Sectioned, Aged	170	2011
Striped Bass	Scales	Cleaned, Pressed	905	2011
Tautog	Opercula	Previous ages revised	213	2001
Tautog	Opercula	Cleaned, Aged	283	2011
Tautog	Otoliths	Baked, Sectioned, Aged	54	2011
White Perch	Scales	Cleaned, Pressed, Aged	114	2011
White Perch	Scales	Aged	500	2008 – 2010
Wolffish	Otoliths	Extracted, Sectioned, Aged	303	2011

Fisheries Dependent Sampling Project

The Fisheries Dependent Sampling Project is responsible for the oversight and sampling of commercial fisheries, implementation of fish biology studies, and support to other projects and senior staff.

Commercial Fisheries Sampling

MarineFisheries conducts at-sea and shore-side (port) sampling of commercial fisheries to document fishery performance and collect biological samples for stock assessment research. Data collected strengthen MarineFisheries' participation on — and contributions to — the fishery management councils and ASMFC. Sampling efforts in which project staff participated during 2011 are shown in Table 4. Units for at-sea sampling are shown as number of sea days and port sampling are shown as number of sampling events, or trips, made to intercept vessels or dealers where information was successfully collected.

Additionally in 2011, a two month study was conducted in Massachusetts Bay to document catch, effort, and cod stock demographics information of the demersal gillnet fishery. With assistance of contracted sea samplers, 50 trips were completed and results were presented to *MarineFisheries* managers for the use in evaluating Massachusetts non-federal groundfish fishery.

Table 4. Participation by Fisheries Dependent Sampling Project staff in commercial sampling and other sampling projects during 2011

At Can Compling (Can Days)	North	South
At-Sea Sampling (Sea Days)	Shore	Shore
Coastal Lobster (commercial)	20	29
Marine Recreational Information Program (recreational)	9	
Resource Assessment (fishery-independent)	11	2
Acoustic Tagging (fishery-independent)	53	
Atlantic Cod (commercial)	8	3
Squid (commercial)		4
Striped Bass Tagging (fishery-independent)	2	
Summer Flounder (commercial)		7
Whiting Raised-Footrope (commercial)		1
Smelt Fyke Net (fishery-independent)		3
Winter Flounder Young-of-Year (fishery-independent)		4
Total	103	53
Port Sampling (Intercepts)	North	South
Tort Sampling (intercepts)	Shore	Shore
Striped Bass Market Sample (commercial)	10	20
Atl. Sea Herring Bycatch Study (commercial)	66	4
Atl. Sea Herring Mid-water Trawl (commercial)	5	
Herring GSI (commercial)	6	
Northern Shrimp (commercial)	15	
Menhaden (commercial)	1	
Spiny Dogfish (commercial)		8
Total	88	12

Small Pelagic Fishery Dockside Monitoring and Avoidance System

MarineFisheries has conducted portside sampling of the herring and mackerel fisheries since 2008 with the goal of quantifying catch composition and verifying landings to assist stock assessment and management. The River Herring Bycatch Avoidance Study was conducted for the second year, supported by a grant from the National Fish and Wildlife Federation and collaboration with SMAST and the commercial fishing organization, Sustainable Fisheries Coalition. The goal of the study is to develop a bycatch avoidance incentive system to minimize the bycatch of river herring in the mid-water trawl fishery. Through this grant, and with the assistance from a contracted sea sampling program, we sampled 80 trips (dockside) which increased port sampling levels to cover 52% of the trips landed in Massachusetts.

The Fisheries Dependent Sampling team was responsible for the following activities performed in 2011: coordination of port sampling staff; participation and support of *MarineFisheries* staff at NEFMC and Herring Plan Development Team meetings; conduct and oversight of port sampling; contracting of port sampling staff and management of this staff; outreach and enlistment of fishery stakeholders for the participation in the bycatch avoidance study; presentation of the bycatch avoidance study at the Sustainable Fisheries Coalition captains' meeting; training of sampling staff; and data maintenance and entry into a relational database.

Special Fisheries Research Projects

Cod Conservation Zone (CCZ) Investigations

Working in collaboration with SMAST, Program staff continued studies using acoustic telemetry, data storage tags, traditional t-bar anchor tags, and underwater video to help understand the fine-scale population structure of inshore Atlantic cod, as well as their behavior and movement patterns. In 2011, 116 Atlantic cod were tagged with data storage tags, four of which were also tagged with acoustic transmitters, and 889 cod with traditional t-bar tags. An acoustic array of 28 Vemco receivers was deployed in the Spring CCZ to detect cod spawning aggregations and their movements in non-real time. Data collection was also conducted in the Winter CCZ to document cod spatiotemporal distribution and stock demographics.

A new collaborative research initiative with NOAA / Stellwagen Bank National Marine Sanctuary (Sanctuary) began in 2011. Through the deployment of passive acoustic hydrophones, DMF and the Sanctuary will study the vocalizations made by cod while spawning. If spawning cod can be identified through vocalizations, then a passive acoustic detection system could be developed to aid researchers in identifying spawning aggregations. The results of these efforts will provide managers with information to help support the management and protection of spawning aggregations and provide researchers with insight on cod reproductive behavior.

Duties preformed by Program staff included coordination and implementation of all tagging efforts and field related activities; collaboration with SMAST and Sanctuary partners; data management and analysis; and presentation of findings to *MarineFisheries* senior staff, the Stellwagen Bank Sanctuary Advisory Committee, and NOAA Fisheries Northeast Regional Office. A manuscript by Micah Dean, William Hoffman, and Dr. Michael Armstrong entitled "Disruption of an Atlantic cod (*Gadus morhua*) spawning aggregation as resulting from the opening of a directed gillnet fishery" was accepted for publication in *North American Journal of Fisheries Management*.

Striped Bass Research Project

Massachusetts is home to the one of the largest striped bass fisheries in the country. High population abundance of striped bass, the diversity of the Commonwealth's nearshore habitat, and many sources of food for stripers are major factors contributing to the success of this fishery. Without a doubt, striped bass are the backbone of our recreational industry and provide enjoyment to hundreds of thousands of recreational anglers each year. Accordingly, we give this important resource a high level of attention by conducting many special investigations and monitoring programs designed to support the regional management process.

Survival Tagging Study

MarineFisheries joined the Striped Bass Cooperative State-Federal Coast-wide Tagging Study in 1991. The study's primary objective has been to develop an integrated database of tag releases and recoveries that will provide current information related to striped bass mortality and migration rates. During 2011, Striped Bass Research Project staff conducted

15 trips aboard contracted vessels, tagging a total of 502 striped bass. Staff, volunteer anglers, and vessel captains were coordinated via daily phone calls and e-mails for all trips. Trip data were entered into appropriate databases.

Market Sampling

Continued and improved monitoring of the age, size, and sex composition of the commercial harvest of striped bass is indispensable for identifying effective management and for substantiating estimates of mortality derived from fishery-independent sources. The objective of this project is to generate a time series database of biological characteristics of Massachusetts's commercial striped bass landings. During 2011, Striped Bass Research Project staff conducted 13 market sampling trips, collecting length, weight, and age structures (scales) from 416 commercially-caught fish.

Acoustic Tagging Study

The Acoustic Tagging Study is a two-phase, multi-year effort to provide fisheries managers with information that can be used to enhance evaluations of striped bass fishing mortality and the impact of the prohibition on recreational striped bass fishing in the Federal Exclusive Economic Zone (EEZ). The primary objective of the study is to determine if striped bass located in the EEZ, adjacent to Massachusetts, enter Massachusetts territorial waters. The secondary objectives are to identify the spatiotemporal patterns of local striped bass movements, confirm if the Cape Cod Canal is an important passageway for striped bass migration, and further investigate the temperature and depth preferences of migrating striped bass.

During 2011, staff deployed and maintained a 32-receiver acoustic array from Cape Ann to Truro; collected, entered, and audited acoustic data; provided collaborating researchers with acoustic detections recorded on the array; and processed tag returns. The acoustic tags will be active through 2012, meaning it will be the final year of data collection.

Volunteer Recreational Angler Data Collection Program

The objective of the Volunteer Recreational Angler Data Collection Program is to generate a time series database of biological characteristics of Massachusetts's striped bass recreational harvest and discards. These data are vital to stock assessments and selecting effective management measures. During 2011, over 2,160 paired length/age samples were collected by participating anglers. Thirty-six anglers also registered to use the web-based *eLogbook* to submit trip information; they entered 2,300 length records on striped bass and 20 other species of marine fish. An in-house report on the *eLogbook* was prepared. A carcass collection project was continued in 2011 to obtain otolith samples from striped bass. Volunteer recreational anglers were asked to keep and store filleted carcasses in freezers placed at three sites along the Massachusetts coast. Volunteers donated over 170 carcasses.

Other Activities

Sportfisheries Technical Assistance

Fish Biology Program staff provide technical expertise to other governmental organizations, private groups, and individuals with concerns about marine fisheries and serve on technical and advisory committees to support management efforts of important marine species. In 2011, Dr. Gary Nelson served as the Massachusetts representative to the ASMFC's striped bass tagging, technical, and stock assessment sub-committees, and the river herring stock assessment sub-committee; Micah Dean served on the ASMFC menhaden technical committee and multispecies committee; and William Hoffman served on the ACCSP bycatch and biological sampling priorities committees. In addition, Dr. Nelson developed a Visual Basic/AD Model Builder program that analyzes striped bass tag return data by using the instantaneous tag return models, and conducted the entire 2011 ASMFC striped bass coastwide assessment.

Publications

In addition to the publications previously mentioned, Dr. Gary Nelson contributed a monitoring report of Massachusetts' 2010 striped bass fishery to the Division's Technical Report Series (#48).

Assessment and Survey Program

Personnel

Steven J. Correia, Program Manager

Resource Assessment Project

Jeremy King, Senior Biologist Matthew Camisa, Biologist Vincent Manfredi, Biologist

Invertebrate Fisheries Project

Robert Glenn, Project Leader
Vin Malkoski, Senior Biologist
Derek Perry, Biologist
Tracy Pugh, Biologist
Kelly Whitmore, Biologist
Steve Wilcox, Assistant Biologist
Mike Trainor, Seasonal Fisheries Technician
Jillian Weber, Seasonal Fisheries Technician

Protected Species Project

Erin Burke, Protected Species Specialist

Scientific Diving Project

Holly Martel Bourbon, Diving Safety Officer

Overview

The Assessment and Survey Program includes the Resource Assessment Project, Invertebrate Fisheries Project, Protected Species Project, and Scientific Diving Project.

The **Resource Assessment Project** monitors the distribution, relative abundance, and size composition of marine fish and invertebrates in Massachusetts' territorial waters by conducting annual surveys utilizing consistent protocols. The year 2011 marked the completion of the 34th consecutive annual spring and fall statewide trawl surveys and the 36th consecutive annual seine survey conducted in Cape Cod estuaries. Data provided by the surveys are used in assessments of numerous regional fish stocks. In addition the surveys inform fishery management decisions in state waters and contribute to evaluation of coastal alteration projects.

The Invertebrate Fisheries Project focuses on research and monitoring of commercially important marine invertebrates including American lobster, horseshoe crab, channeled whelk, Jonah crab, and northern shrimp. Fishery-dependent and fishery-independent surveys as well applied research projects are conducted to characterize the populations of, and the fisheries for, these valuable species as well as to inform the management of these species. Additional tasks include research grant writing and administration and participation in ASMFC fisheries management and stock assessment meetings for key invertebrate species.

The **Protected Species Project** is involved in a variety of activities related to the conservation and management of protected species in Massachusetts waters. In 2011, this covered all efforts of the Large Whale Conservation Program, including the right whale surveillance program, acoustic monitoring of right whales, and large whale disentanglement. In addition, project staff oversees and participates in work on other protected species, such as harbor porpoise and sea turtles. In 2011, these activities covered a range of issues such as the sea turtle disentanglement network, ghost gear removal, acoustic validation of right whale calls, the Massachusetts Lobster labeling and promotion campaign, participation in three federal Take Reduction Teams, general grant management, and providing protected species guidance to *MarineFisheries* staff.

The **Scientific Diving Project** is responsible for the safe management of the scientific diving activities conducted by *MarineFisheries*. Currently operated in accordance with the Occupational Safety and Health Administration's scientific diving exemption, formal standards for training and dive operations afford *MarineFisheries'* divers better protection from accidental injury and/or illness. Since the Dive Program's inception, diving within *MarineFisheries* has markedly increased and contemporary diving and risk management procedures are warranted.

Resource Assessment Project

2011 Trawl Survey

The 34th spring and fall surveys were accomplished in 2011 aboard the R/V Gloria Michelle. During the spring survey, 102 stations were completed in 15 sampling days from May 3-20. During the fall survey, 97 stations were sampled successfully from September 8-21 (Figure 8).

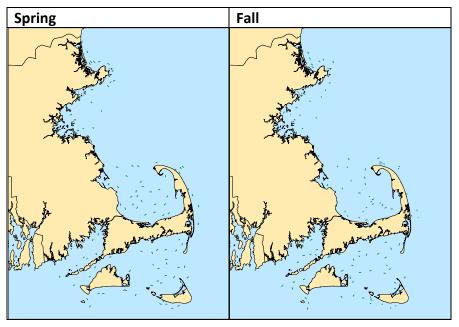


Figure 8. 2011 spring and fall trawl survey station locations

A combined total of 104 different species of fish and invertebrates were weighed, counted, and measured during the 2011 trawl surveys. To aid cooperative fisheries assessments, over 3,000 scale/otolith samples, and sex and maturity observations were taken from Atlantic cod, haddock, summer flounder, yellowtail flounder, winter flounder, windowpane flounder, black sea bass, and scup. As started in 2010, data were collected digitally, providing for immediate data availability for auditing and eliminating the need for post-survey data entry.

Indices of abundance and trends in abundance from the trawl surveys were displayed in posters developed by Project personnel for the ASMFC annual meeting in Boston. At the same meeting, a presentation on the history, methods and products provided by the trawl survey was given to the ASMFC NorthEast Area Monitoring and Assessment Program board.

2011 Seine Survey

The 35th Nantucket Sound Estuarine Winter Flounder Young-of-Year (YOY) Seine Survey was completed from June 21 – July 11, 2011. The primary objective of this survey is to provide a winter flounder YOY abundance index for the Southern New England stock; however, all commercially and recreationally-important finfish and invertebrates are counted. All species not counted were noted for presence.

