Department of Fish and Game

Massachusetts Marine Fisheries

2015 Annual Report

Department of Fish and Game

Massachusetts Division of Marine Fisheries

2015 Annual Report

Commonwealth of Massachusetts
Governor Charles D. Baker
Lieutenant Governor Karyn E. Polito

Executive Office of Energy and Environmental Affairs
Secretary Matthew A. Beaton

Department of Fish and Game
Commissioner George N. Peterson, Jr.
Deputy Commissioner Mary-Lee King

Division of Marine Fisheries
Director David E. Pierce
Deputy Director Daniel J. McKiernan
Chief Financial Officer Kevin Creighton

www.mass.gov/marinefisheries

January 1–December 31, 2015

Table of Contents

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 regulations 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 and Abbreviations

Army Corps	US Army Corps of Engineers
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
EPA	Unites States Environmental Protection Agency
FMP	Fishery Management Plan
GIS	Geospatial Information System
ILF	In-lieu Fee
ISSC	Interstate Shellfish Sanitation Conference
LMA	Lobster Management Area
*Mass*DAR	Massachusetts Department of Agricultural Resources
*Mass*DCR	Massachusetts Department of Conservation and Recreation
*Mass*DEP	Massachusetts Department of Environmental Protection
*Mass*DFG	Massachusetts Department of Fish and Game
*Mass*DOT	Massachusetts Department of Transportation
*Mass*DPH	Massachusetts Department of Public Health
Massport	Massachusetts Port Authority
Mass*Wildlife*	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
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NSSP	National Shellfish Sanitation Program
OLE	Office of Law Enforcement (Massachusetts)
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 SECTION

Fisheries Policy and Management Program

Personnel

Paul Diodati, Director (retired April 30)
Dr. David Pierce, Deputy Director (January–April)/Director (May–December)
Daniel McKiernan, Deputy Director
Steve Correia, Senior Marine Fisheries Biologist (retired June 30)
Melanie Griffin, Fisheries Management Specialist
Nichola Meserve, Fisheries Policy Analyst
Story Reed, Permit Program Administrator
Jared Silva, Regulatory Coordinator
Samantha Andrews, Contracted Economic Fishery Assistance Specialist

Conservation Engineering Project
Michael Pol, Project Leader
David Chosid, Marine Fisheries Biologist
Mark Szymanski, Assistant Marine Fisheries Biologist

Overview

MarineFisheries is responsible for managing the Commonwealth's commercial and recreational fisheries. Management of marine resources unique to state waters and which cross state/federal boundaries is a constant, ongoing endeavor. A core of fisheries management professionals, with many years of practical experience and knowledge of Massachusetts 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.

Advisory Groups

Following below is a summary of 2015 proceedings by groups advising *MarineFisheries* on fishery management issues.

Marine Fisheries Advisory Commission

The Massachusetts Marine Fisheries Advisory Commission (MFAC) is a nine-member board, representing recreational and commercial fishing interests, from various parts of the Massachusetts coast. Commissioners are appointed by the governor to three-year terms and attend monthly business meetings as well as public hearings. Proposed regulatory changes are approved or disapproved by a majority vote at the Commission's monthly business meetings.

The MFAC held seven business meetings and six public hearings during 2015. Regulatory revisions and fishery specifications that were approved by the Commission or became effective during 2015 are included in the summary of fisheries management actions in the following pages. A subcommittee of the MFAC also met once to review permitting issues. Where possible, Commissioners also attended four Massachusetts-based ASMFC public hearings on interstate management plans that were hosted by the Division.

Perhaps most important in 2015, the MFAC fulfilled its responsibility with regards to the Division's leadership. By statute, the Director of *MarineFisheries* is appointed by the Commissioner of the Department of Fish and Game with the approval of the MFAC (MGL C.130 §1A). Effective April 24, Paul Diodati retired from state service after 37 years at the Division, including the last 15 as its Director (Figure 1). On September 10, the MFAC approved the Commissioner's appointment of Deputy Director David Pierce to be the Division's next Director. Pierce served as Acting Director since Diodati's retirement and has 43 years of experience at *MarineFisheries*.

Figure 1. Out-going Director Paul Diodati with members of the MFAC in April 2015. From left to right: Chuck Casella, Bill Adler, Vito Calomo, Randy Sigler, DFG Commissioner George Peterson, Paul Diodati, Mark Amorello, and Ray Kane. (Missing: Joseph Huckemeyer, Edward Nasser, and Domenic Santoro.)

Marine Recreational Fisheries Development Panel

Pursuant to provisions of "An Act Instituting Saltwater Fishing Licenses", a Marine Recreational Fisheries Development Panel was established in 2010 to recommend how annual appropriations from the Marine Recreational Fisheries Development Fund should be spent. All fees collected from the sale of recreational saltwater fishing permits are deposited into this fund for the dedicated purpose of improving recreational fisheries or recreational fishery research in the Commonwealth, with a requirement that one-third of the annual appropriation be used for "improved public access to marine recreational fisheries."

The Panel met during June 2015 to review spending of the Fiscal Year (FY) 2015 fund appropriation and make recommendations for spending of the expected FY2016 fund appropriation of roughly $1.3 million. The approved spending plan included, but was not limited to: possible construction of a new fishing pier on West Island in Fairhaven; continuation of a Small Grants Program through which municipalities can compete for funds (up to $15,000 per project) to finance public access improvement projects within their jurisdictions; engineering and design work for possible future fishing pier construction, including at Deer Island, Boston; continuation of expanded and enhanced sampling and assessment of the recreational fishery; public informational and educational materials and programs; monitoring diadromous fish populations; and monitoring fish populations at artificial reefs. The Panel met again in November 2015 to approve an alternative infrastructure project for FY2016 due to the Town of Fairhaven rescinding its support for the West Island fishing pier. The Panel supported the Division's proposal to build a recreational fishing reef roughly two miles off the coast of Harwich using concrete salvaged from the razing of the town's high school, considered a premium reef-building material.

Members of the Panel attended an October 5 ribbon-cutting event for the newly refurbished fishing pier at Cashman Park in Newburyport (Figure 2). The upgrades to the fishing pier—aside from its attractiveness—added to its size, introduced safety railings, and included handicapped accessible features such as an entry ramp and customized railings along the most fished portions of the pier. The project was financed, in part, by FY2015 funds from the Marine Recreational Fisheries Development Fund.

Figure 2. Marine Recreational Fisheries Development Panel Chairman Chuck Casella (fourth from left) cuts the ribbon for the Cashman Park Pier with other federal, state, and town officials

With the support of the Panel, the Division also established the 2015 free saltwater fishing days (no permit required) as July 4 and 5, a change from prior years when the first weekend in June was selected to mirror the free freshwater fishing days. The Panel supported the later dates to capitalize on a holiday weekend, generally more favorable weather conditions, and greater species availability.

Seafood Marketing Steering Committee

On August 13, 2015, then Governor Patrick signed into law "An Act Promoting Economic Growth Across the Commonwealth," which, in part, established a Seafood Marketing Program within *MarineFisheries*. This program is a direct result of recommendations made by a special commission tasked by the legislature to investigate the merits of developing a Massachusetts seafood marketing program, as well as Senate Bill 1979, "An Act Establishing a Massachusetts Seafood Marketing Program," filed by Senator Bruce Tarr in 2013. The legislation lays out initial objectives of the program, requires the appointment of a 19-member steering committee to guide MarineFisheries in the administration of the marketing program, and designates funding of up to $250,000 per fiscal year from commercial harvester and dealer permit revenues. In 2015, *MarineFisheries* hired a coordinator to oversee this new program. It was expected that the steering committee would be appointed in early 2016.

Shellfish Advisory Panel

MarineFisheries formed a Shellfish Advisory Panel in 2014 to provide guidance to the agency on emerging issues, matters of concern, and possible solutions with regards to the shellfish industry in the Commonwealth. The group includes harvesters, dealers, researchers, aquaculturists, and municipal shellfish officials. The panel met twice in 2015 to discuss and provide industry input on a range of issues including *Vibrio parahaemolyticus* control measures, shellfish propagation permit conditions, and razor clam harvest methods.

Fisheries Management Actions

American Eel

Poaching Fines: To enhance compliance with the long-standing prohibition on harvest of young eels ("elvers", Figure 3), *MarineFisheries* worked with the state legislature to increase the fines for taking eels smaller than 6 inches. Elevated prices for elvers in recent years had led to an increase in poaching. The new fine for taking eels smaller than 6 inches is $10,000 (previously $100) or 30 days in jail, or both. The bill to increase the fines was filed by State Representative Sarah Peake, who also serves as the legislative appointee to the ASMFC.

Figure 3. Elvers caught during their spring migration up river.

American Lobster

OCCLCMA Haul-Out Period: Effective January 13 by emergency action, *MarineFisheries* amended the gear haul out period in the Outer Cape Cod Lobster Conservation and Management Area (OCCLCMA) from January 15–March 15 to February 1–April 30 to align with the new closure to all fixed gear in the Large Whale Seasonal Trap/Pot Gear Closure Area, which encompasses the OCCLCMA entirely. This closure area

represents the state waters' portion of the Massachusetts Restricted Area, part of the 2014/2015 revisions to the federal Atlantic Large Whale Take Reduction Plan. Public hearings were held in January.

Southern New England Trap Allocations and Trap Allocation Transfer Program: In 2012, ASMFC approved Addendum XVIII, which includes trap allocation reduction schedules for LCMAs 2 and 3 designed to scale down the size of the Southern New England fishery to that of the depleted resource. ASMFC also adopted Addendum XXI in 2013 to change the trap transferability programs for LCMAs 2 and 3 in order to allow for flexibility in the movement of traps as these areas' effort consolidation programs are implemented. The trap reductions would not take effect until NOAA Fisheries implemented corresponding trap transferability measures.

In 2015, NOAA Fisheries announced the implementation of the lobster trap transferability program, and began accepting applications for trap transfers to take effect in 2016. The program's implementation required the development of a centralized database, joining both state and federal trap allocation data for the first time. *MarineFisheries* staff members were key contributors to this process. As a result of NOAA's action, Addendum XVII's trap allocation reduction schedules were to begin in 2016. For LCMA 2 (which includes Massachusetts state waters), the reduction is 25% for 2016, followed by 5% annual reductions for five years (2017–2021). At the end of 2015, *MarineFisheries* filed emergency regulations to take effect January 1, 2016 that implemented the LCMA 2 reduction schedule, and liberalized the state's lobster transferability regulations. The latter allows harvesters to obtain multiple coastal lobster permits and trap allocations in excess of trap caps in circumstances of mandatory trap allocation reductions.

Atlantic Herring

Days Out Schedule and Spawning Protection: Consistent with ASMFC action, *MarineFisheries* declared the days out schedule for the directed herring fishery in Management Area 1A, including a five day/week fishery June 1–July 5, a seven day/week fishery July 6–August 28, and a three day/week fishery October 1–November 2. Based on sampling of the commercial Atlantic herring fishery, *MarineFisheries* enacted the spawning area closure during September 21–October 18 and October 21–November 3.

Executive Order 562

Governor Baker signed Executive Order 562 in March 2015, directing state agencies to review all of their regulations to determine whether any should be amended, simplified, or rescinded in order to reduce unnecessary regulatory burden on the public. The executive order encourages state agencies to seek public comment on the agency's review of its regulations. To that end, MarineFisheries held public listening sessions in October. The Division then developed draft regulatory proposals which were expected to go to public hearing in 2016.

Fluke, Scup, and Black Sea Bass

Fluke Commercial Winter Weekly Limit Program: For the fifth year, *MarineFisheries* authorized interested fluke permit endorsement holders to land a weekly limit of fluke rather than the standard daily limit during the Period I fishery. The pilot program was created at the request of offshore trawl vessel fishermen to assist the fleet in achieving its seasonal quota allocation with the goal of also reducing discards. Whereas the regulations establish a 500-pound daily limit beginning February 1 (preceded by a January closure), participants of the 2015 pilot program were allowed to land 1,000 pounds per week beginning January 1. The Division issued 56 Letters of Authorization (LOAs) for the 2015 program.

Scup Trawler Aggregate Program: *MarineFisheries* continued for a second year its pilot program exempting draggers endorsed to land scup from the daily trip limit in favor of a weekly aggregate trip limit during the Summer Period (May 1–October 31). The weekly limit is intended to reduce bycatch and discard mortality and was requested by industry participants. The weekly limit equaled the daily limit times the number of open days per week. The Division issued 32 LOAs for the 2015 program.

Scup Commercial Trip Limits: *MarineFisheries* made several in-season adjustments to the commercial scup fishery limits via the Director's declaration authority. To facilitate more use of the Summer Period quota allocation, all seven days per week were opened to commercial landings during September 11–October 31 and the trawl vessel trip limit was increased from 800 pounds to 1,500 pounds during October 9–31. To complement the federal limit for the offshore Winter II fishery, an 18,000-pound trip limit was set for November 1–December 31. To complement the federal limit for the upcoming offshore Winter I fishery (2016), a 50,000-pound trip limit was set for January 1–April 30. Public comment was collected prior to each declaration.

ASMFC Addendum XXVI (Fluke): In January, *MarineFisheries* hosted an ASMFC public hearing on Draft Addendum XXVI, which proposed the continuation of a regional approach to managing the recreational fluke fishery that was first used in 2014 to address difficulties stemming from the use of state-by-state harvest allocations based on a single year (1998). Approved by the ASMFC in February, Addendum XXVI established the following regions: Massachusetts; Rhode Island; Connecticut–New Jersey; Delaware–Virginia; and North Carolina. Under this system, Massachusetts was able to maintain status quo regulations (other than accounting for an error in the season's end date): May 22–September 23 open season, 16-inch minimum size, and a 5-fish limit.

Recreational Black Sea Bass Measures: Effective April 24 by emergency action, *MarineFisheries* reduced the recreational season for black sea bass (Figure 4) by three and a half weeks in order to achieve a 33% reduction in harvest as required under the federal and interstate management processes. An exemption program for for-hire vessels to fish under alternative measures (higher bag limit at shorter season) through the issuance of an optional letter of authorization was also discontinued due to multiple factors including impacts on the accuracy of catch data and low participation. The resulting regulations applicable to all private anglers and for-hire patrons included an 8-fish bag limit, 14" minimum size and May 23–August 27 season. A public hearing was held in May.

Figure 4. *MarineFisheries* biologist M. Rousseau holds up a recreationally-caught black sea bass.

Gear Issues

Surf Clam and Ocean Quahog Dredge Width: At year's end, *MarineFisheries* awaited executive approval to implement a uniform maximum dredge width of 48" for surf clam and ocean quahog dredges throughout state waters. The proposal was drafted due to changes in fishery participation and desire to preserve the near-shore fishing opportunities for smaller vessels. The existing rules included a 100" maximum for ocean quahog dredges; and a 48" maximum for surf clam dredges with the exception of 100" in certain waters

south of Cape Cod and 16" in the Town waters of Chatham. A review of this issue was initially requested by the Division's Shellfish Advisory Panel. Public hearings were held in January.

Trap/Pot Gear Haul-Out Period: Effective January 13 by emergency action, *MarineFisheries* adopted a new closure to all pot/trap gear (primarily effecting lobstermen, but applicable to other pot/trap fishermen) in the state waters' portion of the Massachusetts Restricted Area, part of the 2014/2015 revisions to the federal Atlantic Large Whale Take Reduction Plan. The closed area, including waters of Cape Cod Bay, Massachusetts Bay, and Outer Cape Cod, is closed February 1–April 30. NOAA Fisheries' initial closure omitted part of OCCLCMA but included January as well, but was shortened in time and enlarged in size at the request of *MarineFisheries* on behalf of industry members to reduce the economic impact without sacrificing whale protection. The timing of certain fixed gear seasonal restrictions on single pots and pot trawls in the Right Whale Cape Cod Bay Critical Habitat Area were also adjusted to correspond to the new closure. Public hearings were held in January.

Fishing of Single Pots: The agency successfully petitioned NMFS to amend a provision of the Atlantic Large Whale Take Reduction Plan that would have banned the commercial fishing of single pots (lobster as well as fish and conch) in state waters. *MarineFisheries* staff argued that buoy lines attached to single pots are less prone to injure a large whale because the gear is usually lightweight with lower breaking strength and predominantly fished nearshore where whales are less common. The Massachusetts Inshore Single Trap/Pots Area includes all state waters south and east of Cape Cod, as well as all waters within three miles from shore north of Cape Cod, with additional area seaward of the 3-mile line along the Billingsgate Shoal in Eastern Cape Cod Bay (Figure 5). In exchange, *MarineFisheries* agreed to an industry-supported gear marking scheme featuring a second color marker for singles fished in the exemption area, so that future analysis will be able to demonstrate whether this gear constitutes a substantial risk to large whales and should be further regulated. *MarineFisheries* was also able to convince NMFS to reduce the ALWTRP's requirement for the number of traps in a trawl to use two buoy lines from six traps to four traps. The ALWTRP also prohibits singles from being rigged with a buoy line with a diameter greater than 3/8 inch. The Federal rules to implement the ALWTRP became effective June 1, 2015, and apply to both state and federal permit holders. At the end of 2015, *MarineFisheries* filed emergency regulations effective January 1, 2016 to complement the federal rules so as to reduce potential negative impacts on enforcement resulting from different state and federal rules. To reduce the risk of entanglement and to streamline enforcement and compliance, DMF also required recreational fishermen to fish under these new rules as well.

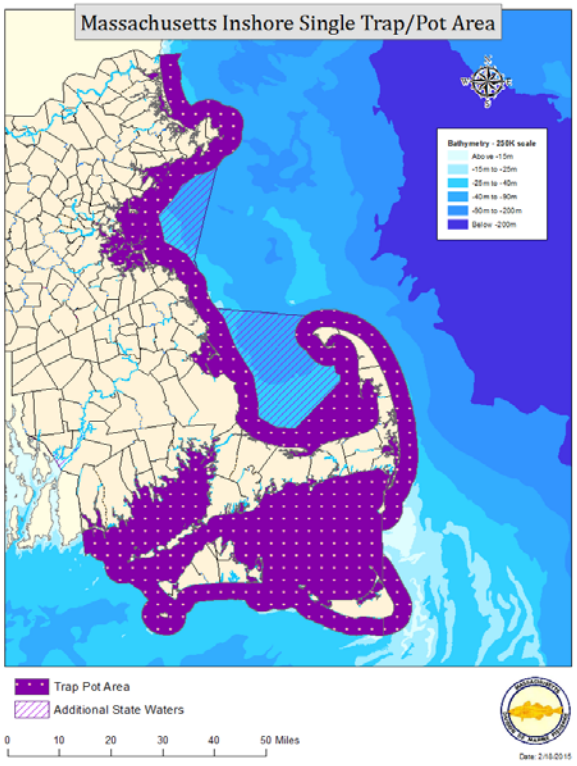


Figure 5. It is unlawful to set, fish, or abandon any single traps in any state waters outside the MA Inshore Single Trap/Pot Area.

Groundfish

Gulf of Maine Cod Conservation: *MarineFisheries* implemented emergency regulations to respond to the severely depleted stock status of Gulf of Maine (GOM) cod and complement federal interim conservation measures. Effective April 16, the state regulations closed the recreational fishery for GOM cod, reduced the GOM cod commercial trip limit from 800 pounds to 200 pounds, and added four months to the existing commercial groundfish closures in the Gulf of Maine. On May 1, different federal measures under Framework 53 and a separate recreational rule-making by NOAA Fisheries took effect, replacing the interim measures. Of note, the FY2015 state waters set aside was reduced by over 75%.

Consequently, *MarineFisheries* went to public hearing in May with a proposal that would keep some but replace others of the emergency measures. The MFAC approved the Division's proposal, except for one element of the commercial groundfish closures based on public comment. Effective December 4, state regulations: (1) allowed private recreational anglers to retain one GOM cod at a 19" minimum size; (2) maintained the emergency rule's prohibition on GOM cod harvest by for-hire vessels; (3) implemented a three-fish limit for GOM haddock and reduced the minimum size from 21" to 17"; (4) maintained the emergency rule's 200-pound commercial GOM cod limit for limited-entry participants; (5) replaced the 75-pound GOM cod limit for commercial open-access participants with a 25-pound mixed groundfish limit; (6) added December–January to the October–November commercial groundfish closures between Plymouth and Marblehead; (7) lifted the entire April commercial groundfish closure between Plymouth and the New Hampshire border; (8) lifted part of the May commercial groundfish closure between Plymouth and the New Hampshire border such that the new southern boundary is off Boston; and (9) maintained the June commercial groundfish closure between Marblehead and the New Hampshire border. Prior to this, the state's emergency measures on the recreational ban and commercial trip limit were extended twice so as to not undermine federal conservation measures.

Groundfish Disaster Economic Assistance Program: Refer to Grants Program (p. 103).

Jonah Crab

Interstate FMP: In July, the Division hosted an ASMFC public hearing on the draft version of what would become the first-ever interstate management plan for Jonah crab. The Jonah Crab FMP was initiated in response to concern about increasing targeted fishing pressure for Jonah crab, which has long been considered a bycatch in the lobster fishery. In August, the ASMFC approved the FMP, with a suite of measures intended to cap effort and protect spawning stock biomass in the absence of a range-wide stock assessment. The FMP limits participation in the trap fishery to only those vessels and permit holders that already hold an American lobster permit or can prove prior participation in the crab fishery. All others harvesters using non-trap gear must obtain an incidental permit. It also establishes a 4.75" coastwide minimum size, requires the landing of whole crabs (with limited exception), establishes a non-trap incidental bycatch limit of 200 crabs/day or 500 crabs/trip, prohibits the retention of egg-bearing females, sets a recreational possession limit of 50 whole crabs per person per day, and requires 100% commercial harvester and dealer reporting with port- and sea-sampling. The Division anticipated holding public hearings in early 2016 in order to implement the plan's requirements by the June 1, 2016 deadline.

Monomoy National Wildlife Refuge

In October 2015, the U.S. Fish and Wildlife Service released its Final Comprehensive Conservation Plan and Environmental Impact Statement (CCP/EIS) for the Monomoy National Wildlife Refuge (NWR) for public review and comment. This document will guide refuge management decisions over the next 15 years in

order to promote NWR priorities of (1) maintaining the biological integrity, diversity, and environmental health of the refuge, and (2) facilitating compatible wildlife-dependent recreation. The Final CCP/EIS included a number of significant modifications from the Draft CCP/EIS, released April 2014, based in part on extensive comments submitted by *MarineFisheries*, in conjunction with other Divisions in the Department.

Recognizing the adequacy of existing federal, state (*MarineFisheries*) and/or Town (Chatham) regulations, the Final CCP/EIS does not further regulate finfishing, fish weirs, shellfishing for soft shell clams, razor clams and quahogs below the MLW, or the non-hand harvest of scallops. Consistent with our comments, the Final CCP/EIS eliminates proposed restrictions on mobile bottom tending gear (including otter trawling, scallop dredging, bay scalloping, and hydraulic clamming) and fish weirs based on the USFWS' determination that existing federal and state regulations adequately protect eelgrass beds. However, certain aspects of the Final CCP/EIS remained unchanged in response to Division comments on the Draft CCP/EIS, such as prohibitions on the harvest of both ribbed and blue mussels, and the use of wheeled carts when harvesting shellfish. *MarineFisheries*, in conjunction with *Mass*DFG, submitted additional comments on the Final CCP/EIS relevant to these aspects in December 2015. The Final CCP/EIS must be approved by the Service's Regional Director before implementation can begin; this was expected in early 2016.

Northern Shrimp

ASMFC Draft Amendment 3: In March, *MarineFisheries* hosted an ASMFC public hearing on the Public Information Document for Draft Amendment 3 to the Northern Shrimp Interstate FMP. This document serves as the first step in the amendment development process. Draft Amendment 3 was initiated to address increased effort in the fishery through a variety of management options including a limited entry program. In August, the Section postponed further development of the amendment to allow Maine to address over-capacity in its fishery given that the fishery is under a moratorium. (In December, the Section voted to continue the moratorium into 2016.)

Quota Transfers

Atlantic Menhaden: During early 2015, Massachusetts transferred 260,000 pounds of unused 2014 commercial Atlantic menhaden quota to New York (210,000 pounds) and Rhode Island (50,000 pounds) to help these states' mitigate unintended overages of their 2014 quotas.

Bluefish: During summer 2015, Massachusetts requested and received 250,000 pounds of 2015 commercial bluefish quota via transfer from New York (200,000 lbs) and Virginia (50,000 pounds) to help extend the open season through the period of resource availability in state waters.

Fluke: During February 2015, Massachusetts accepted a 10,860-pound transfer of commercial fluke quota from North Carolina to account for landings made by a vessel headed to unload in that state but granted safe harbor here due to a medical emergency.

Sharks

White Shark: Effective June 5 by emergency action, *MarineFisheries* established a new permitting requirement for any entity to attract, capture, or perform research on a white shark in the waters under the jurisdiction of the Commonwealth. By prohibiting these activities by anyone without a special permit, *MarineFisheries* addressed a need to restrict white shark/human interactions that may result in harming the shark or threatening public safety. A number of Cape Cod municipalities and constituents had requested *MarineFisheries* involvement in this manner. A public hearing was held in July.

Spiny Dogfish Experimental Short-soak Gillnet Fishery: *MarineFisheries* reauthorized, for a fourth year, the experimental short-soak gillnet dogfish fishery in the October–November groundfish closure in state waters (Plymouth north to Marblehead). The spiny dogfish fishery has been unable to land its quota in recent years and the Division already allows longlining for spiny dogfish during this time-area closure. One letter of authorization was issued to participate in the experimental fishery with conditions including net tending and monitoring requirements. Access to the area was subject to revision if regulatory discards became problematic.

ASMFC Spiny Dogfish Addendum V: Effective September 25, *MarineFisheries* prohibited the at-sea removal or possession of spiny dogfish fins for compliance with Addendum V to the Interstate FMP. The addendum replaced the plan's allowance to remove spiny dogfish fins at sea provided the fins and carcasses were retained and met a certain fish-to-carcass ratio, with a requirement that fins remain naturally attached through landing to ensure consistency with the Shark Conservation Act of 2010. Public hearings were held in January.

Spiny Dogfish Trip Limit: Consistent with ASMFC action, *MarineFisheries* declared a 5,000-pound possession and landing limit for the 2015/2016 commercial spiny dogfish fishery. Public comment was collected in April.

Shellfish Handling

2015 *Vibrio* Control Plan for Oysters and Implementing Regulations: Since 2012, the U.S. Food and Drug Administration has required Massachusetts to develop and implement a plan to minimize the risk of illness associated with *Vibrio parahaemolyticus* related to the consumption of raw oysters. These plans are crafted by *MarineFisheries* and the Massachusetts Department of Public Health (*Mass*DPH) and establish certain time-to-temperature, labeling, and reporting standards for the commercial harvest of wild and aquaculture-raised oysters to safeguard public health. Updates to the *Vibrio* Control Plan and its implementing regulations were needed for 2015 to improve regulatory clarity, further comply with federal mandates to have enforceable regulations, and accommodate certain industry requests.

During April, the MFAC and DMF held public hearings on *Vibrio* management, followed by MFAC approval of the Division's proposal. Later in the month, the Division held three public meetings to announce the 2015 *Vibrio* Control Plan, which applied to all commercial harvest of oysters in Massachusetts during the period of May 21–October 18. See Vibrio Management (p. 45) for more specific information on the regulations. The effective date was May 8.

In December, *MarineFisheries* held public meetings to solicit industry feedback prior to the development of the 2016 *Vibrio* Control Plan for Oysters. Official public comment on a draft 2016 plan was expected to take place in early 2016.

Squid

Seasonal Small Mesh Exception South of Cape Cod: By regulation, the Director may extend the small-mesh squid trawling season south of Cape Cod after June 9 if he determines that continued fishing with small mesh will not result in large catches of small squid less than five inches mantle length and/or juvenile scup, black sea bass, or fluke. In 2015, due to the year's late run of squid and continued commercial interest in the squid fishery, the Acting Director extended the fishery in the waters under the jurisdiction of the Commonwealth within Martha's Vineyard and Nantucket Sounds through June 18.

Use of Small Mesh South of Nantucket and Martha's Vineyard: Effective July 19, *MarineFisheries* rescinded a regulation allowing mobile gear commercial fishermen to fish with small mesh trawls for squid in the waters south of Martha's Vineyard and Nantucket after June 9 (Figure 6). This regulation was newly adopted in 2014 after a pilot program had authorized the same for four years without incident and the Division received generally supportive comment on its public hearing proposal in 2013. However, shortly after the rule change was announced, *MarineFisheries* was contacted by Nantucket fishermen and town officials stating that they were inadequately informed of the proposed rule change, and had they been, they would have opposed it based on various concerns. While the Division did not agree with all the claims made by Nantucket residents, it was clear that a user-conflict situation had been created and the Division agreed to reconsider the regulation. Public hearings were held in January.

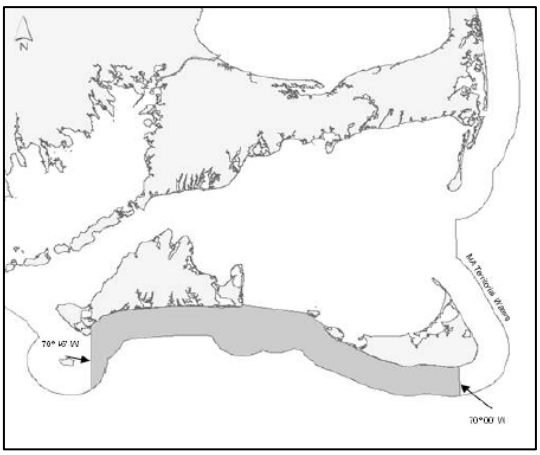


Figure 6. The small mesh squid exemption area (grey shading) was rescinded in 2015.

Striped Bass

Reducing Stockpiling: Effective April 24, *MarineFisheries* established a new requirement for commercial fishermen to remove the right pectoral fin from striped bass greater than 34" taken on a closed commercial fishing day during the commercial season (Figure 7). Concurrently, any striped bass with the right pectoral fin missing was prohibited from being sold into commerce. This action was taken to address the illegal practice of fishing recreationally on a closed commercial day and selling the fish on a subsequent open day, referred to as "stockpiling." The Division modeled this measure after one in the Alaskan salmon fishery to distinguish fish caught for subsistence after constituents voiced concerns about increased levels of stockpiling in response to the prior year's commercial possession limit reduction. Public hearings were held in January.

Figure 7. A dealer demonstrates how to remove the right pectoral fin from a striped bass. Actual removal is to occur by the fisherman upon landing the fish.

ASMFC Addendum IV: Effective April 24, *MarineFisheries* reduced the recreational striped bass limit from two fish to one fish in order to achieve a 25% harvest reduction as required by Addendum IV to Amendment 6 to the Interstate FMP. The recreational minimum size limit remained at 28 inches. Massachusetts' commercial striped bass quota, as established by the Atlantic States Marine Fisheries Commission, saw an equivalent reduction, to 869,813 pounds. Addendum IV was adopted to reduce fishing mortality on the coastal population of striped bass to the target rate in response to declining spawning stock biomass and several years of below-average juvenile recruitment.

Point-of-Sale Striped Bass Tagging Program: In accordance with requirements of the interstate FMP, *MarineFisheries* implemented a point-of-sale commercial striped bass tagging program in 2014. This (2015) was the Division's second year running the program. The goal of the tagging program was to increase accountability in the supply chain and give law enforcement a tool to detect poaching. Under this program, dealers acting as primary buyers of striped bass were required to affix a tag to all striped bass purchased directly from commercial fishermen (a tag can be seen in Figure 7). *MarineFisheries* supplied these tags to dealers at no charge, prior to the season and throughout if they needed more. The tags were imprinted with the species, minimum size, year, state, and unique identification number traceable to the Primary Buyer to whom they were issued. At the end of the season, unused tags and an accounting report were required to be submitted to the agency. The compliance rate was high and, in general, the program ran smoothly in its second year (Table 1).

The number of dealers identifying themselves as potential primary buyers of striped bass on their quota authorization applications dropped from 125 to 115 in 2015. This drop was expected after the first year of the tagging program as dealers that do not typically buy striped bass realized the extra work associated with keeping track of unused tags throughout the season. The number of tags purchased and distributed in 2015 declined, commensurate with a 25% decrease in the Commonwealth's commercial striped bass quota.

Table 1. 2015 Striped Bass Tagging Statistics

# of Tags Purchased	# of Tags Distributed	# of Tags Returned	# of Tags Used	Calculated # of Fish*	% Difference Tags Used	# of Dealers Receiving Tags
80,000	70,980	28,510	42,250	42,346	<1%	115

*Calculated # of Fish = Pounds Sold/20.3

Tautog

ASMFC Amendment 1: *MarineFisheries* hosted an ASMFC public hearing in September on issues to include in the upcoming Draft Amendment 1 to the Interstate FMP. The Tautog Management Board initiated the amendment to consider the use of regional management areas, re-define FMP goals and objectives, address the overfished and overfishing status of the resource, and investigate the application of a commercial harvest tagging program to minimize the illegal, unreported and unregulated harvest of tautog, in addition to other management measures. A 2017 implementation date is expected.

Whelk

Possession Limits: *MarineFisheries* held public hearings in January on a proposal to establish a daily commercial whelk limit of one fish tote for the SCUBA/hand harvest fishery to address concerns about an emerging fishery on a depleted stock, and a daily recreational limit of 15 whelks per person per day to create a threshold for a commercial permit. The rule awaited executive approval at year's end.

Discarding of Whelks: *MarineFisheries* held public hearings in January on a proposal to require the immediate discard of undersized whelk on fishing grounds. This stemmed from concerns that some whelk fishermen, as observed by a shellfish constable, appeared to be retaining undersized whelks and relocating them near-shore. While this activity may have been an effort to seed areas less abundant with whelks, the unintended consequences would actually negatively impact overall abundance. The rule awaited executive approval at year's end.