The 2011 pooled (all strata combined) winter flounder YOY index is 0.247 YOY / m². This marked increase in abundance comes after a decade of observations below the time series median (Figure 9). The YOY summer flounder index dropped below the time series median in 2011, the second year at or below the median, following the four highest years on record (Figure 10). A total of 41 species were encountered in seine hauls.

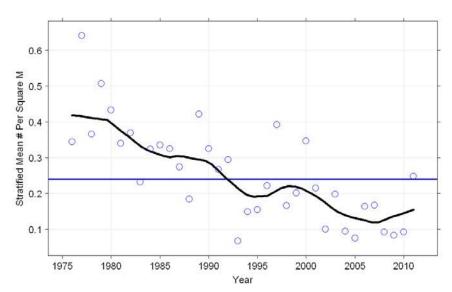


Figure 9. Abundance index for YOY winter flounder, *Pseudopleuronectes americanus*, in Southern New England from the seine survey, 1976-2011

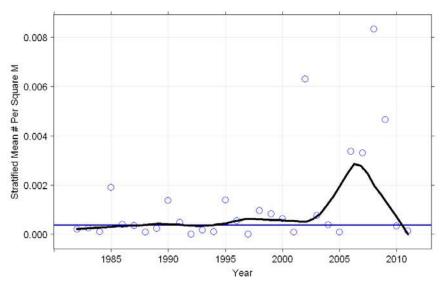


Figure 10. Abundance index for YOY Summer Flounder, *Paralichthys dentatus*, from the seine survey, 1982-2011

Assessment and Fisheries Management Support

Project personnel completed the ASMFC compliance report for winter flounder, and provided survey data and/or summary graphics to other *MarineFisheries* biologists for inclusion in compliance reports for numerous other ASMFC-managed species. Survey data supported regional stock assessments for Gulf of Maine and Southern New England winter flounder stocks at SARC 52, black sea bass and Gulf of Maine cod assessments at SARC 53, and scup and fluke assessment updates. Survey indices of American plaice, witch flounder, ocean pout, and wolffish were provided to NEFMC staff in preparation for multispecies groundfish updates. Survey data was provided to U.S. Fish and Wildlife Service (USFWS) personnel to inform their update of a comprehensive conservation plan for Nantucket Sound. Survey data was provided to inform state management decisions on whelk and cod fisheries in addition to supporting environmental review processes.

Requests for survey data were filled to support research at other government and academic institutions across New England including a study on potential fishery productivity changes in Massachusetts Bay as a result of changes in sewage treatment outflow; the development of an ecosystem service model of Massachusetts Bay; a study on the stock structure of groundfish; and research on shorebird feeding and prey availability. Seine data were provided in a standardized format to Northeast Fisheries Science Center personnel to accompany trawl survey data in the development of a georeferenced Essential Fish Habitat database. A summary of the seine survey data from the Waquoit Bay stations was provided to the Waquoit Bay National Estuarine Research Reserve to support research by staff and visiting researchers.

Commercial Lobster Trap Sampling

The 31st year of Commercial Lobster Trap Sampling was completed. This is an ongoing cooperative effort conducted with Massachusetts commercial lobster fishermen dating back to 1981. A total of 80 trips were conducted in 2011, during which 41,289 lobsters were sampled from 15,400 trap hauls.

Data from the commercial trap sampling program contributed to *MarineFisheries'* bi-annual lobster status of the stock report, and were provided to the ASMFC and ACCSP.

Ventless Lobster Trap Survey

The 6th year of the Coastwide Ventless Trap Survey was completed. The survey is a multistate cooperative effort between state fisheries agencies and commercial lobstermen to evaluate American lobster in coastal waters from Maine to New York. It utilizes a random stratified survey design to provide a more precise relative abundance index and adequate characterization of size distribution. This survey design allows biologists to develop more precise estimates of lobster relative abundance and to adequately characterize the size distribution of lobsters in coastal waters.

In 2011, with additional funding from the Commercial Fisheries Research Foundation, the survey was expanded in Southern New England waters to include the federal portion of NMFS Area 538, as well as the northern portion of

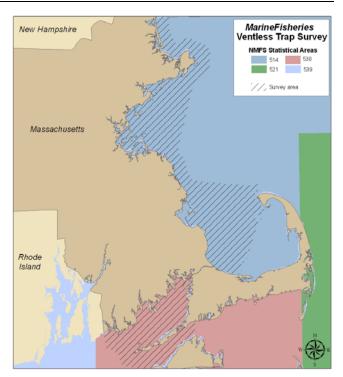


Figure 11. *MarineFisheries* Ventless Trap Survey areas inside NMFS statistical areas 514 and 538, with expansion into the northern portion of statistical area 537

NMFS Area 537 (Figure 11). Each year stations are randomly selected and are then sampled twice monthly from June through September. Sixty stations were sampled in NMFS Area 514, and 42 stations were sampled in the combined 538/537 Areas. A total of 64 sampling trips were completed by *MarineFisheries* staff and more than 24,268 lobsters were sampled from 4,810 trap hauls. Results were made available to the ASMFC Lobster Technical Committee.

Lobster Reproduction Studies

Tracy Pugh continued collaborative work with the University of New Hampshire (UNH) to conduct research on lobster reproduction as part of her PhD dissertation. Working with UNH professor Dr. Win Watson, Pugh is conducting field and laboratory work that examines how male lobsters may be limited in their ability to supply sperm to females (Figure 12), with the end goal being to account for male contributions to reproductive success in the stock assessment process. A manuscript documenting the results of the field work was submitted for publication, and one describing the at-sea sampling methodology was in preparation at year's end.



Figure 12. Taking a non-invasive sample from the seminal receptacle of a female lobster to determine mating success

As a component of this collaboration, a grant from the Commercial Fisheries Research Foundation was awarded to UNH, for which Pugh was responsible for conducting data collection and analysis. The final report for this twoyear grant, entitled "The Buzzards Bay lobster resource: Are changes in reproduction having a negative impact on the fishery?" was submitted to the granting agency for peer review. The report concluded (in part) that female lobsters in the interior of Buzzards Bay had lower mating success than those in the outer regions of the Bay. This finding may be related to low densities of lobsters inside Buzzards

Bay decreasing the odds of finding a mate, or may result from differential habitat preferences causing spatial separation of immature and mature females. Abundance was the only characteristic of the lobster resource in the Buzzards Bay area that was identified as having changed in a way that may negatively affect reproductive success.

Annual Early-Benthic-Phase Lobster Suction Sampling

The 17th year of *MarineFisheries'* Annual Early-Benthic-Phase Lobster Suction Sampling Program was completed. In addition to the 17 historical coastal sites spanning Buzzards Bay, Cape Cod Bay, and Massachusetts Bay, three new stations were surveyed. One was located in Buzzards Bay and two in a new region, Vineyard Sound. Two additional sites in Vineyard Sound were surveyed but did not have appropriate settling habitat. These stations were added to increase spatial coverage and better monitor recruitment signals in southern New England, where recruitment failure has occurred in recent years.



Figure 13. Newly settled YOY lobster

Project staff conducted this year's survey over 11 field days from mid-August to mid-November. Mean densities of YOY lobsters (Figure 13) in the survey regions were similar to time series means with the exception of Buzzard Bay, which has been particularly low in recent years. In 2011, Salem Sound averaged 0.94 YOY/m², Boston Harbor averaged 0.17 YOY/m², Cape Cod Bay averaged 0.33 YOY/m², and Buzzards Bay averaged 0.03 YOY/m².

Lobster Settlement Dynamics

In early 2009, Invertebrate Fisheries Project staff initiated a Commercial Fisheries Research Foundation-funded study, entitled "Examining settlement dynamics of postlarval American lobster (*Homarus americanus*) in Lobster Management Area 2". *MarineFisheries* led this study with participation from Rhode Island Department of Environmental Management, NOAA Fisheries, Bigelow Laboratories, Rhode Island Lobstermen's Association, and Massachusetts Lobstermen's Association.

For this multi-faceted study, we deployed 224 postlarval lobster settlement collectors (Figure 14) in coastal waters from Buzzards Bay to Block Island from June to October 2009, in order to determine geographic distribution of settlement in LMA 2. To track local currents and observe possible larval transport pathways, 44 satellite-tracked drifters were deployed in upper and lower Buzzards Bay, Vineyard Sound, Rhode Island Sound, and Narragansett Bay in 2009 and 2010. *MarineFisheries* divers conducted suction sampling to evaluate habitat suitability in areas likely to receive larval supply, as indicated by drifter tracks.

Data collected from drifters consistently indicated that larvae released outside the mouth of Buzzards Bay, where many egg-bearing female lobsters now concentrate, were unlikely to be transported into the Bay, which was corroborated by settlement collector and suction data. In fact, only two YOY lobsters were observed in collectors throughout the study area indicating negligible settlement in LMA 2. Preliminary findings were presented to the ASMFC Lobster Technical



Figure 14. Hauling settlement collectors

Committee in March 2010 and have been incorporated in recent discussions on the recruitment failure and settlement decline seen in the southern New England lobster stock. A final report prepared by Invertebrate Fisheries Project staff in November 2011 has proved valuable in providing context to the observed declines in lobster settlement in LMA 2.

In 2010 and 2011, *MarineFisheries* expanded the settlement dynamics research effort to the Massachusetts portion of the Gulf of Maine, LMA 1. In both years, roughly 200 settlement collectors were deployed in pairs in shallow (<10 m) coastal waters at 1.9 km intervals from Cape Ann to Cape Cod Bay. A total of 57 YOY lobsters were found in LMA 1 collectors over

the two years of study. To model larval dispersal, we released satellite-tracked drifters where late-stage ovigerous females concentrate. Data compiled from drifter tracks, settlement collectors, and suction sampling will be used to identify coastal currents and lobster settlement patterns in Massachusetts Bay and Cape Cod Bay.

Ghost Gear Study

Despite the large scale and high value of the American lobster fishery, little information exists on the number of lobster pots annually lost or how long these "ghost pots" continue to fish. To address these concerns, *MarineFisheries* initiated a two-year study in 2010, made possible with a research grant from the National Fish and Wildlife Foundation and NOAA Marine Debris Program.

In 2011, Invertebrate Fisheries Project staff prepared and mailed a three-page questionnaire to all Massachusetts commercial lobster permit holders who had actively fished in LMA 1, 2, 3, or OCC (Outer Cape Cod) in 2009. The confidential and anonymous survey collected valuable information about gear loss rates, reasons for loss, costs associate with losses, and regional demographics. The survey achieved a 58% response rate, with 522 of the 884 questionnaires being completed.

As in 2010, project staff also conducted dive surveys to monitor lobster gear set in Buzzards Bay and Cape Cod Bay. Two 6-pot trawls were set and "abandoned" at each location in May of 2010, another trawl was added to each location in November of

2010, and an additional trawl was set in both locations in late spring of 2011 (Figure 15). All lobster traps had a degradable escape panel which is designed to release lobsters and bycatch if a trap is lost. However, our research has shown that if ghost pots continue to fish for even a short-term, there may be a substantial loss of yield and revenue to the industry. Catch lost to ghost fishing could jeopardize long term conservation goals and undermine our ability to fully model lobster population dynamics.



Figure 15. Lobster inside a simulated ghost gear trap

The Cape Cod Bay portion of the study concluded in November of 2011. At the time of trap removal, all survey traps that had been set in 2010 had become disabled. On average, these traps stopped fishing after 277 days in the water. Most were disabled after major storm events. In contrast, only one of the 18 traps set in Buzzards Bay in 2010 had become disabled 519 days after initial placement. This gear was set in a sheltered location and was not subjected to major storm events.

Analysis of the catch data was ongoing at year's end, but preliminary analyses show that ghost pots could be a significant source of undocumented mortality of both lobster and bycatch species. This study was initially scheduled to be completed in December 2011,

but due to continued fishing of the gear in Buzzards Bay, the study will be extended into 2012. The mail survey results will be analyzed in 2012 along with dive survey results, in order to obtain estimates of the impact of derelict fishing gear on Massachusetts lobster fishery resources.

Northern Shrimp Survey and Assessment

Northern Shrimp Assessment Survey: In July, Invertebrate Fisheries Project staff participated on several one-week legs of the annual northern shrimp assessment survey conducted throughout the Gulf of Maine aboard the R/V Gloria Michelle. The 2011 survey indicated a lower than average abundance of large females and juveniles, with the remaining males and females being small for their age. As a result, the ASMFC Technical Committee projected 2011/2012 commercial catches would be comprised mostly of unusually small four-year old female shrimp from the 2008 year class. The Committee recommended a 2011/2012 harvest target based on the survey's results and other stock information.

Commercial Fishery Sampling:

During the 2011/2012 northern shrimp fishing season, Invertebrate Fisheries Project staff conducted triweekly port sampling from vessels landing shrimp in Gloucester, Rockport, and Newburyport. Samplers interviewed fishermen and dealers for tow time, areas fished, catch, and number of boats fishing. They also collected and analyzed 2 kg biological samples from catches (Figure 16). The port samples provided information on size and stage distribution, egghatch, and disease prevalence. Findings were reported weekly to the ASMFC Technical Committee.



Figure 16. Staging northern shrimp from a commercial port sample

Assessment and Management Support: Invertebrate Fisheries Project staff contributed to the preparation of the 2011 ASMFC Northern Shrimp Stock Assessment as member of the ASMFC Northern Shrimp Technical Committee. Work for the assessment included review of fisheries-dependent and -independent data, input of indices into a production model, model analyses, and review of shrimp research and assessments. Project staff also participated on the ASMFC Northern Shrimp Plan Development Team by compiling fishery statistics in preparation of Amendment 2 to the interstate FMP.

Horseshoe Crab Monitoring

Commercial Fishery Sampling: Monitoring of the commercial bait and biomedical harvests continued in accordance with the ASMFC Horseshoe Crab FMP. As in 2010, five-day closures banned harvest around the new and full moons in May and June (the

peak spawning periods) to promote spawning success. Prosomal width measurements were obtained from 1,125 crabs at two dealerships and at the biomedical facility. In addition, prosomal width measurements were obtained from 264 crabs during sea sampling trips aboard three draggers in Nantucket sound. A short-term holding study was conducted at the NMFS Woods Hole Aquarium to evaluate the effectiveness of marking techniques employed by the biomedical facility to identify bled crabs. Alternative techniques will be implemented in 2012 to produce more long-lasting marks.

Spawning Surveys: Nearly 100 volunteers participated in the annual survey of horseshoe crab spawning beaches. The five-day harvest closures around each new and full moon were implemented to reduce harvest effort during this period, but we have not observed increased abundance of spawning animals on the survey beaches. Analysis of the effectiveness of this management measure will continue in 2012.