Conservation Engineering Project

Conservation Engineering (CE) collaborates with members of the commercial fishing industry and others to understand and to improve the design and performance of fishing gear and fishing practices, and to reduce impacts of fishing gear on non-target species, by understanding the behavior of fish around fishing gear. CE's stature continues to grow regionally and internationally through strong relationships with industry members, collaborative projects, peer-reviewed publication, and participation in national and international organizations.

Testing Low Seabed Impact Semi-Pelagic Trawling Technology for Haddock

Led by Pingguo He (SMAST), this project was designed to test whether a trawl with off-bottom doors and ground cables can catch haddock as easily as the same net with traditional on-bottom doors and ground cables (Figure 8). Funding was provided by NMFS Bycatch Reduction Engineering Program. *MarineFisheries* participated in two week-long, at-sea field trials in April 2015 on Georges Bank. In addition to these sea-sampling activities, CE handled the contracting and invoicing for the two trips.

Figure 8. CE collaborated with SMAST to test a semi-pelagic trawl with low seabed impact to target haddock and avoid overfished flounders. The image shows the compared gear types: standard bottom contact trawl doors (inside the vessel) and standard ground gear (aft drum) vs. semi-pelagic doors (outside the vessel) and floating bridles (forward drum).

Redeveloping a Sustainable Redfish Trawl Fishery in the Gulf of Maine

MarineFisheries continued data analysis and report writing for this NOAA Fisheries-funded project which brought together a network of gear researchers, net makers, fishermen, NOAA Fisheries and NEFMC staff, fish processors, and others working to re-establish the redfish trawl fishery in the Gulf of Maine. CE took a

leadership role in the project included financial administration, experimental design, contract management, equipment coordination, data collection and analysis, and report writing.

Analysis of data collected in 2014 indicated that an effective method to minimize retention and mortality of small fish by trawl gear was through a dual grid system plus codend. Specifically, a 40-mm grid spacing matched codend separation while a 50-mm grid decreased catch of all sizes. At year's end, analysis of video to determine where escape from the codend occurs (at depth, during haulback, at surface) was still underway.

Two scientific manuscripts on codend size selectivity were developed based on the project: one on pollock has been published (citation below); the second on redfish was still within the review process at year's end.

Pol, M.V., B. Herrmann, C. Rillahan, P. He. 2015. Selectivity and retention of pollock Pollachius virens in a Gulf of Maine trawl fishery. Fisheries Research doi:10.1016/j.fishres.2015.07.029

Development of an Ultra-low-opening Groundfish Trawl to Avoid Cod

MarineFisheries and the Gulf of Maine Research Institute (Steve Eayrs) initiated a project to develop a trawl with a very low headline height, to fish under cod while targeting flatfish. This Saltonstall-Kennedy Grant funded project brings together a team of fishermen including Dan Murphy and Jim Ford, gear-maker Jon Knight (Superior Trawl), and researchers Chris Glass (University of New Hampshire), Pingguo He (University of Massachusetts), and Paul Winger (Memorial Institute). The project will include consultation with fishermen, computer modeling, flume tank testing, and field testing.

In 2015, project partners reviewed current knowledge about cod and flatfish behavior in front of various types of trawl nets, including video clips previously collected and more recently digitized by CE. Incorporating ideas collected from fishermen on gear modifications to fish "beneath" cod, candidate models were selected for numerical and physical modeling at Memorial University's flume tank in Newfoundland in February 2016.

Reducing Juvenile Haddock and Cod Catch in the Georges Bank Haddock Fishery

Project partners including *MarineFisheries,* Pingguo He (SMAST), fisherman Mike Walsh, and Reidar's Manufacturing kicked-off this Saltonstall-Kennedy Grant funded project in December 2015. The goal is to design and test a "dual-grid" system for eliminating small haddock from a trawl net before they reach the codend, as a means of reducing mortality. Design work and field trials will begin in 2016.

Development of Side-scan Sonar Methodology to Survey Derelict Lobster Pots

With funding from the National Fish and Wildlife Foundation, *MarineFisheries* initiated a project to establish the efficiency of side-scan sonar to identify derelict lobster pots in simple and complex bottom types and conduct a pilot survey. It involves several DMF groups, including CE, Habitat, and Invertebrate Investigations.

Revision of Whiting Special Access Areas

Working with policy and management staff and funding from federal groundfish disaster aid, CE began developing a research plan and Exempted Fishing Permit application to help groundfishermen collect data to potentially support alteration (times and areas) of whiting small-mesh areas in response to changing distributions of fish. In 2015, federal observer data were obtained and analyzed for catch and bycatch trends.

Reducing Flatfish Bycatch in the Sea Scallop Fishery

In partnership with the Provincetown Center for Coastal Studies, the F/V Glutton (Beau Gribben), and Paul Tasha of Provincetown, *MarineFisheries* began a project to evaluate a simple modification to the New Bedford-style scallop dredge to reduce flatfish bycatch. CE's involvement will be dredge design, field testing /sea sampling video, data analysis, and report writing. Funding comes from a federal Saltonstall-Kennedy Grant.

Other CE Activities

Appointments: Michael Pol continued serving on the ICES-FAO Working Group on Fishing Technology and Fish Behaviour, and co-chaired a topic group examining hurdles to adoption of new fishing gears by the fishing fleet. He continued serving on the NEFMC Research Steering Committee and the ASMFC Fishing Gear Technology Workgroup, and was appointed to the NEFMC/MAFMC Northeast Trawl Advisory Panel. Pol accepted an invitation to serve on the Editorial Board of the journal *Fisheries Research*.

Video Digitization: CE has an extensive collection of fishing gear video (over 1,300 individual recordings). To make these videos more available, and to avoid obsolescence, a digitizing effort was begun in 2015; video hardware and software were also updated. At year's end, more than half of the videos had been digitized. CE also produced videos of hydraulic clam dredges from CE's video library. These videos are intended to provide information on operation of the dredges and impact on the seabed.

Outreach: Pol participated in a Trawl Impact Workshop held at the New England Aquarium in March. The workshop prioritized global research needs regarding habitat impact of mobile fishing gears across many stakeholder groups. The workshop results were accepted by the journal *Fish and Fisheries*. He was also invited to present on fishing gear research, characteristics and practices at an Expert Workshop on Estimating Food Loss and Wasted Resources from Gillnets and Trammel Nets in India in April.

CE staff met with US Coast Guard personnel from Boston to discuss and demonstrate methods of measuring meshes. David Chosid was interviewed by Commercial Fisheries News to discuss cooperative research in August.

Project personnel organized *MarineFisheries* booth for the 12th annual New Bedford Working Waterfront Festival, which included a model flume tank to demonstrate mobile fishing gears, in partnership with SMAST.

Other Activities

Marine Fisheries Institute

The Massachusetts Marine Fisheries Institute (MFI) is a cooperative venture between *MarineFisheries* and the University of Massachusetts Dartmouth School for Marine Science and Technology (SMAST). Founded in 2002 by former Division Director Paul Diodati and former SMAST Dean Dr. Brian Rothschild, the MFI exists to promote sustainable fisheries through scientific study and the provision of timely information to protect, conserve, and manage Massachusetts and New England marine fisheries and their habitats in a manner that balances the economic, environmental, and cultural interests of the citizens of the Commonwealth. Diodati continued to serve as MFI co-chair up until his retirement, after which Director David Pierce assumed the role alongside current SMAST Dean Steven Lohrenz.

In March, the MFI hosted a summit to improve stakeholder understanding of the research being undertaken and needed to sustainably manage Massachusetts groundfish fisheries. This summit helped the MFI to secure an additional $450,000 earmark in state funds for collaborative research to assess groundfish biomass. In June, the MFI Advisory Council, a source of external guidance on MFI research priorities, met to provide input on industry-based groundfish survey approaches.

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.

Publications

Advisories: *MarineFisheries* released 83 electronic advisories to subscribers of our listserv on various rule changes, public hearings, quota closures, and other important information.

DMF News: *MarineFisheries* published its newsletter twice in 2015 (Figure 9). These editions of "DMF News" were mailed to subscribers and are available through the Division's website.

Annual Report: *MarineFisheries* published its 2014 Annual Report.

Figure 9. The covers of the two 2015 editions of the DMF News.

Leadership Positions

Director David Pierce assumed the co-directorship of the Massachusetts Marine Fisheries Institute (MFI) from retiring Director Paul Diodati. Both Diodati and Pierce also served on the MFI Executive Committee. Director Pierce was vice chair of the NEFMC's Spiny Dogfish Committee and Risk Policy Working Group. Deputy Director Daniel McKiernan chaired the ASMFC American Lobster Management Board and the agency's Shellfish Advisory Panel.

Management Information Systems and Fisheries Statistics Program

Personnel

Thomas Hoopes, Program Manager (January–June)/Contractor (July–December)
Anna Webb, Harvester Reporting Coordination (January–September/ Program Manager (October–December)
Kim Lundy, Dealer Reporting Coordination & Quota Monitoring
Erich Druskat, Fisheries Data Analyst
Mary Ann Fletcher, Fisheries Data Entry
Rosemary Mitchell, Permitting & Support for Fisheries Reporting
Whitney Sargent, Permitting & Support for Fisheries Reporting

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 and dealers designated as primary buyers. Both data sets are collected in a standardized trip-level format from all commercial 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 as well as permitting staff to issue permits from the Gloucester facility.

Management Information Systems Project

Website 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 the display of quota information, reporting compliance, and both harvester and dealer reporting information. Much of what is displayed on the Statistics Project site is produced from automated scripts that run on a regular basis. Maintaining those scripts to add new data and accommodate changing requirements is an ongoing task.

Oracle Database / Application Development & Maintenance

MarineFisheries continued to use and enhance four production databases during 2015: Commercial Permits and Statistics; Lobster Sampling; Shellfish Sampling & Area Management; and Time Tracking for Federal Grants. Some minor updates were made to the Commercial Permits and Statistics applications during the year. Additionally, in June 2015, EEA-IT upgraded the Division's Oracle production database from version 10G to 12C. This necessitated upgrading the application server, which runs many critical *MarineFisheries*

services including permitting and shellfish forms and reports. Staff spent considerable time testing all forms and reports in the new environment. The upgrade should serve to stabilize the database and application server for several years.

GIS Technical Assistance & Data Development

Individual programs and projects continued to develop and maintain their own GIS datalayers, 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. Since 2005, all primary buyers not already required by federal law to report electronically have been required to report 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.

In 2015, 1,778 businesses obtained a Massachusetts dealer permit. Of those, 460 (or 26%) were categorized as primary buyers, which meant they intended to purchase marine species directly from fishermen. These dealers were required to report their primary purchases, including products retailed themselves. Of the 460 dealers, 215 had a federal dealer's permit which required reporting electronically either to the SAFIS database or to another federal reporting system. These dealers were categorized as "federal-reporting" and the remaining 245 dealers were categorized as "state-reporting." Compared to previous years, these figures are relatively unchanged.

Even though many of the primary buyers in 2015 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.

Throughout the year, 143,454 transactions were entered into the SAFIS database, covering over 306,669 individual species landings. Federal-reporting dealers submitted 75% of these transactions electronically. Of the remaining transactions submitted by state-reporting dealers, approximately one-third were entered electronically by dealers, and two-thirds were submitted on paper-based forms. The latter were either keypunched by project staff or uploaded through the SAFIS file upload module.

Total landings (in whole pounds), as reported through the SAFIS database and including transactions conducted through other federal reporting programs, amounted to 629 million pounds, valued at $525 million (ex-vessel). The top five species in order of value were sea scallop, American lobster, eastern oyster, surf clam, and haddock totaling $396 million, or 75% of the total. Offshore shellfish (sea scallop, surf clam, and ocean quahog), make up 56% of the total value landed in Massachusetts, whereas inshore and intertidal landings of shellfish, such as soft shell clam, northern quahog, blue mussel, and oyster amounted to 7% of total value landed. Landings of invertebrate species (lobster, crabs, and whelk) amounted to 32 million pounds, valued at $95 million, or 18% of the total value landed. All finfish landings, including both pelagic and benthic species, made up 19% of the total value, with groundfish species amounting to just 13% of the total value. Landed species with an individual gross value over $2 million are shown in Table 2; in aggregate, these species account for approximately 96% of the total value of all species landed.

Table 2. 2015 Massachusetts Landed Species with Value Greater than $2 Million.

Species	Landings (whole pounds)	Value
Sea Scallop	179,224,746	$264,941,229
American Lobster	16,446,931	$78,275,162
Eastern Oyster	8,042,964	$22,735,092
Atlantic Surf Clam	100,857,487	$17,570,869
Haddock	11,479,792	$12,049,006
Goosefish	11,084,391	$10,284,662
Ocean Quahog	110,055,905	$9,063,394
Atlantic Herring	70,887,578	$8,804,581
Jonah Crab	9,096,374	$6,894,516
Winter Flounder	3,199,008	$6,745,704
Silver Hake (Whiting)	9,197,409	$6,524,039
Acadian Redfish	10,310,510	$5,890,602
Atlantic Cod	2,913,757	$5,538,954
Bluefin Tuna	1,098,148	$5,499,685
Pollock	5,061,952	$5,206,030
Channeled Whelk	1,984,928	$4,810,794
Soft Shell Clam	2,038,501	$4,469,760
Northern Quahog Clam	5,082,071	$4,386,217
White Hake	2,961,069	$4,019,706
American Plaice (Dab)	2,105,066	$3,939,468
Striped Bass	865,753	$3,575,686
Deep-sea Red Crab	3,254,277	$3,231,116
Summer Flounder (Fluke)	748,731	$2,766,472
Witch Flounder (Gray Sole)	934,133	$2,482,865
Longfin Squid	1,883,827	$2,341,117
Winter Skate	9,674,080	$2,237,960
Sea Mussel	19,292,096	$2,042,120

Source: ACCSP Data Warehouse, as of May 9, 2016.

Certain fisheries are managed by quota in Massachusetts and were monitored in 2015 using the dealer reported landings in the SAFIS database. Automated scripts ran on a nightly basis and the results were displayed on both the *MarineFisheries* internet website (Figure 10) and the internal Statistics Project intranet website. On a weekly basis during the open season, staff reviewed compliance and estimated projections separately for each quota-managed species. Data from dealers that had already purchased during the year or had in past years were included in order to account for potential landings if a dealer had not yet reported purchases. An estimated closure date was calculated based on a regression analysis run at least once per week for each open fishery.

QUOTA MANAGED SPECIES
2015 Landings and Quota Information
as of Feb 04, 2016 - 07:10 A.M.

Species	2015 MA Landings	2015 Quota	Quota Type	Percent Landed
Black Sea Bass	347,964	287,680	MA	121.0%
Bluefish	600,152	602,036	MA	99.7%
Dogfish	7,819,224	29,354,960	CW	to NMFS
Fluke	748,731	760,795	MA	98.4%
Horseshoe Crab*	106,957	165,000	MA	64.8%
Menhaden	2,927,727	3,438,630	MA	85.1%
Scup *(Winter I)*	423,191	9,578,008	CW	to NMFS
Scup *(--)*	904,069	1,785,122	MA	50.6%
Striped Bass	865,753	869,813	MA	99.5%
Tautog	61,752	54,984	MA	112.3%

MA = Massachusetts-specific quota
CW = Coast-wide quota shared between MA and other Atlantic states prompt
*Horseshoe Crab quota and landings reported as count of individual crabs harvested for non-biomedical purposes.

Figure 10. Example display of quota monitoring data available on *MarineFisheries'* website.

Fisherman Catch and Effort Data Collection

Since 2010, all commercial fishermen have submitted, on a monthly basis, comprehensive, standardized trip-level data for all commercial trips conducted under the authority of a Massachusetts commercial permit. Those individuals holding a federal permit with reporting requirements to NOAA Fisheries (e.g., Vessel Trip Report or 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.

Fishermen either submitted their trip-level reports in paper form or 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 or a bulk upload process called eTrips upload to enter data submitted on paper forms. Thus, the primary repository for all trip-level data, except those reported to NOAA Fisheries, is the SAFIS database. Data can easily be downloaded from the SAFIS database to be used for compliance and fisheries analyses.

In 2015, *MarineFisheries* issued 7,133 commercial harvester permits, of which 15% were for federal reporting vessels. The remaining 6,032 commercial permits were designated as "state-reporting", and 30% of the total permit holders reported electronically using the SAFIS eTrips application, representing a 3% increase in electronic reporting participation. This left 55% of harvesters submitting paper reports to *MarineFisheries*. Due to a reduction and turnover in data entry staff, entry of 2015 harvester reports was delayed, but completed in May 2016. Of the 106,928 commercial trips that occurred in 2015 that were entered in the SAFIS database, approximately 25% were entered by commercial permit holders using the SAFIS eTrips application, with the remaining trips entered by *MarineFisheries* staff.

Data Analysis and Dissemination

Project staff provided a wide variety of data and technical support during 2015. Significant time was dedicated to ensuring correct harvester reporting methods and compliance during the permit renewal period. Staff levels were reduced for the latter half of 2015 due to the project leader's retirement in July and budget restrictions that reduced the number of temporary data entry staff employed by the project. Anna Webb was promoted to project lead by October, and considerable effort was spent restructuring the program to maintain critical functions with fewer staff members. Unfortunately, while compliance metrics were maintained for harvester reporting, this came at the expense of near real time harvester data entry, which is an issue that is being addressed for 2016.

State Waters Surf Clam Fishery Characterization: Stemming from reports of dredging activity in Provincetown waters, the project conducted a thorough investigation to characterize the Massachusetts state waters surf clam fishery. The analysis included a combination of data submitted by the federal Individual Transferable Quota program and state reported data, and focused on the permit status of the fleet, location and seasonality of effort and landings, and errors in existing data. Data audits revealed some misreporting of the unit of measure field that resulted in a large scale, multi-species, unit-of-measure audit.

Jonah Crab/Cancer Crab Assessment: In August 2015, the ASMFC approved the first Jonah Crab Interstate FMP. Project staff in collaboration with other *MarineFisheries* staff played a critical role in the development of this plan as Jonah crabs are predominately landed in Massachusetts. The project involved fully characterizing both the historical landings and effort of the state's Jonah crab fishery and its interaction with the American lobster fishery.

Striped Bass Tagging Program: 2015 was the second year of a dealer-based tagging program mandated by ASMFC. Project staff continued to utilize the routines built for 2014, which are based on a two-year average, to estimate the 2015 tag requirements for individual dealers, and then distributed the tags (with sequential tag numbers, Figure 11) in multiples of 20. At the end of the season, returned tags were recorded and any discrepancies identified.

VMS Data: A connection was re-established with the NMFS Office of Law Enforcement allowing regular downloads and updates of Vessel Monitoring System (VMS) data during 2015. The project can use the data to identify a vessel's different trips, the direction a vessel was traveling, and fishing locations based on speed. These data can be combined with permit data, and dealer reports, harvester reports, and/or VTRs to further characterize commercial effort and landings. Moving forward, the project would like to make these data more accessible to *MarineFisheries* staff through an application that geo-spatially displays the data.

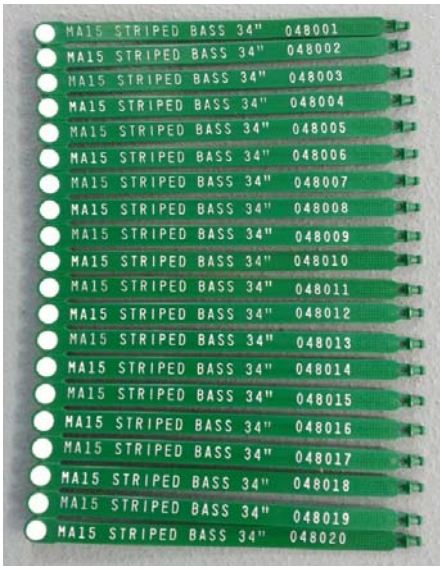


Figure 11. 2015 commercial striped bass tags.

ACCSP Participation and Planning

MarineFisheries staff continued to participate on all partner-based committees within ACCSP, particularly as *MarineFisheries* relies more and more on the services provided. Staff provided technical advice in areas such as data quality and standards, application design, outreach, and Program policies, particularly with regard to addressing issues presented in an Independent Program Review conducted three years ago. Upon

completion of Tom Hoopes' term as chair, Story Reed assumed role of the Massachusetts Operations Committee member.

Swipe Card Pilot Project: One of the largest projects undertaken in 2015 was the swipe card pilot project, also known as SAFIS eDR mobile, which officially kicked off in February. The conceptual idea behind SAFIS eDR mobile application is that a transaction card is used to consummate a point-of-sale transaction between the harvester and dealer. A permit holder presents his transaction card containing information associated with his permit and vessel to the dealer at the time of a transaction. The dealer then uses a card reader attached to a device (mobile, tablet or desktop) that has the application installed to extract the information from the card automatically. The dealer records all attributes about the transaction, including species, quantity, and price, as well as those typically provided by the harvester on a separate report, such as area fished and gear used. Once the transaction is complete, the data is sent directly to ACCSP and inserted into the SAFIS database, or, if the device is offline, the report is saved and queued for submission once an internet connection is established.

This project begins the process of creating a single-ticket commercial data collection system in Massachusetts, for shellfish dealers only, where dealers collect and submit all information about the commercial trip. Expected benefits include: eliminating the cost of data entry for reports submitted by commercial harvesters who sell to participating dealers; eliminating the burden on these harvesters to report (although it will increase the burden on dealers to collect the additional data attributes typically submitted by harvesters, but, at least in the shellfish industry, these are minimal, as area fished is already required to be reported by dealers for public health reasons); immediate submission of data into the SAFIS database (rather than a month or longer delay); eliminating the need to reconcile differences that occur in a two-ticket system; and enhanced accuracy of the data submitted due to certain information being stored on the transaction card.

The latter half of the year saw the development of the software application for Windows, iOS, and Android platforms nearly completed through the initial testing phases. The application uploads collected information when online, and dealers and harvesters can log-in to SAFIS immediately afterward and access those records. Several MA dealers began to pilot the application in October 2015, and provided valuable insight and clarity into how the application will function in a transaction environment. Once the final development and testing are completed, it is the intention to roll out the application in production shortly thereafter.

Looking beyond the immediate benefits, this technology could potentially be expanded to other fisheries in Massachusetts, and other ACCSP partners could take advantage of it, or similar technology. Other long term benefits include greatly enhanced law enforcement capabilities, as a completed transaction could be available to law enforcement officers through special access to the SAFIS database. In addition, if other data attributes can be collected at the point of sale for the purpose of meeting requirements for Public Health, then the consolidation of common reporting requirements would be a benefit to all parties involved. The application also opens the door to other technologies, such as tracing product electronically from harvester, down through the distribution chain to consumer. This could have significant ramifications towards improvements in seafood quality, marketability and value, a potential win-win for both industry and consumer.

SHELLFISH AND HABITAT SECTION

J. Michael Hickey, Section Leader

Shellfish Sanitation and Management Program

Personnel

J. Michael Hickey, Program Manager

Gloucester
Jeff Kennedy, Gloucester Regional Shellfish Supervisor, Shellfish Purification Plant Manager
Jack Schwartz, NPDES-Contaminants Coordinator
Florence Cenci, Shellfish Lab Supervisor
Gregory Bettencourt, Biologist II
Glenn Casey, Biologist II
Ryan Joyce, Biologist II
David Roach Jr., Biologist II
Devon Winkler, Biologist II
Melissa Campbell, Biologist I
Ashley Lawson, Bacteriologist I

Newburyport
Diane Regan, Shellfish Lab Supervisor
Ralph Stevens Jr., Depuration Coordinator
Richard Hardy, Laborer II
Peter Kimball, Laborer II
Paul Thistlewood, Laborer II

New Bedford
Thomas Shields, New Bedford Regional Shellfish Supervisor, Hughes Hatchery Acting Manager
Susan Boehler, Shellfish Lab Supervisor
Neil Churchill, Biologist II
John Mendes, Biologist II
Jerry Moles, Biologist II
Terry O'Neil, Biologist II
Gregory Sawyer, Biologist II
Christopher Schillaci, Biologist II
Kelly Kleister, Biologist I
Jim Rossignol, Biologist I
Katelyn Kotfila, Fisheries Technician
Gabriel Lundgren, Fisheries Technician

Overview

The Shellfish Sanitation and Management Program (Shellfish Program) focuses on public health protection, as well as the direct and indirect management of the Commonwealth's molluscan shellfish resources. Public health protection is ensured through the sanitary classification and the monitoring of marine biotoxins within state waters, including Nantucket Sound.

Nationally, the harvest and handling of all bivalve molluscan shellfish is regulated by the National Shellfish Sanitation Program (NSSP). The NSSP was established in 1925 by the United States Public Health Service for the harvest and handling of shellfish in interstate commerce for human consumption. The NSSP "Guide" is developed and administered today by the United States Food and Drug Administration (USFDA) and the Interstate Shellfish Sanitation Conference (ISSC), a federal/state cooperative. The Commonwealth of Massachusetts is a voting member of the ISSC.

Shellfisheries management is accomplished by direct *MarineFisheries* regulation of the commercial surf clam, ocean quahog, and quahog dredge boat fisheries. In addition, regulations cover the harvest of contaminated shellfish for depuration and relay, and establish size, trip limit, and season for many shellfish species. *MarineFisheries* regulates commercial 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 shellfish resources through a partnership with coastal communities by providing technical assistance to local management authorities in the development of management plans and local regulations for control and conservation.

Shellfish Sanitation and Public Health Protection Project

Shellfish Growing Area Classification

Surveys: Public health protection is accomplished with the use of sanitary surveys to determine a shellfish growing area's suitability as a source of shellfish for human consumption. Sanitary surveys include: 1) identification and evaluation of all actual and potential pollution sources which may affect a shellfish growing area; 2) evaluation of hydrographic and meteorological characteristics that may affect distribution of pollutants; and 3) assessment of overlying water quality. Each shellfish growing area must have a complete sanitary survey every 12 years, a triennial evaluation, and an annual evaluation report to maintain a classification allowing shellfish harvesting. Minimum requirements are set by the *NSSP Guide for the Control of Molluscan Shellfish*.

To satisfy NSSP requirements, staff biologists in the Gloucester and New Bedford offices completed 283 annual evaluation reports, 34 triennial evaluations, and 24 sanitary survey reports (Table 3). Nineteen conditional area/rainfall management plans were re-evaluated. In 2015, a total of 8,827 water samples were collected and analyzed for fecal coliform bacteria from 291 shellfish growing areas, in 61 Cities and Towns of the Commonwealth. All samples were tested at either *MarineFisheries* shellfish laboratory in Gloucester and New Bedford using the mTEC method. Of these, 8191 samples were taken at classification stations, 117 were pollution source samples, while an additional 100 ad-hoc samples were collected. USFDA evaluates Massachusetts annually for compliance with the NSSP. Shellfish growing area files are reviewed for compliance with the NSSP standards for minimum sampling frequency, completion of required growing area reports, conditional area management plan updates, and conformity with appropriate classification area water quality criteria requirements. The USFDA determined Massachusetts remained in compliance with the NSSP during 2015.

Table 3. Summary of 2015 Shellfish Growing Area Report and Sampling Activity

	Gloucester Lab	New Bedford Lab	Total
# of Annual Evaluation Reports	30	253	283
# of Triennial Evaluation Reports	9	25	34
# of Sanitary Survey Reports	8	16	24
# of Management Plans/MOUs Reviewed	14	5	19
# of Water Samples	2,838	5,689	8,827
# of Shellfish Growing Areas Sampled	21	270	291
# of Classification Station Water Samples	2,671	5,520	8,191
# of Pollution Source Water Samples	117	119	117
# of Ad-hoc Water Samples	50	50	100
# of Classification Areas Sampled	108	512	620
# of Cities/Towns Sampled	21	40	61

Shellfish Classification: The NSSP defines five area classification schemes:

1. APPROVED: Open to shellfish harvesting for direct human consumption subject to local rules and regulations. Closed only during major coast-wide events (e.g., hurricane, oil spill or red tide event).
2. CONDITIONALLY APPROVED: Closed some of the time due to rainfall or seasonally poor water quality or other predictable events. When open, it is treated as an Approved area.
3. RESTRICTED: Contains a limited degree of contamination at all times. When open, shellfish can be relayed to a less contaminated area or harvested for depuration.
4. CONDITIONALLY RESTRICTED: Contains a limited degree of contamination at all times, subject to intermittent pollution events and may be closed some of the time due to rainfall or seasonally poor water quality. In Massachusetts, when open, only softshell clams may be harvested by Master/Subordinate Diggers for depuration at the *MarineFisheries* Shellfish Purification Plant.
5. PROHIBITED: Closed to the harvest of shellfish under all conditions, except the gathering of seed for municipal propagation programs under a *MarineFisheries* permit.

Massachusetts utilizes all five classifications throughout 1,744,203 acres (Figure 12). During 2015, the Shellfish Program was involved in a number of initiatives designed to improve shellfish classifications resulting in five upgrades: (1) in January, 88 acres of very productive quahog beds in the West Branch River were reclassified from “Prohibited” to “Conditionally Approved;” (2) in March, a total of 30,913 acres off Rockport were reclassified from “Prohibited” to “Approved;” (3) in June, 400 acres in the southern portion of the Taunton River were reclassified from “Prohibited” to “Restricted”, allowing the Division to permit the harvest of quahogs for contaminated quahog relays by municipalities; (4) in July, a 0.5-acre portion of Phinneys Harbor, an area off Mashnee Island in Bourne, was reclassified from “Conditionally Approved” to “Approved;” and (5) in November, a 0.5-acre portion of Sengekontacket Pond in Edgartown was reclassified from “Prohibited” to “Conditionally Approved”.

Overall, Massachusetts saw a gain in “open” shellfish areas with an increase in Approved, Conditionally Approved, and Restricted Areas of almost 31,000 acres and a corresponding decrease in Conditionally Restricted and Prohibited classified acreage (Table 4).

Notification: A legal notice is required by *MarineFisheries* for each change in a shellfish growing area’s classification or status. These notices reflect the type of opening or closure, the dates, the reason, and other pertinent information. Copies are sent to municipal managers, the state Office of Law Enforcement, *Mass*DPH, USFDA, and other interested parties. In 2015, 510 legal notices were generated by Shellfish Program staff (128 in Gloucester and 382 in New Bedford).

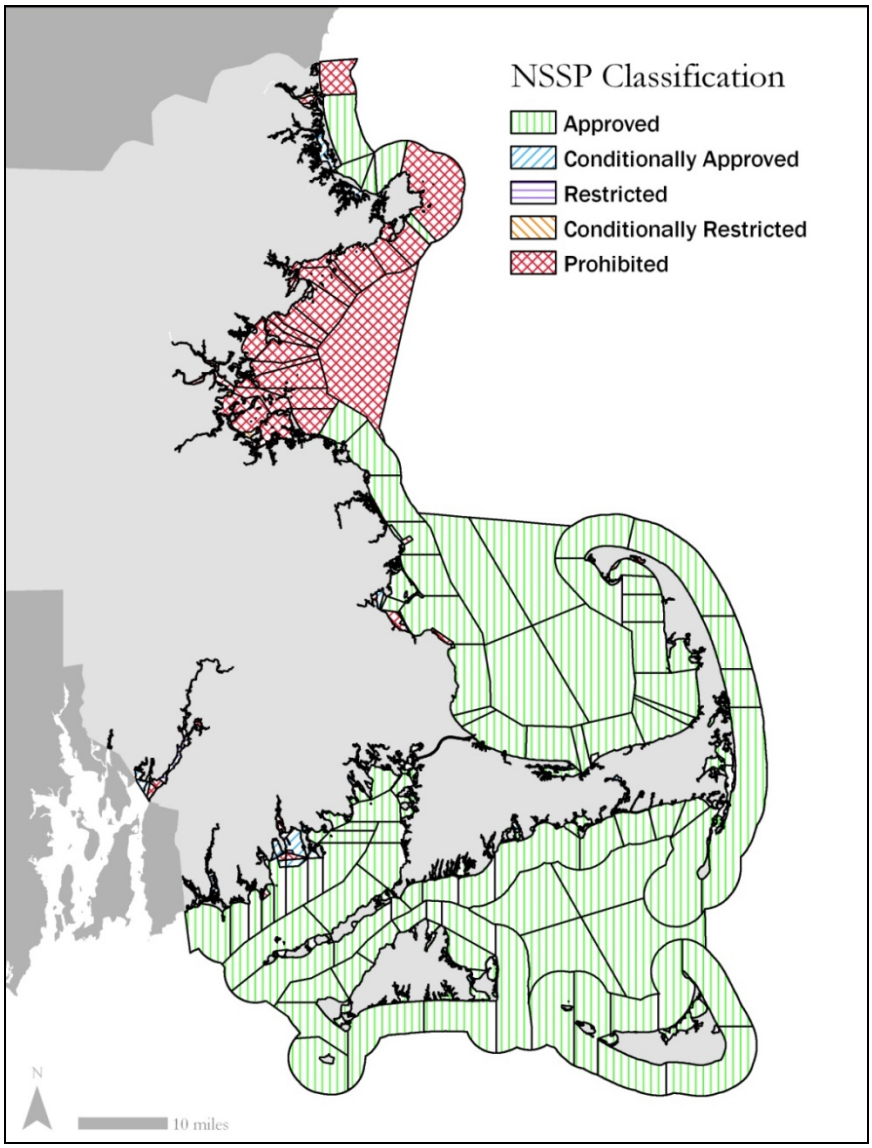


Figure 12. NSSP classification map of MA shellfish growing areas as of December 31, 2015

Table 4. Change in Massachusetts shellfish growing area classification, 2014 to 2015.