Acoustic Telemetry: Project staff concluded a Sea Grant-funded telemetry study to assess the movement patterns and spawning site fidelity of female horseshoe crabs. Coded receivers were again deployed in the Stage Harbor-Monomoy area of Nantucket Sound from April through November 2011 to track the crabs tagged in 2010 (Figure 17). UMass graduate student Sarah Martinez performed manual tracking of individual crabs throughout the summer. All receivers were retrieved and downloaded on August 26 in anticipation of Hurricane Irene and redeployed on August 31. We conducted detection



Figure 17. Horseshoe crab with acoustic tag released off Monomoy Island, June 2010

range testing of the receivers at all stations in September and all receivers and moorings were removed from the water in late November. No additional receivers were lost in 2011. Data analysis was underway at year's end, with the expectation to be completed by June 2012. Preliminary results suggest that crabs tagged in the unprotected area outside of the NPS closure area tended to remain in the general area where tagged, while crabs tagged within the NPS closure zone moved equally between the protected and unprotected areas.

Bottom Temperature Monitoring

The Invertebrate Fisheries Program maintains nine permanent temperature monitoring stations in water depths between 5 and 30 meters from Boston Harbor to Southern Buzzards Bay (Figure 18). Data from these monitors are valuable in detecting environmental change in Massachusetts' waters. Many of the stations have collected bi-hourly temperature readings for over 20 years. Temperature data from southern

New England has shown a warming trend and has helped explain changes in population dynamics of some cold-water species, including American lobster.

In 2011, *Marine Fisheries* SCUBA divers performed 14 dives to locate and replace temperature monitors and deploy an additional temperature anchor and monitor at each station. In the past, some temperature monitors have malfunctioned or have been lost at sea causing gaps in data collection. Temperature monitors are now paired at each station to help avoid gaps in the time series.

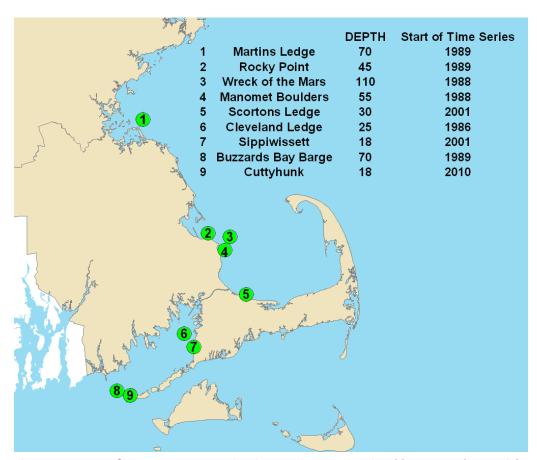


Figure 18. Map of temperature monitoring stations maintained by Invertebrate Fisheries Program (depth is given in feet)

Channeled Whelk Studies

Maturity Study: UMass-Dartmouth, in collaboration with *MarineFisheries*, was awarded a grant through the Commercial Fisheries Research Foundation investigating the biology of the channeled whelk *Busycotypus canaliculatus*. Staff member Steve Wilcox worked with Dr. Kenneth Oliveira and UMass-Dartmouth to determine the size and age of maturation and seasonal reproductive timing for the channeled whelk in Buzzards Bay, Martha's Vineyard, and Nantucket Sound as part of his master's degree work. The two year grant has thus far included the collection and processing of 1,349 channeled whelk between the fall of 2010 and the fall of 2011 (Figure 19). Processing includes taking external measurements and weights, removal of the shell, dissection of reproductive

structures, and aging by way of the operculum. This project is in the early stages of data analysis; results will be forthcoming.

Commercial Fishery Sampling:

Invertebrate Fisheries and
Protected Species staff conducted
fishery-dependent monitoring of
the channeled whelk fishery. A
total of 12 sea sampling trips
aboard cooperating channeled
whelk fishing vessels were
conducted. These data were
collected to characterize the
channeled whelk fishery in
Nantucket Sound and to assess
the relative efficiency of fishing
single pots and trawls. This work
was part of a pilot study to look
at reducing turtle entanglement



Figure 19. Collecting channeled whelk for sampling

in the channeled whelk (conch) pot fishery in Nantucket Sound via reducing vertical lines. Our goal was to evaluate the efficiency of conch pot singles vs. trawls to look at trawls as a potential method to reduce the incidence of entanglement. In addition to sea-sampling, project staff also conducted a dive survey to evaluate the loss rates of conch pots that are hauled as part of a trawl. This project will continue in 2012, where we hope to conduct more trips aboard vessels fishing trawls.

Protected Species Project

Cape Cod Bay Right Whale Surveillance Program

In 2011, the Cape Cod Bay Right Whale Surveillance Program was conducted through a partnership between *MarineFisheries*, the Provincetown Center for Coastal Studies (PCCS), and NOAA Fisheries. The program carried out aerial surveillance and habitat monitoring of right whales in Cape Cod Bay Critical Habitat and adjacent waters (Figure 20).

The five-year trend of extraordinary abundance of right whales in Cape Cod Bay (CCB) continued during 2011. We documented 312 individual right whales in CCB and adjacent areas — approximately 65% of the known population (490 whales). In addition, nine calves were observed.

The habitat monitoring program, which collects data on the relationship between right whales and their food resource in CCB, found the zooplankton pattern to be consistent with previous years. However, *Pseudocalanus* abundance persisted well beyond its usual depletion in early April, likely contributing to the lasting, dense food resource available to right whales in 2011. The exceptional abundance seen in CCB this year further highlights the importance of this habitat.

Public advisories to mariners about right whale densities and the potential for vessel collisions were issued through USCG advisories and via notices to standard media outlets.



Figure 20. Right whales spotted off Provincetown in April 2011 (taken under NMFS permit #14603)

Large Whale Disentanglement Network

MarineFisheries and the PCCS cooperatively administer large whale disentanglement efforts around Massachusetts through a grant from NMFS. During 2011, the Massachusetts entanglement hotline received over 200 reports concerning marine animals, including entanglements, strandings, out of habitat animals, and carcasses. Staff confirmed that 39 were entanglement-related sightings, involving 22 individuals – nine right whales, 10 humpback whales (one individual entangled twice), and two minke whales – within or adjacent to the response area. PCCS performed 20 on-water responses to entanglement, in which three humpback and two right whale cases were wholly or partially resolved. Project staff assisted PCCS and NMFS by investigating gear retrieved from entangled animals, such as a minke whale entanglement in Vineyard Sound.

Abandoned and Non-Compliant Gear Removal

Staff worked with the Massachusetts Environmental Police to reduce entanglement risk in CCB Right Whale Critical Habitat. Project staff analyzed and mapped gear locations provided by the PCCS aerial team and relayed them to Environmental Police for use in gear removal efforts. In addition, the overlap between right whales and fishing gear was mapped and analyzed over the duration of the season to determine if further protective measures were warranted regarding entanglement risk.

Strings of multiple pots are legal in the CCB during the right whale season if the gear is equipped with required modifications (e.g., breakaway links, orange flags, sinking groundline). Single traps and gillnets are not allowed. Gear locations provided by the PCCS aerial surveillance team were used to guide enforcement patrol missions in the bay. Gear was checked for violations and pulled if illegal. No non-compliant traps were removed from the CCB Critical Habitat by the Massachusetts Environmental Police from January 1 – May 15, 2011. *MarineFisheries* removed seven traps from the Critical Habitat in April with the assistance of a commercial lobsterman, as the abandoned gear was reported to be near feeding right whales.

Leatherback Sea Turtle Research and Disentanglement

MarineFisheries has operated the Massachusetts Sea Turtle Disentanglement Program with the PCCS since 2005. In recent years, Dr. Molly Lutcavage of UMass has been attaching satellite tags to leatherback turtles around Massachusetts. Leatherback sea turtles (Figure 21) are seasonal visitors to our waters, where they feed on abundant jellyfish, particularly in CCB, Nantucket Sound, and Buzzards Bay. Now our groups have joined forces to study the behavior and distribution of leatherbacks in Massachusetts waters and to minimize and mitigate fishery-related entanglements. With the support of a three-year NMFS contract awarded in 2010, we will combine a variety of methods to accomplish our goals, including aerial survey, tagging, disentanglement, gear analysis, and outreach.

Project staff administered the grant for this program, including report writing, contracting and processing invoices. In addition, a complete inventory of fishing gear and analysis of the entanglement, including identification of the owners and the fishery involved, was conducted. In 2011, a training session with *MarineFisheries'* staff on turtle disentanglement was completed. Unfortunately, due to low turtle abundance in 2011, we were unable to tag any turtles. Ten leatherback sea turtles were disentangled by our partners at PCCS.



Figure 21. A leatherback sea turtle (picture taken under NOAA 50 CFR 222.310, with authorization of the ESA)

NMFS Vertical Line Reduction Plan

Through the Atlantic Large Whale Take Reduction Team, NMFS is pursuing a vertical line reduction solution for fixed gear to reduce the risk of entanglement for large whales. *MarineFisheries* staff assisted NMFS and their contractor, Industrial Economics, in the development and evaluation of this plan. This involved fixed gear data analysis for Massachusetts, writing comments and strategies, conducting outreach to the fishing industry on the reduction plan, and attending numerous meeting regarding this matter.

Commonwealth Quality Program

In 2010, the *Mass*DAR launched a new campaign, called Commonwealth Quality, to certify, label, and promote local and sustainable food products. Project staff continued to assist *Mass*DAR and the Massachusetts Lobstermen's Association in getting Massachusetts lobster included as a sector in the program. *MarineFisheries* participated in numerous meetings and discussions about how to allow the lobster industry to participate in this program, based on the criteria developed for all participants. In addition, the project staff helped the Massachusetts Lobstermen's Association collate lists of regulations and in developing Best Management Practices required for inclusion in the program.

Environmental Review of Offshore Energy Development Area

State and federal governments are assessing the area south of Martha's Vineyard and Nantucket for future offshore wind energy development. Project staff assisted EEOEA and the Massachusetts Clean Energy Center in the development of a study to characterize how marine mammals and sea turtles utilize this area. Assistance was provided with developing the request for proposals for the survey, reviewing bids, and negotiating with bidders.

Scientific Diving Project

In 2011, *MarineFisheries* safely conducted over 1,050 research dives to support on-going research and monitoring programs, including eelgrass monitoring and restoration; lobster temperature monitoring, ghost gear, and early-benthic-phase suction; shellfish abundance and habitat surveys; sportfish acoustic receivers and temperature monitors; PCB monitoring sample collection; horseshoe crab acoustic receivers; and dive program training.

Project staff provided safety, first responder, and dive training to 17 *MarineFisheries* scientific divers (Figure 22). The Diving Safety Officer (DSO) completed required instructor training courses. All Project records were maintained and updated for the 2011 year. Current protocols were enforced and a newly formed Dive Control Board met to review a proposed protocols manual. Routine annual maintenance was completed on all program dive equipment, and the air fill station was relocated.



Figure 22. Diver training

Additionally, the DSO attended two diving related conferences and also participated in several collaborative efforts. The DSO was an active member of the Mystic Aquarium Dive Control Board, worked with the Northeast Reef Environmental Education Foundation, acted as secretary and member of the Association of Dive Program Administrators, and provided educational programs for local dive shows and schools.

Other Activities

The Program Manager, Steve Correia, serves as a member of the NEFMC Scientific and Statistical Committee and the NEFMC Groundfish, Monkfish, and Atlantic Herring Plan Development Teams. In doing so, he helped develop overfishing limit and acceptable biological catch advice for groundfish stocks, whiting, and small hakes, and generated analyses to support development of Frameworks 46 and 47 to the Groundfish FMP, Amendment 5 to the Atlantic Herring FMP, and Framework 7 to the Monkfish FMP.

During 2011, the Program Manager served as chair of ASMFC Winter Flounder Technical Committee and continued as a member of the ASMFC Herring Technical Committee and Assessment Science Committee. The Program Manager finalized the ASMFC winter flounder ageing manual, and continued to provide technical assistance on sampling designs and statistical analyses on an as-needed basis to other *MarineFisheries* projects and SMAST and URI graduate students. Two large ongoing projects included an analysis of water quality and periphyton data from various rivers in three states to identify smelt habitat suitability thresholds and relationships between water quality and size of smelt runs, and analyses to support a performance evaluation of national shellfish laboratories by the Northeast Lab Evaluation Officers and Managers.

Recreational and Diadromous Fisheries Program

Personnel

Dr. Gregory B. Skomal, Program Manager

Recreational Fisheries Project

Paul Caruso, Senior Marine Fisheries Biologist, Project Coordinator John Boardman, Marine Fisheries Biologist, John Chisholm, Marine Fisheries Biologist Matt Ayer, Marine Fisheries Biologist Andrea Petrella, Seasonal Fisheries Technician Kim Little, Seasonal Fisheries Technician

Large Pelagics Research Project

Dr. Gregory Skomal, Senior Marine Fisheries Biologist, Project Coordinator John Chisholm, Marine Fisheries Biologist

Diadromous Fish Passage and Restoration Project

Brad Chase, Senior Marine Fisheries Biologist, Project Coordinator Edward Clark, Carpenter, Fishway Crew Luis Carmo, Laborer, Fishway Crew

Diadromous Fish Biology and Management Project

Brad Chase, Senior Marine Fisheries Biologist, Project Coordinator John J. Sheppard, Marine Fisheries Biologist Edward Clark, Carpenter, Fishway Crew Luis Carmo, Laborer, Fishway Crew Andrea Petrella, Seasonal Fisheries Technician Kelly Kleister, Seasonal Fisheries Technician

Overview

The Recreational and Diadromous Fisheries Program includes the Recreational Fisheries Project, the Large Pelagics Research Project, the Diadromous Fish Passage and Restoration Project, and the Diadromous Fish Biology and Management Project.

The purpose of the **Recreational Fisheries Project** is to preserve, enhance and promote the marine recreational fisheries of the Commonwealth. Goals are to conserve key recreational species through science-based management to support local sustainable fisheries; support the recreational fishing community, including local recreational fishing businesses, and educate the Commonwealth's citizens of the features and benefits of local recreational fisheries resources. Project personnel measure abundance, length frequency, and age classes of key finfish populations for input to stock assessments and to design and analyze management options; assess habitat and prey needs of key species; measure harvest and release of key species; promote and enhance recreational fishing access through the purchase and maintenance of access sites; and disseminate information on all aspects of recreational species and fisheries to the public.