Area Classification	Acreage		
	2014	2015	*Change*
Approved	1,445,139	1,476,095	+ 30,956
Conditionally Approved	25,288	25,321	+ 33
Restricted	2,927	3,343	+ 416
Conditionally Restricted	5,041	4,653	- 388
Prohibited	265,808	234,791	- 31,017

Pollution Discharge and Contaminant Assessment

Program biologists also comment and provide recommendations regarding United States Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) permits in marine and estuarine receiving waters. Fifteen permits were reviewed in 2015. Nine permits were associated with point source discharges generated from wastewater collection and treatment systems. The review of potential health and environmental impacts on shellfish growing areas was provided when associated with plant permit failures, required monitoring, loss of fecal coliform disinfection as well as chlorination/de-chlorination, with consultation with EPA, Massachusetts Department of Environmental protection (*Mass*DEP), and the Massachusetts Office of Coastal Zone Management (CZM). Four permits involved the intake and discharge of non-contact cooling water. There were two desalination plant permit and monitoring reviews on behalf of the Water Resources Commission (WRC), CZM, and *Mass*DEP. Staff assisted a proponent for the design of an oyster upweller cultivation system discharging to marine waters from a land-based facility. Requirements relative to a concentrated aquatic animal production facility per EPA NPDES regulations were evaluated. Information was provided to the Maine Department of Marine Resources describing how the Shellfish Program engages in the EPA NPDES permitting process so that Maine could adopt some of our procedures.

Program biologists also conducted assessments of chemical contaminants associated with marine fisheries resources. Contaminant information was researched, and recommendations were forwarded to *MarineFisheries* senior staff to inform management decisions. Analytical methods were reviewed and costs were provided to support proposed testing for contaminants in recreational and commercially caught striped bass. The Massachusetts Department of public Health (*Mass*DPH) was consulted on existing and proposed regulations that support continued fish consumption and seafood safety. Program biologists provided field sampling for the Gulfwatch Contaminant Monitoring Program on behalf of the Gulf of Maine Council for the Marine Environment (GOMC). Biota samples from several locations along the Massachusetts coastline were collected. Coordination and scheduling for sampling and laboratory processing was contributed to support the GOMC Gulfwatch Program. The US Geological Survey received technical support to utilize Gulfwatch Program station locations for sediment sampling in Massachusetts. USGS Coastal and Marine Geology Program will use the locations for measuring the movement of contaminants in sediment during flooding from major storms. The Maine Centers for Disease Control requested and received the laboratory protocol for establishing the edible portion of shellfish for the analysis of chemical contaminants.

PSP Monitoring

A 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 tide". Consumption of shellfish containing certain levels of PSP toxin can cause severe illness and even death. Shellfish Program personnel collect shellfish from 13 primary stations weekly from March through October. Samples are analyzed at 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.

Table 5. Summary of 2015 PSP Analysis

Species	Count
Blue Mussel	372
Atlantic Sea Scallop	14
Stimson Surf Clam	1
Surf Clam	45

A total of 432 shellfish samples were processed through the Gloucester Shellfish Laboratory for PSP during calendar 2015 (Table 5). Surf clam samples included 35 whole and 10 homogenate samples, collected as part of an agreement between *Mass*DPH, NMFS, and DMF.

The 2015 PSP sampling season began on March 23 with blue mussel and ended October 18 with sampling for all remaining primary stations beginning April 27, and ending October 19. Toxicity was limited to the Nauset system, where a 29-day closure from May 12–June 10 was effective (Figure 13). No other primary sampling sites displayed toxicity above the detection limit. Once again in 2015, there were no reported illnesses due to red tide in Massachusetts or attributed to Massachusetts shellfish in interstate commerce.

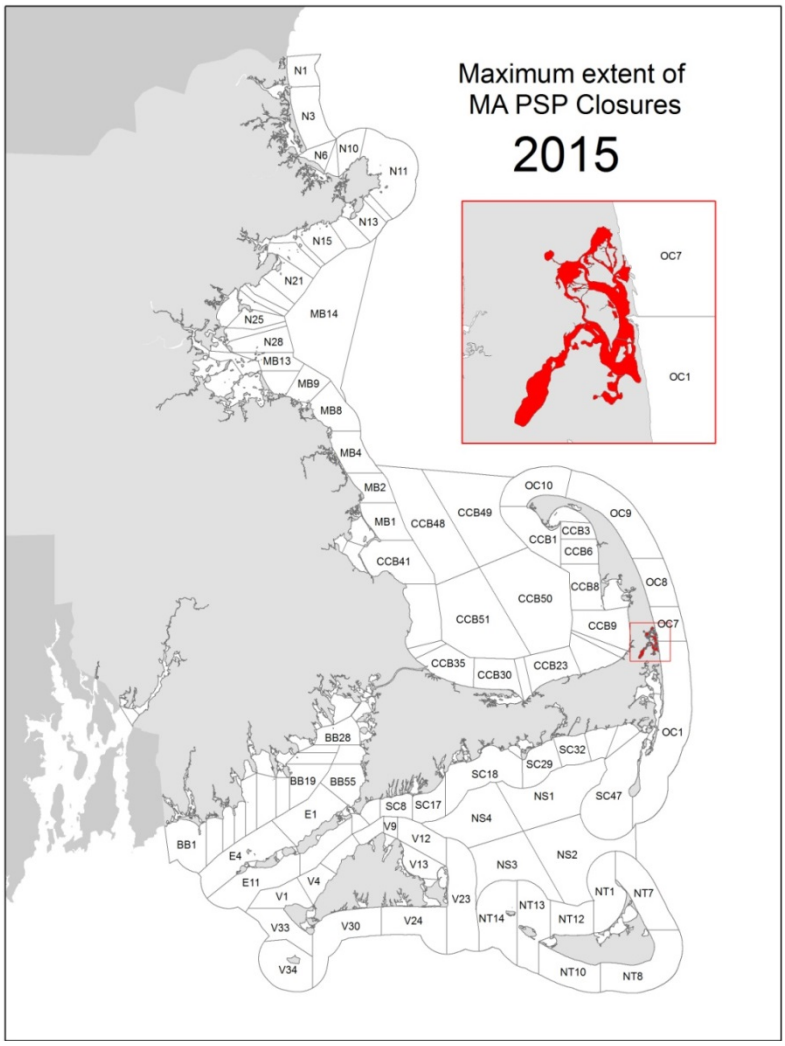


Figure 13. Geographical limit of PSP shellfish area closures in 2015

Phytoplankton Monitoring

Monitoring for other potentially toxic phytoplankton species co-occurs with PSP sampling. In 2015, 157 phytoplankton samples were collected statewide as part of routine sampling. On the north shore, four primary stations in Newburyport, Ipswich, Essex, and Gloucester were sampled beginning April 16 and concluding October 9. *Alexandrium* was present on two occasions in three different locations, all with low cell counts. No species of concern were observed at actionable levels. On the South Shore, 109

phytoplankton samples were collected from eight stations in Cohasset, Scituate, Plymouth, Sandwich, Wellfleet, Orleans, and Falmouth (2). No species of concern were observed at actionable levels.

Additional phytoplankton tows were performed in several embayments in Buzzards Bay and along the south shore of Cape Cod in response to reported visible plankton blooms. In each of these cases, *Cochlodinium sp.* was identified as the source of the bloom. Reports of these often dramatic rust colored blooms have become commonplace along the southern Massachusetts coast from Rhode Island northward into Cape Cod Bay, including on the islands of Martha's Vineyard and Nantucket, during the warm summer months.

Due to a bloom of the phytoplankton *Dinophsis sp.* known to produce Okadaic Acid, the cause of Diarrhetic Shellfish Poison (DSP) toxicity in shellfish, as well as DSP toxicity in Blue Mussels, a closure was instituted on July 15 in Salt Pond (OC6) Eastham. The area was reopened on August 21 after phytoplankton monitoring and toxicity testing indicated the bloom was over and toxicity levels dropped below detection.

Shellfisheries Management Project

Contaminated Shellfish Resources

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

Commercial Bait Harvest: In 2015, 14 dredge boat permits were issued for the contaminated surf clam bait fishery off Nantasket Beach in Hull. Due to confidentiality restrictions, landing statistics for this small fishery cannot be reported for this period.

Relay: *MarineFisheries* permits municipalities to relocate, between and within communities, bacterially contaminated shellfish to Approved and Conditionally Approved waters for natural purification and propagation. Relays are conducted under strict NSSP guidelines and are heavily supervised by state and local enforcement authorities. The Division requires that shellfish remain in the water through at least one spawning season: contaminated shellfish must remain at the transplant site until at least September 15 if relocated by June 15; if the shellfish are relayed after June 15, the shellfish must remain in the transplant site until September 15 of the following year. No shellfish can be harvested until bacterial testing has been completed on each lot. Quahogs are the most frequently relayed species followed by oysters.

Disease monitoring was conducted in the Taunton River in March 2015 prior to commencement of harvesting. The samples were sent to Kennebec Marine Biosciences in Maine for analysis. Approximately four weeks later, results were received with all three samples negative for quahog diseases.

As a result, three dredge boats contracted by the towns were allowed to commence relay harvesting in mid-April. The majority of the shellfish relaying was completed by June 15 except for Westport, Falmouth, Edgartown, Plymouth, and Wareham. The three boats provided a total 13,924 bushels of quahogs to 14 coastal communities for transplant. An additional 277 bushels of oysters were relayed within the town of Falmouth. A total of 29 areas received shellfish in the 14 towns who participated in the program. See Table 6 and 7.

Table 6. 2015 Contaminated Quahog Relays.

Town	Harvest Site	Transplant Site	Area	Bushel	Last Day Planted
Tisbury	Taunton River	Lagoon Pond	V11	174	12-May-15
Westport	Taunton River	W. Branch (River Rd)	BB3	180	23-May-15
Westport	Taunton River	E. Branch (Ship Rock)	BB4	195	30-May-15
Westport	Taunton River	E. Branch (Gunning Island)	BB4	1,908	11-Jul-15
Westport	Taunton River	E. Branch (Halfmoon Flat)	BB4	1,424	13-May-15
Westport	Taunton River	E. Branch (David Rd)	BB4	1,392	27-Jul-15
Yarmouth	Taunton River	Lewis Bay	SC28	1,200	6-Jun-15
Bourne	Taunton River	Phinney's Harbor	BB46	413	12-Jun-15
Bourne	Taunton River	Red Brook Hbr. (Winsor)	BB49	372	30-May-15
Bourne	Taunton River	Fisherman's Cove	BB43	425	13-Jun-15
Eastham	Taunton River	Salt Pond	OC6	260	2-May-15
Eastham	Taunton River	Town Cove	OC4	240	29-Apr-15
Barnstable	Taunton River	Cotuit Bay (Bluff Pt.)	SC21	589	15-Jun-15
Barnstable	Taunton River	Cotuit Bay (Cordwood)	SC21	591	26-May-15
Barnstable	Centerville River	North Bay (Bay St.)	SC23	232	10-Jun-15
Truro	Taunton River	Pamet Harbor	CCB7	214	5-Jun-15
Oak Bluffs	Taunton River	Sengekontacket Pond (#1)	V16	120	5-Jun-15
Oak Bluffs	Taunton River	Sengekontacket Pond (#4)	V16	240	9-Jun-15
Oak Bluffs	Taunton River	Sengekontacket Pond (#5)	V16	240	12-Jun-15
Sandwich	Taunton River	Sandwich Harbor	CCB37	198	6-Jun-15
Fairhaven	Taunton River	Nasketucket Bay (North Cove)	BB21	1,050	11-Jun-15
Plymouth	Taunton River	Plymouth Harbor	CCB42	200	24-Jun-15
Wareham	Taunton River	Broad Cove	BB42	700	8-Jul-15
Wareham	Taunton River	Muddy Cove	BB42	300	8-Jul-15
Edgartown	Taunton River	Sengekontacket Pond	V16	257	21-Oct-15
Westport	Taunton River	E. Branch (The Let)	BB4	810	5-Nov-15

Table 7. 2015 Contaminated Oyster Relays

Town	Harvest Site	Transplant Site	Area	Bushels	Last Day Planted
Falmouth	Little Pond	West Falmouth Harbor	BB54	140	18-Oct-15
Falmouth	Little Pond	Quisett Harbor	BB58	108	18-Oct-15
Falmouth	Little Pond	Green Pond	SC12	29	18-Oct-15

Depuration: *MarineFisheries* has operated the Shellfish Purification Plant in Newburyport since 1961. The commercial harvest of mildly contaminated soft-shell clams (*Mya arenaria*) is made possible through depuration at the plant. During the purification process, seawater pumped from a saltwater well is used to flush pathogens (disease-causing bacteria) out of the shellfish, making them safe for market. The management and oversight of this process is a sizeable and critical activity for *MarineFisheries*.

Clams are harvested from *Conditionally Restricted* areas in Boston Harbor, the Pines River in Revere and Saugus, and the Merrimack River in Newburyport and Salisbury, and then transported by licensed and bonded Master Diggers under strict enforcement to the Shellfish Purification Plant. The plant has nine depuration tanks which are filled with seawater from two 130-feet deep wells; the water is maintained at a constant temperature and salinity and is continuously disinfected with ultraviolet light. Each tank can hold 108 dealer bushels/racks of clams. The depuration process is typically three days, during which analysis of shellfish and tank water is accomplished by daily testing in the on-site certified laboratory. Upon completion, the clams are returned to the harvesters who pay a depuration fee. The purified clams are then sold into commerce

During 2015, the plant received shellfish on 134 days up from 127 in 2014. In terms of racks, depuration landings increased 73% over 2014. Conditionally restricted harvesting accounted for 11% of all Massachusetts landed softshell clams, up from 6% in 2014. Overall Massachusetts state softshell clam landings remained static between 2014 and 2015. All lots met release criteria with no product recalls. Seven Master Diggers delivered clams to the Purification Plant in 2015, up from five the previous year; the issuance of Subordinate Digger permit increased from 51 to 59.

Wet Storage

2015 marked the third year that the Shellfish Purification Plant has offered wet storage processing to wholesale shellfish dealers. Wet storage processing at Newburyport utilizes the same tanks, seawater, ultraviolet sterilizers, and biological flushing as the depuration process to flush, sand, mud, and grit out of shellfish harvested from NSSP-classified Approved areas. As these shellfish are already at safe bacterial levels, the focus of wet storage is on enhancing them for market and extending shelf-life. While there is no mandatory process time or microbiological testing like for depurated shellfish, wet stored shellfish are also regulated by the NSSP, overseen by *Mass*DPH and USFDA, and must comply with strict controls and standards, like traceability.

In 2015, wet storage increased 4% from the prior year. Shellfish Plant combined production was up 37% from 2014. Fees per rack remained at $6 for both depuration and wet storage.

Shellfish Purification Plant and Laboratory

Laboratory Activities: The Shellfish Purification Plant's laboratory analyzed 231 lots of shellfish from 134 Runs. A total of 525 shellfish samples were tested for fecal coliform in compliance with Federal and state depuration standards. To validate the seawater used in the depuration process, tank and raw seawaters were examined for dissolved oxygen and temperature daily and for turbidity, salinity and pH monthly. In addition, 510 UV light effluent water samples and 210 raw seawater samples were bacteriologically tested daily for the more stringent drinking water standard of total coliform.

In 2015, the laboratory participated and passed two proficiency evaluations: USFDA for shellfish meats, depuration waters, and Vibrio; and Northeast Laboratory Evaluation Officers and Managers for classification waters. In response to the potential of a new shellfish standard being adopted in the NSSP, the Laboratory Supervisor continued testing shellfish for this new indicator. Male Specific Coliphage (MSC) is a virus of *E. coli*, and its presence has been correlated with the presence of Norovirus and other human viral pathogens found in shellfish and shellfish waters. In 2015, 18 shellfish samples were tested for MSC. A validation study for the MSC was initiated in July. Only one NSSP lab in the US has demonstrated proficiency in utilizing the new MSC procedure. In 2015, five trials were completed at the Shellfish Plant Laboratory; additional trials will be run in 2016 to hone correlation.

This year, the laboratory ran tests for *Vibrio parahaemolyticus* (*Vibrio*) on Duxbury and Katama submergence studies and environmental monitoring samples when needed. Samples where run for the tlh gene of *Vibrio* and the toxic genes of tdh and trh. 155 oyster samples were analyzed and a total of 3,056 wells were analyzed, some in duplex. Duxbury samples were analyzed on the day of receipt in Newburyport and Katama samples were analyzed an hour after collection in a lab that was brought down and set up at the Division's John T. Hughes Research Facility.

Education and Outreach: Numerous scheduled tours were provided throughout the year for school groups and the general public, as well as impromptu tours. Local legislators were also provided a tour detailing the fishery, plant history, public health standards, national water quality standards, and the use and impact the facility has on the local shellfish industry. The plant also continued to supply seawater to local educators for classroom saltwater cultures, displays, and aquaria.

The lab supervisor attended relevant meetings throughout the year, including a Massachusetts Shellfish Officers' Association meeting in March, the MassBay "State of the Bay" Conference in April, the ISSC Biennial Meeting in Salt Lake City, UT, and a Vibrio Regional Risk Assessment meeting in CT in November.

Facility Maintenance: The Plant was inspected on a monthly basis by *Mass*DPH, Food Protection Program in addition to review by the USFDA Plant Standards. All sanitation and maintenance records are current.

In winter of 2015, Plum Island experienced extreme cold, freezing the City's vacuum sewer pumps. Depuration and wet storage processing was suspended for three weeks until pumps were thawed and clean-up completed. The dispatch office was renovated to expand and comply with updated state regulations. Plant maintenance and general improvements continued throughout the year.

Boston Harbor Soft-Shell Clam Enhancement

2015 marked the tenth year in which the Shellfish Program conducted its Boston Harbor Softshell Clam Enhancement project. From July 2 through October 7, an estimated 520,000 juvenile clams (*Mya arenaria*) were planted within 58 plots at five sites on intertidal flats of Boston Harbor and surrounding communities (Figure 14). The clams were purchased from Salem State University's Northeastern Massachusetts Aquaculture Center (NEMAC) hatchery.

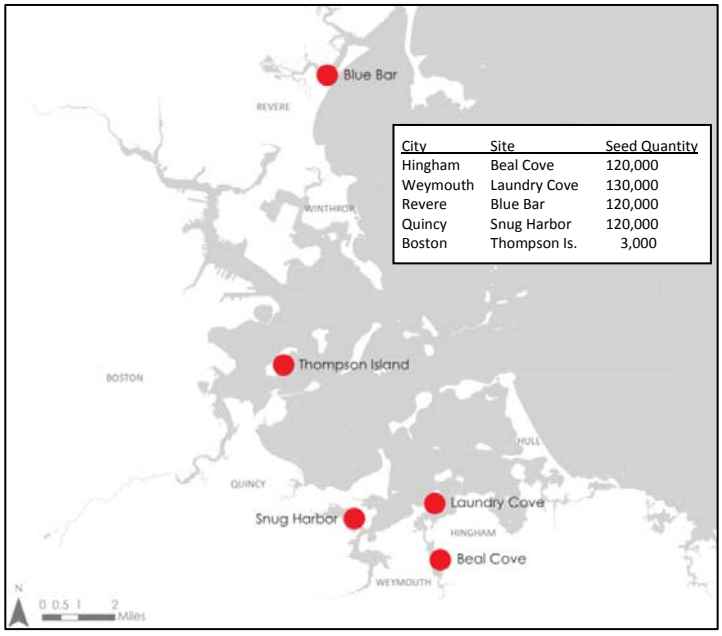


Figure 14. 2015 enhancement sites

Standardized techniques were used for all procedures. Seed clams averaged about ½ inch in shell length and planted roughly 30 per square foot. Enhancement plots were covered with nets to protect clams for predators. *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. Undergraduate students of Salem State University assisted in seed planting, sampling and measuring, and net removal. All nets were extracted from enhancement sites starting in late December, continuing into early January.

Shellfish Restoration and Mitigation in Buzzards Bay

Since 2014, South Coast Shellfish Section staff in New Bedford has been involved in two major shellfish restoration and mitigation activities in Buzzards Bay. Generally speaking, shellfish restoration refers to enhancing or augmenting shellfish stocks that have waned or been lost due to a myriad of possible factors, some of which include overfishing, disease, natural predation, poor recruitment and natural changes in habitat features. Shellfish mitigation, on the other hand, refers to replacement of shellfish that have been permanently lost due to direct human actions, including shoreline alteration projects, dredging activities and placement of pipe lines and electric cables.

New Bedford Marine Commerce Terminal Quahog Mitigation: The New Bedford Marine Commerce Terminal (NBMCT) located at the South Terminal in New Bedford was created to develop a multi-purpose marine terminal capable of supporting offshore renewable energy facilities, international shipping, and other industries within New Bedford. It is estimated that approximately 9.8 million shellfish were lost as a result of the filing and dredging activities involved with the project. In fulfillment of an agreement between the Massachusetts Clean Energy Technology Center and *MarineFisheries* to fulfill certain requirements of the Final Mitigation Plan for the NBMCT, the Division plans to purchase and plant 2.5 quahog seed for every one quahog impacted by the project, for a total of 24.5 million seed quahogs out-planted within New Bedford waters over the next 10–12 years.

Planting activities will target shallow subtidal areas in City of New Bedford waters, in Approved and Conditionally Approved areas only. Each year, seeding will take place in a portion of one of 10 separate sub-areas. The planted area will then be shut down for shellfishing for a maximum of three years in order to allow the seed to grow to a sufficient size to spawn and reach legal harvest size. The annual objective of the seeding program is to plant 2 million juvenile quahogs (in the 20–25mm size range).

During the summer and fall of 2015, Division staff planted a total of 582,500 seed quahogs in three areas within Area 6 (Table 8). The quahogs were purchased from Bill Avery's Quality Bay Clams in Galloway, NJ. On three separate occasions, Seawatch International Ltd. kindly transported the quahogs within their refrigerated trucks free of charge. This resulted in tremendous savings of resources and labor. An additional 20,000 seed quahogs were planted in nearshore waters by the New Bedford Shellfish Department.

Table 8. Summary of 2015 quahog planting activities

Planting Date	Planting Area	# Planted	Avg. Size (mm)	Target Density (per ft^2)
6/17/2015	6A	250,000	19.2	2.5
8/27/2015	6B	222,500	21.6	4.5
10/21/2015	6C	110,000	19.8	3.1
Total	----	582,500	20.2	3.4

Post-seeding surveys were completed in the planted areas (Table 9). Results underscore the need for pre-selection of optimal quahog habitat. 2015 pre-planting diver surveys within Area 6 failed to provide adequate resolution of optimal habitat throughout the 207-acre area. As a result, 2015 plantings often occurred on subpar substrate, which makes it difficult for planted seed quahogs to quickly burrow into the bottom sediment, making them more vulnerable to predation. Given the uncertainty of substrate conditions within the mitigation area, it will be necessary to include hydroacoustic surveys of the target planting areas to select optimal soft bottom substrate for planting seed quahogs.

Table 9. Summary of the 2015 diver surveys within two of the three planted areas.

Dive Date	Planting Area	# Quahogs	Avg. Size (mm)	Density (per ft^2)
7/17/2015	6A	9	19.1	0.45
7/30/2015	6A	22	20.9	0.42
12/4/2015	6B	9	19.5	0.14
11/16/2015	6C	44	17.7	0.58
Total	----	84	19.3	0.4

In late-October 2015, divers planted 37,000 4–15 mm quahogs produced by the Martha's Vineyard Shellfish Group (MVSG) at *MarineFisheries* Hughes Hatchery in Oak Bluffs. These smaller seed quahogs were planted within a marked experimental plot for future monitoring of quahog growth and survival during 2016. Depending on documented growth and survival rates, the Division may expand the quahog mitigation program by including smaller hatchery reared quahogs from Hughes Hatchery in future years.

B-120 Buzzards Bay Shellfish Restoration Project: In April of 2003 the grounding of the B-120 oil barge, owned and operated by the Bouchard Transportation Company, resulted in an estimated 98,000-gallon oil spill in Buzzards Bay. Federal and state Trustee representatives were tasked, through the Natural Resource Damage Assessment process, with managing and supporting restoration of natural resource and resource use injuries. Restoration planning was completed in 2014 and injuries to shellfish resources and the recreational shellfishery were among those addressed. In partnership with nine Buzzards Bay communities, *MarineFisheries* was selected by the Trustees to implement specified restoration strategies.

MarineFisheries designed a five-year program to restore shellfish resources and benefit public recreational shellfishing, including four activities: (1) contaminated quahog transplants; (2) quahog upweller and seed plantings; (3) single oyster purchases and out-planting; and (4) working collaboratively with The Nature Conservancy (TNC) by providing monitoring services for TNC conducted oyster and bay scallop restoration work. *MarineFisheries* will work collaboratively with the Trustees on all aspects of these projects and will provide technical oversight on all TNC B-120 shellfish restoration work via participation in a Technical Advisory Committee.

During 2015, *Marine Fisheries* initiated Activity 1 (in October); Activities 2–4 are scheduled to begin in 2016 or 2017. The five-year quahog transplant project will oversee the relocation of quahog broodstock harvested from a bacterially contaminated closed donor site in the Taunton River to designated transplant sites within the municipal waters of Westport, Dartmouth, New Bedford, Fairhaven, Mattapoisett, Marion, Wareham, Bourne and Gosnold. It is anticipated that this relay program will result in improvement of local populations which then contribute to sustainable recreational shellfisheries. The first year included the relay of 2,500 contaminated quahogs to four communities (Table 10). Shellfish program staff assisted Shellfish Department personnel in each town with surveying and mapping each site, surveying each site for resident quahog size distribution and density, and sampling the relayed quahogs for shell length.

Table 10. Summary of B-120 Buzzards Bay quahog relay activities

Town	# Bushels Relayed	Estimated # Quahogs	Size Range (mm)	Avg. Size (mm)
Westport	810	176,094	51-101	80.3
Mattapoisett	810	170,100	45-104	81.7
NB	810	187,920	55-104	77.7
Gosnold	70	16,369	55-104	77.7
Total	2,500	550,483	45-104	79.35

Aquaculture Project

Permitting

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 2015, *MarineFisheries* issued shellfish propagation permits to 331 private aquaculture license site holders and 25 municipalities (for public propagation activities) operating shellfish aquaculture projects in 28 coastal municipalities throughout the Commonwealth. See Table 11 for the number of private shellfish propagation permits and acreage under cultivation by town.

Table 11. 2015 Private Shellfish Propagation Permits and Acreage Under Cultivation, by Municipality

Municipality	# Growers	Total Acres	Species Grown
Aquinnah	1	2.6	Quahog
Barnstable	49	138.76	Oyster, Quahog, Soft Shell Clam
Bourne	2	2.9	Oyster
Brewster	9	8.5	Oyster, Quahog
Chatham	2	8	Oyster, Quahog, Soft Shell Clam, Razor
Chilmark	7	23.06	Oyster, Blue Mussel
Dartmouth	1	0.5	Oyster
Dennis	28	30	Oyster, Quahog, Soft Shell Clam
Duxbury	29	70.66	Oyster, Quahog
Eastham	20	19.47	Oyster, Quahog, Soft Shell Clam, Mussel
Edgartown	12	15.5	Oyster
Fairhaven	2	36	Oyster, Quahog, Bay Scallop
Falmouth	9	40.1	Oyster, Mussel
Gosnold	1	32	Oyster
Ipswich	2	2	SS Clam
Kingston	3	8.5	Oyster
Marion	3	1.5	Oyster
Mashpee	4	13.9	Oyster, Quahog, Soft Shell Clam
Mattapoisett	2	104.9	Oyster, Bay Scallop
Nantucket	8	71	Oyster, Quahog, SS Clam
Oak Bluffs	1	2	Oyster
Orleans	14	23.28	Oyster, Quahog, Mussel, Surf Clam
Plymouth	8	35.37	Oyster, Quahog, Soft Shell Clam
Provincetown	8	14	Oyster, Quahog, Mussel, Surf Clam
Rowley	12	18.5	Oyster, Soft Shell Clam, Razor Clam
Truro	8	19	Oyster
Wareham	7	86.18	Oyster, Quahog
Wellfleet	71	259.1	Oyster, Quahog, Soft Shell Clam, Mussel, Razor Clam
Westport	5	25	Oyster, Quahog
Yarmouth	3	16.5	Oyster, Quahog
Grand Total	**331**	**1,128.78**	

Aquaculture Landings

Aquaculture landings, as derived from SAFIS dealer reports, are presented in Table 12. Confidentiality of an individual or corporation's data is protected by only displaying summarized values and quantities that could not be used to identify data attributed to a single permitted entity. Units for quantity are converted for reporting purposes using standardized conversion factors developed by *MarineFisheries*. Value is calculated from the unit prices reported by dealers with the average unit price used to fill in missing data.

Table 12. 2015 Aquaculture Landings and Value

American Oyster		
Town or Region	Pieces	Reported Value
Duxbury	9,571,229	$5,479,278
Barnstable	7,559,181	$4,492,595
Wellfleet	6,689,444	$3,763,302
Edgartown	2,624,124	$1,602,975
Wareham	1,776,855	$1,031,783
Orleans	1,240,896	$723,483
Dennis	1,220,628	$710,548
Buzzards Bay	1,202,551	$645,698
Falmouth	958,802	$550,585
Brewster	904,650	$534,958
Nantucket & Vineyard Sounds	903,992	$576,502
Plymouth	719,481	$390,095
Eastham	497,079	$275,526
Kingston	319,100	$179,805
Nantucket	283,126	$200,519
Yarmouth	205,778	$112,420
Mashpee	147,471	$84,303
Provincetown/Truro	97,605	$57,288
Marion	69,600	$38,299
Nantucket	17,600	$15,785
Total	**37,009,191**	**$21,465,746**

Quahog		
Town or Region	Pieces	Reported Value
Wellfleet	5,931,686	$1,300,735
Barnstable	389,535	$82,674
Pleasant Bay	135,470	$34,328
Other	54,830	$12,753
Total	**6,511,520**	**$1,430,490**

All Other Aquaculture Species (Soft Shell Clam, Blue Mussel, Bay Scallop)	$198,200
Total Aquaculture Landings Value	**$23,094,437**

John T. Hughes Hatchery & Research Station

Infrastructure investments in *MarineFisheries*' John T. Hughes Hatchery and Research Station continue to pay off in the form of enhanced public shellfish beds through its partnership with the Martha's Vineyard Shellfish Group (MVSG). The MVSG, a consortium of the Shellfish Departments of the six towns of Martha's Vineyard, continues to use portions of this Division-owned facility to spawn and culture shellfish for eventual transplant to harvestable shellfish beds throughout the waters of Martha's Vineyard. Access to the hatchery greatly expanded MVSG's hatchery and nursery capacity. This activity supports several of the Division's strategic goals, including improving fisheries sustainability, supporting the Commonwealth's commercial and recreational fisheries, and providing technical support to Martha's Vineyard Town Shellfish Departments.

In 2015, MVSG continued to expand capacity at the station to culture algae for feeding young bivalves in the hatchery's new greenhouse. In addition, two new conical tanks were constructed to expand capacity for culturing oyster and bay scallop larvae (Figure 15). Culture activities in the main building continue to include nursery grow-out of quahog and bay scallop juveniles in downwellers utilizing fresh seawater from Lagoon Pond, aeration, and electrical systems for its many tanks, silos, and tables.

MVSG also continues to diversify activities at Hughes Hatchery by expanding their remote setting of spat-on-oyster shells and culturing of blue and ribbed mussels. These activities are intended to support expanded efforts by Martha's Vineyard communities to utilize cultured shellfish to improve water quality and marine habitats in compromised nearshore waters that are plagued by eutrophic conditions caused primarily by excess nutrients.

Shellfish production at Hughes Hatchery continued to increase in 2015 (Table 13). Oyster and scallop larvae were produced; phytoplankton tanks provided additional food for setting quahogs, scallops, and spat-on- oyster shells; quahog and scallop larvae were set in re-circulated and flow-through systems; and blue and ribbed mussel seed was cultured.

Table 13. Estimated 2015 shellfish production at the Hughes Hatchery.

Shellfish	Number
Quahog Seed	8 million
Single Oyster Seed	617,000
Blue Mussel Seed	20,000
Ribbed Mussel Seed	25,000
Blue Mussel Eyed Larvae	1 million
Bay Scallop Eyed Larvae	6.7 million
Oyster Eyed Larvae	1.6 million

MVSG also continued to develop capacity at Hughes Hatchery to provide young kelp plants to interested aquaculturists. The interest in sugar kelp *(Saccharina latissima)* farming in the New England waters is very recent. The Division has received a growing number of inquiries from potential and active aquaculturists about kelp culture in Massachusetts waters. Shellfish growers see kelp culture as a way of diversifying their crop and allowing the production and sale of a second product in the winter and early-spring when demand for shellfish is low. After three years of trials with several species of macro algae and various methods of culture, MVSG was able to obtain very promising results with the spool and long line culture of sugar kelp (Figure 16). They are planning on expanding their production in order to provide young kelp plants to interested oyster farmers on Martha's Vineyard.

Figure 15. Larval conical tanks for rearing oyster and scallop larvae at the Hatchery.

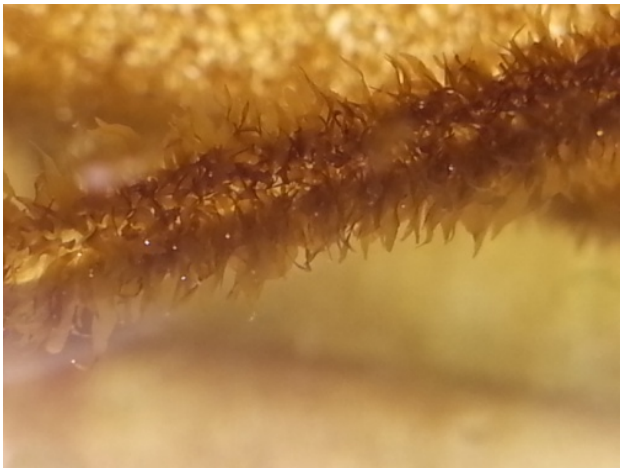


Figure 16. Kelp sporelings on a grow-out line at the Hatchery.