Since 1987, the Large Pelagics Research Project has been conducting research to enhance our understanding of the ecology, life history, and relative abundance of sharks, tunas, and billfish off the coast of Massachusetts, where extensive recreational fisheries for these species occur. In addition to this research, the goals of the Large Pelagics Research Program are to foster cooperative research; to participate in the state, regional, and federal management process; and to provide public education and technical information on the biology, management, and utilization of highly migratory species.

The **Diadromous Fish Passage and Restoration Project** is coordinated among *MarineFisheries* staff, state and federal agencies, municipalities, and private groups to facilitate, design, and execute restoration projects with the goal of enhancing diadromous fish populations and habitats. In addition, technical assistance and monitoring are provided as needed for individual restoration projects and coastal watersheds.

The **Diadromous Fish Biology and Management Project** is responsible for the management, investigations, and assessment of over 10 species of diadromous fish stocks in Massachusetts. Species such as river herring (alewife and blueback herring), rainbow smelt, white perch, tomcod, American eel, and American shad are evaluated for run counts, indices of population abundance, size and age composition, local harvests, and restoration potential. Information generated by this project is necessary for the sustainable management of diadromous fish populations as required by state and federal law.

Recreational Fisheries Project

MRIP For-Hire Sampling Project

Since 1983, recreational fisheries catch and harvest data have been collected along the Atlantic Coast through NMFS' Marine Recreational Information Program (MRIP). In 2011, *MarineFisheries* continued to manage the "party boat" survey segment of MRIP for Massachusetts waters; training personnel, scheduling trips, logging data, and maintaining equipment. Daily oversight is provided and two wave data review meetings were attended by the project coordinator in 2011.

During 2011, 68 sea sampling trips were completed – most with two samplers for a total of 120 sampler days and 1,180 angler intercepts. A year-end summary report was generated. Work commenced regarding updates to the MRIP Access Point Angler Intercept Survey site registry. This included site visits to approximately 200 sites on Cape Cod and 100 sites on the South Coast and South Shore to gather location information. This initiative was in response to NMFS revisions to the MRIP sampling program, anticipated to begin in 2013.

Recreational Fishing Derby

Project staff administered *MarineFisheries'* Saltwater Fishing Derby. This included regular communications to weigh stations, preparing press releases for derby promotion and announcement of winners, logging of certified weigh-in shops, and tracking of derby standings in a database. Winners were recognized with awards at the annual Worcester Sportsmen's Show.

The catch and release derby component was promoted with outreach materials and press releases. Project personnel created, printed, and distributed promotional minimum size rulers and rule pamphlets.

Recreational Species Research, Assessment, and Management

Policy, Technical Committee, and Stock Assessment Support: Participation on various technical committees of the ASMFC and MAFMC continued. Stock assessment updates were undertaken, presented to managers, and/or reviewed and management options discussed for key recreational species including summer flounder, tautog, scup, bluefish, black sea bass, sturgeon, striped bass, and river herring.

In 2011, project personnel reviewed local and regional fishery performance and assessed potential bag, size, and season restrictions for scup, summer flounder, and black sea bass. Tautog, bluefish, black sea bass, summer flounder and scup databases of catch, landings, and adult and YOY survey indices were updated, trend analysis performed, and predictive relationships examined. Annual compliance reports were submitted for each species. Regulatory updates were communicated to Massachusetts Environmental Police (MEP) officers and *MarineFisheries* licensing staff.

Striped Bass Tagging, Age, and Growth: Staff contributed to tagging efforts, collection of otoliths, and market sampling for striped bass (see Fish Biology Program for more information).

Tautog Age and Growth: *MarineFisheries* started voluntary age and growth sampling of tautog in 1995, followed by mandatory sampling under a 2002 interstate management plan revision. The resulting age/length data from Massachusetts is used in coast-wide stock assessments and local assessments for Massachusetts and Rhode Island which allows these two states to manage tautog unilaterally, in addition to continuing to contribute to the overall ASMFC assessment and management process.

In 2011, *MarineFisheries* obtained a total of 283 tautog through directed sea sampling, purchase from commercial fishermen, and angler donations. Opercula were obtained from all samples, cleaned and read. Otoliths were obtained from approximately 20 fish for comparison to operculum ages. Age data were entered into the database and a 2011 agelength key created.

Summer Flounder Tagging: *MarineFisheries* initiated a tagging study for summer flounder in 2009. While the primary purpose of the study is to determine if summer flounder exhibit inter-annual homing and examine migratory timing and pathways, the length frequency data collected during the study have been a beneficial byproduct. These data can be used to project recreational harvest under different minimum size limits. The study is the only source of data available with respect to this analysis.

In 2011, project staff captured 449 summer flounder, of which 374 were tagged. Fishermen reported 21 recaptures of tagged fish, 16 of which were tagged in 2011 and five in 2010. Over 1,100 fish have been tagged and released since 2009.

Habitat and Access

Access-related work included periodic site monitoring and maintenance to the Craven's Landing Access site in Sandwich, as well as the preparation of a site management plan. Maintenance included fixing or replacing some fencing and signage. Staff maintained regular communications with the property's neighbors as well as routine contact with law enforcement officers regarding enforcement of the rules. Warning letters were sent to several violators. The Project recruited and supervised seasonal staff to patrol the site on summer weekends and holidays.

In 2011, there was a temporary emergency shutdown of the Craven's Landing Access site to boat launching due to the presence of an endangered species, the piping plover. This required the installation of a temporary gate and signage, as well as communications with Massachusetts Audubon Society, Massachusetts Division of Fisheries and Wildlife (Mass*Wildlife*), and Town of Sandwich Conservation Commission staff.

Site improvements for the Dogfish Bar Fishing Access Site on Martha's Vineyard were investigated with a site visit and communications with the Commonwealth's Office of Fishing and Boating Access. Accordingly, a site improvement plan was written and discussions were initiated with Town of Aquinnah Conservation Commission staff.

Exploration of a potential new access site in Wareham on the Weweantic River began, which included two site visits and discussions with the Office of Fishing and Boating Access and the Town of Wareham Conservation Agent.

Routine communication regarding local fisheries resources and fisheries activity was maintained with Environmental Review Program staff. This included technical assistance to habitat project staff on projects related to diadromous and recreational fish resources.

Outreach

Staff routinely answered public inquiries regarding recreational fisheries, including the new saltwater fishing permit, attended meetings of the recreational fishing community, and delivered public presentations on fisheries management and program research to organized groups such as local schools and fishing clubs.

Informational materials were distributed at the Standish Sportsman's Club, Bears Den Flyfishing Expo, Eastern Fishing and Outdoors Exposition, Massachusetts Striped Bass Association Fishing Expo, the Rhode Island Saltwater Anglers Association Fishing Expo, the New England Boat Show, and the Topsfield Fair. The annual Anglers Guide and Regulatory Abstract were printed and distributed to over 140 bait and tackle shops and 30 other venues.

Large Pelagics Research Project

Massachusetts Sportfishing Tournament Monitoring Program

Extensive recreational fisheries for sharks, tunas, and marlins off the coast of Massachusetts warrant monitoring. In an effort to characterize the relative abundance of these species, the Massachusetts Sportfishing Tournament Monitoring Program has been collecting catch and

effort data at fishing tournaments since 1987. These data allow analysis of annual trends in relative abundance based on angling success. The program has made efforts to rectify biases in the calculation of catch-per-unit effort (CPUE) indices from tournament data by surveying tournament participants and working with tournament organizers to collect complete catch information comprising all fish landed, tagged, released, and lost. Data collected include: fishing date, number of boats/fishermen, fishing time, species caught, time of catch, weight, length, sex, bait used, water temperature, disposition of catch (boated, released, tagged, lost), and weather conditions.

In 2011, Project staff obtained data from one multi-species tournament and one shark tournament (Table 5). Data were entered into the program's tournament database for calculation of summary statistics and comparison to previous years' results. In addition, data summaries were prepared on the historical catch, CPUE, and/or mean weight of each species landed for the two tournaments and distributed to tournament organizers and participants. Project staff provided relevant data to NMFS for inclusion in the federal tournament monitoring program.

During the 2011 tournament season, program personnel tallied 1,444 fish comprising 11 species. The proportion of fish released was species-dependent, ranging from 0 to 100%; overall, 95.8% of the tournament catch was released and the balance was boated; 2.4% was tagged when released. Size data were collected from 44 fish boated during the 2011 events.

Tournament	Species	Dates	No. Boats	Effort (boat hrs.)		
Oak Bluffs Monster Shark, 25 th Annual	Shark	7/22-23	104	1,649		
Falmouth Grand Prix, 22 nd Annual	Billfish/tuna/shark	7/29-30	7	97.5		
Total			111	1,746.5		

Table 5. 2011 Massachusetts offshore fishing tournaments

Massachusetts Shark Research Program

MarineFisheries established the Massachusetts Shark Research Program in 1989 to more fully elucidate the ecology, distribution, and relative abundance of sharks subjected to fisheries off the coast of Massachusetts. The program conducts angler and longline surveys and opportunistically collects information and samples from recreational and commercial fishermen. Biological parameters including age determination, feeding ecology, movements, and reproductive status are examined through dissection and tagging of shark specimens. The goals of the program are to foster cooperative shark research; to participate in the state, regional, and federal management process; and to provide public education and technical information on the biology, management, and utilization of sharks.

With the exception of trawl, longline, and gillnet fisheries that target spiny dogfish (Squalus acanthias), there are no directed commercial fisheries for sharks in Massachusetts. Of the millions of pounds of sharks landed in the Commonwealth in 2011, the vast majority were spiny dogfish (9.1 million pounds) with a commercial value of \$1.93 million (Table 6). The balance consisted of smooth dogfish (Mustelus canis), shortfin make (Isurus oxyrinchus), longfin mako (Isurus paucus), and porbeagle (Lamna nasus) taken incidental to trawl, longline, and gillnet fisheries.

Table 6. Estimates of 2011 commercial shark landings in Massachusetts

Species	Landings (lbs)	% of Catch	Value	Price/lb.
Spiny Dogfish	9,068,787		\$1,930,598	\$0.21
Smooth Dogfish	*		*	*
Shortfin Mako	34,402		\$47,422	\$1.38
Longfin Mako	*		*	*
Porbeagle	*		*	*

Source: SAFIS, * indicates confidential data due to less than three fishermen or dealers reporting landings

A substantial recreational fishery for sharks occurs in Massachusetts from June through October each year. Harvest estimates from NMFS' MRIP indicate that Massachusetts' recreational fishermen caught about 512,000 sharks in 2010 (the most recent year available), with spiny and smooth dogfish comprising 99% of the catch (Table 7). However, while MRIP data reflect those species commonly taken by land-based and nearshore fishermen, they do not adequately represent the species composition, relative abundance, and temporal and spatial distribution of sharks targeted by fishermen in offshore waters. The NMFS Large Pelagic Survey, which is more reflective of offshore fisheries, reported 5,410 sharks taken by Massachusetts recreational fishermen in 2010 comprising blue (*Prionace glauca*, 3,569), shortfin mako (1,653), and common thresher (*Alopias vulpinus*, 188) sharks; overall, 90% were released (Table 7).

Table 7. Estimates of 2010 recreational shark landings (numbers) in Massachusetts

Source	Species	Boated	Released	Tagged	Total	Percent Released
	Blue		679	22	701	100%
	Shortfin Mako	17	87	9	113	85%
	Common Thresher	22	11		33	33%
₽	Dusky		6		6	100%
MSTMP	Porbeagle	1			1	0%
Σ	White		1	1	2	100%
	Sandbar		1		1	100%
	Hammerhead		1		1	100%
	Total	40	786	21	858	95%
	Blue	140	3,429		3,569	96%
LPS	Shortfin Mako	261	1,392		1,653	84%
_	Common Thresher	152	36		188	19%
	Total	553	4,857		5,410	90%
Ы	Dogfish	82	510,056		510,138	99.98%
MRIP	Other		106,738		106,738	100%
_	Total	4,968	730,736		735,704	99%

MSTMP = Massachusetts Sportfishing Tournament Monitoring Program

LPS = NMFS Large Pelagics Survey (Source: NMFS, Fisheries Statistics Division)

MRIP = NMFS' Marine Recreational Information Program (Source: NMFS, Fisheries Statistics Division)

Data from the Massachusetts Sportfishing Tournament Monitoring Program indicate that of the 858 sharks caught during two Massachusetts big game fishing tournaments in 2010, 701 (82%) were blue sharks, 113 (13%) were shortfin makos, and 33 (4%) were common threshers; the balance included 6 dusky (*Carcharhinus obscurus*), 2 white (*Carcharodon carcharias*), 1 porbeagle, 1 sandbar (*Carcharhinus plumbeus*), and 1 hammerhead (*Sphyrna* spp.) sharks (Table 7). During these events, 95% of the sharks were released. Although these data represent only tournament-caught sharks taken in offshore waters (>3 miles), they do provide an indication of species composition, landings, and catch rates for important recreational shark species off Massachusetts.

Movement and Habitat Studies: With external funding from private and federal grants, Shark Research Program personnel continued in 2011 to collaborate with federal and academic researchers on the study of broad and fine-scale movements of numerous shark species using pop-up satellite tags, acoustic transmitters, and conventional tags. These species include white, basking, and sand tiger sharks.

White Shark: While known to be relatively rare in the Atlantic, the number of seasonal (summer, early fall) white shark sightings off the coast of Massachusetts has been rising in recent years. There has also been an increase in the number of white shark attacks on seals, largely adjacent to Monomoy Island off the coast of Cape Cod, which hosts a sizeable and growing population of gray seals. White sharks, which were thought to generally feed offshore in the Atlantic, appear to be exhibiting a dietary shift in response to changes in seal abundance (Figure 23).



Figure 23. A white shark (upper right corner) lurks near a group of grey seals

The relative increase in white sharks off the coast of Cape Cod has facilitated *MarineFisheries'* use of new tagging technologies that have allowed researchers to examine the movements, habitat use, and behavior of white sharks in the Pacific and Indian Oceans. During the summers of 2009, 2010, and 2011, we tagged 17 individuals with satellite-based tracking tags or acoustic transmitters. In 2011, we also expanded our passive acoustic receiver array in the Chatham area. These have been the first successful efforts to apply high-tech tags to white sharks in the North Atlantic Ocean.

Given the high profile nature of the white shark, these tagging efforts garnered considerable media attention.

In addition, a joint research project was initiated with engineers from the Woods Hole Oceanographic Institution to modify an Autonomous Underwater Vehicle for fish tracking. Initial trials were conducted in November 2011 with promising results.

Basking Shark: With funding from the National Science Foundation, Project personnel continued in 2011 to examine basking shark movements as they relate to oceanographic features. In 2011, 20 basking sharks were PSAT-tagged (with pop-up satellite archival tags) off Massachusetts, bringing the total to 32 basking sharks tagged since 2008. The broad- and fine-scale horizontal and vertical movements of this species are being examined by Tobey Curtis as part of his PhD project at SMAST.

Sand Tiger Shark: With additional funding from the NMFS Proactive Species Conservation Grant Program, the Massachusetts Environmental Trust, and the Marine Fisheries Institute, our research continued to examine habitat use, local movements, and broad scale migration of the sand tiger in Plymouth-Kingston-Duxbury Bay, the largest nursery for this species north of Delaware Bay. Specifically, the project is designed to obtain detailed information on small scale movements and habitat use within the nursery and surrounding regions using passive acoustic telemetry. The study is being conducted by SMAST graduate student Jeff Kneebone working with Project personnel. During 2009-2011, more than 60 sand tigers were tagged in this embayment and tracked as far south as Florida.

Post-release Survivorship Studies: Project personnel continued research on stress physiology in sharks. During 2011, efforts were directed at the publication of proceedings from the *Physiological Stress Response in Elasmobranch Fishes Symposium*, held at the 2010 Annual Meeting of the American Elasmobranch Society on July 11, 2010 in Providence, RI. Organized in cooperation with the New England Aquarium and co-sponsored by the American Elasmobranch Society, Fisheries Conservation Fund, and Save Our Seas Foundation, the symposium featured 17 papers presented by eight professionals, three post-docs, and five students. Dr. Skomal reviewed their manuscripts and co-authored a paper entitled "The physiological response to anthropogenic stressors in marine elasmobranch fishes: A review with a focus on the secondary response" with John Mandelman (New England Aquarium) for publication of the proceedings in the journal *Comparative Biochemistry and Physiology A*.

In 2011, work continued with University of Massachusetts researcher Diego Bernal to study the physiological effects of longline capture in sandbar and dusky sharks. Funding for the study was obtained from the Saltonstall-Kennedy Program and field work was initiated at the shore lab of the Virginia Institute of Marine Science. This research is being conducted by Heather Marshall as part of her PhD project with the University of Massachusetts.

In conjunction with the study on sand tiger movements (see above), the physiological effects of capture stress are being investigated in this species as part of the graduate research of SMAST student Jeff Kneebone. From 2009-2011, sand tigers were held captive to quantify the physiological effects of the capture stress and recovery. Post-release survival of sand tigers was monitored with passive acoustic telemetry and linked to blood chemistry data collected during the tagging process. This study is also funded by a grant from the

NMFS Proactive Species Conservation Grant Program and the Massachusetts Environmental Trust.

Life History: Project personnel continued to support SMAST student Derek Perry on his graduate research into the feeding ecology of smooth dogfish. Work in 2011 focused on thesis preparation.

On several occasions in 2011, technical evaluations were provided to marine mammal researchers, local officials, and the general public regarding the interaction of marine mammals with white sharks. In several cases, bite marks on the carcasses of gray seals, harbor seals, and right whales were analyzed for evidence of shark predation.

Working with NMFS and WHOI researchers, Project personnel generated age and growth estimates for the white shark in the western North Atlantic with bomb carbon validation. Efforts in 2011 included annulus interpretation, data analysis, and manuscript preparation.

Shark Management: Program personnel participated in the development and/or amendment of state (*MarineFisheries*), interstate (ASFMC), federal (NMFS), and international (ICCAT) shark management plans. During 2011, Greg Skomal chaired the ASMFC Coastal Sharks Technical Committee, and was member to the ASMFC Coastal Sharks Plan Development Team, ASMFC Spiny Dogfish Technical Committee, ICCAT Advisory Committee Shark Working Group, and NMFS Highly Migratory Species Advisory Panel.

Outreach and Media: To meet the public's demand for information on sharks, especially white sharks, over 20 presentations pertaining to sharks were delivered by Program personnel in 2011 to the public. Technical information on sharks was also provided to several media outlets.

As adjunct faculty to SMAST, the UMass Biology Department, Woods Hole Oceanographic Institute, and the King Abdullah University for Science and Technology, Greg Skomal served on the committees of 13 graduate students in 2011; 11 of these students are investigating the relative abundance, life history, movements, and/or physiology of elasmobranch fishes. He was the primary graduate advisor for three of these students.

Diadromous Fish Passage and Restoration Project

HubLine Restoration

Anadromous fish restoration is a component of ongoing HubLine mitigation and resource restoration efforts. In 2007 and 2008, scopes of work were drafted for five HubLine restoration projects. During 2011, three of the projects were active (described below); no effort was given to the projects at Scituate's Bound Brook (scope was not adopted) and Weymouth's Back River (completed in 2010).

Herring Brook (Pembroke): A new fish ladder and spillway was completed in 2011. The new Alaskan steeppass fish ladder replaced a wood Denil fish ladder build in 1991 by our Fishway Crew. No fish passage was possible at this site during 2009-2011 as the wood ladder washed out in 2008 and the concrete spillway was failing.

Weir River (Hingham): Permit applications were filed for a smelt habitat restoration project in 2011. At the close of the year, nearly all permits were issued. The project is scheduled to go to construction in the summer of 2012.

Fore River (Braintree): Limited design work for a herring restoration project was conducted during 2011. More extensive planning was delayed due to region-wide work load limitations on the USFWS fishway engineer design staff.

Cape Cod Water Resources Restoration Project

Project personnel devoted much effort in 2011 to coordination of the Cape Cod Water Resources Restoration Project with the National Resource and Conservation Service (NRCS). Planning for this project spanned over 10 years and it received federal stimulus funding in 2010 that included funds targeting fish passage improvements. The following projects were approved for fish ladder replacement after an extensive selection process: Carter Beal Park, Monument River, Bourne; Cedar Lake, Falmouth; Red Brook, Bourne; Santuit Pond, Mashpee; and Marston Mills River, Barnstable. In addition, funds were given for technical assistance to future fishway work at Pilgrim Lake in Orleans and John's Pond in Mashpee. A contract was prepared with *MarineFisheries* to hire and supervisor a full-time fish passage coordinator for these projects. Technical assistance was provided on all aspects of project planning and design on these seven projects. No projects went to construction in 2011 as design and permitting continued throughout the year.

Diadromous Fish Restoration Priority List

Work continued to complete the update of the diadromous fish restoration priority list and to incorporate the data file into GIS data layer linking diadromous fish habitat to *Mass*DOT infrastructure. *Mass*DOT contracted AECOM to develop the *Mass*GIS data layer. Final drafts of priority lists for all four coastal drainage areas were sent to AECOM in 2011 after extensive updates and QA/QC. This completes *MarineFisheries*' tasks for the project. The next step will be to receive a full data layer from AECOM to ground truth the product and make modifications for use among *MarineFisheries* staff.

River Herring Habitat Assessment

In 2011, staff completed two-year river herring habitat assessments at Bourne Pond (Falmouth) and Red Brook Pond (Bourne), and initiated two more at the Back River (Weymouth) and Cedar Lake (Falmouth). The three Cape Cod pond assessments were associated with NRCS restoration planning. Monthly assessment trips were made from May through September. Assessment data entry and auditing was completed for two assessments that ended in 2010, the Jones River (Silver Lake, Kingston) and Sippican River (Hathaway Pond and Leonard's Pond, Rochester). The next step for these two assessments will be data analysis and report drafting.

MarineFisheries Technical Assistance

Staff reviews potential restoration projects upon request from local, state, and federal agencies and interests. The assistance ranges from brief technical advice to joining long-term projects as an active partner. In addition, routine assistance is provided upon

request to potential projects in the form of site visits, proposal reviews, support letters, and information on existing resources. Effort spent on such technical assistance can amount to relatively few hours for individual projects; however, on an annual basis the communications and meetings add up to a large expenditure of time to provide this form of constituent service.

Fishway Crew Field Assistance

MarineFisheries Fish Crew attended to a total of 22 different fishways in 17 different river systems prior to the commencement of the spring spawning migrations in 2011. Systems where work was performed are listed below. In addition, the Fishway Crew responded to requests from towns and local groups to visit sites each month throughout the year, clearing river debris, repairing fish ladders, and servicing eel ramps.

Elks Ladder	Dighton Cohasset Rehoboth Marshfield Pembroke Wareham Wareham
Route 130 Crossing Fishway	Mashpee - Mashpee Mashpee Barnstable Weymouth - Weymouth - Wingston - Plymouth - Plymouth Watertown
Moody Street Dam Fishway Upper Shawme Pond Fishway Lower Shawme Pond fishway	Sandwich

Fishway Operations and Maintenance Plans

A new effort was launched in 2011 to develop standardized fishway operation and maintenance (O&M) manuals for all new and recently constructed fishways. The general laws of Massachusetts (Chapter 130, Section 19) prescribe the authority of the Division's Director to prepare and require fishway O&M plans. The documentation of management practices for fishways is needed for present operations and to guide future state and local staff. Nine O&M plans were drafted in 2011 and circulated for local review and Departmental legal review.

2011 Completed Projects

Herring Brook Fish Ladder, Pembroke: Staff completed the fish ladder described earlier in the HubLine section.

Santuit River Sluiceway, Barnstable: The *MarineFisheries* Fishway Crew designed and installed a wood bog sluice with fishway baffles in the Santuit River, Barnstable. The project was funded by the U.S. Natural Resources Conservation Service's (NRCS) Wildlife Habitat Incentive Program and was shifted to the Fishway Crew after the local bog owner declined to provide matching costs for the NRCS engineered plan. The former sluice was degraded and providing inefficient fish passage. The structure also provides water control for the adjacent bog.

Lover's Lake Fishway, Chatham: The *MarineFisheries* Fishway Crew designed and installed a concrete vertical slot fishway at the outlet to Lover's Lake in Chatham (Figure 24). The eight foot custom ladder was a cooperative project with the Town of Chatham and funded by the Town. This project follows the construction of the downstream ladder at Stillwater Pond by the crew in 2010.



Figure 24. Lover's Lake fishway, Chatham

Pilgrim Lake Eel Pass, Orleans: The *MarineFisheries* Fishway Crew designed and installed an innovative, gravity-fed eel pass at the outlet to Pilgrim Lake, in Orleans in 2010. This technology is unique for a non-siphon, gravity fed eel pass and has promise to assist eel passage in the future. The eel pass collected more than 40,000 eels in 2011, the most recorded for any eel pass in Massachusetts since the first coastal river eel pass was installed in 2007. During 2011, the Fishway Crew refined the design and constructed a custom aluminum tank to be installed for 2012.

Mystic Lake Dam Fish Ladder, Medford: The Massachusetts Department of Conservation and Recreation (*Mass*DCR) reconstructed the Mystic Lake Dam in 2010 and included a fish ladder and eel ramp (Figure 25). The second phase of this project included construction of a juvenile herring downstream passage facility. This component was completed in 2011, along with the drafting of a cooperative fishway Operation and Maintenance Plan with *Mass*DCR for the fishway, eel ramp, and juvenile downstream passage.



Figure 25. Mystic Lake Dam, Medford

Leonard's Pond Fish Ladder, Rochester: An Alaskan Steeppass fish ladder was installed at the Leonard's Pond Dam during December 2010 and January 2011. *MarineFisheries* paid for the scoping design from USFWS and two sections of steeppass for the project. The Coalition for Buzzards Bay funded the final design, engineering and construction for the ladder. Several site visits were made in 2011 to discuss tuning the ladder's upstream elevation.

Cockeast Pond Fishway Improvement, Westport: With assistance from *MarineFisheries*, the Town of Westport removed and reset an incorrectly constructed culvert at Cockeast Pond. The culvert contains fishway baffles, installed by *MarineFisheries*, to allow passage from the West Branch of the Westport River to Cockeast Pond.

Wapping Road Dam Removal, Kingston: Led by the Jones River Watershed Association and the Massachusetts Division of Ecological Restoration, the Wapping Road Dam in Kingston was removed in 2011. *MarineFisheries* was a project partner and donated cash match and technical assistance. This project is the most significant coastal river dam removal in Massachusetts in terms of diadromous fish restoration potential to date.

New/Ongoing Projects

Draka Dam Fish Ladder, Dighton/Taunton: Project lead, Save the Bay, awarded an engineering and permitting contract to Tibbetts Engineering to install an Alaskan steeppass ladder at the Three Mile River's Draka Dam (Dighton/Taunton). During 2011, meetings were held with and letters drafted to property owners, engineering plans were completed, and permitting inquiries were sent to ACOE and *Mass*DCR.

Morey's Bridge Dam Replacement, Taunton: MassDOT and MassDCR are teaming up to replace both the Morey's Street Bridge and the Morey's Bridge Dam in Taunton in 2012. This \$4.5 million project will include a steeppass fishway and eel ramp that will be fully funded by the construction project. MarineFisheries was involved in extensive technical assistance, planning and funded the USFWS design of the fish ladder. Our fishway crew will receive material to fabricate and install the eel ramp. This project will provide access where none presently exists to the 266 acre Lake Sabbatia and is part of a large restoration partnership to remove 3 downstream dams.

Town Brook Smelt Habitat Enhancement, Quincy: Efforts continued to resolve long-standing degradation of smelt spawning habitat in Town Brook, Quincy. A feasibility study to restore brook flows was completed by Gomez and Sullivan under ISA contract with *MarineFisheries*. Extensive meetings were held and technical assistance provided to the Quincy Downtown Development project that includes a component called the "The Town Brook Smelt Habitat Enhancement Project". These projects were undergoing separate permitting in 2011. The enhancement project has the potential to adopt the Gomez and Sullivan flow restoration recommendations.

Hathaway Pond Dam Removal, Rochester: *MarineFisheries* attended several meetings and site visits for this potential dam removal project in Rochester lead by the Buzzards Bay Coalition. The project also involved numerous communications related to the complex resource use conflicts brought on by the project. River herring habitat assessment data from 2009-2010 were provided to project partners.

Forge Pond Dam Fish Passage Improvement, Kingston: The Gulf of Maine Council accepted a grant proposal, with *MarineFisheries* as the lead, to fund a feasibility study for providing fish passage at Forge Pond Dam and into Silver Lake in Kingston. The contract was received in December 2011 with no further work done beyond the grant proposal and partner coordination.