Vibrio Management

An increasing component of the *MarineFisheries* Shellfish Program's public health protection responsibilities is the implementation of control measures intended to limit the human health risks associated with the exposure of *Vibrio parahaemolyticus* bacteria (*Vibrio*) from the consumption of raw oysters. Since 2011, Massachusetts has seen an increase in the number of *Vibrio* cases reported to the state (Table 14). Exposure to *Vibrio* can cause gastrointestinal illness and in some cases can be lethal; as a result the USFDA requires NSSP member states with a history of *Vibrio* illness to monitor conditions in oyster harvest areas, implement *Vibrio* control measures, and respond in the event of a *Vibrio* illness outbreak associated with shellfish consumption. *MarineFisheries* is also responsible for the closure of harvest areas following the notification of a *Vibrio* outbreak from *MassDPH*.

Table 14. Vibrio cases related to the consumption of MA-harvested shellfish

Year	# of Cases
2011	2
2012	9
2013	33
2014	11
2015	28

The *Vibrio* Control Season in Massachusetts runs from May to October, when the risk of *Vibrio* infection is highest. During this period, commercial oyster harvesters are required to tag containers of oysters with the time of harvest and time of icing; maintain a harvest logbook; shade oysters during harvest and transportation; and adequately ice oysters within two hours of harvest. Additionally, certain aquaculture activities related to the culling and processing of oysters are subject to *Vibrio* related restrictions. *MarineFisheries,* in cooperation with local shellfish constables and the Massachusetts Office of Law Enforcement, work with harvesters and growers to educate and verify compliance with the *Vibrio* Control Plan through routine compliance monitoring and training workshops. During 2015, the regulations were amended to simplify and clarify existing controls as well as to accommodate industry requests to allow for a single icing tag and the ability to broadcast re-submerge oysters following oyster culture practices.

In an effort to reduce *Vibrio* illness, and where possible reduce the growing regulatory burden *Vibrio* has placed on the Massachusetts oyster industry, *MarineFisheries* initiated new research efforts in 2015. Working with local, federal, and state partners, these efforts aim to evaluate the effectiveness and fine-tune existing *Vibrio* controls and explore additional illness reduction options. The Shellfish Program maintains environmental monitoring stations in Massachusetts shellfish growing areas and collects and analyzes samples to determine the level of *Vibrio* present in oyster tissue in major oyster production areas.

Despite the substantial efforts made in Massachusetts to curb *Vibrio* illness, certain harvest areas have continued to produce elevated levels of *Vibrio* illness. During the 2015 season, two outbreaks of *Vibrio* were again traced back to oysters harvested in the adjacent Duxbury and Kingston Bays and Katama Bay resulting in two-week harvest closures at all three growing areas. As a result of improvements in reporting and investigation protocols, the closures were put in place prior to the illness level reaching the federal recall threshold, avoiding costly recalls and minimizing the closure period.

MarineFisheries and *MassDPH* evaluate the effectiveness of *Vibrio* controls annually and work with industry and other stake holders to make improvements and incorporate state-specific data where possible. This process informed changes to the *Vibrio* Control Plan and implementing regulations for 2016. These changes primarily focus on meeting illness reduction goals in the three growing areas that continue to show an annual occurrence of *Vibrio* illness. Additionally, a slight liberalization to the resubmergence requirement (shortened from 14 days to 10 days) was made possible by research conducted by *MarineFisheries* in 2015.

Other Activities

Technical Assistance: In Massachusetts, cities and towns manage the shellfisheries in all waters within their boundaries not closed by *MarineFisheries* for public health reasons, and with the exception of commercial harvest of surf clams and ocean quahogs which remain under state control. The Shellfish Program assists municipalities on a wide variety of shellfisheries management issues providing technical and regulatory information as well as recommendations on a numerous subjects to local shellfish managers. Assistance includes: shellfish propagation; predator control; survey methods; management openings and closures; habitat improvement; shellfish management plans; aquaculture development and regulation; water quality; public health and sanitation; and permitting. Shellfish staff provided technical assistance to municipal managers and boards, state and federal agencies, academia and non-governmental research and management organizations, and individuals.

Professional Organizations: Program staff participated in many professional organizations such as the ISSC, Northeast Shellfish Sanitation Association, the Massachusetts Shellfish Officers Association, and the New England Estuarine Research Society. In 2015, Program staff participated in the ISSC 2015 Biennial Meeting, numerous ISSC committees throughout the year, and the Northeast Shellfish Sanitation Association Annual Meeting.

New Bedford Lab Relocation: On March 27, the New Bedford microbiology lab located at 838 South Rodney French Boulevard was closed down until June 22, while a new lab was built at the SMAST building located at 706 South Rodney French Boulevard. During this period, critical bacteriological sampling continued with samples analyzed by Division staff in the Shellfish Lab at the Annisquam River Station in Gloucester.

EU Commission Audit: To assist FDA's Center for Food Safety and Nutrition in discussions with the European Union (EU) concerning shellfish program reciprocity to aid reopening international trade of shellfish, *MarineFisheries* allowed FDA and EU shellfish specialists to review the Division's Shellfish Program files and conduct site visits at selected shellfish growing areas within the Commonwealth. The audits, occurring March 23 and 24 at the Division's New Bedford and Gloucester offices, included discussion of sanitary criteria to determine eligible harvest areas, *Vibrio* controls, and marine biotoxins. The group also visited processing plants in New Bedford and Ipswich, conducted shellfish growing area site visits in Barnstable Harbor and Duxbury Bay, and toured *MarineFisheries*' microbiology/biotoxin Lab in Gloucester.

In part due to the audit, the EU recently announced that shellfish trade will be reinstated between selected EU member countries and shellfish producers only in Massachusetts and Washington State.

Habitat Program

Personnel

Dr. Kathryn Ford, Program Leader
Jillian Carr, Assistant Marine Fisheries Biologist
Wesley Dukes, Marine Fisheries Biologist
Tay Evans, Marine Fisheries Biologist
Eileen Feeney, Marine Fisheries Biologist
Dr. John Logan, Marine Fisheries Biologist
Katelyn Ostrikis, Assistant Marine Fisheries Biologist
Christian Petitpas, Assistant Marine Fisheries Biologist
Mark Rousseau, Marine Fisheries Biologist
Steve Voss, Marine Fisheries Biologist
Amanda Davis, Seasonal Technician
Alina Arnheim, Intern
Joshua Tefft, Intern
Erin Berry, Intern

Overview

The goal of the Habitat Program is to protect and enhance marine fisheries resources. Strategies include: 1) reviewing coastal alteration projects and providing science-based guidance that addresses their potential impacts on fisheries resources and habitats of the Commonwealth; 2) initiating and performing fisheries habitat research and applied studies; 3) developing and overseeing *MarineFisheries'* climate change program; 4) supporting ocean planning in the Northeast; and 5) coordinating technical responses to emerging issues.

Technical Review Project

The Technical Review Project 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. This project is also responsible for recommending mitigation, tracking mitigation projects, and reviewing state and federal policy documents. To meet these goals, the Technical Review team tracks coastal and marine construction projects, solicits specific resource information from *MarineFisheries* biologists, conducts literature reviews, attends 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.

Technical Review

In 2015, staff reviewed 565 specific projects in 106 municipalities. Of these projects, 388 were new. Five full-time staff members dedicated up to 75% of their time to technical review; one part-time contractor continued to play a vital role in maintaining records and assisting with the preparation of comment letters in New Bedford.

Major review projects included: Salem Lateral LNG pipeline; Long Island Bridge demolition (Boston Harbor); Sandwich Town Neck erosion project; Logan Airport Runway Mitigation; ComCast/NSTAR fiber optic cable in Martha's Vineyard; Wynn Casino in Everett; and Boston Harbor Deep Draft Navigation Improvements.

Other major activities follow. Staff participated in sea level rise meetings and engineering workshops to better understand the practical issues associated with sea level rise and the various shoreline protection efforts underway. The Project received a grant from Sandy Relief Funds to develop a biologically friendly shoreline protection structure and determine beneficial reuse options for the Boston Harbor Deep Draft Navigation Improvements. Staff edited EEA's nutrient removal guidance document, focusing on sections characterizing the effectiveness of using shellfish and algae for nutrient remediation. Staff reviewed the Army Corps of Engineers revision of the Massachusetts General Permit which underwent extensive and complicated changes including significant changes in the protections of submerged aquatic vegetation. Staff also reviewed the Monomoy National Wildlife Refuge's Draft Comprehensive Conservation and Management Plan, which included complex boundary and jurisdictional issues. We participated in scoping of restoration projects with the Natural Resource Damages Trustee Council for the Bouchard Barge-120 oil spill, as well as with the Atlantic Coastal Fish Habitat Partnership. Lastly, staff participated on several technical advisory panels, pre-application discussions, and on related committees including the Massachusetts Bays Management Committee.

Data Management

Data management and archiving are important parts of Technical Review. Our archiving standard was developed in 2012 and our Access database developed in 2013. We continue to improve these systems. During 2015, the groundwork was laid to conduct spatial analyses using this database.

In Lieu Fee Program

In 2014, the Massachusetts In-Lieu Fee (ILF) Program Instrument was signed by the Army Corps of Engineers (Army Corps). *Mass*DFG, as program sponsor, is responsible for overseeing a statewide ILF program for Massachusetts. This program mitigates for unavoidable impacts under the Army Corps General Permit and Individual Permits. From 2009–2014, *MarineFisheries* was the program sponsor for the Coastal ILF Program which preceded the statewide, Department-led program. The Coastal ILF Program addressed authorized impacts of less than one acre in extent to coastal 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). Under the Coastal ILF Program, 27 construction projects impacting 18,980 square feet of aquatic habitat contributed nearly $230,000. All obligations under the program, including project tracking, fund disbursement, and annual reporting were accomplished. Four restoration projects, selected through a Request for Proposals (RFP) process, have been funded by ILF funds: Off Billington Street Dam, Plymouth; Rough Meadows Wildlife Sanctuary, Rowley; Great Marsh, Newbury; and Draka Dam, Taunton. During 2015, project staff monitored the funded projects and will continue to do so through 2019 (Figure 17).

Figure 17. 2015 *MarineFisheries* ILF restoration monitoring. Left: Lou Wagner of MA Audubon escorting Army Corps scientists to *Phragmites* removal treatment area in Rough Meadows Wildlife Sanctuary. Right: decaying *Phragmites* stand treated in 2014 by the Great Marsh Revitalization Task Force.

Fisheries Habitat Research Project

The Fisheries Habitat Research Project conducts research, monitoring, and restoration relevant to the mapping, identification, and quality of marine fisheries habitats. Research projects in 2015 included eelgrass monitoring, restoration, conservation, and mapping; artificial reef siting, construction, and monitoring; dock impacts on salt marsh; and bottom temperature continuous monitoring. Project staff served on a variety of habitat-related committees, including the ASMFC Habitat and Reef Committees, the Atlantic Coastal Fish Habitat Partnership (ACFHP), the NEFMC Habitat Plan Development Team, the NROC Habitat Classification Working Group, the NERACOOS Benthic Working Group, and the NEERS Executive Committee. Staff also participated on working groups for the Boston Harbor Habitat Coalition and Mass Bays Management Committee and reviewed proposals for NOAA and MIT Sea Grant. Some of the highlights from committee work in 2015 include editing the ASMFC Habitat Hotline, reviewing and selecting fisheries habitat restoration projects funded annually through ACFHP, and describing potential closed areas for the Omnibus Habitat Amendment for NEFMC.

Habitat Characterization

The Habitat Research team conducts research focused on seafloor mapping. Using single-beam sonar, sidescan sonar, and video equipment, the team maps eelgrass beds and shallow coastal areas not covered by other seafloor mapping studies in each year. In 2015, we mapped eelgrass in Sandwich and Cohasset in partnership with the EPA, MassBays, and MIT Sea Grant to quantify carbon storage potential of eelgrass beds (Figure 18). The meadow mapped in Sandwich was previously undocumented. The project team participated in an interagency workshop to discuss blue carbon research in December 2015.

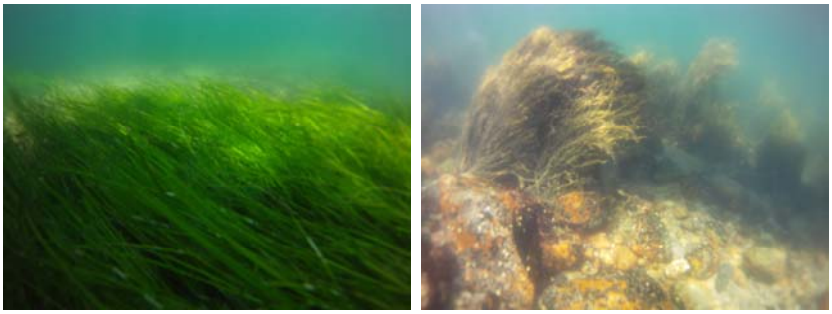


Figure 18. Seafloor images from Sandwich, MA, August 2015.

Based on questions raised during the development of the Massachusetts Ocean Plan, the habitat team started assembling a website which presents data on the spatial distribution of fish and creates a framework for tracking environmental events.

For the past several years, there have been ongoing concerns over the impact of hydraulic clamming in the Herring Cove region of the Provincetown Coast. The Habitat Program assembled previous work that was done in the area and participated in a day-long scientific workshop regarding the potential for impact from this gear type.

Eelgrass

Due to its value in supporting commercial and recreational fisheries and its vulnerability to impact, eelgrass has been a habitat of primary importance to the Division for over a decade. The eelgrass team focuses on research, monitoring and restoration of eelgrass in Massachusetts. The team is in its ninth year of monitoring a long-term transect in an eelgrass bed in Salem Sound, as part of the international SeagrassNet monitoring program which tracks short- and long-term trends in eelgrass distribution and health. This program is an important "canary in the coal mine" with respect to assessing threats to eelgrass, including invasive species. This monitoring effort is also a partner in the Marine Invader Monitoring and Information Collaborative.

The Hubline mitigation-funded eelgrass restoration project was completed in 2015 after five years. This is the largest and most successful eelgrass restoration activity in Massachusetts, successfully restoring two acres of eelgrass. Through our eelgrass restoration work, we have tested and perfected several transplant methods and site selection tools. Our work has opened the door to lasting partnerships with academic groups, non-profits and resource agencies including Northeastern, EPA, and the Cornell Cooperative Extension. We also partnered with students through the New England Aquarium, Outward Bound, and the Endicott College internship program. A final report is scheduled for completion in 2016, but the Division intends to continue tracking the restoration success as funding allows. We expect that it will take several more years for the eelgrass to become fully established.

Because restoration remains a difficult and expensive process, the eelgrass team continued to focus on establishing effective conservation methods for eelgrass. Many mooring fields overlap with eelgrass meadows and traditional chain moorings create scars in the meadows. In order to minimize this type of damage to existing beds, moorings with floating, flexible rodes have been recommended by resource agencies for over a decade. Since 2010, we have been studying the effectiveness of these "conservation moorings". In 2015, with funding from Massport, monitoring continued at sites in Gloucester, Manchester, Wareham, and Falmouth. We have been finding that properly designed, installed, and maintained conservation moorings are effective at preventing damage and enabling eelgrass regrow at moorings that were previously traditional moorings. However, installation and maintenance is more difficult than with traditional mooring systems, and the systems can get considerably fouled. In about 50% of the cases, conservation moorings created larger scars in the eelgrass meadow.

In 2014, Project staff quantified large losses of eelgrass in Duxbury, Kingston, and Plymouth Bays. This led to a MassBays-funded project to describe the losses in more detail and explore potential causative factors. The project was launched in the fall of 2015 and was expected to be finished in the spring of 2016. Part of this project includes the most thorough examination so far of *Mass*DEP eelgrass mapping methodology.

The eelgrass team also maintained a blog and presented at regional conferences including the New England Estuarine Research Society (NEERS) and "Zosterapalooza," the annual eelgrass conference hosted by EPA.

Artificial Reefs

Properly sited and constructed artificial reefs serve as hard bottom structured habitat for marine fish and invertebrate species and provide near-shore fishing opportunities for anglers. The Fisheries Habitat team oversees the four state-permitted artificial reef locations. Monitoring sites were visited annually to document the presence of finfish, invertebrates, and invasive species and service temperature monitors (Figure 19). In 2014, permits for a fifth location were procured, and in 2015 the ongoing collaboration with Harwich and the Recreational Fisheries Program laid additional groundwork for deployment of a reef in 2016. Funding for deployment of material to the site was approved for early spring of 2016.

Figure 19. Left: Divers conduct monitoring transects on the Yarmouth reef site. Center: Five Sisters breakwaters, Winthrop. Right: subtidal image of habitat at the toe of the Five Sisters Breakwater.

In 2015, with funding from the National Fish and Wildlife Foundation's Hurricane Sandy grant, we launched a project focused on siting and designing nearshore artificial reefs. The intent is to develop and site reefs that could be used for shoreline protection as well as serve as productive biological habitats (Figure 20). This project was initiated after discussions of how to beneficially reuse dredged rock material expected to come from the Army Corps Boston Harbor Deepening Project in 2017. In 2015, 33 preliminary sites were identified and filtered down to 10 potential sites. In 2016, two sites will be selected and pre-permitting studies initiated.

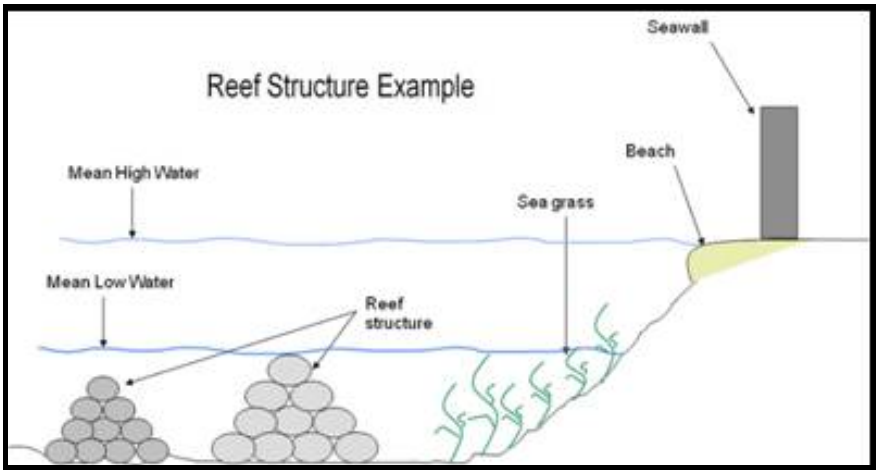


Figure 20. Graphic illustrating the nearshore artificial reef for shoreline protection concept.

Salt Marsh

Many docks and piers are constructed over salt marsh in order to provide access to bordering estuaries. The proliferation of small docks and piers in coastal states has led to concerns about cumulative environmental impacts. Since 2013, with partial funding from MassBays, we have conducted controlled studies to evaluate the impact of docks on marsh vegetation and abiotic conditions (Figure 21).

Figure 21. A view from the high marsh of the experimental dock shading study site in Marshfield. Docks were installed over the marsh during the growing season from 2013–2015. Four foot wide docks were set two, four, and six feet above the marsh platform to assess the relative shading impacts of docks relative to the 1:1 height to width ratio guideline for dock construction over salt marsh.

In 2015, we completed the third and final field season of shading at our experimental dock shading site in Marshfield. We found a significant influence of dock height on relative shading impacts, providing experimental evidence that supports maintaining at least a 1:1 height to width ratio, as recommended by state permitting guidelines. While docks maintaining a 1:1 ratio had less shading impacts than shorter docks in the low marsh, shading from these 1:1 docks still resulted in an approximate 50% reduction in vegetation biomass at the conclusion of the three-year study relative to unshaded plots.

Climate Change Project

The Climate Change Project, initiated in 2010, is focused on three priority action items: (1) creating an inventory of existing *MarineFisheries* data sets relevant to climate change research; (2) identifying, developing, and publishing data collection and storage standards for *MarineFisheries* climate data; and (3) examining how to forecast fisheries shifts resulting from climate change.

In 2014, temperature datasets were inventoried and assembled into an Access database (7.2 million temperature records from 26 coastal stations); a schedule was established to track and update all temperature monitors; and standards for data collection and redundancy were adopted. In 2015, we applied

for a NERACOOS grant to expand the network to additional stations, connect to the NERACOOS website, and improve the database. Although grant money was not received, efforts are being made to move from the Access database to an Oracle database for stability. Staff also coordinated a meeting with representatives from Onset to discuss technology needs of *MarineFisheries* programs collecting climate change-relevant data. Four data requests from outside research institutions were fulfilled.

MarineFisheries maintains more than 60 permanent bottom temperature monitoring stations, including five new stations added in 2015 (Figure 22). Sixty new temperature loggers were purchased to update old equipment and to standardize data collection. Many of the stations have been collecting data for over 25 years, making these data sets among the longest running bottom temperature time series in the northeast. Data from these monitors are incorporated into population monitoring and stock assessment work. They are valuable in detecting environmental change in Massachusetts waters. For example, temperature data from southern New England have shown a warming trend which helped to explain changes in population dynamics of some cold-water species, including American lobster. During the summer of 2015, *MarineFisheries* divers from numerous Projects retrieved and replaced temperature monitors at the stations. These monitors contained data from late 2014 through mid to late 2015.

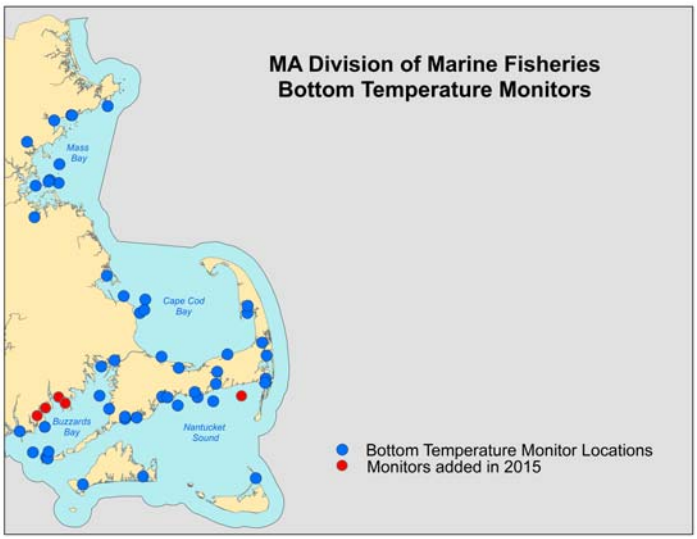


Figure 22. *MarineFisheries* bottom temperature monitor locations.

In 2015, well below normal winter temperatures quickly gave way to well above normal summer temperatures. This pattern was observed both north and south of Cape Cod and across all depth ranges monitored. At several locations along the Massachusetts coast the record low bottom water temperature and record high bottom water temperature was observed in 2015. These types of wild swings in water temperature are related to climate change and can have dramatic effects on the distribution, local availability, vital population parameters, and fisheries for many important marine species in the Commonwealth.

We continued our participation on several climate change-related committees, including the Gulf of Maine Climate Network's Sentinel Monitoring Project and the EEA's Climate Change Adaptation subcommittee. Many other Division staff are involved with climate change related activities as well, primarily focusing on changes associated with sea level rise and acidification.

National Coastal Condition Assessment

Every five years, the EPA oversees the collection of environmental samples to assess environmental quality in estuaries nationwide as part of the National Coastal Condition Assessment (NCCA). From July–September 2015, *MarineFisheries* conducted the fish collections for Massachusetts state waters. Working with personnel across the agency as well as commercial and charter fishing partners, Habitat Program staff oversaw the collection of fish samples from 47 stations (Figure 23). Whole fish as well as muscle plug samples were collected, processed, and shipped to EPA for analysis of mercury and other contaminants.

Species collected as part of the sampling program included scup (*Stenotomus chrysops*), black sea bass (*Centropristis striata*), winter flounder (*Pseudopleuronectes americanus*), striped bass (*Morone saxatilis*), American eel (*Anguilla rostrata*), Atlantic silversides (*Menidia menidia*), mummichogs (*Fundulus heteroclitus*), striped killifish (*Fundulus majalis*), red hake (*Urophycis chuss*), ocean pout (*Zoarces americanus*), northern sea robin (*Prionotus carolinus*), oyster toadfish (*Opsanus tau*), and cunner (*Tautogolabrus adspersus*).

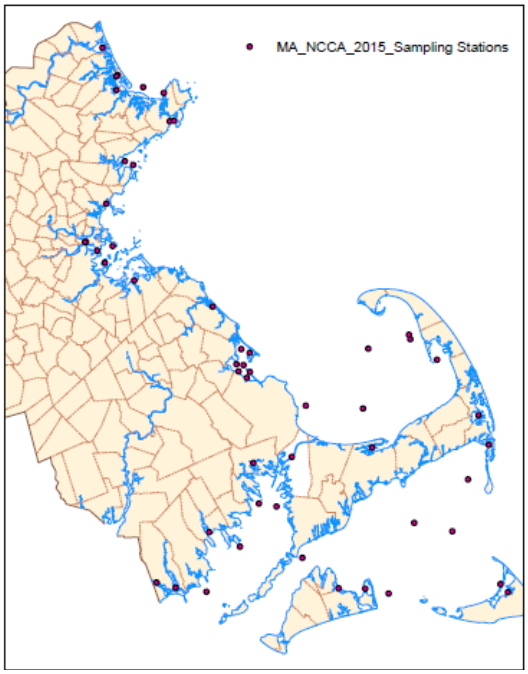


Figure 23. Right: Massachusetts sampling station locations for the 2015 NCCA. *MarineFisheries* scientists conduct NCCA sampling in the Merrimack River.

Offshore Wind & Ocean Planning

The Massachusetts Wind Energy Area was designated south of Martha's Vineyard in 2014 and the federal leases were awarded in January 2015 to two companies: Offshore MW and Dong Energy. *MarineFisheries* participates on the Massachusetts Renewable Energy Task Force and the Joint RI-MA Renewable Energy Task Force, as well as the Habitat and Fisheries Workgroups for the Mass Wind Energy Area. In 2015, we participated in several meetings introducing the developers and reviewing status reports from marine mammal, turtle, bird, and seafloor research in the area.

The Massachusetts Ocean Plan was updated and released in January of 2015 so this year ocean planning activities were centered around the Northeast Regional Planning Body (NERPB). The NERPB started the drafting of the regional ocean plan this year. They met twice and there were many working group meetings in the time between RPB meetings. Most notably, *MarineFisheries* was instrumental in developing and participating on the Ecosystem Based Management Working Group. The Habitat Program has participated as a designee of the Director on the NERPB and plays an active role in various committees and subcommittees. Many other Division staff have reviewed documents, research activities, and participated on subcommittees related to ocean planning.

In September 2015, NOAA announced that the President was considering a proposal for a marine national monument in the Atlantic. The Habitat Program participated in meetings and kept *MarineFisheries* and DFG administration apprised of developments.

Other Activities

Outreach

Habitat Program staff provided outreach support for Women in Science and Engineering; NEERS Science Programming; the Topsfield Fair; and the New England Boat Show.

Publications and Presentations

Ford, K.H. and S. Voss. 2015. Eelgrass mapping in Cohasset and Sandwich, MA. Blue Carbon Workshop, Dec 9 2015, Saugus, MA. Lecture.

Simpson, J., P. Colarusso, A. Novak, K. Ford, P. DiBona. 2015. Estimating carbon storage in eelgrass meadows in the Gulf of Maine. 23rd Biennial Coastal and Estuarine Research Federation Conference, Nov 8-12 2015, Portland, OR. Poster.

Ford, K.H. 2015. Using shellfish for nutrient remediation in Massachusetts, the DMF perspective. Massachusetts Shellfish Officer's Association Meeting. March 2015. Lecture and Panel Discussion.

Ford, K.H. 2015. Shallow water eelgrass mapping using a low-cost sidescan sonar unit. SMAST and UNH seminar series. February 2015. Lecture.

Logan, J.M., Golet, W. & M.E. Lutcavage. 2015. Diet and condition of Atlantic bluefin tuna (Thunnus thynnus) in the Gulf of Maine, 2004-2008. Environmental Biology of Fishes 98(5): 1411-1430.

Butler, C.M., Logan, J.M., Provaznik, J.M., Hoffmayer, E.R., Staudinger, M.D., Quattro, J.M., Roberts, M.A., Ingram, Jr., G.W., Pollack, A.G., & M.E. Lutcavage. 2015. Atlantic bluefin tuna (Thunnus thynnus) feeding ecology in the northern Gulf of Mexico: a preliminary description of diets from the western Atlantic spawning grounds. Journal of Fish Biology 86: 365-374.

Young, J.W., Olson, R.J., Ménard, F., Kuhnert, P.M., Duffy, L.M., Allain, V., Logan, J.M., Lorrain, A., Somes, C.J., Graham, B., Goñi, N., Pethybridge, H., Simier, M., Potier, M., Romanov, E., Pagendam, D., Hannides, C., & C.A. Choy. 2015. Setting the stage for a global-scale trophic analysis of marine top predators: a multi-workshop review. Reviews in Fish Biology and Fisheries 25(1): 261-272.

Logan, J., A. Davis, and K. Ford. 2015. Environmental impacts of docks and piers on salt marsh vegetation across Massachusetts estuaries: a quantitative field survey approach. State of the Bays Symposium, April 15, 2015, Boston, MA. Poster.

Logan, J.M., S. Bean, and A. Myers. 2015. Authorship in ecological publications: what it means to be a co-author. New England Estuarine Research Society (NEERS), Bristol, RI, April 16-18, 2015. Lecture.

FISHERIES BIOLOGY SECTION

Dr. Michael Armstrong, Section Leader

Fish Biology Program

Personnel

Dr. Gary Nelson, Program Manager
Micah Dean, Senior Biologist
William Hoffman, Senior Biologist
Scott Elzey, Biologist
Nicholas Buchan, Assistant Biologist
Brad Schondelmeier, Assistant Biologist
Kimberly Trull, Assistant Biologist
Elise Koob, Ageing Technician
Collin Farrell, Ageing Technician

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' fishery resources. Biological data collected from harvested and released fish include age structures (i.e., scales, otoliths, and 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 needs.

Age and Growth Project

In 2015, staff aged hard-part structures from many species important to the recreational and commercial fisheries. Table 15 shows the number of samples processed. Several species projects in which the Age and Growth Project was involved in 2015 are highlighted below.

River herring: Sampling of river herring bycatch from the Atlantic herring fishery continued in 2015 (n=4,237). Otoliths and genetic samples were collected to aid in a project to better understand the composition of the bycatch. Alewife were also collected from the Division's resource assessment trawl survey in the spring of 2015 to better understand size distributions of age 1 and 2 fish. Although in both 2014 and 2015 the transition between age 1 fish and age 2 fish happened around 15cm, samples will need to be collected annually as length distributions are expected to change slightly each year.

American shad: Two external shad ageing projects were undertaken by the Age and Growth Lab this year. Staff aged 770 shad for a Northeast Fisheries Science Center study of the population structure and fecundity of American shad in the Connecticut River. Another 100 aged samples were sent to the Florida Fish & Wildlife Conservation Commission, upon the agency's request, to help ensure that Florida staff were correctly identifying annuli. Such exchanges are important to improve consistency between ageing labs.

Whelk: In 2015, the Age and Growth lab initiated the ageing of channeled and knobbed whelk. Operculum and statoliths were examined from 460 whelks to determine age (Figure 24). The ages will be used in conjunction with size and maturity data to better manage the whelk fishery.

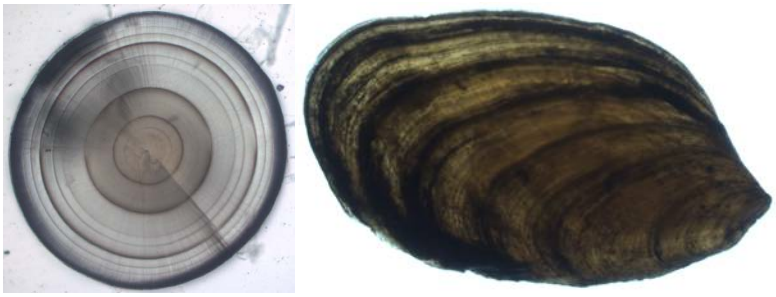


Figure 24. A statolith and an operculum from a 7 year old channeled whelk.

Atlantic cod: Otoliths were removed from juvenile Atlantic cod (n=213) captured on the resource assessment trawl survey. Counts of daily growth rings were made to determine hatch date. The processing of these data is ongoing.

Ventless trap samples: 2015 marked the beginning of ageing tautog and black sea bass samples collected on the ventless trap survey. The ventless survey is being used as an alternate sample source for these species for which obtaining adequate structures to age has been difficult.

Table 15. Samples processed for age in 2015; all samples were collected in 2015.

Species	Structure	Process	Number
American shad	Otoliths and scales	Otoliths aged, scales checked for repeat spawning	362
Atlantic cod	Otoliths	Daily ring counts	213
Black sea bass	Otoliths and scales	Cleaned, mounted, aged	1,046
Bluefish	Otoliths	Baked, sectioned, aged	146
Fluke	Scales	Cleaned, pressed	80
Rainbow smelt	Scales	Cleaned, mounted, aged	792
River herring	Otoliths and scales	Cleaned, mounted, aged	8,670
Scup	Scales	Cleaned, pressed	104
Striped bass	Otoliths	Extracted, sectioned, aged	114
Striped bass	Scales	Cleaned, pressed	1,988
Tautog	Otoliths and opercula	Cleaned, sectioned, aged	437
Whelk	Opercula and statoliths	Polished, aged	460
Winter flounder	Otoliths	Sectioned, aged	957

Other activities: Within the lab, regular maintenance and expansion of reference collections was performed as well as the creation of a reference collection for black sea bass.

In 2015, Age and Growth staff participated in the Marine Science Symposium for high school students as well as a version of the science symposium directed at teachers. Staff participated in the continued joint effort by ASMFC and Gulf States Marine Fisheries Commission to construct an age determination manual. A meeting was held in Woods Hole, MA to edit and reorganize the document. Also, the Age and Growth Lab

was included as a collaborator on two different Saltonstall-Kennedy grant proposals, one involving the ageing of wolffish and the other the ageing of Atlantic halibut.

Early in 2015, the Age and Growth Lab published a paper comparing ageing precision between scales, otoliths, opercula, and vertebrae from American shad as well as a comprehensive technical report of the ageing protocols used in the lab:

Elzey, S. P., K. A. Rogers, and K. J. Trull. 2015. Comparison of 4 aging structures in the American shad (Alosa sapidissima). Fishery Bulletin 113: 47-54.

Elzey, S. P., K. J. Trull, and K. A. Rogers. 2015. Division of Marine Fisheries Age and Growth Laboratory: Fish Aging Protocols. Massachusetts Division of Marine Fisheries Technical report TR-58.

A paper assessing the aging of structures collected in non-lethal sampling of tautog was also submitted for publication.

Fisheries Dependent Sampling Project

The Fisheries Dependent Sampling (FDS) Project is responsible for the at-sea and shore-side sampling of catch, and assessment of fishery performance from the commercial fisheries that occur in and adjacent to Massachusetts territorial waters. The Project also conducts other fish biology research studies and provides support to other projects and senior staff.

Commercial Fisheries Sampling

Project staff collects data and biological samples from commercial fisheries to document fishery performance, characterize the fishery in support of stock assessments and research, and address specific management questions. Collected data strengthens *MarineFisheries*' participation on, and contributions to, the regional fishery management councils and ASMFC.

Port sampling of commercial catch, summarized in Table 16, was conducted in collaboration with Recreational Fisheries Project staff. Due to a reduction in staff and an increase in requested support, the sampling of several fisheries was significantly reduced or eliminated for 2015. These fisheries were mainly based out of the southern part of the state and included the longfin squid, spiny dogfish, summer flounder, whelk, menhaden, and horseshoe crab fisheries. Several species, including striped bass and black sea bass, were identified as high priority and samplers based out of the Gloucester field station were able to collect the required south shore samples at a Boston fish processing facility.

Northern shrimp, which once supported an important winter day-boat fishery, was closed to harvest in 2015 due to historic low levels in abundance. To maintain the time series of fishery-dependent data, an experimental fishery was created with support of the ASMFC through which a contracted bottom-trawl vessel was allowed to catch and land shrimp with a requirement to provide *MarineFisheries* staff with samples of catch that could be processed and used to support the stock assessment. Staff was deployed on the first experimental fishing trip, and trained the fishermen how to collect representative samples from the catch. For subsequent trips, staff intercepted the vessel shore-side and collected additional samples and processed them in the Gloucester lab.

Table 16. Number of port sampling events, or trips, made to intercept commercial vessels or seafood dealers where information was collected in 2015.

Species	Intercepts	Number individuals	Number age samples
Black sea bass	6	245	100
Longfin squid	1	50	0
Northern Shrimp	5	*	0
Spiny dogfish	6	127	0
Striped Bass	30	689	689
Tautog	3	160	0

*sampled in 2 kilogram batches

At-sea sampling activities by Project staff are summarized in Table 17. Consistent with past years, monitoring the state's costal lobster fishery was a large undertaking. Sampling occurred between May and November and was conducted out of five ports: Rockport, Gloucester, Beverly, Quincy, and Boston. Reliance on Project staff for field support (and data management) for grant-funded acoustic telemetry studies continued to grow in 2015, and became the dominant activity in terms of sea days. The list of supported research efforts includes: estimating the post-release mortality of rod and reel caught Atlantic cod, haddock, and cusk; elucidating the spatio-temporal distribution of the Gulf of Maine Atlantic cod winter spawning sub-stock; evaluating the efficacy of release mechanisms for rod and reel caught cusk; enhancing the understanding of striped bass migration patterns and identifying the proportion of sub-stock contingencies by region in Massachusetts; and defining American shad migrations in the Charles River and coastal Massachusetts.

Table 17. Summary of at-sea sampling efforts by Project staff in 2015.

Sea Days (#)	Project
44	Acoustic telemetry studies
35	Coastal lobster
24	Resource assessment
7	EPA-NCCA collection
3	GMGI cod sampling
3	Shellfish Project vessel support
1	Northern shrimp experimental fishery

MarineFisheries added a new vessel to its fleet in 2015 when a 38' Southshore (Figure 25) was transferred from Massachusetts Environmental Law Enforcement. Subsequently, the vessel was completely refitted. Project staff was tasked with overseeing this project including coordinating vessel surveys, engine repairs, procuring a boat builder, upgrading the electronics package, and managing the refit. The boat builder selected was Wilbur Yachts out of Southwest Harbor, ME. The boat is a lobster-style Maine built boat, and given the familiarity of the boat design and

Figure 25. The newest edition to the fleet, the *Craven*.

demonstrated experience, Wilbur Yachts was an ideal company for the job. The vessel is the largest and ablest vessel in the *MarineFisheries* fleet and will act as a stable and safe platform to support current telemetry grants, diving activities, and fixed gear enforcement and removal (in cooperation with MA Environmental Police). It is available for all programs within the Division to utilize and will create more research opportunities by helping the Division leverage future grants and increase our at-sea capabilities.

Atlantic Herring Fishery Portside Sampling and River Herring Bycatch Avoidance

Project staff continued into the eighth year of portside sampling of the Atlantic herring and mackerel mid-water trawl (MWT) and bottom trawl fisheries, and into the fifth year of administering River Herring Bycatch Avoidance programs, in collaboration with industry and SMAST. Funding for sampling and bycatch avoidance was provided through the NOAA-issued Atlantic Herring Research Set-Aside (RSA), an ASMFC grant, and NOAA Fisheries funds. In 2015, with the aid of contracted biologists, *MarineFisheries* sampled 132 trips portside, and incorporated data from an additional 38 trips sampled by other programs—most often the NMFS Northeast Fisheries Observer Program. From landings in MA ports, 95 MWT trips totaling 16,512 metric tons of herring or mackerel were sampled. From bottom trawl landings in RI ports, 37 trips totaling 747 metric tons were sampled. Combined, this sampling represents over 20% of coast-wide landings in the Atlantic herring and mackerel fishery. From these sampled landings, over 13,000 Atlantic herring lengths and over 2,000 mackerel lengths were collected. Over 2,800 alewife and blueback herring lengths were taken and over 4,400 individual specimens were collected and frozen for further analysis.

The goal of the bycatch avoidance program is to reduce the incidental catch of river herring (alewife and blueback herring) and American shad in the pelagic mid-water trawl fishery and Rhode Island-based small-mesh bottom trawl (RI SMBT) fishery. Under the bycatch avoidance program, portside sampling data are aggregated and bycatch rates reported back to the industry, allowing vessels to make more informed decisions about where to fish in order to reduce river herring and shad bycatch. Recent improvements to the real-time communication system were built upon over the course of the year using a shore-based fleet electronic report tool called BTConnect. This software allows vessel oversight by program coordinators and allows for monitoring of high bycatch area in real time (Figure 26).

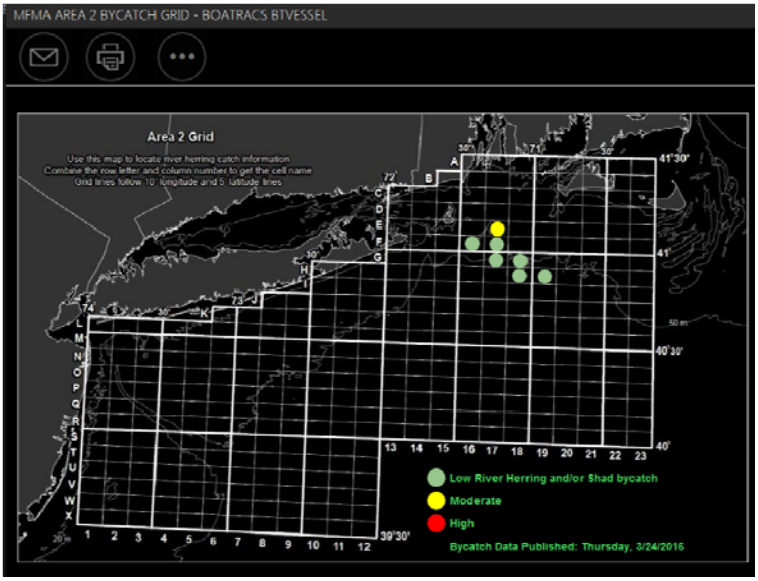


Figure 26. New real-time hotspot mapping function (in "night mode") available to participating vessels. Sampling data from Southern New England (Area 2) shown.

Project staff conducted extensive outreach with industry, fisheries managers and stakeholders during the year. Talks and presentations were provided to the MA Maine Fisheries Advisory Commission, the Mid-Atlantic Fishery Management Council's River Herring/Shad Committee, the River Herring Technical Expert Working Group, the Marine Fisheries Institute's Advisory Council, the Massachusetts River Herring Wardens, and multiple herring industry and stakeholder groups. Informational documents were published through the *MarineFisheries*

website and social media, the SMAST bycatch avoidance website, and Massachusetts Lobstermen's Association.

MarineFisheries' collaboration with external agencies continues to broaden the scope of research and utility of river bycatch data. *MarineFisheries* staff co-authored a paper that used genetic tools to assign alewife and blueback herring bycatch to general spawning stock areas:

Hasselman, D.J., E.C. Anderson, N.D. Bethoney, S.R. Gephard, D.M. Post, B.P. Schondelmeier, T.F. Schultz, T.V. Willis, E.P. Palkovacs. 2015. Genetic stock composition of marine bycatch reveals disproportional impacts on depleted river herring genetic stocks. Canadian Journal of Fisheries and Aquatic Sciences. doi: 10.1139/cjfas-2015-0402.

In 2015, *MarineFisheries* and SMAST were granted 2,136 metric tons of Atlantic herring RSA for 2016, 2017 and 2018. This collaborative funding source has produced over $110,000 in funding over the past two years and will sustain the portside sampling and River Herring Bycatch Avoidance program for three years. In addition, the program will evaluate, and possibly integrate, a *MarineFisheries* pelagic species distribution model. *MarineFisheries* and SMAST began work on a comprehensive River Herring Bycatch Avoidance program evaluation. This study aims to compare MWT fishery data from the four years preceding (2007–2010) the Bycatch Avoidance Program with the first four years of high-level portside sampling and bycatch avoidance work (2011–2014).

In order to inform the closure of the Massachusetts/New Hampshire (MA/NH) Spawning Area closure, *MarineFisheries* sampled the gonad somatic index (GSI) of commercial landings from Herring Management Area1A. In 2015, *MarineFisheries* sampled 13 trips from August 10 to October 27, eight of which were sampled during or after the MA/NH spawning closure. In addition, *MarineFisheries* obtained four GSI samples on landings from Georges Bank. While there are currently no regulations that address harvest of spawning herring on Georges Bank, collection of spawning data from these offshore areas is a continued priority.

As part of an ASMFC cooperative project to study river herring bycatch in New England, Dr. Gary Nelson began the construction of a river herring life history model that will be used to examine the impact of bycatch on productivity and population characteristics of alewife.

Special Fisheries Research Projects

MarineFisheries greatly expanded its involvement with groundfish research in 2015 by collaborating with 10 different research institutions on nine separate grants, covering five different groundfish species.

Atlantic Cod Spawning Activity

Our team of collaborators from *MarineFisheries*, the Nature Conservancy, SMAST, NEFSC and the Stellwagen Bank National Marine Sanctuary were awarded a Saltonstall-Kennedy grant from NOAA Fisheries in 2014 to describe the distribution of winter spawning cod in Massachusetts Bay. Relatively little is known about the spawning time and location for this group of fish and our work will be instrumental in providing the necessary information to design appropriate conservation measures.

This project has relied on a combination of acoustic telemetry and passive acoustic recording to remotely observe the movements and behavior of spawning cod in their natural environment. This third and final year of field work represented the most important for data collection under this project because all telemetry detections came from fish tagged in previous seasons and are therefore most representative of natural spawning behavior. While no additional spawning cod were tagged in this season, a total of 317 fish tagged

over the previous two years were still at liberty and had tags with sufficient battery life to be detected through the 2015/2016 winter spawning season. An array of 56 acoustic receivers encompassing a 350 square kilometer portion of Massachusetts Bay was maintained from September through March. In addition, multiple autonomous underwater vehicles (AUV) were deployed and programmed to make five complete surveys of Massachusetts Bay between November and January, providing detections of our acoustically tagged fish over an even wider area. Each AUV (Figure 27) was also equipped with a passive acoustic monitoring device to record the spawning vocalizations produced by male cod. Six additional passive acoustic monitoring devices were deployed at fixed stations to further augment our ability to describe the distribution of cod spawning activity.

Figure 27. Two AUVs await deployment (Photo credit: Mark Baumgartner, WHOI)

A related project, funded by MIT Sea Grant and in partnership with WHOI and SMAST, is allowing us to combine the information we have obtained on the spatial distribution of cod at various life stages (e.g., eggs, larvae, juveniles, spawners) with environmental variables (e.g., temperature, density, current, sediment) and a hydrodynamic model to construct a full life history model of cod movements in the Gulf of Maine. To provide empirical observations for comparison with model outputs for the transport of pelagic cod eggs and larvae, we partnered with local school groups to build and deploy surface drifters equipped with GPS tracking devices that continuously relay their position via ARGOS satellite. Work from these projects were presented at multiple scientific conferences in 2015, including the ICES Annual Science Conference in Copenhagen, Denmark (September), and the Southern New England Chapter of the American Fisheries Society (June). Biologist Micah Dean also gave seminars in Woods Hole (April) and Westboro (July), as well as presentations to student groups at the Gloucester Maritime Heritage Center and an elementary school in Beverly. Finally, Dean was an invited guest on the NPR "Living Lab" radio show in February to discuss our cod spawning research.

Atlantic Cod Discard Mortality

MarineFisheries biologists continued their collaboration with the New England Aquarium, SMAST, and the University of New England to provide a more accurate estimate of the post-release mortality of recreationally caught cod. This project, funded under a NOAA Fisheries grant, used acoustic telemetry to monitor the long-term survival of discarded cod caught via hook-and-line. A total of 136 fish were affixed with depth-sensing transmitters and released into a dense array of 31 acoustic receivers, allowing for the determination of mortality from their horizontal and vertical movements. Environmental and fishery variables were collected for each fish (e.g., fight time, handling time, injury score, water temperature) that allowed us to determine which factors most influence post-release survival. Results from this study were used in the updated Gulf of Maine cod assessment to determine the level of mortality resulting from discards in the recreational fishery. A peer-reviewed paper was published from this study in 2015, with more expected in 2016:

Benoit, H. P., Capizzano, C. W., Knotek, R. J., Rudders, D. B., Sulikowski, J. A., Dean, M. J., Hoffman, W., Zemeckis, D. R., and Mandelman, J. W. 2015. A generalized model for longitudinal short- and long-term

mortality data for commercial fishery discards and recreational fishery catch-and-releases. ICES Journal of Marine Science.

Atlantic Haddock Discard Mortality

Building on our success at utilizing acoustic telemetry to estimate the discard mortality of Atlantic cod, the same collaborative team received two separate NOAA grants to evaluate the recreational discard mortality of haddock in the GOM. These combined funds allowed us to tag 156 haddock with acoustic transmitters over 19 trips between April and September. We also recorded observations on an additional 2,422 haddock that will be used to model the influence of release condition on discard mortality. An array of 32 receivers was maintained at the study site (central Jeffrey's ledge) from April through October, to monitor the fate of tagged haddock. An initial review of the data collected in 2015 looked promising and we expected to produce a robust estimate of haddock discard mortality for use in future stock assessments.

Cusk Discard Mortality

Another discard mortality study funded by the NOAA Saltonstall-Kennedy program in 2015 focused on cusk, one of the more severely depleted species in the groundfish complex. Planning meetings were held in 2015, with field work scheduled to begin in Summer 2016. Acoustic telemetry will once again be used to monitor the fate of fish post-release; however, we will modify our approach to account for the physiology and behavior of this species. Nearly all cusk caught by the recreational fishery exhibit severe barotrauma symptoms and are unable to re-submerge to their natural benthic habitat. Therefore, we will be using and evaluating release devices to return cusk to the seafloor and recompress their gas bladders. A positioning system array, which will allow us to reconstruct the precise 3D positions of tagged fish within just a few meters, will be deployed. The data generated by this dataset will also reveal an unprecedented view of the behavior and movements of this species.

Fishermen's Ecological Knowledge of Georges Bank Spawning Cod

In collaboration with SMAST, Canadian Department of Fisheries and Oceans and the Penobscot East Resource Center, *MarineFisheries* initiated a project to investigate the spawning distribution of Atlantic cod on Georges Bank by interviewing current and retired commercial fishermen about their observations from this fishery. This approach was previously applied to GOM cod and yielded a wealth of information on population structure and fishery interactions, and has been instrumental in directing subsequent research. A total of 32 fishermen were interviewed in 2015 (21 New Bedford, five Chatham, six Nova Scotia), with more planned for 2016. Through these interviews, 167 fine-scale spawning grounds were identified that will be collated once all interviews are complete to produce a composite description of fishermen's views of the spatial and seasonal distribution of cod spawning on Georges Bank.

Geolocation of Groundfish from Archival Data Storage Tags

This project, a collaboration between scientists at *MarineFisheries*, SMAST, Northeastern University, and the Gulf of Maine Research Institute, is focused on developing geolocation methods for reconstructing the movements of tagged fish in the GOM from the depth and temperature record provided by data storage tags. This approach has been used elsewhere in the world to describe the natural movements and habitat associations of fish species; however, the unique tidal and temperature characteristics of the GOM prevent the direct application of existing methods and present a unique modeling challenge. Results will be shared with the broader GOM research community to augment the utility and information provided by data storage

tag studies. Existing datasets on Atlantic cod, yellowtail flounder, and monkfish will serve as the raw material around which the geolocation model will be constructed.

Industry-Based Survey for Gulf of Maine Cod

Recent stock assessment updates for GOM cod have repeatedly found that the stock is overfished and that biomass continues to decline to unprecedented lows, despite repeated management actions to achieve rebuilding. To better understand the population dynamics and improve our ability to assess and manage this stock, *MarineFisheries* has committed to conducting an industry-based trawl survey (IBS) in a portion of the GOM that is west of 69.5 degrees longitude, an area that encompasses 97% of the cod biomass and 93% of the commercial cod landings, beginning in April 2016. This survey will use a contracted commercial fishing vessel and captain to execute standardized bottom trawl tows according to a stratified random sampling design. Every element of the survey design has been optimized for cod and will specifically address key areas of uncertainty in the stock assessment and management plan.

Another primary goal of this initiative is to address fishermen's concerns that the current stock assessment does not reflect the true abundance of GOM cod. Through repeated communication with the fishing industry, we have identified several issues that underlie their disbelief in the scientific advice on stock status. The IBS effort will attempt to directly answer as many of these questions as possible. Furthermore, to ensure that our results are scientifically credible and relevant, we have also sought advice from scientists that have expertise in stock assessment, trawl surveys, and cod life history. A total of 50 tows in each of eight months, covering the two peaks in cod spawning activity (Spring: April-July; Winter: October-January) will be made.

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 striped bass are major factors contributing to the success of this fishery. Without a doubt, striped bass are the backbone of the Massachusetts recreational industry and provide enjoyment to hundreds of thousands of recreational anglers each year. Accordingly, this important resource is given a high level of attention by conducting many special investigations and monitoring programs designed to support the regional management process.

Survival Tagging Study

MarineFisheries has participated in the Striped Bass Cooperative State-Federal Coast-wide Tagging Study since 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 2015, Striped Bass Research Project staff conducted 14 trips aboard contracted vessels, tagging a total of 365 striped bass. Annual post-release survival of striped bass (28 inches and greater) tagged in Massachusetts waters has been relatively stable over the last decade, averaging 74%. A technical report summarizing the tagging studies conducted by *MarineFisheries* since 1991 was produced:

Nelson, G. A., J. Boardman and P. Caruso. Massachusetts striped bass tagging programs, 1991-2014. Massachusetts Division of Marine Fisheries technical report TR-61. 37 p.

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 2015, Striped Bass Research Project staff conducted 21 market sampling trips, collecting length, weight, and age structures (scales) from 689 commercially-caught fish.

Acoustic Tagging Study

In 2015, *MarineFisheries* initiated a new acoustic telemetry study of striped bass in Massachusetts waters. This study is a collaboration between staff in the Fish Biology Program and Diadromous Fisheries Project and examines how mortality is influenced by their selection of habitat and migratory route to and from Massachusetts waters. The study design combines analysis of acoustically tagged fish with genetically derived population composition estimates of summering aggregations. Biologists hope to apply the movement patterns observed in the tagged bass to the larger schools of fish in state waters. *MarineFisheries* biologists are collaborating with researchers from University of Massachusetts–Amherst, University of Montana, and University of New Brunswick–St. John to develop genetic tools and analyze collected data. The creation of a genetic population baseline for striped bass will allow *MarineFisheries* to establish spawning-population-specific mortality rates for striped bass harvested by Massachusetts anglers. A total of 1,214 genetic samples were collected from striped bass caught in state waters with 525 of these from recreationally caught fish and 689 from commercially caught fish.

During the year, 182 striped bass were released with implanted acoustic transmitters in three distinct areas: Boston Harbor, east side of Cape Cod, and waters of Buzzards Bay and Vineyard Sound. To monitor the movements of tagged striped bass, acoustic receivers were deployed between Nahant and Hull in Boston Harbor, off Provincetown and Monomoy on Cape Cod, and between East Chop

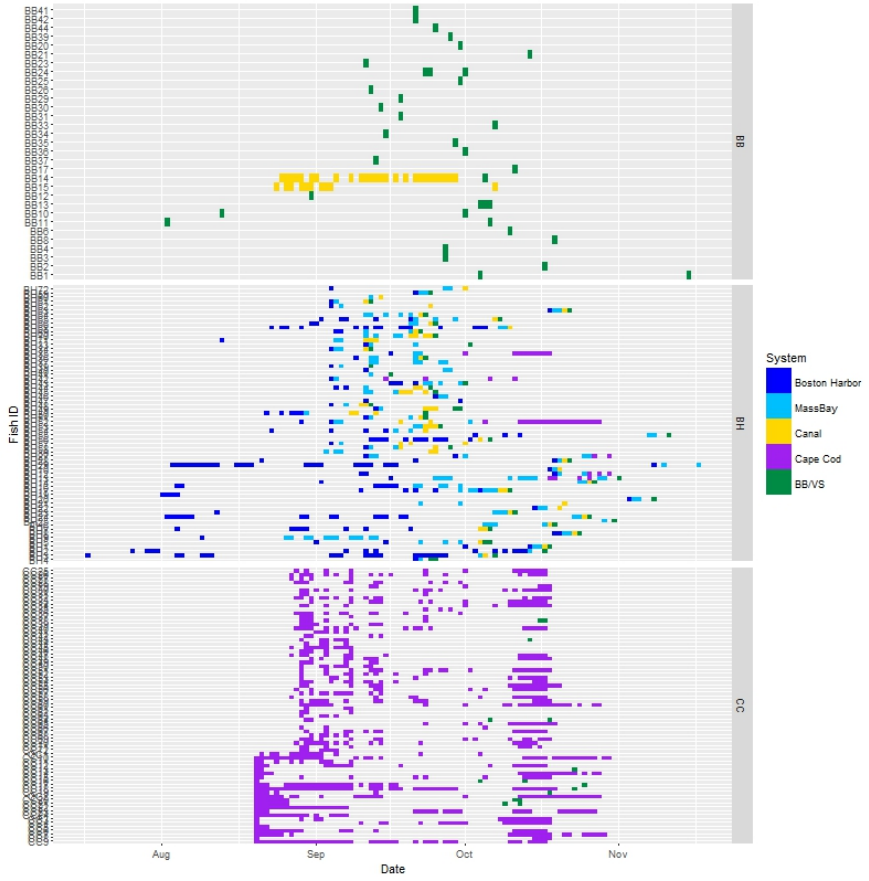


Figure 28. Compilation of detections by area for 168 striped bass. Each panel represents a tagging aggregation (BB=Buzzards Bay, BH=Boston Harbor, CC=Cape Cod). Colored cells in each row depict regional daily detections.

and Falmouth as well as Gay Head and the Gooseberry Islands in Vineyard Sound and Buzzards Bay. These receivers complemented the many others already in the water (e.g., Cape Cod Canal, Jeffries Ledge) for other studies. One hundred sixty-eight fish have been detected since their release. Detections of tagged striped bass in the summer and fall of 2015 suggested that fish did not move between aggregation areas and clearly depict a fall migration out of Massachusetts waters (Figure 28). More fish will be tagged in the summer of 2016 and acoustic monitoring will continue through at least 2018.

Volunteer Recreational Angler Data Collection Program

Implemented in 2002, the objective of the Sportfish Angler Data Collection Team (SADCT) program is to generate a time series database of biological characteristics of Massachusetts' striped bass recreational catch. During 2015, 54 participating anglers collected over 1,300 paired length/age samples from striped bass. The size composition of striped bass reported by participating anglers and fishing mode (shore versus boat fishing) is shown in Figure 29.

In 2013, the SADCT program was expanded to include black sea bass, scup, and fluke. In 2015, SADCT anglers collected 268 samples from black sea bass, 80 samples from fluke, and 104 samples from scup.

An annual report on the SADCT program for the contributing anglers was prepared and a ten-year retrospective analysis of the SADCT program was produced in a technical report:

Nelson, G. A. and J. Stritzel-Thomson. 2015. Summary of recreational fishery data for striped bass collected by volunteer anglers in Massachusetts. Massachusetts Division of Marine Fisheries Technical Report TR-60. 19 p.

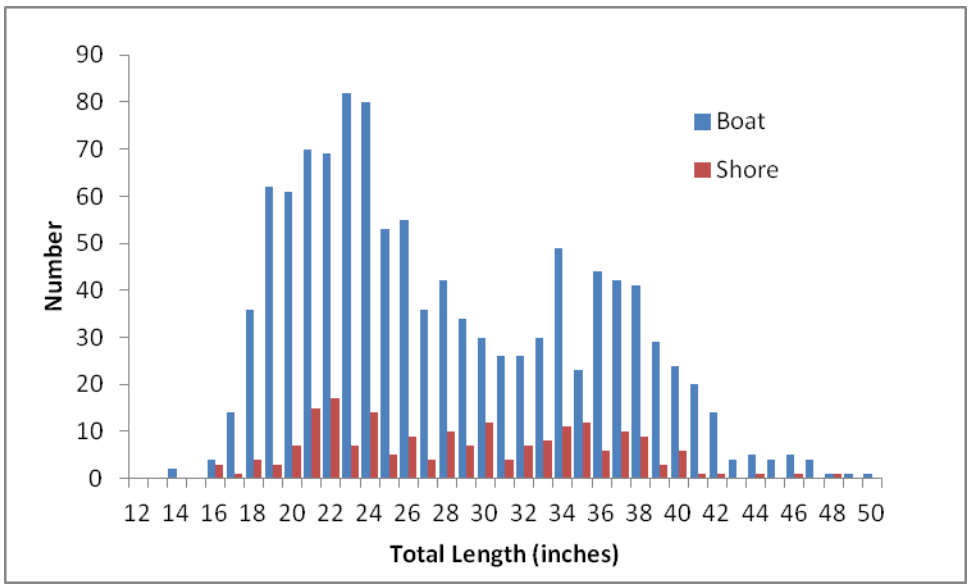


Figure 29. Size composition of striped bass collected by SADCT anglers in 2015.

The striped bass carcass collection program also continued in 2015 and obtained 54 otolith samples from volunteer anglers.

Striped Bass Stock Assessment

As the developer of the ASMFC striped bass stock assessment model, Dr. Gary Nelson conducted the updated striped bass stock assessment in 2015.

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 2015, Dr. Gary Nelson served as the Massachusetts representative to the ASMFC's striped bass tagging, technical, and stock assessment sub-committees. Micah Dean served on the ASMFC menhaden technical committee and multispecies committee and the New England Fisheries Management Council's Atlantic Herring plan development team. William Hoffman served on the ACCSP bycatch and biological sampling priorities committees. Scott Elzey served on the ASMFC age and growth QA/QC manual committee. Many presentations were given by staff to other governmental organizations and private groups.

Awards

Dr. Gary Nelson received the Robert L. Kendall Best Paper Award in Transactions of the American Fisheries Society for his 2014 article "*Cluster sampling: a pervasive yet little recognized survey design in fisheries research*".

Assessment and Survey Program

Personnel

Steven J. Correia, Program Manager (retired June 30)
Robert Glenn, Program Manager (October–December)

Resource Assessment Project
Jeremy King, Project Leader (retired June 30)
Matthew Camisa, Biologist (January–September)/ Project Leader (October–December)
Vincent Manfredi, Biologist

Invertebrate Fisheries Project
Robert Glenn, Project Leader (January–September)
Tracy Pugh, Biologist (January–September)/Project Leader (October–December)
Derek Perry, Biologist
Kelly Whitmore, Biologist
Steve Wilcox, Biologist
Mike Trainor, Seasonal Fisheries Technician
Theresa Burnham, Seasonal Fisheries Technician

Protected Species Project
Erin Burke, Protected Species Specialist

Recreational Species Stock Assessment Project
Dr. Mike Bednarski, Stock Assessment Specialist

Overview

The Assessment and Survey Program includes four projects.

The **Resource Assessment Project** monitors the distribution, relative abundance, and size composition of marine fish and invertebrates in Massachusetts waters by conducting annual surveys utilizing consistent protocols. These include spring and fall statewide trawl surveys and a seine survey in certain south-facing Cape Cod estuaries. Survey data are used in assessments of numerous regional fish stocks, inform fishery management decisions, 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, whelk, Jonah crab, and northern shrimp. Fishery-dependent and -independent surveys, as well as applied research projects, are conducted to characterize the populations of, and the fisheries for, these valuable species and to inform their management. Additional tasks include research grant writing and administration, and participation in ASMFC technical meetings.

The **Protected Species Project** is involved in various activities related to the conservation and management of protected species in Massachusetts waters. This covers all efforts of the Large Whale Conservation Program, including oversight of the right whale surveillance program, acoustic monitoring of right whales, and large whale disentanglement. Project staff oversees and participates in work on other protected species, such as harbor porpoise and sea turtles. Issues range from the sea turtle disentanglement network, to participation in federal Take Reduction Teams, to grant management and the potential risk of

entanglement in subtidal aquaculture gear.

The **Recreational Species Stock Assessment Project** provides dedicated staff to the task of contributing technical and analytical skills in support of regional stock assessments and management decisions for key recreational species, including fluke, scup, black sea bass, tautog, and bluefish. The Project is funded by saltwater fishing permit revenues through the Marine Recreational Fisheries Development Fund.

Resource Assessment Project

2015 Trawl Survey

The 38th spring and fall surveys were accomplished aboard the R/V *Gloria Michelle*. The spring survey completed 99 stations from May 4–22, while the fall survey completed 95 stations from September 8–24 (Figure 30).

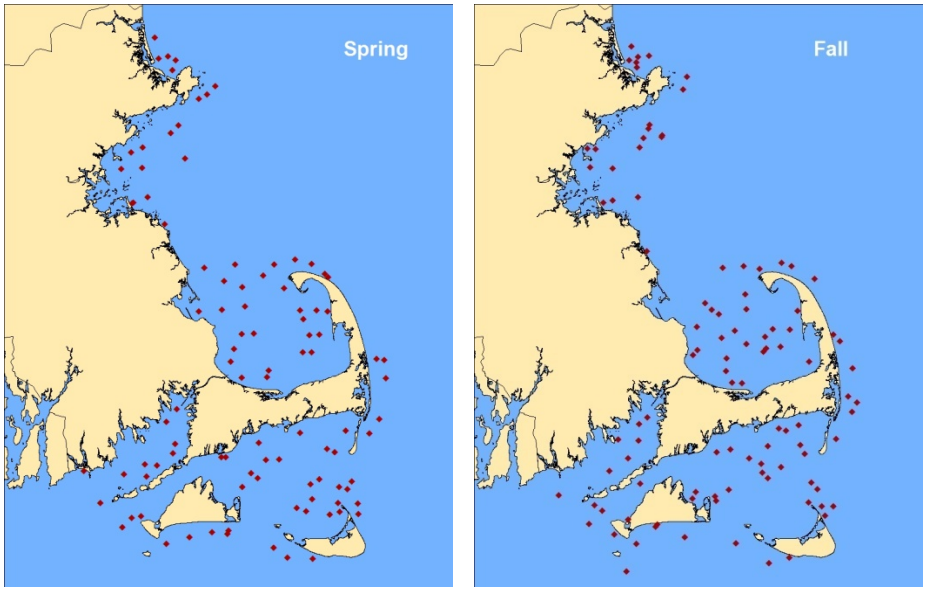


Figure 30. 2015 spring and fall trawl survey station locations.

The 2015 trawl surveys provided weights, counts, and measurements for 99 different species of fish and invertebrates. To aid cooperative fisheries assessments, survey crew collected over 2,900 age structures and sex and maturity observations from cod, haddock, American plaice, summer flounder, yellowtail flounder, winter flounder, windowpane flounder, black sea bass, scup, weakfish, northern sea robin, American lobster, and tautog. Additional collections supported studies on the spatial structure of cod populations, climate change, the National Coastal Assessment Program, and the Ocean Genome Project.

Project personnel contributed to committee work of the ASMFC's Northeast Area Monitoring and Assessment Program (NEAMAP), including the preparation of an annual update of trawl survey practices and results which was presented to the NEAMAP Board at the ASMFC Annual Meeting. Project members serve on the following committees of NEAMAP: Operations, Data Management, and Trawl Technical.