Tihonet Fish Ladder, Wareham: A site visit and follow-up meeting was held with AD Makepeace and Dick Quinn of USFWS to launch a new fish ladder replacement project in the Wankinco River watershed, Wareham. The design was nearly complete at the close of 2011.

Grass Pond Flow Management Plan, Harwich: In association with *MarineFisheries* and local partner's eel ramp operations at Grass Pond (Harwich), a water flow management plan was drafted and completed in 2011 that outlines watershed management measures to coordinate eel ramp requirements with cranberry harvesting water needs.

Diadromous Fish Biology and Management Project

Biological Assessments for River Herring

The alewife (*Alosa pseudoharengus*) is the most abundant anadromous fish in Massachusetts. A close "cousin" is the blueback herring (*Alosa aestivalis*) which, although a separate species, is often confused with the alewife. The species are usually lumped together under the heading of river herring.

Biological studies continued with adult river herring counts and sample collections from Monument River, Bournedale; Town Brook, Plymouth; Mystic River, Medford; Agawam River, Wareham; Wankinco River, Wareham; Mattapoisett River, Mattapoisett; Nemasket River, Middleboro; Merrimack River, Lawrence; Parker River, Newbury; and Acushnet River, Acushnet. A total of 2,103 river herring (plus 259 American shad) were sampled and assessed from seven of these ten coastal systems in 2011.

MarineFisheries data collections indicate that river herring populations are experiencing a truncation in age structure, with fewer older fish being collected and fish apparently smaller at age than in past years. Counts varied from approximately 3,679 fish in the Acushnet River, Acushnet to 662,052 in the Nemasket River in Middleboro. Electronic monitoring of several coastal systems in 2011 indicated that in some systems there was a modest increase in the number of fish returning to their natal spawning grounds. Counts in the Mattapoisett River in 2011 (12,857 fish) increased slightly compared to 2010 (12,319 fish). In addition, counts in the Acushnet River in 2011 (3,679 fish) increased compared to 2010 (2,710 fish). However, adult returns declined in the Monument River, Bourne in 2011 (68,639 fish) compared to 2010 (106,210 fish).

MarineFisheries also provides technical assistance to local groups conducting volunteer, visual counts of herring runs. These efforts in 2011 included participating with a grant project to develop a River Herring Warden Network and analytical assistance on count data for some runs.

Passage of diadromous species is monitored during the spring/summer each year at the first obstruction on the Merrimack River (Essex Dam in Lawrence). Passage of American shad on the Merrimack River for 2011 (13,835 fish) declined compared to 2010 (23,299 fish) and 2009 (23,199 fish). In addition, 42 striped bass, 2,575 sea lamprey, and 740 river herring (a decrease from 1,456 river herring in 2010) were also lifted above the dam in 2011.

Dr. Gary Nelson, former project coordinator Phillips Brady (retired), John Sheppard, and Dr. Michael Armstrong contributed "An Assessment of River Herring Stocks in Massachusetts" to the Division's Technical Report Series. Dr. Nelson presented the work at the Southern New England Chapter of the New England Association of Environmental Biologists 2011 Annual Meeting in Sturbridge, MA, and the American Fisheries Society's 2011 Winter Meeting in Woods Hole, MA.

Propagation

Efforts to re-establish, augment, and enhance natal anadromous runs in conjunction with ongoing fishway improvement projects included a total of 26,660 pre-spawning adult river herring trapped and transported via stocking truck or lifted above a barrier into seven

coastal systems throughout the Commonwealth (Table 8). The seven systems that received gravid fish in 2011 were: Agawam River, Wareham; Herring Brook, Pembroke/Hanson; Town Brook, Plymouth; Island Creek, Duxbury; Monument River, Bourne/Plymouth; Three Mile River, Dighton; and Eel River, Plymouth. An additional 2,000 alewives were trapped from a Massachusetts donor system and released into two Rhode Island coastal systems (Turner Reservoir, East Providence, and Kickemuit Reservoir, Warren) in a cooperative effort to sustain their small populations.

Table 8. Number of pre-spawning adult river herring trapped and transported via stocking truck or lifted above a barrier in 2011

Donor System	Recipient System	Number of Adults
Nemasket River	Three Mile River*	1,200
Nemasket River	Ten Mile River**	1,000
Nemasket River	Kickemuit Reservoir**	1,000
Town Brook	Billington Sea	4,750
Town Brook	Russell Mill Pond*	1,800
Town Brook	Island Creek*	1,200
Herring Brook	Oldham Pond	9,910
Agawam River	Glen Charlie Pond	1,400
Monument River	Great Herring Pond	6,400

^{*} Denotes out-of-basin transfer (between river systems)

Restoration efforts of American shad to the Charles River also continued with the introduction of nearly 4 million shad fry into the waters around the Woerd Avenue Boat Launch in Waltham. Monitoring trips were conducted daily between May 1, 2011 and July 15, 2011 in order to identify the presence of hatchery adult returns. No adult shad were encountered during the 34 spawning run monitoring trips. In late June and early July, several electrofishing trips were made with the USFWS below the Watertown Dam. These trips yielded a total of nine adult shad. The otoliths of each adult were removed and examined along with scales from each fish to determine fish age and origin. The otoliths were also examined under ultraviolet light for the presence of an oxytetracycline (OTC) mark. Of the nine adults retained, seven were age-5 fish and four of those fish were marked with OTC. These results indicate that the four marked age-5 fish were part of the 2006 stocking in the Charles River (which was the first year of the stocking program). Assessment of the OTC stocking will continue in spring of 2012 and efforts will strive to reach the project goal of an annual release of 3 million young-of-the-year (YOY) shad.

Rainbow Smelt Population Monitoring, Propagation, and Stocking

Rainbow smelt are a popular sportfish in Massachusetts and important forage for many species of fish and wildlife. Smelt population declines since the 1980s prompted *MarineFisheries* to initiate spawning run monitoring using in-stream fyke nets in 2004. The fyke net catches of smelt provide a relative index of population abundance and agestructure data. The project has received funding support from the NOAA Office of Protected Species under two grants.

^{**} Denotes out-of-basin transfer (between states)

The project targeted 33 fyke net hauls over an 11 week season in eight coastal rivers in 2011. The project also conducted PIT (Passive Integrated Transponder) tagging of smelt in the Fore River, Braintree, to track spawning run movements; conducted net catch efficiency trials in the Fore River; and provided smelt gametes used for restoration stocking and genetic samples for a study under the NOAA grant collaboration with Maine and New Hampshire.

A large effort continued in 2011 to conduct data analyses and begin drafting a Gulf of Maine Rainbow Smelt Conservation Plan. The plan is the primary product of a NOAA Species of Concern grant that is due in July 2012. In addition, planning and preparations were made for the 4th North American Rainbow Smelt Workshop held in January 2011 in Portland, Maine. The Species of Concern grant funded the workshop, and *MarineFisheries* was a co-sponsor. *MarineFisheries* smelt efforts were featured with three first author presentations and represented by a poster and two other co-author presentations.

Rainbow smelt propagation included preparing the laboratory, tank spawning of adult brood stock, hatching, marking and stocking of larvae.

American Eel Young-of-the-Year Monitoring

All East Coast states conduct standardized monitoring of YOY American eel under mandatory ASMFC protocols. *MarineFisheries* has monitored the spring migration of YOY eels in the Jones River since 2001 to contribute to a coastwide index of eel population relative abundance. YOY monitoring stations are also maintained in the Acushnet, Saugus, and Parker Rivers. The project targeted 40 Sheldon trap hauls over a 10-week season at the four stations in 2011. The YOY catches in the Jones River rebounded in 2011 to a level near the time series mean after the lowest catches on record in 2010. The Jones River YOY data were accepted in 2011 by the ASMFC American Eel Stock Assessment Sub-Committee as one of only three fishery-independent indices of abundance for YOY eels in New England for the present stock eel assessment. *MarineFisheries* staff noted an increase in poaching activity for YOY eels during the monitoring season that was prompted by sharply increasing international prices paid for legal YOY fisheries in Maine.

The project also works with volunteer organizations to monitor juvenile eels using eel passage ramps in the Saugus River, Wankinco River, Pilgrim Lake, and Cold Brook. The eel ramps were designed by *Marine Fisheries* starting in 2007 to allow eels to pass over dams. Eel ramp catches represent a census of eels able to move upstream of the dams. The seasonal catches at the ramps has typically been in the range of 5 to 10 thousand eels, with the exception of over 25,000 eels passed at Cold Brook in 2009 and 42,000 eels at Pilgrim Lake in 2011.

Other Activities

ASMFC Participation: *MarineFisheries* staff participates in ASMFC Technical Committees and with diadromous fish stock assessments. This year was particularly busy for ASMFC committee work due to ongoing stock assessments for both river herring and eel. Brad Chase began serving as the American Eel Technical Committee's Chairman as well as on the stock assessment subcommittee. He also participated on a steering committee for an eel passage workshop held in March in Gloucester, and presented at the workshop.

Tasks were received under these roles to draft the Fisheries section of the stock assessment, analyze commercial eel pot CPUE data for New England states, and conduct length-based mortality estimates for suitable East Coast datasets. Gary Nelson invested much time and effort in the river herring stock assessment as a sub-committee member. Matt Ayer worked on sturgeon Technical Committee issues as well as the Merrimack River Working Group. Staff also completed annual compliance reports to the ASMFC for sturgeon (Matt Ayer), American eel (Brad Chase), and American shad and river herring (John Sheppard).

Publications and Reports: Staff developed several reports in addition to those listed previously.

Brad Chase and John Shepherd co-authored (with Dr. Kathryn Ford and Tay Evans), the document "Marine Fisheries Time of Year Restrictions (TOYs) for Coastal Alteration Projects," part of the *MarineFisheries* Technical Report Series (#47).

John Sheppard authored a report, "Monitoring of river herring and American eel populations in the Acushnet River after improvements to fish passage." He also presented this study at the National Conference on Engineering & Ecohydrology for Fish Passage, in Amherst, MA.

Presentations: In addition to those previously mentioned, staff prepared and gave presentations on diadromous fish issues to several interested local groups and other state and federal agencies in 2011. Three presentations were given and one poster displayed at the 4th North American Rainbow Smelt Workshop held in January in Portland, Maine. Staff also served on the steering committee for the workshop. Presentations on Mystic Lake fish passage and habitat restoration were provided at the ASMFC Annual Meeting held in Boston in November and at Tufts University in Medford in April. Two presentations on river herring management and biology were given at the River Herring Network Meeting in Buzzards Bay in October. Staff attended numerous other meetings as well.

ADMINISTRATION

Personnel

Kevin Creighton, Chief Fiscal Officer

Finance

Darlene Pari, Accounts Payable Coordinator Eva Morales, Accountant III Jeanne Hayes, Accounts Receivable Coordinator Shannon Davis, Program Coordinator - Revenue

Boston Permit Office

Kerry Allard, Permitting Leader Cecil French, Permitting Supervisor Kerry Faugno, Permitting Receiving Teller Sandra Downing, Permitting Receiving Teller

New Bedford Permit Office

Marie Callahan, Permitting Office Manager Kim Trotto, Permitting and Administrative Support Lynne Besse, Permitting and Administrative Support

Gloucester Permit Office

Rosemary Mitchell, Permitting and Administrative Support Whitney Sargent, Permitting and Administrative Support

Grant Programs

Stephanie Cunningham, Federal Aid and Grants Coordinator Tom Beaulieu, Project Leader, Clean Vessel Act Eileen Feeney, Program Coordinator, Clean Vessel Act

Capital Assets and Facilities Management

Brian Castonguay, Gloucester Office, Head of Facilities and Capital Assets Ralph Stevens, Shellfish Purification Plant, Facilities

Overview

MarineFisheries Administrative Program is responsible for the Division's fiscal functions, permitting, grants management, and capital assets. The Program develops, analyzes, and manages the Division's financial planning and resource allocation activities including budget submissions to the Legislature. Analysts provide financial and performance analysis of Division programs, operations, and policies. Analysts are responsible for the following: monitoring and forecasting revenue and expenditures; preparing the Division's annual budget recommendation and spending plans; working with Department, Legislative and Executive Branch budget staff; identifying and monitoring key budget and policy issues; and, analyzing and proposing policy and savings initiatives. The Program is responsible for permit issuance, collecting fees, and reconciling revenue. The Program also provides all fiscal oversight and reporting on grants, contracts and mitigation projects. In addition, all capital

assets are procured, inventoried, managed, and maintained through the Bureau. Facilities Management is conducted with the intent to provide a healthy and productive working environment. This is accomplished by supplying staff agency-wide with the tools needed to meet their project's goals and objectives. This includes a safe working environment and equipment, vehicles, and vessels maintained and repaired on a timely basis as necessary.

Budget

State-Appropriated Funds

The *MarineFisheries* operating budget has been trending down over the past five fiscal years (FY); the FY2011 budget was approximately 15% lower than that of FY2007. Although overall revenues for the Commonwealth have been up in each of the past two years, the *MarineFisheries* operating budget reflected a reduction of almost 2% in FY2011. The fiscal year 2010 and 2011 state appropriations are shown in Table 9.

Table 9. Fiscal Year 2010 and Initial 2011 Appropriations

Title	Acct. Number	FY2010	FY2011	Change
General Operating	2330-0100	\$4,522,821	\$4,426,578	-2.13%
Sport Fish Program	2330-0120	\$544,860	\$545,143	+0.05%
Sport Fish Retained Revenue	2330-0121	\$217,989	\$217,989	0
Total		\$5,851,363	\$5,285,670	-1.82%
*Saltwater Sport Fish Licensing	2330-0300	n/a	\$101,500	New

(*In 2011, MarineFisheries instituted a new program to issue recreational saltwater fishing permits as required by the "Saltwater Act" which was signed into law by Governor Deval Patrick in November of 2009. The law mandates that all revenue collected under this program be directed to the Marine Recreational Fisheries Development Fund. Available funds may then be appropriated as part of the normal budget process for authorized expenses in the following fiscal year. As FY2011 was the first year of this program, the appropriated amount is not included in the total amount in Table 9 so that an accurate comparison between fiscal years can be made.)

In order to meet the requirements of the approximate 2% operating budget reduction, *MarineFisheries* continued to utilize "soft money" through grant opportunities and shifted costs where appropriate. In addition, all state-funded travel was suspended, spending in the lower subsidiaries was drastically reduced, and three full-time employee positions were eliminated.

The breakdown of overall costs by primary spending category for the *MarineFisheries* operating accounts can be seen in Table 10 and Figure 26.

Table 10. Fiscal Year 2011 Costs, State Appropriations (rounded to whole dollars)

Account Number	2330-0100	2330-0120	2330-0121	Line Total
Salaries	\$3,781,336	\$534,792	\$31,039	\$4,347,167
Employee Expenses	\$9,355		\$2,326	\$11,681
Contracts	\$4,218		\$81,467	\$85,685
Facility Maintenance	\$30,100		\$2,059	\$32,159
Field & Lab Supplies	\$44,560		\$18,272	\$62,832
Fringe Costs	\$76,205	\$10,215	\$593	\$87,013
Fuel	\$35,931		\$3,902	\$39,833
Utilities	\$126,720		\$2,446	\$129,167
Lease/Rent	\$64,114			\$64,114
Maintenance/Repair	\$34,128		\$6,696	\$40,824
Office & Administrative	\$72,344		\$52,407	\$124,751
Services/Equipment Lease	\$13,263		\$13,417	\$26,680
Outside Agencies	\$129,657		\$724	\$130,381

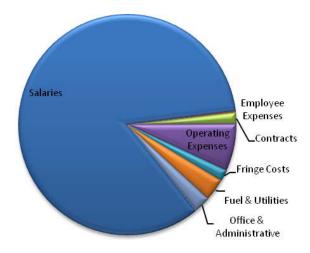


Figure 26. FY2011 Spending Category Summary

Staffing

Authorized personnel levels for calendar year 2011 are shown in Table 11.

Table 11. Fiscal Year 2010 and 2011 Authorized Personnel Levels

Title	Acct. Number	FY2010	FY2011
MarineFisheries General Operating	2330-0100	70	67
Sport Fish Program	2330-0120	10	10
Federal Grants and Trust Account	2330-xxxx*	22	22
Total Employees in All Appropriations		102	99

^{*}Multiple account numbers

A total of three full-time positions were eliminated over the course of fiscal year 2011 when compared to fiscal year 2010. Two of the positions eliminated were the result of retirements; a facilities foreman from the south coast field station and a senior biologist from the anadromous fisheries program. The third position eliminated was a bacteriologist from the shellfish purification plant. Reductions to the overall operating budget did not allow for any of these positions to be backfilled.

Revenue

MarineFisheries collects fees primarily from permit issuance and from processing racks of soft-shelled clams at the Shellfish Purification Plant in Newburyport. A total of 31,293 permits and endorsements were issued by the Licensing Program producing General Fund revenue of \$2,052,070 in 2011. This represents a slight decrease in revenue (~2.6%) from permit issuance in 2010. The Shellfish Purification Plant processed 12,278 racks of soft-shelled clams in 2011. This resulted in General Fund revenues of \$73,668, which is an 11.4% decrease over the 2010 value of \$83,184. In addition to General Fund revenue, MarineFisheries completed the first year of permit issuance for the recreational saltwater fishing permit resulting in 126,659 permits and \$1,051,271 in revenue for the Marine Recreational Fisheries Development Fund.

Commercial Fisherman Permits

Anyone who lands and sells finfish, shellfish, lobsters, edible crabs, or other living marine resources in Massachusetts must have a *MarineFisheries* commercial fishing permit and must sell only to licensed Massachusetts dealers. All commercial permits, except Rod & Reel and Seasonal Lobster, may be endorsed for shellfish at no additional cost. See Table 12 for the number of commercial fisherman permits issued, by type, in 2011 and resulting revenue.

Table 12. 2011 Commercial Licensing and Revenue Statistics

Permit Type	Permits Issued (#)		Revenue
(and resident/non-resident fee)	Resident	Non-Resident	Revenue
Coastal Lobster (\$260/\$520)	1,237	6	\$324,740
Offshore Lobster (\$260/\$520)	344	91	\$136,760
Seasonal Lobster (\$65/\$130)	93	5	\$6,695
Boat 99'+ (\$260/\$520)	13	17	\$12,220
Boat 60-99' (\$195/\$390)	73	152	\$73,515
Boat 0-59' (\$130/\$260)	2,777	268	\$430,690
Individual (\$65/\$130)	315	23	\$23,465
Shellfish (\$40/\$80)	851	24	\$35,960
Shellfish & Rod & Reel (\$55/\$130)	463	1	\$25,595
Rod & Reel (\$35/\$100)	771	77	\$34,685

Coastal Lobster Permit allows the taking, landing, and sale of lobsters and edible crabs (to a licensed dealer) harvested from within the coastal waters of the Commonwealth. There is a maximum pot limit per vessel that is based on Lobster Management Areas and individual

allocations. The permit may be endorsed to take and sell shellfish and finfish at no additional cost. In the case of skin or scuba divers, only the licensee is covered.

Offshore Lobster Permit allows the landing and sale of lobsters and edible crabs (to a licensed dealer) taken outside of the coastal waters of the Commonwealth only; pursuant to appropriate federal permit(s). If the permit is endorsed for the use of pots to harvest lobster, there is a maximum pot limit per vessel that is based on Lobster Management Areas and individual allocations. The permit may be endorsed to take and sell shellfish and finfish at no additional cost.

Seasonal Lobster Permit is issued to full-time students only (verification required), and allows the licensee only to take and sell lobsters and edible crabs (to a licensed dealer) from June 15 - September 15. A maximum of 25 pots may be used. Diving is not permitted; sale of fish and/or shellfish in not permitted.

Boat Permit allows the taking, landing, and sale of fish (to a licensed dealer) and may be endorsed for shellfish. The permit covers everyone aboard the vessel. Price varies with vessel size. No lobsters or edible crabs may be taken.

Individual Permit allows the holder only to take, land, and sell fish (to a licensed dealer) and may be endorsed for shellfish. No lobster or edible crabs may be taken.

Shellfish Permit allows an individual to take, land, and sell (to a licensed dealer) shellfish and seaworms. A shellfish ID card from *MarineFisheries* and a town permit are also required.

Rod & Reel Permit allows the holder only, to catch and sell finfish (to a licensed dealer) caught by Rod & Reel only. No other gear types may be used.

Dealer Permits

Anyone engaged in the wholesale or retail trade of raw fish, shellfish, lobsters, or bait, whether frozen or unfrozen, must have a *MarineFisheries* Dealer Permit and may be subject to inspection from the Massachusetts Department of Public Health (*Mass*DPH). Shellfish dealers must check Food and Drug regulations for tagging and record keeping. Massachusetts seafood dealers who purchase seafood products, even if for bait purposes, directly from fishermen are considered primary buyers, and must be so endorsed on their dealer permits. See Table 13 for the number of dealer permits issued, by type, in 2011 and resulting revenue.

Table 13. 2011 Dealer Licensing and Revenue Statistics

Permit Type	Permits	Revenue	
(and resident/non-resident fee)	Resident	Non-Resident	Revenue
Wholesale Dealer (\$130/\$260)	397	9	\$53,950
Wholesale Truck (\$130/\$260)	100	134	\$47,840
Wholesale Broker (\$130/\$260)	23	2	\$3,510
Retail Dealer (\$65/\$130)	742	2	\$48,490
Retail Truck(\$65/\$130)	50	5	\$3,900
Retail Boat (\$65/\$130)	87		\$5,655
Bait Dealer (\$65/\$130)	150	9	\$10,920

Wholesale Seafood Dealer Permit allows the holder to acquire, handle, store, distribute, process, fillet, ship or sell raw fish and/or shellfish, whether frozen or unfrozen, in bulk or for resale. It also allows retail sales from the same single, fixed location. An approved inspection from the Division of Food and Drugs is required. A copy of the inspection report must be submitted with the application to *MarineFisheries*. The name and address must be the same on the inspection report and permit. This permit may be endorsed for bait (excluding shellfish), with an inspection specifically stating, "Approved for Retail and Bait License". A Hazard Analysis and Critical Control Points (HACCP) plan is required.

Wholesale Seafood Truck Dealer Permit allows the holder to acquire, handle, distribute, ship or sell raw fish, whether frozen or unfrozen, in bulk or for resale from a truck only. It does not allow the holder to process raw fish, whether frozen or unfrozen, lobster or shellfish. Nor does it allow the holder to purchase shellfish or shuck, relabel or repack shellfish. An approved inspection from the Division of Food and Drugs is required. A copy of the inspection report must be submitted with the application to *MarineFisheries*.

Wholesale Seafood Broker Permit allows the holder to act as an agent who negotiates contracts of purchase and sale of seafood. The brokerage activities will not involve the actual handling, processing or reshipping of finfish, shellfish or other marine resources. A "broker only" waiver must be filed in lieu of a health inspection.

Retail Seafood Dealer Permit allows the holder to sell raw fish, whether frozen or unfrozen, shellfish and lobsters at one retail location. The holder must purchase shellfish only from a holder of a wholesale dealer or wholesale truck permit, or from a certified out-of state wholesale dealer. Shellfish CANNOT be purchased directly from a harvester. It does not allow the holder to shuck, relabel or repack shellfish. An approved inspection from the Division of Food and Drugs must be submitted to *MarineFisheries*. The name and address must be the same on the inspection report and permit. This permit may be endorsed for bait (excluding shellfish). The inspection must specifically state "Approved for retail and bait license".

Retail Seafood Truck Dealer Permit allows the holder to sell fish or lobsters at retail from a mobile unit (does not include shellfish). It does not allow the holder to process, fillet, shuck, cook, etc. An inspection is required from a town or county Board of Health. A copy of the inspection must be submitted with the application. The name and address must be the same on the inspection report and permit. A Hawkers and Peddlers permit may also be required.

Retail Boat Seafood Dealer Permit allows the holder to sell "whole" fish and lobsters from his/her boat only (does not include shellfish). A commercial fisherman's permit is required in addition to this permit. A boat waiver must be filed in lieu of a health inspection.

Bait Dealer Permit allows the holder to take and sell marine bait. No inspection is required. Local regulations (i.e., on worms, eels, etc.) may apply.

Special Permits

Special permits are required for scientific collection, shellfish aquaculture, shellfish propagation, contaminated shellfish harvest, and for the non-commercial harvest of lobster. Regulated fisheries are issued as endorsements on commercial permits. See Table 14 for the number of special permits issued, by type, in 2011 and resulting revenue.

Table 14. 2011 Special Licensing and Revenue Statistics

Permit Type	Permi	Povonuo	
(and resident/non-resident fee)	Resident	Non-Resident	Revenue
Non-Commercial Lobster (\$40/\$60)	8,733	181	\$360,180
Regulated Fishery Endorsements (\$30/\$60)	11,833	716	\$397,950
Master Digger (\$250/\$500)	7		\$1,750
Subordinate Digger (\$100/\$200)	92		\$9,200
Scientific Collection (\$10/\$20)	80	19	\$1,180
"Other" Special Permits (\$10/\$20)	320	1	\$3,220

Non-Commercial Lobster Permit is required to fish for or take lobsters and edible crabs for personal use. This authorizes the holder and members of the holders' immediate family, residing in the same residence, to fish for and take lobsters using 10 pots only. The immediate family is defined as the spouse, parents, children, grandparents, brothers, and sisters of the holder. This permit may be endorsed for diving by the permit holder only. Other family members may purchase additional permits for diving only.

Regulated Fishery Endorsement is required for commercial fishing in certain areas under certain conditions. Regulated fishery endorsement are required for dragging, gillnetting, and netting in inshore net areas, and for setting fish pots in waters under the jurisdiction of the Commonwealth. Regulated fishery endorsements are also required for the commercial harvest of northern shrimp, surf clams, ocean quahogs, sea herring, sea urchins, fluke, black sea bass, scup, striped bass, dogfish, American eel, horseshoe crabs, and groundfish.

Master Digger Permit is required for an individual who wants to harvest contaminated clams from areas classified as "restricted". Shellfish are depurated at the Shellfish Purification Plant in Newburyport in accordance with regulations and established procedures. In addition to this application form, applicants must also include a \$1,000 surety bond, sign a master digger affidavit, have their vehicle inspected and approved by MassDPH Division of Food and Drugs, and they must be at least 18 years of age, and may not possess an "open" area commercial shellfish license at the same time as a Master Digger Permit.

Subordinate Digger Permit is required for the harvest of contaminated clams from areas classified as "restricted". Shellfish are depurated at the Shellfish Purification Plant in Newburyport in accordance with regulations and established procedures. Subordinate diggers must work for a Master Digger, they must be at least 18 years of age, and may not possess an "open" area commercial shellfish license at the same time as a Subordinate Digger Permit.

Other Special Permits are required for specific activities in the marine environment, including; aquaculture, scientific collection, shellfish propagation, and shellfish relay.

Recreational Fishing Permit

Governor Deval Patrick signed into law "An Act Instituting Saltwater Fishing Licenses" (Saltwater Act) on November 23, 2009. This bill enabled MarineFisheries to build and implement a state permitting program for 2011, exempting the Commonwealth's saltwater recreational anglers from the more expensive federal registry that was mandated by the US Congress with the 2006 reauthorization of the Magnuson-Stevens Fisheries Conservation

and Management Act. All fees collected from the sale of recreational saltwater fishing permits, including permits issued to the for-hire fleet, are deposited into the Marine Recreational Fisheries Development Fund.

MarineFisheries began issuing recreational saltwater fishing permits in December 2010 for the first year of the new program. In addition to recreational saltwater permits and for-hire permits, many individuals contributed donations for recreational fishing improvements. See Table 15 for the number of permits issued, by type, in 2011 and resulting revenue.

Table 15. 2011 Recreational Saltwater Permitting and Revenue Statistics

Permit Type	Permits Issued (#)		Revenue	
(and resident/non-resident fee)	Resident Non-Resident			
Recreational Saltwater (\$10/\$10)	82,141	12,341	\$944,820	
Recreational Saltwater Age 60+ (\$0)	27,070	4,196	No Fee	
Charter Boat (\$65/\$130)	806	49	\$58,760	
Head Boat (\$130/\$260)	51	5	\$7,930	
Donations			\$39,761	
Marine Recreational Development Fund	\$1,051,271			

Recreational Saltwater Fishing Permit is required of all fishermen age 16 and over. Exceptions have been made for anglers fishing aboard legally permitted for-hire vessels, individuals that are disabled, and for those fishermen with a valid recreational saltwater fishing permit from another coastal state that has entered into a reciprocity agreement with Massachusetts. The fee for the permit has been set at \$10 for fishermen between the ages of 16 and 59, inclusive. The permit is free for fishermen aged 60 and over.

Charter Boat Permit is required for a vessel that can carry up to 6 persons fishing as passengers from the for-hire vessel.