2015 Seine Survey

The 40th Nantucket Sound Estuarine Winter Flounder Young-of-Year (YOY) Seine Survey was completed between June 15 and June 30, 2015. The objective of this survey is to index winter flounder YOY abundance for the Southern New England stock; however, we count all commercially and recreationally-important finfish and invertebrates, and record presence/absence for all other species (Figure 31).

The trend in the annual index for YOY winter flounder is one of decline. The 2015 stratified mean index fell below the time series median. Forty species occurred in 2015 seine survey hauls.

Figure 31. Seine survey biologist, M. Szymanski, enumerates and counts catch.

Assessment and Fisheries Management Support

Project personnel fulfilled requests for survey data to support various fisheries research, monitoring, and management initiatives both within the agency and externally. Survey data were provided to staff for inclusion in annual compliance reports for ASMFC-managed species. In 2015, survey data supported regional assessment efforts on haddock, cod, lobster, winter flounder, summer flounder, scup, and black sea bass.

V. Manfredi served on the ASMFC Winter Flounder TC and M. Camisa served on the NEFMC Scallop PDT.

Survey data provided to outside institutions in 2015 supported studies related to: ocean planning and environmental review; effects of temperature on fish distribution; and grey seal prey availability east of Cape Cod.

Invertebrate Fisheries Project

American Lobster Research and Monitoring

Commercial Lobster Trap Sampling: *MarineFisheries* has worked cooperatively with Massachusetts commercial lobster trap fishermen to sample their catch since 1981. In 2015, the 35th year of operation, a total of 75 trips were conducted by staff members of the Invertebrate Fisheries Project and the Fisheries Dependent Sampling Project, during which 44,873 lobsters were sampled from 15,701 trap hauls. This effort also includes shell disease monitoring, which tracks the prevalence of shell disease symptoms on lobsters in Massachusetts coastal waters. In 2015, a total of 6,220 lobsters were sampled for shell disease. All commercial trap sampling program data are provided annually to the ASMFC and ACCSP.

Substantial attention has recently been directed towards bycatch issues in lobster traps (especially cod and other groundfish). To begin to address these concerns, new bycatch sampling was implemented in 2015. A total of 247 individual fish were observed over 75 trips. Division staff collaborated with NMFS Northeast Fisheries Observer Program (NEFOP) staff to create standardized data collection protocols and increased efficiency in trip allocation between state and federal programs, and with NMFS Population Dynamics staff to ensure that an appropriate sampling frame is incorporated in the estimation of sea days, as determined by the Standardized Bycatch Reporting Methodology (SBRM). Initially the sampling frame included only federally-permitted lobster vessels with VTR reporting requirements, which was an inaccurate representation of the lobster fleet, and had resulted in a disproportionate amount of sea days being assigned to the Massachusetts lobster fleet. This has been addressed, and the sampling frame now used in the SBRM process includes all federally-permitted lobster vessels, and has resulted in a more appropriate distribution of sea days amongst states.

Ventless Lobster Trap Survey: The 2015 Ventless Trap Survey took place from June through September with eight contracted vessels. This is a cooperative effort between the Division and lobster fishing industry to monitor and forecast the abundance of lobster (and bycatch species). In the northern survey area (Cape Cod Bay to the NH border), a total of 17,731 lobsters were sampled from 2,784 trap hauls. In the southern survey area (Buzzards Bay, Vineyard and Nantucket Sounds, and south of the Islands), a total of 5,079 lobsters were sampled from 1,975 trap hauls. Staff completed data entry and preliminary analyses, and will provide data to ASMFC and ACCSP. Ventless lobster trap survey data were integrated into the 2015 ASMFC benchmark lobster stock assessment; this marks the first time an industry cooperative fishery independent survey was integrated into a lobster stock assessment.

Biological sampling of bycatch species was added to the survey's protocols in 2015, in order to increase available data on the sizes of commercially important crab and finfish species including black sea bass, tautog, Jonah and rock crabs, and whelk. Critically important age and maturity data were collected from black sea bass and tautog.

A technical report was drafted to describe results of the survey from 2006–2012.

Annual Early-Benthic-Phase Lobster Suction Sampling: *MarineFisheries* completed the 21st year of this sampling program in 2015. The program is conducted to track year class strength of newly settled post-larval American lobsters and to delineate coastal habitat important to the settlement of these juveniles. A total of 23 coastal sites were surveyed in 2015 spanning Buzzards Bay, Cape Cod Bay, and Massachusetts Bay. Project staff conducted the SCUBA-based survey over 13 field days from mid-August to mid-September. Mean densities of young-of-year (YOY) lobsters were well below time series means in all survey regions, with YOY found only in Cape Ann (Table 18).

Assessment and Fisheries Management Support: R. Glenn served as chairperson and T. Pugh as a member of the ASMFC American Lobster Technical Committee, playing key roles in the completion of the 2015 Benchmark Stock Assessment, as well as additional analyses requested by the ASMFC Management Board to further describe and project stock conditions.

Region (# yrs surveyed)	2015 YOY Mean	Time Series Mean
Cape Ann (6)	0.17	0.44
Salem Sound (20)	0	0.67
Boston (19)	0	0.15
South Shore (4)	0	0.05
Cape Cod Bay (21)	0	0.29
Buzzards Bay (21)	0	0.08
Vineyard Sound (6)	0	0.02

Table 18. Comparison of YOY lobster densities in 2015 and time series means by region.

Presentations and Publications: At the US-Canada Science Symposium on "The American Lobster in a Changing Ecosystem" in Prince Edward Island, T. Pugh presented a talk titled "Spatial patterns of female American lobster mating activity in the inshore waters of southern Massachusetts," and K. Whitmore presented a poster titled "Relationship of American lobster year-class strength to fishery recruitment in Massachusetts Gulf of Maine coastal waters." T. Pugh also participated in a review panel to judge student contributions. T. Pugh published an article resulting from her lobster reproductive research:

Pugh, T.L., M. Comeau, K. Benhalima, W.H. Watson, III. 2015. Variation in the size and composition of ejaculates produces by male American lobsters Homarus americanus H. Milne Edwards, 1837 (Decapoda: Nephropidae). J. Crust. Biol., 35: 593-604.

Horseshoe Crab Monitoring

Commercial Fishery Sampling: Monitoring of the commercial bait and biomedical harvests continued in accordance with the interstate FMP. Prosomal width measurements were obtained from 2,408 crabs during sampling from a local biomedical facility.

Fisheries Independent Surveys: Annual volunteer-based spawning surveys continued at 15 beaches along the South Coast, Cape Cod, and the islands. *MarineFisheries* staff conducted 28 surveys at Swift's Beach in Wareham. Peak spawning activity was seen during mid to late May. Staff began work to standardize methodologies and survey intensity among volunteer groups so that future survey efforts can be used to characterize horseshoe crab abundance in Massachusetts coastal waters.

Figure 32. Juvenile horseshoe crabs observed in a Buzzards Bay marsh.

MarineFisheries researchers spent six days with staff from the Mass Audubon's Wellfleet Bay Wildlife Sanctuary and the U.S. National Park Service exploring juvenile horseshoe crab habitat in Wellfleet Harbor, Buzzards Bay, and Monomoy National Wildlife Refuge. Efforts to locate juveniles were successful (Figure 32). Work began to design a survey for monitoring juvenile horseshoe crab abundance.

Assessment and Fisheries Management Support: D. Perry served on the ASMFC Horseshoe Crab Technical Committee.

Jonah Crab Research

Traditionally considered bycatch of the American lobster fishery, Jonah crab is now a targeted species, supporting one of the top ten most valuable fisheries in the state. In 2015, over 9 million pounds of Jonah crab were landed in Massachusetts with a value of over $6.9 million. Over 60% of all Jonah crab commercially harvested in the United States is landed in Massachusetts.

Our biologists measured and sexed 7,846 Jonah crabs in 2015 as part of our port and market sampling programs. The sampled catch was comprised of mostly males (99%) and crabs over 4.75 inches in carapace width (97%). The average crab was 5.4 inches; the largest, 6.8 inches. Sampled crabs were landed by both inshore and offshore boats fishing in multiple statistical reporting areas.

MarineFisheries received funding to conduct two Jonah crab studies in 2015. The NOAA Saltonstall-Kennedy Grant Program awarded $399,870 to the Rhode Island-based Commercial Fisheries Research Foundation (CFRF), of which *MarineFisheries* and the Atlantic Offshore Lobstermen's Association (AOLA) received roughly $103,000 to conduct a Jonah crab maturity study. Work began in October to determine male and female gonadal and morphometric maturity in five regions (inshore Gulf of Maine, offshore Gulf of Maine, Georges Bank, inshore Southern New England, and offshore Southern New England).

In another partnership with AOLA, *MarineFisheries* received $63,636 from the Atlantic States Marine Fisheries Commission to conduct a tagging study. *MarineFisheries* staff and commercial fishermen will tag 20,000 Jonah crabs to determine movement patterns, stock boundaries, and collect growth information. Crabs will be tagged in the Gulf of Maine, Georges Bank, and Southern New England.

Assessment and Fisheries Management Support: In August 2015, the ASMFC Lobster Management Board approved the interstate Jonah Crab Fishery Management Plan. *MarineFisheries* staff was involved with its development as members of the Plan Development Team (R. Glenn), Plan Review Team (R. Glenn and D. Perry), and Technical Committee (D. Perry).

D. Perry participated in the Jonah Crab Fisheries Improvement Project (FIP). The FIP working group consists of fishermen, processors, seafood dealers, retailers, non-governmental organization representatives, academia, and state and federal managers and scientists, collaborating with the goal of promoting sustainable harvest of Jonah crab.

Northern Shrimp Research and Monitoring

Northern Shrimp Assessment Survey: In July and August, *MarineFisheries* staff participated on several one-week legs of the 32nd annual northern shrimp assessment survey conducted throughout the Gulf of Maine aboard the NOAA Ship R/V *Gloria Michelle* (Figure 33). For the fourth consecutive year, the survey indicated exceptionally low abundance of shrimp that will be available to the fishery in the upcoming fishing season, and record low recruitment of the newest year class. The ASMFC Technical Committee recommended a 2015/2016 harvest moratorium based on the 2015 survey and assessment results, and noted that recently-observed unfavorable water temperatures may contribute further to poor recruitment.

Assessment and Fisheries Management Support: As chairperson of the ASMFC Northern Shrimp Technical Committee, K. Whitmore summarized and presented results of the 2015 industry-cooperative winter research sampling program, assisted preparation of the 2015 ASMFC Northern Shrimp Stock Status Report, and facilitated development and implementation of the 2016 cooperative winter research sampling program. Whitmore also participated on the ASMFC Northern Shrimp Plan Development Team, which worked to develop a public information document for Draft Amendment 3 to the interstate plan.

Figure 33. Staff from *MarineFisheries* (K. Ostrikis and A. Webb, 2nd and 5th from left, respectively) and other marine resource agencies aboard the R/V Gloria Michelle during the 2015 Gulf of Maine Northern Shrimp Assessment Survey.

Whelk Research

Commercial Fishery Sampling: Staff conducted several commercial sampling trips aboard commercial "conch" (channeled whelk) vessels this season, measuring over 4,000 whelk. Fishery-dependent sampling trips have been conducted opportunistically in Nantucket Sound since 2003. Over this timeframe, there has been a ⅜-inch decrease in the average size of channeled whelk observed, from an average width of 3⅛ inch in 2003 to 2¾ inch in 2015. Despite a minimum legal size increase over the past two years, the average size has decreased and there are fewer whelk above the size at which females reach maturity than in previous years.

Size-at-Maturity: In 2013, when it approved two ⅛-inch minimum size increases for 2014 and 2015, the MFAC requested that size-at-maturity be reinvestigated following the second increase. In the fall of 2015, staff collected and dissected 472 channeled whelk and 60 knobbed whelk for maturity staging, and found no evidence to support a decrease in size-at-maturity for either species.

Gauging: In the winter, a memo was released reiterating proper usage of the standardized chute-style gauge developed by the agency and first implemented for whelk in 2013. An alternative use was also investigated at the request of several industry members. Staff determined the largest size whelk that would pass through the current 3-inch gauge in any orientation would result in a de facto gauge increase of 3/16 inch. Consideration was also given to finding the corresponding gauge dimension that would apply to the 3-inch minimum legal shell width definition. Consensus from an informational meeting held with industry members discussing these research results was that original gauge and definition were preferred.

Trap Tag Loss: An ongoing concern regarding the channeled whelk trap fishery has been gear loss and requests for additional replacement trap tags. Fishermen have been issued 10% extra trap tags to account for traps lost during the season. Routinely in the whelk fishery requests are made for additional tags due to trap loss in excess of 10%. During 2015, responses to a survey conducted in 2014 regarding gear loss in the whelk fishery were analyzed. Approximately ⅔ of all active whelk trap fishermen participated in this survey. Results indicated that those using trawls (strings in excess of five traps) lost 5–10% of their traps in 2013, while fishermen using single traps lost on average 25–35% of their traps. Survey results and industry knowledge will serve as key pieces of information moving forward.

Protected Species Project

Cape Cod Bay Right Whale Surveillance Program

In 2015, *MarineFisheries* partnered with the Provincetown Center for Coastal Studies (PCCS) and NOAA Fisheries to carry out the 17th year of the Cape Cod Bay Right Whale Surveillance Program. The program conducts aerial surveillance and habitat monitoring of right whales in Cape Cod Bay Critical Habitat.

The trend of high abundance of right whales in Cape Cod Bay continued in 2015. At least 26% (n=135) of the known right whale population was documented in Cape Cod Bay and adjacent waters (Figure 34). The proportion of the population visiting CCB in 2015 was lower than recent years (e.g., 65% in 2011) but the season was marked by extended residency of right whales leading to a high number of sightings, with the whales leaving the bay later than observed in the previous 17 years of study. Habitat monitoring suggested that unusually cold winter-time water temperatures delayed the accumulation of *Calanus* species of copepods, the right whales primary food source, effecting their movement in and out of the Bay. In addition, right whales exhibited a strong preference for the western side of the bay in 2015, similar to 2013. Overall the continued pattern of high abundance of right whales illustrates how important Massachusetts waters are to the North Atlantic population.

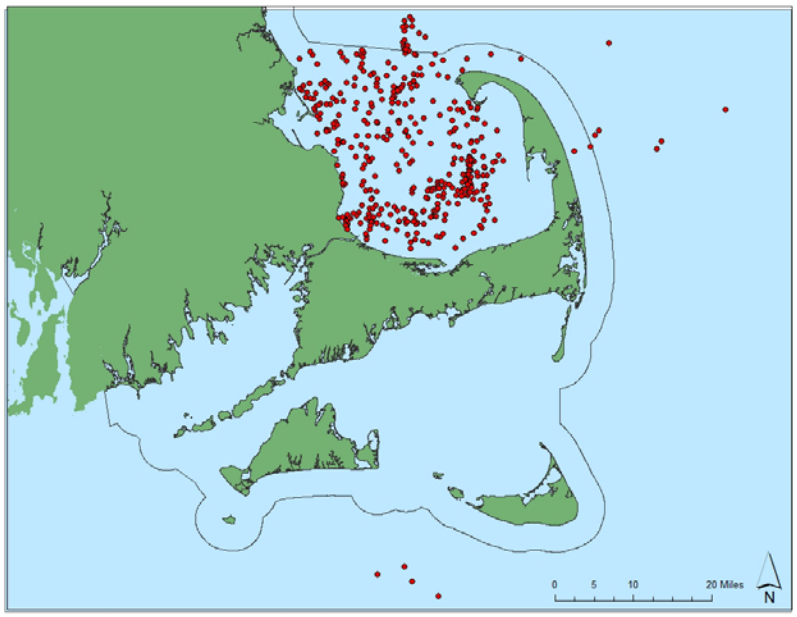


Figure 34. Map of 2015 right whale sightings (PCCS aerial data)

Project Staff administered the grant from NMFS that supports aerial surveillance and habitat monitoring and assisted in coordination of large whale conservation activities. The Division issued advisories to mariners, drafted by the Project, about the presence of high risk right whale aggregations.

Atlantic Large Whale Take Reduction Plan

2015 was the first year of the February–April fixed gear closure in the Massachusetts Bay Restricted Area, which NMFS enacted through amendments to the Atlantic Large Whale Take Reduction Plan. Additional gear marking requirements were also put in place for pot fishermen, including a second buoy line marking color for single pot fishermen in state waters. Project Staff assisted *MarineFisheries* in providing outreach to fishermen about the new regulations.

Large Whale and Sea Turtle Disentanglement

MarineFisheries and PCCS cooperatively administer the large whale and sea turtle disentanglement efforts around Massachusetts through a grant from NMFS. Project Staff assisted in disentanglement efforts, gear analysis, and performed all grant management activities.

Of the 31 whale entanglement cases documented in 2015 along the United States and Canadian coasts, 24 of those were observed off the coast of Massachusetts: seven right whales, two humpback whales, three fin whales, and two minke whales. Eight of those cases were fully resolved; one minke whale and seven humpback whales were disentangled. Relatively few of the remaining cases were in a position to be resolved, either due to time of day, distance from shore, or status of the entanglement.

In 2015, there were eight confirmed leatherback sea turtle entanglement cases, lower than the average of 15, and in sharp contrast to the record highs in 2012 and 2013 (37 and 51, respectively). Of these eight cases, only two were disentangled, due to lack of stand-by from reporters or inability to relocate the animal.

Other Activities

E. Burke participated as a member of the Massachusetts Habitat Working Group. This body assists EEOEA, the federal Bureau of Ocean Energy Management, and the Massachusetts Clean Energy Center with analysis of natural resource data as it relates to potential impacts in the Massachusetts Wind Energy Area (WEA). State and federal governments are assessing the area south of Martha's Vineyard and Nantucket for future offshore wind energy development. Burke advised the Habitat Working Group on monitoring whales, marine turtles, and other potential protected species in the WEA.

E. Burke provided guidance to DMF shellfish personnel and municipal shellfish authorities on the potential impacts of subtidal aquaculture projects to protected species. Entanglement in ropes is a major cause of injury and mortality for endangered large whales and sea turtles. The potential for subtidal aquaculture gear to increase entanglement risk should be carefully considered when developing and licensing these projects, especially if they fall within the boundaries of Right Whale Critical Habitat. Burke also participated in a NMFS regional task force to look at aquaculture and protected species issues.

Recreational Species Stock Assessment Project

M. Bednarski served on the ASMFC weakfish, bluefish, tautog, black sea bass, scup and summer flounder technical committees as well as the MAFMC bluefish, black sea bass, scup and summer flounder monitoring committees. He participated in the ASMFC bluefish and weakfish assessments as well as the NEFSC scup assessment. These assessments were completed in the spring of 2015, spring of 2016 (projected), and spring of 2015, respectively. He was involved with the ongoing ASMFC Atlantic sturgeon assessment as well as the interagency black sea bass assessment. He conducted analysis of regulatory options for Massachusetts' 2015 recreational black sea bass fishery.

M. Bednarski supplied technical assistance to Division projects that collect information on recreational fisheries. He worked closely with staff from the Recreational Fisheries and Resource Assessment Projects to provide recommendations on how to collect samples in a way that meets ASMFC requirements while filling the information gaps identified through the assessment process. Biological sampling for black sea bass, tautog, bluefish, and weakfish have all been streamlined because of his efforts. He also assisted Recreational Fisheries Project staff to determine how to best allocate sampling effort for the MRIP program, which estimates recreational fish catch in Massachusetts. Through this exercise, he was able to document that the additional effort put forth by *MarineFisheries*, which is also funded in part by saltwater permit revenues, is working to increase the certainty of the MRIP estimates.

Recreational and Diadromous Fisheries Program

Personnel

Dr. Gregory Skomal, Program Manager

Recreational Fisheries Project
Dr. Gregory Skomal, Senior Marine Fisheries Biologist, Project Leader
John Boardman, Marine Fisheries Biologist
Matt Ayer, Marine Fisheries Biologist
Ross Kessler, Public Access Coordinator
David Martins, MRIP Coordinator

Large Pelagics Research Project
Dr. Gregory Skomal, Senior Marine Fisheries Biologist, Project Leader
John Chisholm, Marine Fisheries Biologist

Diadromous Fisheries Project
Brad Chase, Senior Marine Fisheries Biologist, Project Leader
John Sheppard, Marine Fisheries Biologist
Dr. Sarah Turner, Marine Fisheries Biologist
Ben Gahagan, Marine Fisheries Biologist
Edward Clark, Carpenter

Overview

The Recreational and Diadromous Fisheries Program includes three Projects.

The **Recreational Fisheries Project** works to preserve, enhance, and promote the marine recreational fisheries of the Commonwealth. Goals are to conserve key recreational species through science-based management; 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.

The **Large Pelagics Research Project** has been conducting research since 1987 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 Fisheries Project** is comprised of two major initiatives: fish passage and restoration, and fish biology and management. The former 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 latter 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 Sampling Project

Since 1983, recreational fisheries catch and effort data have been collected along the Atlantic Coast through NOAA Fisheries' Marine Recreational Information Program (MRIP). *MarineFisheries* has managed the at-sea head boat survey segment for Massachusetts waters since 2003, and assumed the shore-side sampling of charter vessels, shore anglers, and private/rental vessel anglers in 2013. The benefits of doing so include the ability to increase sample sizes and the precision of catch estimates.

Figure 35. Biologist J. Boardman measures catch on a headboat.

In 2015, *MarineFisheries* continued its coordination of these MRIP surveys—training personnel, scheduling trips, logging data, maintaining equipment, attending data review meetings, and maintaining regular communication with the contractor to NOAA Fisheries, Research Triangle Institute, regarding survey performance and sampling. During 2015, 70 head boat sea sampling trips were completed for a total of 1,210 angler intercepts (Figure 35). For shore-side sampling, our MRIP field interviewers completed 1,180 assignments for a total of 3,858 angler intercepts: 2,852 from private vessels, 467 from charter vessels, and 539 from shore anglers.

To improve awareness about the project, staff presented the new survey methodology to numerous fishing clubs and similar organizations early in the year. This included two For-Hire Fisheries Forums held with charter and headboat captains during January in Gloucester and Bourne.

Recreational Fishing Derby

Project staff administered *MarineFisheries'* Saltwater Fishing Derby. The derby, formally known as the Governor's Cup hosted by the Division of Tourism, was moved to *MarineFisheries* in 1983. Activities in 2015 included creating, printing, and distributing rule pamphlets and minimum size rulers, regular communications to weigh stations, preparing press releases and outreach materials for derby promotion and announcement of winners, logging certified weigh-in shops, and tracking derby standings. Winners were recognized with awards at the annual New England Boat Show in 2016. The agency also recognized the winner of the Skillful Skipper award, who had three of the derby winning fish taken on his boat.

Recreational Species Research

Summer Flounder Tagging: *MarineFisheries* initiated a tagging study in 2009 to examine seasonal movements of summer flounder (fluke), *Paralichthyus dentatus*. During 2009–2014, 1390 summer flounder, ranging in size from 13–20 inches, were tagged in the coastal waters of southeastern Massachusetts during the summer months (June–August). To date, 84 fish have been recaptured by commercial and recreational fishermen in state and federal waters from Massachusetts to Virginia (Figure 36).

Analysis of tag return data continued in 2015. Fish exhibited seasonal movement from the summer inshore tagging areas to offshore wintering grounds from Southern New England to Virginia, a migratory pattern previously described for this species. Distance moved ranged from 0–416 miles (mean=68 mi) and time at liberty ranged from 5–1,180 days (mean=145 days). The results from this study, which were presented at the winter meeting of the Southern New England Chapter of the American Fisheries Society, provide evidence of population mixing and are likely to inform future management decisions.

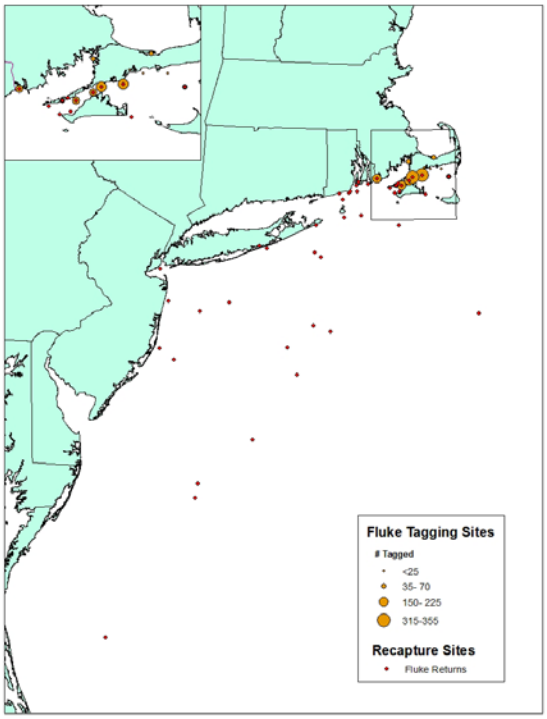


Figure 36. Summer flounder tagging and recapture sites, 2009–2014

Public Access

The *MarineFisheries* Public Access Coordinator position is funded from the Marine Recreational Fisheries Development Fund. The Coordinator manages all *MarineFisheries* saltwater fishing access projects, working closely with the Office of Fishing and Boating Access (OFBA), NGOs, towns, and other state and federal agencies to identify, plan, and implement construction/renovation/improvement of new fishing piers and other structures for fishing access. The Coordinator also serves as a liaison to the fishing public for all matters of saltwater fishing access including advocating for beach and shore access.

In 2015, *MarineFisheries* worked with the OFBA to refurbish the fishing pier in Newburyport at Cashman Park (Figure 37); complete improvements to the Dogfish Bar Fishing Access Site in Aquinnah; form an agreement with the Town of Salem to rebuild the Salem Willows Fishing Pier; and perform engineering and contracting for a fishing pier in Boston on Deer Island. In addition, *MarineFisheries* collaborated with the Massachusetts Natural Heritage Program and many other organizations to write a Habitat Conservation Plan for alternate management options in piping plover habitat.

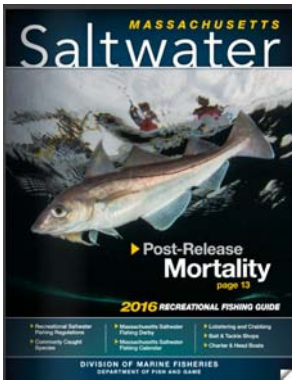
Figure 37. The newly improved Cashman Park Fishing Pier in Newburyport.

In 2015, *MarineFisheries* completed another year of the Small Grants program to assist local towns with small public access projects. This program allows for municipalities to apply for grants that fund projects promoting or supporting recreational fishing activities and access in their towns. This year, three projects were funded in: Eastham—expansion of pre-existing dredging project to make the State boat launch more useable; Marshfield—creation of a path gangway, car top vessel launch, and fishing dock at Peter Igo Park on the Green River; and Weymouth—new LED lighting at the Back River boat launch.

At the *MarineFisheries* Craven's Landing access site on Scorton Creek in Sandwich, periodic site monitoring and maintenance were required. A major improvement to the fence at Craven's landing was completed. A seasonal contractor was hired for site patrol and coordinated for weekly summer assignments. For the fifth consecutive year, a brief closure of Craven's Landing was necessary due to the presence of federally protected piping plovers. When piping plover chicks are present, *MarineFisheries* works closely with Mass Audubon to comply with USFWS regulations. Access is limited at Craven's Landing after the plover chicks are born and re-opened when young plovers are no longer in danger.

R. Kessler also worked with various entities to develop proposals for access sites of interest for future funding. These include USFWS, The Trustees of Reservations, Massachusetts Water Resource Authority, local municipalities, and several NGOs including Massachusetts Striped Bass Association, Mass Audubon, Barnstable County League of Sportsmen, Plymouth County League of Sportsmen, Cape Cod Charter Boat Association, Bay State Divers Council, Nantucket Anglers Club, Standish Sportsman's Club, Mass Sportsman's Council, Falmouth Fisherman's Association, and Massachusetts Beach Buggy Association.In 2015, R. Kessler responded to numerous inquiries from user groups and private individuals regarding shore-side fishing sites, public access rights, and future access projects, and he represented the agency at multiple fishing and boating trade shows.

Outreach



Staff routinely answered public inquiries regarding recreational fisheries, attended meetings of the recreational fishing community, represented the agency at fishing and boating trade shows, and delivered presentations on fisheries management and research to organized groups such as local schools and fishing clubs.

The Massachusetts Saltwater Recreational Fishing Guide (Figure 38) was prepared and distributed at numerous trade shows, over 140 bait and tackle shops, similar locations along the coast, and to requesting anglers by mail and website downloads. In addition, an e-mail based newsletter—*The Broadcast*—was distributed to permit holders via e-mail.

Figure 38. The cover of the 2015 fishing guide.

Large Pelagics Research Project

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 field research and opportunistically collects data from recreational and commercial

fishermen's catch. Biological parameters including age, feeding ecology, movements, and reproductive status are examined through dissection and tagging of sharks. The program's goals are to foster cooperative shark research; participate in state, regional, and federal management processes; and provide public education and technical information on the biology, management, and utilization of sharks.

Movement and Habitat Studies: With external funding from private and federal grants, Shark Research Program personnel continued in 2015 to collaborate with federal and academic researchers on the study of broad and fine-scale movements of numerous shark species (described below) using pop-up satellite tags (PSAT), real-time satellite tags (SPOT), acoustic transmitters, and conventional tags.

White Shark: Our efforts to study the movement ecology of white sharks off Massachusetts and the eastern US seaboard continued in 2015. An additional 24 white sharks were tagged in 2015, bringing the total number tagged since 2009 to 80 individuals. These sharks were tagged with one or more of the following technologies: PSAT, SPOT, coded acoustic transmitters, autonomous underwater vehicle transponders, active acoustic transmitters, and NOAA Fisheries conventional tags. The tagged sharks ranged from roughly 7.5 to 18.5 feet in total length.

In 2014, project personnel initiated a five year study to quantify the regional population size of white sharks in Massachusetts waters. With funding and logistical support from a local non-profit, the Atlantic White Shark Conservancy, aerial and vessel surveys were conducted from mid-June through October off the eastern coast of Cape Cod. The distribution of white sharks shifted throughout the season in 2015 (Figure 39). In total, 141 individual white sharks (74 males, 59 females) were identified. Throughout the summer and fall, 31 white sharks were detected by the *MarineFisheries'* acoustic receivers. This quantitative study is being conducted by SMAST student Megan Winton as part of her PhD research.

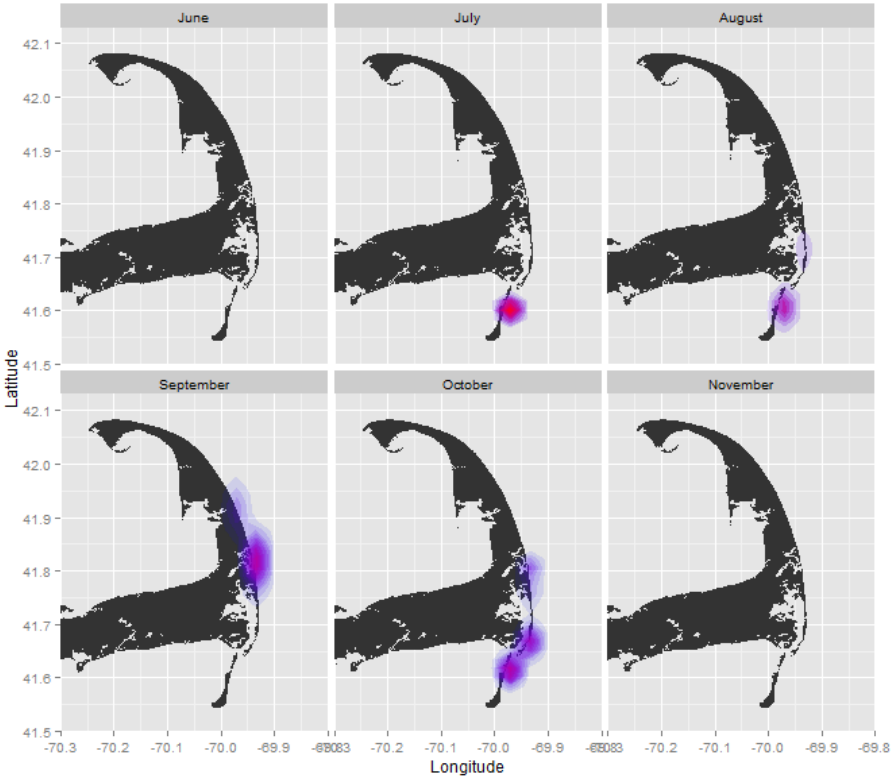


Figure 39. Density plots showing monthly distribution of white sharks off the coast of Cape Cod in 2015.

Basking Shark: Since 2004, 57 basking sharks have been tagged with PSAT tags and 10 with SPOT tags. 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. In 2015, he conducted a quantitative analysis of the broad-scale movements of PSAT-tagged basking sharks as they relate to international boundaries and Exclusive Economics Zones.

Blue and Shortfin Mako Sharks: In cooperation with the MIT/WHOI PhD student Camrin Braun, blue and shortfin mako sharks were tagged with SPOT and PSAT tags during the summer of 2015 to study the fine-scale movements of these species as they relate to eddy fields in the North Atlantic.

Post-release Survivorship Studies: In 2015, work continued with University of Massachusetts researcher Diego Bernal and PhD student Heather Marshall to study the physiological effects of longline capture in sandbar and dusky sharks. Funding for the study was obtained from the Saltonstall-Kennedy Program. In 2015, Marshall prepared a manuscript resulting from this research that was published in *Fisheries Research* (see below).

Life History: Working with NOAA Fisheries and WHOI researchers, Project personnel generated age and growth estimates for the white shark in the western North Atlantic. Using bomb-produced radiocarbon, which acts as a kind of bone marker, vertebral growth bands were counted and validated as annual. In 2015, this research was published in *Marine and Freshwater Research* (see below).