Head Boat Permit is required for a vessel that can carry 7 or more persons fishing as passengers from the for-hire vessel.

Grants

In FY2010, *MarineFisheries* had spent approximately \$5.8 million on federal grants and mitigation projects operating out of the *MarineFisheries* Trust account. In FY2011, total spending dropped by about \$800,000. Most of the reduction can be attributed to the closeout of a 2010 grant that provided economic relief to shellfish fishermen impacted by a massive red tide outbreak that occurred in 2008.

In FY2011, *MarineFisheries* spent approximately \$5.1 million on grants and mitigation projects. Most of the expenditures were on existing programs and continuation grants. However, several new projects began in FY2011, including the following:

- A \$500,000 federal contract to develop a network for creating a sustainable redfish trawl fishery in the Gulf of Maine;
- A \$843,000 federal contract to Conservation Engineering and the Marine Fisheries Institute to develop a network approach to conservation engineering in groundfish fisheries;

- A fully staffed and implemented eelgrass mitigation project that was funded as a result of the Algonquin HubLine Project in Massachusetts during the previous fiscal year;
- A \$300,000 federal grant to develop the Massachusetts Leatherback Sea Turtle Research and Disentanglement Program; and
- Several new research grants awarded through entities such as the Northeast Consortium, Commercial Fisheries Research Foundation, Marine Fisheries Institute, Gulf of Maine Council, Sea Watch International, as well as multiple private donors for sponsored shark research.

The Federal Grant Awards and expenditures out of the *MarineFisheries'* Trust are provided in Table 16.

Table 16. Fiscal Year 2010 and 2011 Appropriations

Title of Federal Grant or Trust	Account Number	FY2010	FY2011
Clean Vessel Act	2330-9222	\$850,000	\$800,000
Fisheries Statistics	2330-9712	\$135,000	\$130,000
Right Whale Conservation	2330-9713	\$40,000	\$0
Anadromous Fisheries	2330-9721	\$22,000	\$0
Boating Infrastructure	2330-9725	\$100,000	\$100,000
Interstate Fisheries	2330-9730	\$233,000	\$230,000
ACCSP	2330-9732	\$50,000	\$71,000
Economic Relief	2330-9738	\$2,000,000	\$275,000
Turtle Disentanglement/Protected Species	2330-9739	\$60,000	\$770,000
Fish Age & Growth	2330-9742	\$215,000	\$200,000
Marine Fisheries Research Trust	2330-0101	\$2,288,000	\$2,650,000

The Clean Vessel Act Program

MarineFisheries administers the Clean Vessel Act (CVA) Program to ensure that adequate convenient pumpout facilities are provided to meet the needs of recreational boaters using Massachusetts coastal waters. This is achieved with the addition of new infrastructure and funding sub-grantees for operation and maintenance costs. Responsibilities include the identification of appropriate sites for additional pumpout equipment, making technical assistance and information readily available to boaters and others in need of information regarding the MassCVA Program, and agency coordination with public and private parties.

In 2011, *MarineFisheries* enjoyed its 17th year of participation in the CVA Grant Program. Seventeen years ago, few boaters even considered using their holding tanks; now the demand for pumpouts along the 1,500 miles of Massachusetts coastline is greater than ever, representing an entirely new attitude regarding boaters' personal share of responsibility for clean water. We remain steadfast in supporting the backbone of our program-participant operation and maintenance funding, inspection protocols, and needs assessment initiatives. All activities are sustained by our strong program administration. With these tools, we continue to build on our program's strengths, tackle new challenges, and form a vision for many more years of clean boating in Massachusetts.

Innovative Ideas, Accomplishments, and Outreach: The geography of the Massachusetts coastline, with its hundreds of bays, coves, and inlets, and our short, intense New England boating season, make it fiscally impossible to site enough fixed shore-side facilities to adequately service the total boating population in the coastal zone. Consequently, we have been a leader in the implementation of pumpout vessel use; our combination of pumpout vessels and shore-side pumpouts (Figure 27), along with dump stations has created much wider boater access along the coast than twice the number of conventional shore-side facilities could have provided, and has been instrumental in Massachusetts' efforts to establish a statewide No Discharge Area (NDA). Providing this type of operator support was one of the key recommendations in the Sport Fish and Boating Partnership Council's 2008 review of the National CVA Program. *Mass*CVA has been providing this innovative funding since the program's inception.



Figure 27. A combination of pumpout boats and fixed location pumpout stations help meet the needs of the Commonwealth's recreational boaters

We are also moving ahead with our preemptive compliance program, capital reinvestment program, and innovative embayments incentive program. In particular, our capital reinvestment program has enabled *Mass*CVA to expand with minimal costs to new subgrantees that lack the capital for a full investment in new infrastructure. Through this program, when a sub-grantee replaces an existing *Mass*CVA pumpout boat or fixed-location station, the replaced equipment is provided to a new applicant who will pay to have it refurbished at a fraction of the cost of new equipment.

The MassCVA Program has wide participation with public, private, and non-profit partners. In 2011, we enhanced our program with the addition of a new sub-grantee; our sub-grantees include 46 private marinas, three non-profit organizations, and 50 cities and towns. Also, we are currently partnering with two federal agencies, three state agencies, and more than a half dozen non-profit organizations as part of our information and education efforts.

In 2011, we completed our fifth consecutive year of exhibiting, in partnership with our state boating law enforcement agency, at the New England Boat Show. This has led to record increases in requests for new infrastructure from new operators allowing us to fill long standing gaps in pumpout coverage coastwide and increase awareness of the *Mass*CVA Program among boaters and the general public.

As a direct result of our successful outreach and needs assessment efforts to sub-grantees and the general public, program shortfalls are being more effectively identified and addressed. In addition, NDA designations have been approved in all but a few embayments along the Massachusetts coastline. The *Mass*CVA Program was proactive in reaching out to communities and private marina operators early in the NDA application process. Consequently, this year's request for new infrastructure (Table 17) has again exceeded expectations and we are quickly approaching the removal of more than 5 million gallons of effluent from state coastal waters.

Table 17. New Infrastructure for 2011

Location	Infrastructure Type
Boston Waterboat Marina	Replacement engine on pumpout boat
Town of Bourne	Replacement pumpout boat & fixed location pumpout station
Captain's Cove Marine	Replacement fixed location pumpout station
Town of Dartmouth	Replacement pumpout boat
Town of Duxbury	Replacement fixed location pumpout station

The total project costs for the above new equipment was \$225,000. In addition, \$873,500 was distributed to 83 sub-grantees to cover the operation and maintenance expenses of 65 pumpout boats and 55 fully functional fixed-location pumpout stations.

Boating Infrastructure Grant Program

The Massachusetts Boating Infrastructure Grant (BIG) Program, begun in 2001, is a two-tiered federal grant program, directed through the USFWS and administered by *MarineFisheries*. The BIG Program is paid for by money from the Sport Fish Restoration Fund which in turn is funded by a small percentage of the Federal Gasoline Tax – an amount which represents fuel purchased by boaters across the nation. BIG is designed to provide grants to upgrade or install facilities for transient recreational boats 26 feet or more in length at public or partnered private facilities.

Tier I grants are limited to about \$100,000 per year per state with the advantage of using a more streamlined state approval process. The Massachusetts BIG Program has attempted to fund as many qualified projects as possible each year under Tier I. Since 2001, the BIG Program has granted awards for 13 projects in 9 different communities totaling \$741,816 (Table 18). Awards averaged \$57,063 per project.

Proposed projects filed under Tier II can be much larger in scope than those in Tier I. Unlike Tier I, Tier II proposals are judged in a nationally competitive process based on a strict point system. Massachusetts has not yet had a successful Tier II project.

Both grant tiers are reimbursement grants, meaning that payments are made upon the submission of invoices for work accomplished. Selected applicants provide at least a 25% match for Federal funds received. All payments are based on 75% reimbursement of invoices from work completed. The federal regulation on BIG can be viewed in its entirety at the USFWS website.

Table 18. Massachusetts BIG Project Summary

Year	Project	Award	% Complete
2001	Nantucket Transient Boater Restrooms (Town Pier)	\$90,413	100%
	Tisbury Transient Dockage & Dinghy Dock (Lake Tashmoo)	\$52,000	100%
2002	Wellfleet Transient Dockage (Town Pier)	\$62,625	100%
	Chatham Transient Moorings & Navigational Aids (Stage Harbor)	\$15,000	100%
2003	Chatham Transient Boater Restrooms (Stage Harbor)	\$69,000	100%
	Beverly Transient Moorings (Great Misery Island)	\$17,394	100%
2004	Boston Harbor Islands Transient Moorings (Long Island) Boston Harbor Islands Transient Moorings (Peddocks Island)	\$25,000	100%
	Owen Park Transient Dockage (Vineyard Harbor)	\$53,752	100%
2005	Provincetown Transient Courtesy Float (MacMillan Pier)	\$60,000	100%
	Nantucket Transient Boater Navigational Aids (Nantucket Harbor) Nantucket Transient Boater Navigational Aids (Madaket Harbor)	· \$19,382	100%
2007	New Bedford Transient Navigational Aids & Moorings (New Bedford Harbor) New Bedford Transient Dinghy Dock (New Bedford Harbor)	\$95,000	100%
2009	Scituate Marine Park Transient Access (Scituate Harbor)	\$90,000	85%
2011	Wessagusset Transient Dockage (Fore River, Weymouth)	\$92,250	0%

Three grants were open in 2011, and are described in more detail.

Scituate Marine Park Transient Boater Access Project: This project is well on the way to increasing transient boater berthing and access to Boston Harbor's natural, historic, and scenic attractions at a newly designed, multi-use boating facility through the purchase and construction of: one aluminum ADA compliant gangway, transient dockage for 14 vessels, handicapped accessible restroom and showers, and a Maritime Boater Visitor Center (Figure 28).

The Project is part of a multi-year, multi-million dollar Marina Redevelopment Program designed to: (1) renovate and expand the municipal marina, (2) provide new docks, a pumpout station, (3) a working boatyard, (4) an ADA accessible marina and maritime

center and comfort station with showers, laundry facilities, and snack machines, and (5) a maritime park walkway with decorative benches, and marsh viewing stand, and lighting throughout. The Town of Scituate has purchased a \$4.3 million dollar parcel of land encompassing the boatyard, marine park, and sensitive marshland, in an effort to preserve it for use by all and to preclude commercial or private development. The park, expected to be completed in 2012, will be enjoyed by all via a waterfront promenade, a pedestrian walkway from the maritime center to a viewing platform near the marshland, and water taxi and walkways to Scituate's downtown restaurants, stores, and shops.





Figure 28. The new boater visitor center and transient boater dockage in the Town of Scituate funded by a BIG grant

New Bedford Transient Boater Access Project:

The New Bedford Harbor Development Commission, as part of its long term plan to expand and improve transient boater access to the cultural, historic, and recreational resources of New Bedford Harbor, completed the installation of a combination of dingy docks, gangways, floats, and landings at four different locations throughout the harbor – Coast Guard Park, Ishmael's Landing, Tonnessen Park, and Pope's Island. This multifaceted project also includes channel markers, environmentally friendly helix anchor systems, and moorings for transient boater use. The grant funds covered about 2/3 of the total project cost.

On October 18, 2011, Lt. Governor Timothy Murray helped celebrate the completion of the project with a press event at the Coast Guard Park transient tie-up docks conveniently located in downtown New Bedford (Figure 29). The facility is located adjacent to the historic sailing vessel, the Ernastina. The Lt. Governor thanked the Division of Marine Fisheries



Figure 29. Coast Guard Park transient access site and new Clean Vessel Act Pumpout Boat, New Bedford Harbor

and our partners in completing such a worthwhile boating access project.

Wessagusset Yacht Club Public Transient Boater Dockage Project: The objective of this project is to increase transient boater berthing and access to Boston Harbor's natural, historic, and scenic attractions by providing dockage for eight transient boats > 26' through the purchase, construction and installation of two 50' by 14' dock units. The eight additional transient berths at this renovated, full-service yacht club will provide additional safe berthing in a high demand region. The dock units will be placed to provide easy, deep water access in and out of the facility for transients. The units were chosen specifically for their ability to provide stable and safe dockage in a potentially high energy environment and under all weather conditions. The completed project will help the community by supporting new revenue generating businesses in the waterfront area.

Other Activities: The BIG Coordinator is an active member of the Massachusetts Legislative Boating Caucus, and provided agency representation at one meeting in 2011. The Coordinator also maintains agency membership with the States Organization for Boating Access.

The Coordinator is responsible for preparing annual financial and progress reports, preparing annual grant submissions, and working with potential applicants. Other Grant Program staff contribute significantly to this work. In 2011, considerable technical assistance was provided to the year's Tier I applicant, the Wessagusset Yacht Club. The Coordinator also took part in online accessibility training and provided information learned to current and prospective sub-grantees.

Capital Assets

Facilities

MarineFisheries maintains facilities at several coastal locations throughout the state. Headquarters are located in Boston, and the two primary field stations are located in Gloucester and New Bedford. Other facilities include the Shellfish Purification Plant in Newburyport, the Martha's Vineyard Research Station in Vineyard Haven, and a subsidiary field office and storage facility in Sandwich.

In FY2011, *MarineFisheries* spent almost \$500,000 in facility planning, infrastructure maintenance, and emergency repairs. In New Bedford, plans were halted on the build-out of a support facility to be constructed on a 3-acre parcel owned by the Division in the South Terminal Extension on Blackmer Street; plans to relocate this project to an alternate site were begun. The Gloucester Office relocated a walk-in freezer from the sampling area to outside, completed an overhaul of the gear sampling room, had engineering plans drafted for a new parking area, completed emergency repairs to a sewer line, replaced corroded water supply lines, and painted three sections of the facility. Repairs at the Shellfish Purification Plant included the installation of a new overhead door, the replacement of the flooring in the process area, repair of a failed AC unit, upgrades to the public bathrooms to make them ADA compliant, and emergency repairs to corroded/leaking pipes. *MarineFisheries* entered into an agreement with UMass to renovate the Lanesville Lab located on the shore in Gloucester. Renovations at the Lanesville Lab included a complete interior remodeling, a new roof, replacement doors and windows, and exterior painting.

Vehicles and Boats

MarineFisheries maintains a fleet of 40 vehicles and 16 boats. In 2011, just over \$116,000 was paid to the Office of Vehicle Management for lease vehicles, and an additional \$30,000 was spent on maintenance and repair for all stock. No vehicles, boats or outboards were replaced in 2011.