Shark Management: Program personnel participated in the development and/or amendment of state, interstate, federal, and international shark management plans. During 2015, Project Leader Skomal served on the following committees: ASMFC Coastal Sharks Technical Committee, ASMFC Coastal Sharks Plan Development Team, ASMFC Spiny Dogfish Technical Committee, ICCAT Advisory Committee Shark Working Group, and NOAA Fisheries Highly Migratory Species Advisory Panel.

Outreach and Media: To meet the public's demand for information on sharks, especially white sharks, numerous presentations pertaining to sharks were delivered to the public. Technical information on sharks was also provided to several media outlets. In several cases, bite marks on the carcasses of gray seals, harbor seals, and right whales were analyzed for evidence of shark predation.

As adjunct faculty to SMAST, the UMass Biology Department, Woods Hole Oceanographic Institution, and the King Abdullah University for Science and Technology, Skomal co-advised and/or served on the committees of 10 graduate students; eight of which are investigating the relative abundance, life history, movements, and/or physiology of elasmobranch fishes.

Other Activities

Due to personnel constraints, the **Massachusetts Sport Fishing Tournament Monitoring Program** was discontinued in 2015. This activity has been collecting catch and effort data at fishing tournaments since 1987 to better characterize the relative abundance of sharks, tunas, and marlins off the coast of Massachusetts.

Publications: The following peer-reviewed papers were published in 2015:

Ashe, J.L., K.A. Feldheim, A.T. Fields, E.A. Reyier, E.J. Brooks, M.T. O'Connell, G.B. Skomal, S.H. Gruber, and D.D. Chapman. 2015. Local population structure and context-dependent isolation by distance in a large coastal shark. Marine Ecology Progress Series, 520:203-216, doi: 10.3354/meps11069.

Braun, C.D., et al. 2015. Movements of the reef manta ray (Manta alfredi) in the Red Sea using satellite and acoustic telemetry. Marine Biology 162:2351-2362.

Legare, B, J. Kneebone, B. DeAngelis, and G. Skomal. 2015. The spatiotemporal dynamics of habitat use by blacktip (Carcharhinus limbatus) and lemon (Negaprion brevirostris) sharks in nurseries of St. John, United States Virgin Islands. Marine Biology, DOI 10.1007/s00227-015-2616-x.

Marshall, H, L., G. Skomal , P.G. Ross, and D. Bernal. 2015. At-vessel and post-release mortality of the dusky (Carcharhinus obscurus) and sandbar (C. plumbeus) sharks after longline capture. Fisheries Research. 172:373-384.

Natanson, L.J. and G.B. Skomal. 2015. Age and growth of the white shark, Carcharodon carcharias, in the western North Atlantic Ocean. Marine and Freshwater Research, DOI: dx.doi.org/10.1071/MF14127.

Skomal, G.B., E.M. Hoyos-Padilla, A. Kukulya, and R. Stokey. 2015. Subsurface observations of white shark predatory behaviour using an autonomous underwater vehicle. Journal of Fish Biology 87:1293-1312.

Diadromous Fisheries Project

Biological Assessments for River Herring

The alewife (*Alosa pseudoharengus*) is the most abundant and well-known anadromous fish in Massachusetts. Together with the close relative, blueback herring (*Alosa aestivalis*), both species are known commonly as river herring. River herring have had high cultural and economic importance historically, but present populations are well below former levels and harvest has been banned since 2006.

Management goals to restore river herring populations prompted a ramping up of river herring monitoring in the last decade. Adult river herring monitoring continued with counts and biological sample collections from: Monument River, Bournedale; Town Brook, Plymouth; Mystic River, Medford; Agawam River, Wareham; Wankinco River, Wareham; Mattapoisett River, Mattapoisett; Nemasket River, Middleboro; Herring River, Harwich; Merrimack River, Lawrence; Parker River, Newbury; Acushnet River, Acushnet; Back River, Weymouth; Herring Brook, Pembroke; and Essex River, Essex. A total of 3,171 alewives and 948 blueback herring were sampled from these coastal systems in 2015 (Table 19).

River	Biological	Counts
Parker River	Yes	Video
Essex River	No	Electronic
Mystic River	Yes	Visual (Volunteer)
Back River	Yes	Electronic
Herring Brook	No	Electronic
Town Brook	Yes	Electronic (Town)
Monument River	Yes	Electronic
Herring River	Yes	None
Acushnet	No	Electronic
Nemasket River	Yes	Visual (Volunteer)

Table 19. *MarineFisheries* river herring monitoring locations. The locations listed are the sites where *MarineFisheries* collects biological samples and/or river herring counts.

MarineFisheries data collections indicate that river herring populations have experienced a truncation in age structure, with fewer older fish being collected. However, analyses also indicate recent increases in herring size-at-age when compared to past years. In most rivers sampled, the age structure of alewives is comprised mainly of age-4 fish; however, shifts to younger (modal age-3) fish in the Merrimack and Mystic Rivers were observed.

In 2015, river herring counts varied from approximately 3,673 fish in the Acushnet River to 741,048 in the Nemasket River. While electronic monitoring showed declines in some of the southern Massachusetts herring runs in 2015 (following a general trend of 3–4 years of improvement), there was continued improvement north of Cape Cod. For example, adult returns decreased from 2014 to 2015 in the Monument River (from 278,134 to 240,372 fish), the Acushnet River (from 10,144 to 3,673 fish), the

Mattapoisett River (from 55,429 to 42,332 fish), the Agawam River (from 48,873 to 24,398 fish), and the Wankinco River (from 18,625 to 14,170 fish); however, adult counts increased in the Nemasket River (from 590,105 to 741,048 fish), the Mystic River (from 239,059 to 477,827), and the Parker River (from 7,189 to 19,852 fish). The recent herring count improvements in the Mystic River and Parker River are encouraging and may result, in part, from fish passage improvements in both systems during 2011–2014. In Boston Harbor and the north shore, most runs increased from 2014 to 2015.

MarineFisheries also provides technical assistance to local groups conducting volunteer visual counts of herring runs. In 2015, a total of 31 rivers in 27 towns were monitored in Massachusetts.

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 counts of American shad on the Merrimack River for 2015 (86,857) increased compared to 2014 (34,789). In addition, 219 striped bass, 5,035 sea lamprey, and 128,692 river herring (a substantial increase from 33,517 river herring in 2014 and a result of stocking into headwaters in previous years) were also lifted above the Essex Dam in 2015.

Propagation

MarineFisheries has the capacity to collect and transport live river herring to assist efforts to re-establish, augment, and enhance river herring runs. This work has gone on for decades and is presently guided by a Stocking Protocol policy prepared in 2013. To assist ongoing fishway improvement projects, a total of 2,906 pre-spawning adult river herring were trapped and transported via our stocking truck or lifted above a barrier into two coastal systems in the Commonwealth (Table 20): Poshka Pond (Nemasket River, Lakeville) and Pentucket Pond (Parker River, Georgetown). An additional 2,000 alewives were trapped from a Massachusetts donor system (Nemasket River, Middleborough) and released into two Rhode Island coastal systems (Ten Mile River, Turner Reservoir, East Providence; and Kickemuit Reservoir, Warren) in a cooperative effort to improve these populations.

Donor System	Recipient System	# of Adults
Nemasket River	Poshka Pond	200
Nemasket River	Ten Mile River*	1,000
Nemasket River	Kickemuit Reservoir*	1,000
Parker River	Pentucket Pond	408
Parker River	Main Street (Parker R.)	298

Table 20. Number of pre-spawning adult river herring trapped and transported via stocking truck or lifted above a barrier in 2015.

* Denotes out-of-basin transfer (between states)

In 2015, *MarineFisheries*, in conjunction with the USFWS Central New England Fisheries Resource Office, continued efforts to restore American shad to the Charles River watershed. Approximately 1.75 million young-of-year shad from the USFWS North Attleboro hatchery were hatched from Merrimack River broodstock and released above the Moody Street dam. A double oxytetracyclene mark was used on hatchery larvae to validate ageing methods and examine year-class specific mortality of shad in the Charles River.

Technical Assistance

Routine technical assistance is provided to local authorities, private organizations, and other agencies on topics related to diadromous fish resources. Numerous requests are received each year, especially during the spring, requiring a wide range of responses. Technical assistance can also be dedicated to larger requests that need a sustained effort or specific assignments or tasks such as the following items.

River Herring Habitat Assessment. River herring habitat assessments are conducted to assess the suitability of habitats for restoration potential and to contribute to habitat and water quality remediation efforts. In 2015, assessments were conducted during May–September at: Great and Little Herring Ponds, Bourne/Plymouth; Mashpee-Wakeby Pond, Mashpee; and Lake Nochoquoke, Westport. Staff also assisted in assessments by the Ipswich River Watershed Association in the Ipswich River watershed. The Great and Little Herring Pond assessment was completed in 2015. After the field season, effort focused on data processing and assessment writing. An assessment report for the Fore River watershed was published in the *MarineFisheries* Technical Report series (TR-57) in 2015. Data transcription and processing for assessment datafiles for Whitman's Pond, Weymouth, and Lake Sabbatia in Taunton were completed in 2015.

River Herring Sustainable Fisheries Plans. A state-prepared sustainable fishery plan must be approved by the ASMFC prior to the re-opening of any waters to the harvest of river herring. Massachusetts' river herring runs have all been closed to harvest since 2006. At the request of the Middleborough-Lakeville Herring Commission, the process to prepare a Sustainable Fishery Plan for the Nemasket River began in 2014. Two drafts were submitted to the Herring Commission for review in 2015, with the second draft then advanced to the ASMFC Technical Committee. A third draft was submitted for *MarineFisheries* management and Office of Law Enforcement review in December.

Diadromous Fish Restoration Priority List/*Mass*DOT Diadromous Fish GIS Datalayer. Project staff maintain a diadromous fish restoration priority list to document the status of diadromous fish passageways and prioritize restoration projects. The priority list was last updated in 2011 and contains about 450 fishways, impediments, and potential restoration sites in the four major coastal regions of Massachusetts: Buzzards Bay, Cape Cod, South Shore, and North Shore/Boston Harbor. The restoration sites are ranked by restoration potential within each region. The restoration list focuses on passageways for river herring, but also considers other diadromous fish species and watershed connectivity.

MarineFisheries teamed up with MassDOT to link the fish passage survey and priority list to a GIS datalayer that supports *Mass*DOT transportation infrastructure planning. *Mass*DOT funded a cooperative project to create the diadromous fish GIS datalayer and hired a consultant to work with *MarineFisheries* to merge datalayers on transportation infrastructure, diadromous fish habitat, and *MarineFisheries* species Time-of-Year data. A large effort occurred in 2014 to complete the GIS datalayer. The completed datalayer was used by MassDOT and *MarineFisheries* staff for project planning and environmental review in 2015. Efforts began to update the datalayer and run through a second round of groundtruthing for the first version. The overall goal is to improve data quality and make the updated version accessible to a wider audience. During 2015, a substantial effort allowed two of the four coastal drainage areas to be updated.

River Herring Network. *MarineFisheries* provided technical and financial assistance to a coalition called the River Herring Network that has evolved from the earlier River Herring Warden Network to encompass a wider audience. J. Sheppard served on the Network's steering committee in 2015. At the Network's 2015 annual meeting, *MarineFisheries* staff gave presentations on river herring and American eel management in Massachusetts (B. Chase), the status of river herring monitoring (J. Sheppard), and ocean bycatch of river herring (B. Schondelmeier).

Diadromous Fish Research Studies

In 2015, Diadromous Project biologists initiated an acoustic telemetry project to study movements of individual American shad with the purpose of informing managers about migration habits and potential challenges to shad restoration in the Charles River. Staff deployed an array of 10 receivers at various locations in the river to monitor shad movements after tagging. During late May and early June, staff captured 50 American shad while boat electrofishing and surgically implanted tags. An analysis of the duration of time tagged shad spent in each area of the river reveals that the Watertown Dam and Charles River Locks had much higher residence time than other locations (Figure 40). When fish exited the river, transit from the Watertown dam area to the locks was rapid. A total of 11 fish were detected in outer Boston Harbor or other arrays, including on Jeffreys Ledge and in Massachusetts Bay as late as October.

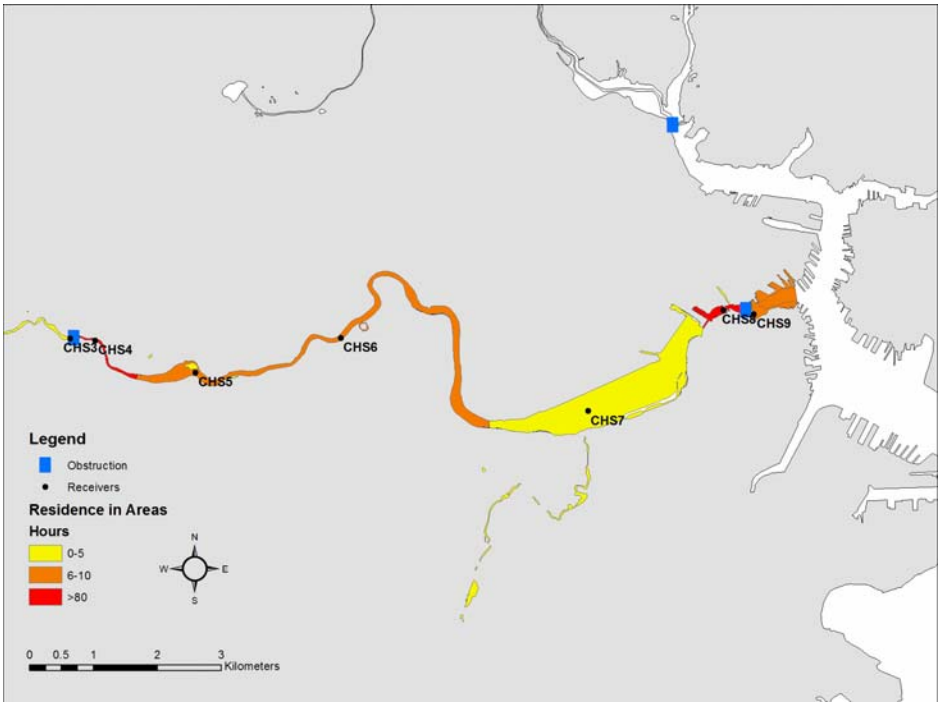


Figure 40. Average residence time (hours) of tagged American shad in the Charles River during the spring of 2015.

In the Parker River, Diadromous Project biologists conducted a third year of a Passive Internal Transponder (PIT) tag study (Figure 41). Biologists have tagged over 1,200 river herring below the Woolen Mill Dam (the first dam on the river) to measure passage efficiency following design changes and repairs to the ladder and downstream weirs. Following two years of physical changes to the site, biologists documented improved passage in 2015. While passage at this dam has improved, overall rates remain low, indicating that further work at the dam is needed. Tagging will continue for a final year in 2016 and the site will be monitored through 2018 to provide novel information on repeat spawning and mortality of river herring.

Figure 41. *MarineFisheries* biologists PIT tag a river herring in the Parker River

Rainbow Smelt Population and Habitat Monitoring

Rainbow smelt are a popular sport fish 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 age-structure data. A five-year grant from the NOAA Office of Protected Species (Species of Concern Project) supported the fyke net project for 2008–2012, including a full-time Fisheries Supervisor position. Following the conclusion of the grant in 2012, field monitoring in 2013 was reduced from nine to six stations given the staff reduction. In 2014, the project committed to long-term monitoring at four fyke net stations: Parker River, Newbury; Fore River, Braintree; Jones River, Kingston; and Weweantic River, Wareham. Smelt catches in 2015 were delayed by the historically harsh winter and well below time-series averages for each station except the Fore River. To date, over 35 species of fish have been caught in the fyke nets, including 10 diadromous species.

Following the spring field season, project effort shifts to field data entry, processing and analysis. Maintenance of a database on the fyke net project is conducted each year. Project analysis continued for manuscripts on smelt population demographics and smelt spawning habitat characteristics in the study area of Maine, New Hampshire, and Massachusetts.

American Eel Young-of-the-Year Monitoring

All U.S. East Coast states conduct standardized monitoring of YOY American eels under mandatory ASMFC protocols. *MarineFisheries* has monitored the spring migration of YOY eels in the Jones River using a Sheldon trap since 2001 to contribute to a coastwide index of eel population relative abundance. YOY monitoring stations were discontinued in 2015 at the Acushnet River and Parker River due to a combination of site condition changes and data quality concerns following a multi-year data review. A new station at the Essex River was initiated in 2014. The Jones River trap catch declined for the 4th straight year in 2015. For the first time in the 15 year data series, the catch was below the 25th percentile for two consecutive years. Annual efforts continued to organize and improve the trap data files for inclusion in the ASMFC eel compliance report and for the next coastwide eel stock assessment.

Project staff also monitors eel ramps installed in coastal rivers to provide eel passage over barriers. *MarineFisheries* first installed an eel ramp in the Saugus River in 2007 and has averaged about one ramp installation annually since. Most ramps are managed cooperatively with local groups and outfitted with a collection tank to evaluate the performance of the eel ramp and the potential to use the location as a monitoring station for census counts of YOY or age-1+ eels. The following locations have eel ramps with cooperative monitoring efforts ongoing: Saugus River, Saugus (2007); Cold Brook, Harwich (2008); Wankinco River, Wareham (2009); Pilgrim Lake, Orleans (2009); and Mystic Lakes Dam, Medford (2010), and Mill Brook, Rockport (2012), Morey's Street Dam, Taunton (2014), and Silver Springs Pond, Wellfleet (2014). Letters of authorization were prepared for each site to allow local groups to collect and transport juvenile eels upstream. Efforts were underway in 2015 to evaluate data from the Saugus River ramp for suitability as a long-term index of abundance station.

Fish Passage and Habitat Restoration Projects

Numerous projects to improve and maintain diadromous fish passage and habitat are worked on each year. In 2015, there were over 20 individual projects in various stages of development and implementation. The following list includes completed projects, large ongoing projects of regional significance that require the most effort among all projects, and some ongoing projects that required staff time in 2015.

Tom Matthews Pond, Yarmouth. *MarineFisheries* Fishway Crew, working with the Bass River Rod and Gun Club, installed a 24-foot wood weir and pool fish ladder at Tom Matthews Pond in Yarmouth in March 2014. After observing the fishway performance for the 2014 season, a 4-foot custom entrance box was added in 2015 to improve fish passage at low tide.

Mill Pond, West Tisbury. The Fishway Crew, working with the West Tisbury Herring Warden, installed a 35-foot wood weir and pool fish ladder at the Mill Pond Dam in West Tisbury in May 2014. After observing the fishway performance for the 2014 season, a 3-foot custom entrance box was added in 2015 to improve fishway attraction.

Herring Brook, Pembroke. *MarineFisheries* funded a project with the Town of Pembroke to replace the fish ladder at Third Mill Pond on Herring Brook. The ladder was installed in 2011 with accessory work conducted in 2012–2013. These post-construction efforts and an as-built survey revealed that the fish ladder exit elevation was sitting too high. The Fishway Crew corrected this in 2015 by disconnecting the fish ladder and raising it with a mini-excavator to allow resetting the ladder with suitable modifications.

Pilgrim Lake, Orleans. The Fishway Crew began work in 2014 with the Town of Orleans to repair a degraded concrete weir and pool fish ladder connecting Pilgrim Lake to tidal waters in Orleans. A new concrete form exit chamber was constructed and 60 feet of the concrete weir and pool ladder were repaired. Work continued in 2015 and was completed with an additional 60 feet of weir and pool ladder repaired.

Seymour Pond, Harwich. The Fishway Crew began work in 2014 to replace an 8-foot wood weir and pool fishway flume at Seymour Pond. The old structure had degraded and was severely laden with sand. The replacement flume was fabricated and the old structure partially dug out by hand in October. Rising pond levels caused the project conclusion to be delayed until 2015. We returned with our mini-excavator in 2015 to remove the old structure, dig out the channel and install the new fishway (Figure 42).

Figure 42. Installation of a new fishway at Seymour Pond.

Fore River Watershed. Efforts continued on the multi-site project to restore diadromous fish to the Fore River Watershed in the Boston Harbor region. This project ranks high among potential diadromous fish restoration projects in the region given the opportunity to create a large river herring run to the 180-acre Great Pond Reservoir and strong local support. A project scope and contract was prepared in 2015 to work with an engineering firm to conduct additional feasibility studies and preliminary designs on the Armstrong Dam removal project. Grant applications were prepared cooperatively with the Town of Braintree and Fore River Watershed Association to advance the project goals and submitted to NOAA Restoration and the Massachusetts Bay Program. Efforts continued to support the design of a new fish ladder at the impassible Great Pond Reservoir Dam proposed by the Tri-Town Water Board for permitting in 2016.

Three Mile River, Taunton. The project to construct a fishway at the impassable Draka Dam on the Three Mile River continued in 2015 after receiving all construction permits in 2014 except the DCR Office of Dam Safety (ODS). Issues raised in the review of the ODS permit application were addressed in a Final Design Report that was finalized in 2015. Tibbetts Engineering was hired in 2015 to integrate recommendations from the Final Design Report into revised fishway plans and to address further questions from ODS and the dam owners. The results of the Final Design Report and the revised fishway plans were favorable to the interests of ODS regulations and permitting requirements and were submitted to ODS for review by the end of the year.

Bourne Pond, Falmouth. A request from the Town of Falmouth to reconstruct a pond outlet at Bog Pond in the Bourne Pond watershed set in motion a multi-year investigation on the suitability of Bourne Pond to support river herring and the feasibility of constructing and operation of a small fish ladder. A two-year habitat assessment was conducted in 2010–2011 and fishway scoping designs were prepared by the USFWS during 2012–2014. The project development gained focus and moved past the feasibility stage in 2015. Habitat assessment data were summarized and depth loggers were deployed at the ponds to gain better data on water level interactions. A cost estimate and project narrative was in preparation to include these data sources and to advance the USFWS fishway design.

Forge Pond, Kingston. Efforts continued on the project to restore diadromous fish to the 640-acre Silver Lake in the Jones River watershed. Work continued on a Memorandum of Understanding (MOU) between *MarineFisheries* and the City of Brockton to establish the legal basis for constructing a fish ladder, including a meeting with the Brockton Water Commission. A revised MOU was submitted to the Department of Fish and Game for review. Several days were devoted to stream channel maintenance in the Jones River downstream of Forge Pond Dam.

Back River, Weymouth. *MarineFisheries* continued work with the Town of Weymouth on a study to replace or redesign the flood control tunnel gate at the Back River Jackson Square fishway that has caused several large fish kills in recent years. An engineering contractor was hired by Weymouth in 2014 to conduct the project design and permitting. Efforts in 2015 focused on a design and permit applications for the preferred option: a constructed fish diversion to keep herring out of the tunnel and associated smelt spawning habitat improvements.

Westport River, Westport. River herring in the East Branch of the Westport River are impeded from reaching the 165-acre Lake Noquochoke at two impassable dams. After two years of site investigations, a large-scale restoration effort in the Westport River began in 2014. The USFWS was contracted to produce a conceptual design for several options for a fishway at the first dam, Forge Pond Dam, and completed the design in 2015. Meetings were held with the dam owner and Town of Westport officials to discuss the project and a Lake Nochaquoke habitat assessment was started in 2015. A presentation was given to the Westport Conservation Trust in January on the project and Westport River diadromous fish resources. Late in the year, work began on drafting a MOU between *MarineFisheries* and the dam owner on the legal basis for constructing a fishway at Forge Pond Dam.

Town River, West and East Bridgewater. An effort was initiated in 2013 to work with the Towns of East and West Bridgewater to prepare operation and maintenance plans for the Town River fish ladders at War Memorial Park and the High Street Dam. Both sites need fishway improvements; however, basic guidelines for fishway operations and flow targets are lacking. Efforts in 2015 focused on the High Street Dam. The *MarineFisheries* Fishway Crew replaced the boards at the diversion wall next to the High Street Dam fish ladder entrance using oak stock provided by the dam owner. A day of stream channel maintenance was conducted downstream of the dam with the Town River Fishery Commission. A second draft of the O&M

plan for the High Street Dam and a letter requesting support for advancing a feasibility study for the removal of the High Street Dam was sent to the dam owner for review.

Looks Pond, West Tisbury. Preparations were made in 2015 to construct a fish ladder at Looks Pond Dam in West Tisbury. Two site visits were made that included discussions with the property owner and Town officials. A project design and narrative was prepared and submitted to the West Tisbury Conservation Commission for their review.

James Pond, West Tisbury. Site visits to Martha's Vineyard also included site visits and project development for preparing a channel maintenance plan for James Pond to allow local officials to manage diadromous fish passage at this natural channel. A project design and draft maintenance plan was prepared and submitted to the West Tisbury Conservation Commission for their review.

Ipswich River, Ipswich. Efforts were underway to revisit a feasibility study from 2007 to improve fish passage at the Willowdale Dam on the Ipswich River. A USFWS conceptual design for a new Alaskan steeppass ladder was received in 2014. Meetings were held with the dam owner in 2015 and a MOU between *MarineFisheries* and the owner was drafted to establish the legal basis for constructing a fish ladder at the dam.

Aberjona River, Winchester. Efforts continued in cooperation with the Town of Winchester to construct a fish ladder at the presently impassible Central Falls Dam on the Aberjona River in the Mystic River watershed. A funding opportunity arose to provide local mitigation funding for the final design, permitting, and construction of the fish ladder. Two meetings were held with the Town and a fishway O&M plan and MOU were drafted and under review. The project also included consideration for providing fish passage to Horn Pond further upstream in the Aberjona River.

Parker River, Newbury. A multi-year effort continued to make progress with fish passage improvements and river herring population restoration in the Parker River. *MarineFisheries* staff worked with the dam owner and cooperative partners to advance a proposal for dam removal at the Larkin Mill Dam. Our staff was actively involved with fishway management at the Woolen Dam and spent several days working on stream channel maintenance in the watershed.

Concord River, Billerica. *MarineFisheries* led the beginning of a multi-agency collaboration to restore diadromous fish to the Concord River. Using available funds from the Nyanza Damage Assessment, staff bid out and contracted a feasibility study to examine restoration options at Middlesex Falls, Centennial Falls Dam, and Talbot Mills Dam. Some level of passage is currently available at the first two sites but not Talbot Mills. Fish passage or dam removal at Talbot Mills would open up more than 35 main stem miles and 100 tributary miles of habitat for diadromous fish. The Feasibility study will include a full archeological and historic report. Given the cultural and environmental significance, public comment will be a large part of the decision process following the finished feasibility study.

Fishway Permitting and Operation and Maintenance Plans

An initiative 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) establishes the authority of the Division's Director to prepare and require fishway O&M plans. The documentation of management practices for fishways is clearly needed for present operations and to guide future state and local staff. Three O&M plans were drafted in 2015: Center Falls Dam, Aberjona River, Winchester; a revised draft for the High Street Dam, Town River, Bridgewater; and the Mill Pond Dam, Rockport. Several site visits were made to fishways in relation to O&M working drafts and planning for future O&Ms. *MarineFisheries* issues DMF Fishway Construction Permits following the review of final

engineering plans to construct, rebuild or alter fishways. Fishway Construction Permits were prepared for projects at Town Brook, Plymouth and Little River, Gloucester in 2015.

River Herring Stream Channel Maintenance

The DMF Fishway Crew routinely fields requests to assist Towns to maintain passageways for river herring. The work can involve developing plans for removing debris jams and excessive plant growth in channels or responding quickly during the migration season to remove blockages that threaten sea-run fish survival. In 2015, ongoing efforts took place at Furnace Brook to connect the main stem Taunton River to Lake Rico in Taunton, Herring Brook in Pembroke, Jones River in Kingston, Palmer River in Rehoboth, Town River in Bridgewater, Pilgrim Lake in Orleans, Parker River in Georgetown and Alewife Brook in Essex. A one-mile stretch in Furnace Brook required 16 trips over three years to open passage for river herring to Lake Rico. Stream maintenance plans were drafted for Furnace Brook, Herring Brook in Pembroke, a joint plan for the Town River in Bridgewater and West Bridgewater and Mill Brook in West Tisbury in 2015. The plans receive approval from the town's Conservation Commissions to allow local management of the annual maintenance essential for sea run fish passage.

Other Activities

Technical Committee Participation: Staff actively participated on ASMFC committees and with diadromous fish stock assessments. Compliance reports were drafted in 2015 for American eel (B. Chase), and river herring/American shad (B. Chase and J. Sheppard). Committee work included the River Herring and American Shad Technical Committee (TC), American Eel TC, Fish Passage TC, and American Eel Plan Development Team (B. Chase); the Connecticut River Atlantic Salmon Commission TC and Technical Committee for Anadromous Fishery Management of the Merrimack River Basin (B. Gahagan).

Publications, Reports, and Presentations:

Gahagan, B., Fox, D., and D. Secor. 2015. Partial migration of striped bass: revisiting the contingent hypothesis. Marine Ecology Progress Series. 525:185-197.

Sheppard, J.J., and M. S. Bednarski. 2015. Utility of single-channel electronic resistivity counters for monitoring river herring populations. North American Journal of Fisheries Management 35 (6): 1144–1151.

Gahagan, B. 2015. River Herring in the Mystic and Coastal Massachusetts. Mystic River Watershed Association Monthly Meeting. Medford, MA. 1/6/2015.

Rosset, J., A. H. Roy, B. I. Gahagan, A. R. Whiteley, A. P. Jordaan, and J.J. Sheppard. 2015. Life history characteristics of Alewife (Alosa pseudoharengus) in freshwater environments. American Fisheries Society Southern New England Chapter Meeting. University of Rhode Island, Narragansett, RI. 2/24/2015.

Gahagan, B. 2015. River Herring on the North Shore. Ipswich River Watershed Association Annual Volunteer Count Training. Ipswich, MA. 3/10/2015.

Gahagan, B. River Herring Identification. 2015. Massachusetts Environmental Police Training. Westborough, MA. 3/23/2015.

Rosset, J., A. H. Roy, B. I. Gahagan, A. R. Whiteley, and A. P. Jordaan. 2015. Shedding Light on Past Assumptions: A Look at Life History Characteristics of Alewife (Alosa pseudoharengus). American Fisheries Society 145th Annual Meeting. Portland, Oregon. 8/17/2015.

Bowden, A., D. Borggard, and B. Gahagan. 2015. New Approaches for Rangewide Conservation of River Herring. American Fisheries Society 145th Annual Meeting. Portland, Oregon. 8/18/2015.

Bailey, M., B. Gahagan, and K. Cheung. 2015. Methodologies of acoustic telemetry tags in American Shad. American Fisheries Society Atlantic International Chapter Annual Meeting. Cap-Pelé, New Brunswick, Canada. 9/21/2015.

Sheppard, J.J. 2015. Status and trends of river herring runs in Massachusetts. River Herring Warden Network Annual Meeting. Pembroke Public Library, Pembroke, MA. 10/15/2015.

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
Story Reed, Head of Permitting
Kerry Allard, Permitting Leader
Kerry Faugno, Permitting Receiving Teller
Sandra Downing, Permitting Receiving Teller

New Bedford Permit Office
Marie Callahan, Permitting Office Manager (retired October 2015)
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

Grants Management
Stephanie Cunningham, Federal Aid and Grants Coordinator
Cecil French, Project Leader - Clean Vessel Act and Boating Infrastructure Grant
Maren Olson, Clean Vessel Act and Angler Education Coordinator
Melanie Griffin, Project Leader - Revolving Loan Fund & Groundfish Disaster Economic Assistance
Samantha Andrews, Program Coordinator - Groundfish Disaster Economic Assistance Program

Outreach
Elaine Brewer, Information & Education Coordinator

Seafood Marketing
Wendy Mainardi, Marketing Coordinator

Scientific Diving
Vincent Malkoski, Diving Safety Officer

Capital Assets and Facilities Management
Brian Castonguay, Gloucester Office, Head of Facilities and Capital Assets
Vincent Malkoski, New Bedford Office, Facilities and Capital Assets
Ralph Stevens, Shellfish Purification Plant, Facilities

Overview

MarineFisheries Administration is responsible for the Division's fiscal functions, permitting, grants management, capital assets, diver training, outreach efforts, and seafood marketing. 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 and operations, and 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. Outreach is conducted through the creation of educational media, event planning, and other activities. Seafood Marketing efforts support and promote Massachusetts seafood and the commercial industry. Capital Assets and Facilities Management is conducted with the intent to provide a healthy and productive working environment.

Budget

State-Appropriated Funds

The *MarineFisheries* general fund budget increased by just over 5% in Fiscal Year (FY) 2015. The FY2014 and FY2015 state appropriations are shown in Table 21.

Table 21. Fiscal Year 2014 and 2015 Appropriations (available funds for operations)

Title	Acct. Number	FY2014	FY2015	Change
General Fund Accounts				
General Operating	2330-0100	[1]$4,814,039	[2]$5,078,532	+5.49%
Sport Fish Program	2330-0120	$591,800	$599,041	+1.22%
General Fund Total		$5,405,839	$5,677,573	+5.03%
Retained Revenue Accounts				
Sport Fish Retained Revenue	2330-0121	$217,989	$217,989	0%
Depuration Retained Revenue	2330-0150	$57,016	$45,768	
Lobster Permit Research Fee	2330-0199	n/a	$250,000	
Special Fund Accounts				
Saltwater Sport Fish Licensing	2330-0300	$1,042,470	$1,340,766	+28.61%
Seafood Marketing	2330-0104	n/a	$250,000	

[1]The final budget for FY2014, Chapter 38 of the Acts of 2013, was $5,509,039, and included the following earmarks: $425,000 and $75,000 to the School of Marine Science and Technology; $200,000 for the Gloucester Marine Genome Initiative; $50,000 for the protection of the Herring Run in the town of Weymouth; and $75,000 for shellfish propagation in Barnstable, Dukes, and Nantucket counties. Late in FY2014, a supplemental budget was passed for FY2014 that included $130,000 for *Vibrio* monitoring.

[2] The final budget for FY2015, Chapter 165 of the Acts of 2014, was $6,037,213, and included the following earmarks: $450,000 to the School of Marine Science and Technology; $133,000 for the Great Marsh Green Crab Trapping Program; $50,000 for the protection of the Herring Run in the town of Weymouth; $50,000 for the Fishing Academy, Inc.; and $100,000 for shellfish propagation in Barnstable, Dukes, and Nantucket counties. The final budget was reduced mid-way through the fiscal year by Governor Charles Baker through the 9c budget reduction process, which reduced the *MarineFisheries* operating budget by $175,681 and reduced earmarks by $288,000.

Overall, *MarineFisheries* realized an increase of approximately 5% in appropriated funds for the operating budget in FY2015. The increase was approved to primarily cover increased annualized costs for payroll and utilities, which rose by 4.9% over the previous two fiscal years. In addition, a new retained revenue account was created to fund research on lobster and invertebrate species; the account is funded by a research fee surcharge added to all lobster permits issued by the Division. The Legislature raised the appropriation on the Saltwater Sport Fish Licensing account by just over 28% to cover the costs of an expanded Marine Recreational Information Program (MRIP), and a new stock assessment biologist. FY2015 was the first year of funding for the newly created Seafood Marketing Program; the program is funded by revenue collected from the issuance of commercial fisherman and seafood dealer permits. Chapter 165 of the Acts of 2014 established a $250,000 budget for the Seafood Marketing program; however, only $50,000 was available in FY2015 after the budget was reduced as part of the 9c budget reduction of 2015. Table 22 provides the breakdown of overall costs by primary spending category for the *MarineFisheries* operating accounts.

Table 22. Fiscal Year 2015 Costs, State Appropriations (rounded to whole dollars)

Account Number	2330-0100	2330-0120	2330-0121	2330-0150	2330-0199
Salaries	$4,302,955	$589,665	$36,573	$18,147	$136,470
Employee Expenses	$12,201		$9,535	$3,191	
Contracted Employees	$24,332		$749		$26,114
Contracts	$29,943		$55,177		
Facility Maintenance	$15,573		$3,942		
Field & Lab Supplies	$34,826		$21,202	$6,563	
Fringe Costs	$68,803	$9,376	$593	$289	$2,585
Fuel	$57,117				
Utilities	$109,739				
Lease/Rent	$151,290				
Maintenance/Repair	$71,383		$11,068	$13,676	
Office & Administrative	$175,441		$38,938		
Services/Equipment Lease	$19,849		$14,000		
Information/Technology			$1,838		
Outside Agencies	$101,182		$990		
Grants	$415,462		$19,740		

Staffing

Authorized personnel levels for Calendar Year (CY) 2015 are shown in Table 23.

Table 23. Calendar Year 2014 and 2015 Authorized Personnel Levels

Title	Acct. Number	CY2014	CY2015
MarineFisheries General Operating	2330-0100	62	61
Sport Fish Program	2330-0120	8	10
Saltwater Sport Fish Licensing	2330-0300	7	8
Federal Grants and Trust Account	2330-xxxx*	22	19
Total Employees in All Appropriations		**99**	**98**

*Multiple account numbers

Although staffing levels were virtually unchanged between CY2014 when compared to CY2015, *MarineFisheries* had significant staff turnover by the end of 2015. Six long term employees retired in 2015, including the Director. New positions were added to the Grants Program (Clean Vessel Act), the Age & Growth Project, the Recreational and Diadromous Fisheries Program, and the recently created Seafood Marketing Program. The loss of senior staff as a result of retirements will have a noticeable impact in key areas of *MarineFisheries* including: fisheries management, shellfish management, and fisheries statistics. Some of these vacancies were expected to be backfilled in 2016.

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 28,154 permits and endorsements were issued by the Licensing Program for the categories of commercial fishing, seafood dealers, and special permit types, producing General Fund revenue of $2,118,505 in 2015. Overall, there was a decrease in total number of permits issued by approximately 3.5%. However, revenue increased by just over 7% as a result of a new invertebrate species research fee that is assessed on issuance of all lobster permits.

Revenue from the depuration of soft-shelled clams at the Shellfish Purification Plant in Newburyport has shown a steady decline over the past decade. To increase the plant's productivity, the Massachusetts legislature approved an expansion of services in the 2012 budget to include de-sanding of non-contaminated shellfish, a fee-for-service provided to seafood dealers seeking to improve product marketability. De-sanding operations began in March of 2013, and the plant realized a slight increase in processed racks of soft-shelled clams in 2013 (depuration and de-sanding combined) as compared to 2012. This was the first increase in volume from one year to the next in more than 10 years. De-sanding accounted for more than 60% of the plant's production. As had been the trend prior to 2013, volume once again declined in 2014 with the plant processing only 6,974 racks. After plant production reached a historic low in 2014, the plant processed 8,891 racks in 2015 resulting in General Fund revenues of $53,344. This was an increase of approximately 27% as compared to the 2014 value of $41,842.

In addition to General Fund revenue, *MarineFisheries* generated $1,299,516 in revenue for the Marine Recreational Fisheries Development Fund from the issuance of 168,312 recreational saltwater fishing permits in 2015. Since inception in 2011, the total number of permits issued has increased each year, with steady growth of about 2.5% over the past three years.

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 24 for the number of commercial fisherman permits issued, by type, in 2015 and resulting revenue. In 2015, a new invertebrate species research fee was approved by the legislature; all lobster permits are assessed the research fee ($50 for commercial permits and $15 for non-commercial permits).

Table 24. 2015 Commercial Licensing and Revenue Statistics

Permit Type (and resident/non-resident fee)	Permits Issued (#)		Revenue
	Resident	Non-Resident	
Coastal Lobster ($310/$570)	1,133	4	$353,510
Offshore Lobster ($310/$570)	303	90	$145,230
Seasonal Lobster ($80/$145)	86	2	$7,170
Boat 100'+ ($260/$520)	12	17	$11,960
Boat 60-99' ($195/$390)	68	143	$69,030
Boat 0-59' ($130/$260)	3,103	321	$486,850
Individual ($65/$130)	218	7	$15,080
Shellfish ($40/$80)	723	12	$29,880
Shellfish & Rod & Reel ($55/$130)	407		$22,385
Rod & Reel ($35/$100)	450	36	$19,350

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 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 is not permitted.

Boat Permit allows the taking, landing, and sale of finfish (to a licensed dealer) and may be endorsed for shellfish. The permit covers everyone aboard the vessel. Price varies with vessel size (0–59', 60–99', and 100+'). No lobsters or edible crabs may be taken.

Individual Permit allows the holder only to take, land, and sell finfish (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.

(A Shellfish Transaction Card allows the named individual holding a commercial permit endorsed for shellfish and seaworms to sell shellfish and seaworms when used in conjunction with a Registry of Motor Vehicles identification card. In 2015, *MarineFisheries* issued 3,064 shellfish transaction cards; of which, 137 were issued as employee shellfish transaction cards to 78 shellfish businesses.)

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.

Over the past decade, *MarineFisheries* has seen a steady decrease in commercial fisherman permit sales, with the exception of small boats, 0–59' in length. Generally, this change can be attributed to more

restrictive regulations and the increasing cost of operation within the fisheries. Figure 43 illustrates the 10-year trend in sales for four of *MarineFisheries'* frequently issued commercial permits: (1) Coastal Lobster Permit sales have steadily decreased 19% over the past 10 years; (2) Shellfish Permits have seen an overall decrease of 23% from 2006 to 2015, although sales fluctuated over the entire time period; (3) Rod & Reel Permit sales remained relatively constant from 2006 to 2013, but decreased 38% from 2013 to 2015; and (4) Boat Permits have seen the only rise in numbers over the past decade of all Commercial Fisherman Permits issued by *MarineFisheries*, with the largest spike (9%) occurring between 2013 and 2015.

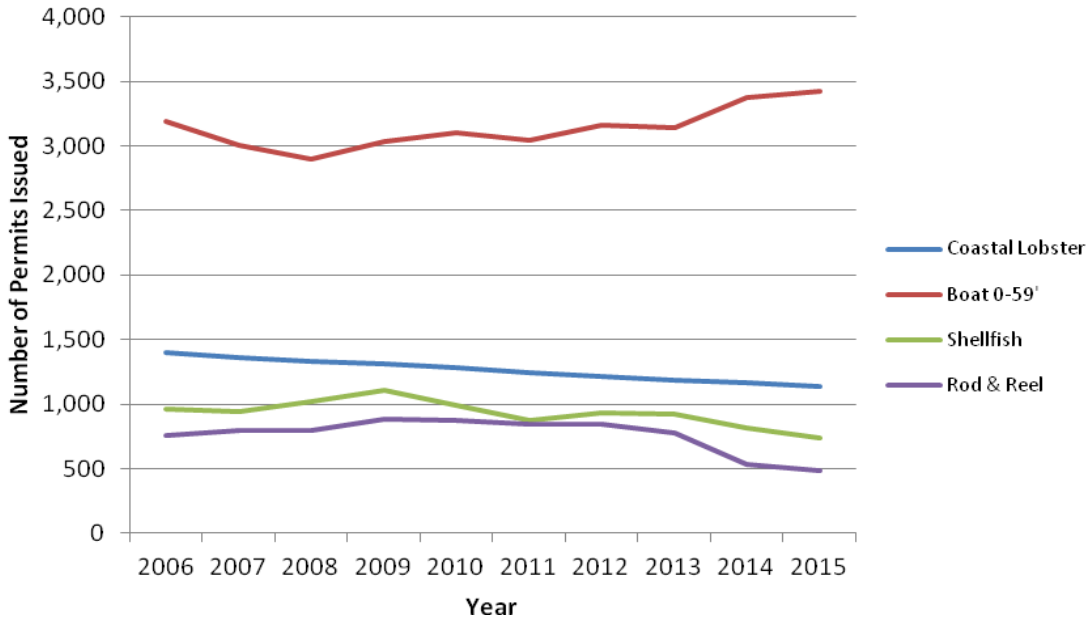


Figure 43. Trend of Commercial Permit Sales from 2006-2015

Dealer Permits

Anyone engaged in the wholesale or retail trade of raw fish, shellfish, lobsters, or bait, whether frozen or fresh, must have a *MarineFisheries* Dealer Permit and may be subject to inspection from the Massachusetts Department of Public Health (*Mass*DPH). Shellfish dealers must abide by *Mass*DPH 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 25 for the number of dealer permits issued, by type, in 2015 and resulting revenue.

Table 25. 2015 Dealer Licensing and Revenue Statistics

Permit Type (and resident/non-resident fee)	**Permits Issued (#)**		**Revenue**
	Resident	**Non-Resident**	
Wholesale Dealer ($130/$260)	385	8	$52,130
Wholesale Truck ($130/$260)	102	132	$47,580
Wholesale Broker ($130/$260)	36	9	$7,020
Retail Dealer ($65/$130)	740	66	$56,680
Retail Truck($65/$130)	37	3	$2,795
Retail Boat ($65/$130)	102	1	$6,760
Bait Dealer ($65/$130)	144	13	$11,050

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, re-label, 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 26 for the number of special permits issued, by type, in 2015 and resulting revenue.

Table 26. 2015 Special Licensing and Revenue Statistics

Permit Type (and resident/non-resident fee)	Permits Issued (#)		Revenue
	Resident	Non-Resident	
Non-Commercial Lobster ($55/$75)	6,896	137	$389,555
Regulated Fishery Endorsements ($30/$60)	10,993	705	$372,090
Master Digger ($250/$500)	7		$1,750
Subordinate Digger ($100/$200)	58	1	$6,000
Scientific Collection ($10/$20)	67	21	$1,090
"Other" Special Permits ($10/$20)	356		$3,560

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, groundfish, and menhaden.

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 *Mass*DPH Division of Food and Drugs, 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, 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.

Of the Special Permits issued, the Non-Commercial Lobster Permit has had the largest percent decline in sales over the past ten years (36%), from 10,920 permits to 7,033 permits. A number of factors can be contributing to this trend, including the financial costs of boating and diving, the time commitment for a recreational activity, and changing ocean conditions which have potentially impacted the spatial distribution of near shore lobsters.

Limited Entry Permit Transfer Program

Limited entry permits are those permits and permit endorsements that are restricted in distribution to renewals and are only transferable according to criteria established by regulation. Transfer criteria include

two key components: the permit's activity and the transferee's experience. Limited entry permits include, but are not limited to, coastal lobster, fish pot (scup, conch, and black sea bass), gillnetting, surf clam, ocean quahog, mobile gear coastal access, fluke, horseshoe crab, groundfish, black sea bass, and menhaden.

Coastal Lobster Permits can be transferred by the holder along with lobster related business assets under the historical transfer criteria developed for the coastal lobster fishery. A permit must be actively fished prior to the transfer request, where "actively fished" means landing and selling at least 1,000 pounds of lobster or landing and selling lobster on at least 20 occasions, in a single year. The transferee must document that s/he has at least one year of full-time or equivalent part-time experience in the commercial lobster trap fishery or two years of full-time or equivalent part-time experience in other commercial fisheries.

Limited entry endorsements for fish pot-scup, fish pot-conch, fish pot-sea bass, ocean quahog, mobile gear coastal access, fluke, horseshoe crab, groundfish, quahog-dredge, menhaden, and black sea bass can be transferred by the holder provided they have been actively fished for four of the past five years. "Actively fished" means any landings, unless otherwise determined by the Director in a written policy. For fish pot endorsements, the transferee must document that s/he has at least one year of full-time or equivalent part-time experience in the commercial trap fishery or two years of full-time or equivalent part-time experience in other commercial fisheries. For the other endorsements, the transferee must document that s/he has at least one year full-time or equivalent part-time experience in a commercial fishery.

Staff continued to use a new pre-application to allow permit holders to determine their eligibility to participate in a transfer. This resulted in a smoother transfer process in 2015. See Table 27 for a summary of transfers administered by *MarineFisheries* during the year.

Table 27. 2015 Transfer Statistics (permits with no transfers are not listed)

Permit/Endorsement Type	Permits Transferred (#)	
	Resident	Non-Resident
Coastal Lobster	37	0
Mobile Gear Coastal Access	2	0
Fish Pot	4	0
Fluke	4	0
Sea Bass	1	0
Groundfish	1	0
Surf Clam	1	0
Quahog-Dredge	1	0
Horseshoe Crab	1	0

Recreational Fishing Permit

MarineFisheries began issuing recreational saltwater fishing permits in 2011 for the first year of the recreational saltwater fishing permit program. The program was created as a "user-pays, user-benefits" program, ensuring 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. In addition to permit issuance, many individuals contributed to the program through direct donations to the agency to improve recreational fishing programs. The number of permitted fishermen showed significant growth in each of the first three years of the program as fishermen became aware of the permit requirement. Permit issuance has continued to rise at about 2.5 to 3% per year for the past four years, but

revenue has leveled off as a result of fewer for-hire permits, lower donations, and most of the permit growth being in the Age 60+ category (no fee). See Table 28 for the number of permits issued, by type, in 2015 and resulting revenue.

Table 28. 2015 Recreational Saltwater Permitting and Revenue Statistics

Permit Type (and resident/non-resident fee)	Permits Issued (#)		Revenue
	Resident	Non-Resident	
Recreational Saltwater ($10/$10)	105,084	14,833	$1,199,170
Recreational Saltwater Age 60+ ($0)	41,959	5,583	$0
Charter Boat ($65/$130)	760	44	$55,120
Head Boat ($130/$260)	43	6	$7,150
Donations			$38,076
Marine Recreational Development Fund, Total Revenue Collected:			**$1,299,516**

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 six persons fishing as passengers from the for-hire vessel.

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

Grants Program

In each of FY2013 and FY2014, *MarineFisheries* spent approximately $5.5 million on federal grants and mitigation projects operating out of the *MarineFisheries* Trust account. In FY2015, total expenditures were approximately $15.5 million. The increased spending can be mainly attributed to the federally funded Groundfish Disaster Economic Assistance Program (see below). The Federal Grant Awards and expenditures out of the *MarineFisheries* Trust are provided in Table 29.

Table 29. Fiscal Year 2014 and 2015 Expenditures

Title of Federal Grant or Trust	Account Number	FY2014	FY2015
Clean Vessel Act	2330-9222	$480,000	$1,300,000
Fisheries Statistics	2330-9712	$100,000	$120,000
Boating Infrastructure	2330-9725	$10,000	$190,000
Interstate Fisheries	2330-9730	$250,000	$290,000
ACCSP	2330-9732	$100,000	$20,000
MFI Infrastructure	2330-9736	$580,000	$0
Turtle Disentanglement/Protected Species	2330-9739	$600,000	$625,000
Economic Relief	2330-9741	$740,000	$10,150,000
Fish Age & Growth	2330-9742	$165,000	$160,000
Marine Fisheries Research Trust	2330-0101	$2,518,257	$2,650,000

The Revolving Loan Fund (RLF)

The Massachusetts Commercial Fisheries RLF Program, operating under a Memorandum of Agreement (MOA) between NOAA Fisheries and *MarineFisheries*, seeks to promote the effective implementation of catch-share programs in New England, while minimizing any potential adverse socio-economic impacts to fishing communities and small-scale fishing businesses that are sometimes attributed to catch-share programs. *MarineFisheries* has contracted with three financial institutions to provide approved loan services to eligible applicants throughout the Commonwealth: (1) the Cape Ann Commercial Fishermen's Loan Fund, (2) Tremont Credit Union, and (3) the Community Development Partnership.

During calendar year 2015, the program evolved to expand eligibility to additional groundfish sector operations. On balance, more loan applications were approved (4) than rejected (2).

Groundfish Disaster Economic Assistance Program

MarineFisheries was awarded $21,715,292 in federal grants to distribute disaster aid funds in three bins to the benefit of the Commonwealth's groundfish fishermen and communities. The Commonwealth's Groundfish Disaster Economic Assistance Program is part of a greater consensus framework for the distribution of $32.8 million in federal disaster aid monies to the New England groundfish industry. In the consensus framework, the state fishery directors from Maine through New York, in partnership with NOAA Fisheries, apportioned funds between three themes (roughly $11 million each): one-third to be used for direct assistance, one-third to be split among the states and used at their discretion, and one-third to be used in developing a federally-funded buyout or industry-funded buyback.

Federal disaster aid stems from a September 2012 disaster declaration in the Northeast multispecies (groundfish) fishery by the Acting Secretary of Commerce. The disaster designation was requested by Governor Deval Patrick and other elected officials recognizing the severe hardships being faced by commercial fishermen—hardships being felt well before the May 1, 2013 federal designation.

Under Bin 1, *MarineFisheries* disbursed $6,269,198 in direct subsidies to 201 pre-identified active commercial groundfish fishermen home-ported in Massachusetts. Preliminary eligibility was based on a vessel's landing history of at least 5,000 pounds of groundfish, which were allocated to sector and common pool vessels, in any one of the 2010–2013 fishing years. During CY2015, *MarineFisheries* completed payments, the majority of which occurred in CY2014, to all 201 eligible entities.

Beginning in February 2015, *MarineFisheries* began disbursing aid as part of the Commonwealth's state-specific Bin 2 spending plan for $8,255,031 in federal funds. Bin 2 was primarily aimed at assisting additional federal and state permit holders, crew, groundfish sectors, and impacted shoreside businesses. During CY2015, *MarineFisheries* disbursed the majority of Bin 2 funds. See Table 30 for the disbursement of Bin 2 funds, by program, in CY2015

Table 30. Disbursement of Bin 2 Funds by Program

Bin 2 Program	Number of Eligible Entities	Entities Paid in CY2015	Budgeted Amount	Paid in CY2015
Permit Holders	142	141	$3,919,500	$3,887,000
Crew Members	525	516	$3,185,531	$3,134,136
Shoreside Businesses	30	30	$750,000	$750,005
Sector Administration	10	0	$300,000	$0

Early in October 2015, *MarineFisheries* implemented the third and final spending bin for the Commonwealth's Groundfish Disaster Economic Assistance Program. Reprogrammed for state-by-state distribution from unsuccessful buyout/buyback discussions, Bin 3 allocates $6.7 million to the Commonwealth of Massachusetts to stabilize the commercial groundfishery in Massachusetts. An additional non-discretionary $200,000 has been provided to *MarineFisheries* for support in further developing an industry-funded buyback program.

Under Bin 3, *MarineFisheries* supported the continued viability of the commercial groundfish fishery in Massachusetts by distributing $6 million in direct aid to eligible federal commercial groundfishermen. In CY2015, *MarineFisheries* distributed direct aid subsidies to 120 of the 171 eligible permit holders. The remaining $700,000 will be apportioned between support for an Industry-Based Survey of Gulf of Maine Cod and development of extra fishing opportunities for small mesh species like whiting.

For both Bin 2 and Bin 3, the qualifying criteria and overall programs were developed through a public process and with input of an Industry Working Group.

The Clean Vessel Act Program

MarineFisheries administers the Clean Vessel Act (*Mass*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 by providing funding for a combination of new infrastructure and operation and maintenance costs for program operators. 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 *Mass*CVA Program, and agency coordination with public and private parties.

In 2015, the 21st year of our participation, *Mass*CVA is proud to help support Massachusetts' status as a No Discharge Zone (NDZ). The Program is administered by Cecil French, the CVA and BIG Grant Program Coordinator. This year, Maren Olson joined Cecil to assist with program organization and expansion of *Mass*CVA outreach and site visits.

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 and logistically challenging to provide adequate shore-side pumpout facilities along the Massachusetts coastline. Consequently, we have been a leader in the implementation of pumpout vessel use. Our matrix of pumpout vessels and shore-side pumpouts (Figure 44), along with dump stations, has created more extensive 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 NDZ.

In 2015, our operators included 44 private marinas, one non-profit organization, and 45 cities and towns. We requested funds for three more private marinas and one additional town in our 2015 federal grant application.

Figure 44. A combination of pumpout boats (left) and fixed location pumpout stations (right) help meet the needs of the Commonwealth's recreational boaters.

In 2015, we completed our ninth consecutive year of exhibiting with our public and private partners at the New England Boat Show. Additionally, we partnered with two federal agencies, three state agencies, and more than a half dozen non-profit organizations as part of our information and education efforts. We also co-hosted the States Organization for Boating Access conference in Vermont to discuss nation-wide CVA challenges and address upcoming federal regulatory changes within the program.

As a direct result of our outreach and needs assessment efforts to operators and the general public, program shortfalls are being more effectively identified and addressed. New and replacement infrastructure for 2015 is summarized in Table 31. We are quickly approaching the removal of an aggregate eight million gallons of effluent from state coastal waters.

Total match reimbursements for all replacement equipment reimbursed through the CVA program in 2015 was $315,910. In addition, $569,872 was spent on operation and maintenance costs for 94 operators during the 2015 calendar year to help their facilities operate successful pumpout programs. The operation and maintenance funds we apply for every year helps keep pumpouts free for the recreational boaters of Massachusetts. During the 2015 boating season, there were 66 pumpout boats and 67 fixed-location pumpout stations available to the recreational boating public.

Table 31. New and Replacement Infrastructure for 2015

Recipient	Equipment
McDougall's Marina	Repower and rehab pumpout boat
Town of Mashpee	Replacement pumpout boat
Town of Rowley	Replacement pumpout boat
Town of Westport	Replace trailer for pumpout boat
Town of Winthrop	Replacement pumpout boat
Town of Yarmouth	Replacement pumpout boat

Boating Infrastructure Grant Program

The Massachusetts Boating Infrastructure Grant (*Mass*BIG) Program, begun in 2001, is a two-tiered federal grant program, directed through the USFWS and administered by *MarineFisheries*. The *Mass*BIG Program is funded by 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.

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. 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.

Three Tier II grants were awarded and one Tier I was applied for in 2015. The three communities awarded—Gloucester, Newburyport, and Manchester-by-the-Sea—worked with project staff to complete permitting and compliance. Nantucket worked with the BIG team to submit a successful Tier I proposal.

The City of Gloucester was awarded $263,930 to construct and maintain 72 linear feet of dinghy dock, 75 linear feet of dock for temporary tie-up, and 118 linear feet of dock for pick-up/drop-off for transient recreational boaters as part of their ADA compliant Solomon Jacobs Park Harbormaster Facility located in downtown Gloucester right on Gloucester Harbor.

The City of Newburyport was awarded $448,059 to construct and maintain a Visiting Boater Facility that includes dedicated transient boater bathrooms complete with showers, a visiting boater laundry with washers and dryers, a 382-square foot reception and customer service area, and a 92-foot ADA compliant ramp. The project also includes six additional transient moorings and six additional dinghy dock spaces. This project is conveniently located along the Merrimack River Riverwalk in downtown Newburyport.

The Town of Manchester-by-the-Sea was awarded $360,222 to construct and maintain a new ramp and float system to provide new transient docking space for 10 recreational vessels that are 26 feet or longer and their dinghies (Figure 45). The project will allow transient vessels, currently required to anchor on transient moorings in the outer harbor, to access amenities and services. Lack of dockage is the greatest obstacle to access for visiting vessels. The Town will provide handicap access via an ADA compliant 80-foot ramp from the pier to the float system.

Figure 45. Reed Park in Manchester-by-the-Sea site of proposed BIG Tier 2 transient dockage

The Town of Nantucket applied for a Tier I BIG grant in 2015. Nantucket proposes to replace 15 Nun buoys, 15 Can buoys, 20 Anchors, and 10 lights that will maintain and improve navigation for transient boats greater than 26 feet. This will help transient boaters safely access the island from the federal navigation channel through Nantucket and Madaket Harbors.

See Table 32 for a summary of projects completed and in progress in Massachusetts.

Table 32. Massachusetts BIG Project Summary, 2001 to 2015

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)	$25,000	100%
	Boston Harbor Islands Transient Moorings (Peddocks Island)		
	Owen Park Transient Dockage (Vineyard Harbor)	$53,752	100%
2005	Provincetown Transient Courtesy Float (MacMillan Pier)	$60,000	100%
2007	New Bedford Transient Navigational Aids & Moorings (New Bedford Harbor)	$95,000	100%
	New Bedford Transient Dinghy Dock (New Bedford Harbor)		
2009	Scituate Marine Center Transient Access (Scituate Harbor)	$90,000	100%
2011	Wessagusset Yacht Club Transient Dockage (Fore River, Weymouth)	$92,250	100%
2013	Wessagusset Yacht Club Transient Dockage Phase II (Fore River, Weymouth)	$92,250	100%
	Seaport Landing Marina Transient Dockage (Lynn)	$267,700	10%
2015	Solomon Jacobs Park Harbormaster Facility Project (Gloucester Harbor)	$263,930	10%
	Newburyport Visiting Transient Boater Project (Merrimack River)	$448,059	10%
	Manchester by-the-Sea Transient Boater Infrastructure Improvement Project (Manchester Harbor)	$360,222	10%
	Nantucket Transient Boater Navigational Project (Nantucket and Madaket Harbors)	Tier I Proposal applied for in 2015	

Outreach

The *MarineFisheries* Outreach Project is aimed at establishing a more consistent connection with the Massachusetts saltwater fishing community and general public. Funds for the project, including the salary of an information and education coordinator, are from the Marine Recreational Fisheries Development Fund.

In 2015, the fourth year of this project, a number of activities were completed. A "Marine Habitats of Massachusetts" coloring and activity book was created by the program's coordinator, Elaine Brewer. She

also published six reports in the Technical Report series in 2015, and co-edited two issues of DMF News, the *MarineFisheries* newsletter.

The second "Let's Go Fishing!" youth fishing clinic was held in August in Yarmouth (Figure 46). Pre-registered youngsters between the ages of seven and 15 participated in a number of activities, including learning knots, casting practice, and dropping baited lines from the Yarmouth fishing pier. A second fishing clinic was held in conjunction with the Cape Cod Canal Visitor's Center's Boater and Water Safety Day in June.

Figure 46. The "Let's Go Fishing!" youth angling clinic was held August 2015 in Yarmouth.

Outreach was present at various trade shows throughout the year. Informational brochures on research and policy were distributed at the Working Waterfront Festival in New Bedford, New England Boat Show in Boston, and the Fishing and Outdoor Expo in Worcester, among others.

MarineFisheries furthered its virtual interaction with Massachusetts residents by expanding online communications through Facebook (user MaMarineFisheries). Communications with constituents through our other platforms continued: Twitter (handle @MassDMF), YouTube (channel MA MarineFisheries), and Flickr (user MA MarineFisheries). *MarineFisheries* uses these platforms to share information regarding policy and research as well as to cross promote with sister agencies within the Commonwealth.

At year's end, there were 44 videos posted by the agency on the *MarineFisheries* YouTube channel. Brewer worked with *MarineFisheries* biologists to gather video from the field, then edited and produced each for YouTube viewing. Three videos contracted to be made and produced by Northern Light Motion Pictures, Inc. are included in the YouTube listings.

Brewer is a co-webmaster for the *MarineFisheries* pages on Mass.gov, which was migrated to a new platform in 2013. Page content was updated in response to current research and information and will continue to be, moving forward.

Since inception of *MarineFisheries* Outreach Project, Brewer has been the *MarineFisheries* representative to local and national educational groups including Massachusetts Marine Educators (MME), National Marine Educators Association (NMEA), and the New England Ocean Science Education Collaborative (NEOSEC). She is on the Marketing and Communication (chair), and North Shore High School Marine Science Symposium committees, as well as on the Board of Directors for MME. She is the chair of both the social media committee and the communications pod for NMEA, and was awarded the chair-elect position for NEOSEC. She will take on chair in July 2016.

Brewer also initiated a monofilament fishing line recycling program in 2015 and has developed new outreach materials pertaining to this program, circle hook promotion, and recreational fishing in general.

Seafood Marketing

One year after Governor Deval Patrick signed into law "An Act Promoting Economic Growth Across the Commonwealth," which established a Seafood Marketing Program within *MarineFisheries*, a coordinator, Wendy Mainardi, was hired which effectively marked the start of the program. Initial work began in late 2015 to increase the public's knowledge about the health benefits of consuming seafood, educate the public on fisheries management, create name recognition for the Commonwealth's seafood products, stabilize market prices, and develop a coordinated marketing strategy.

Staff began by conducting an unofficial survey of similar programs throughout the country, speaking with counterparts in several different states and non-profits to gain knowledge of best practices and challenges. Meanwhile, *MarineFisheries* staff became active with the MA Food Policy Council and continued to push seafood into the local food system movement by contributing to and utilizing the MA Food Plan, published December 2015.

In the interest of ensuring that no efforts are being duplicated and that there is stakeholder engagement during the planning process, staff worked to establish partnerships for programming. *MarineFisheries* collaborated with MA Farm to School to establish seafood as a future Harvest of the Month (May 2016) in public schools throughout the Commonwealth and continued to participate as a member of NOAA's Seafood Marketing Committee. Additional activities include working with various chef organizations, non-profits, and other Massachusetts state agencies to create outreach programs.

In March 2015, *MarineFisheries* participated in Food Export-Northeast's 2015 Seafood Buyer's Mission orientation leading a presentation on under-utilized species, including redfish, dogfish, and scup. More than $6 million in sales were made onsite by Northeast seafood dealers during the buyer's mission.

Efforts began at the end of the year to solicit proposals from marketing firms to conduct initial research to name and brand the educational material for the program.

The Seafood Marketing Program legislation established a 19-member steering committee composed of Governor-appointed industry members, legislators, and agency heads. The inaugural steering committee meeting will take place in Spring 2016 and the official launch of the program will take place in Summer 2016.

Scientific Diving

Scientific Diving is responsible for management of all scientific diving activities conducted by *MarineFisheries*. First organized in 1972, the program has evolved to meet the standards of the Occupational Safety and Health Administration's scientific diving exemption. This structure sets high standards for *MarineFisheries*' training and dive operations, affording *MarineFisheries*' divers greater protection from accidental injury and helping to ensure the success of research performed by diving.

MarineFisheries' scientific divers conducted over 600 dives in 2015 to support on-going research and monitoring programs, including artificial reef site surveys; benthic temperature monitoring; early-benthic-phase lobster suction surveys ; eelgrass monitoring and restoration; shellfish abundance and habitat surveys; maintenance of acoustic telemetry receivers; PCB monitoring sample collection; and dive program training.

Routine program management duties included diver training, equipment maintenance and repair, and maintenance of the air system.

Educational and outreach efforts to dive clubs, schools, and local dive shows continued. Highlights included a *MarineFisheries* booth at the Boston Sea Rovers Show, World Oceans Day, and the Beneath the Sea Show

in New Jersey. The Division also hosted the 2015 Boston Sea Rovers Summer Intern, Brendan Sullivan and the 2015 North American Our-World Underwater Scholar, Michele Felberg during the summer field season.

Capital Assets and Facilities Management

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 Hughes Hatchery and Research Facility in Vineyard Haven, a storage facility in New Bedford, and a subsidiary field office and storage facility in Sandwich.

In FY2015, *MarineFisheries* spent approximately $320,000 in facility planning, infrastructure maintenance, emergency repairs, and equipment. Office and restroom facilities were rehabbed at the Shellfish Purification Plant and plans were developed for a new heating system. A dry lab was built out at the Gloucester facility and renovations were completed on the conference room. Foundation repairs were completed at the Hughes Hatchery. Throughout the agency, outdated office equipment was replaced.

Vehicles and Boats

MarineFisheries maintains a fleet of 40 vehicles and 16 boats. Six passenger vehicles were replaced in 2015. In addition, a 23' Privateer with outboard, electronics, and trailer was purchased to replace a 15-year old vessel of the same size. Lastly, *MarineFisheries* obtained a surplus lobster style boat from the Office of Law Enforcement that was in need of repair; the 38' Southshore was sent out for a complete overhaul at a cost of $275,000 (see p. 59 for further detail).