Horseshoe crabs take to the beach for their annual spring spawning event.

Department of Fish and Game

Massachusetts Division of Marine Fisheries 2023 Annual Report

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Commonwealth of Massachusetts

Governor Maura T. Healey

Lieutenant Governor Kimberley L. Driscoll

Executive Office of Energy and Environmental Affairs

Secretary Rebecca L. Tepper

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Division of Marine Fisheries

Director Daniel J. McKiernan

www.mass.gov/marinefisheries

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Introduction

The Massachusetts Division of Marine Fisheries (DMF or Division) of the Department of Fish and Game is the Commonwealth's marine fisheries management agency. DMF 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

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

Achieve sustainable fisheries and healthy marine ecosystems through sound science, innovation, collaboration, effective leadership, and stewardship all serving to enrich the productivity and socioeconomic value of marine fisheries to the Commonwealth.

Goals

Advance understanding and stewardship of our living marine resources, including fish, habitat, and marine protected species.

Support sustainable commercial and recreational fisheries.

Protect public health through monitoring and management of shellfish resources and advance the development of a sustainable marine aquaculture industry.

Expand and foster regional science, management, and education partnerships.

Build and maintain a high level of staff professionalism and administrative leadership.

Frequently Used Acronyms and Abbreviations

USACE	US Army Corps of Engineers
ACCSP	Atlantic Coastal Cooperative Statistics Program
ASMFC	Atlantic States Marine Fisheries Commission
BOEM	Bureau of Ocean Energy Management (Federal)
CCB	Cape Cod Bay
CCS	Center for Coastal Studies (Provincetown)
DMF	Division of Marine Fisheries (Massachusetts)
EOEEA	Executive Office of Energy and Environmental Affairs (Massachusetts)
EPA	Unites States Environmental Protection Agency
FMP	Fishery Management Plan
GIS	Geospatial Information System
GOM	Gulf of Maine
ILF	In-lieu Fee
ISSC	Interstate Shellfish Sanitation Conference
LCMA	Lobster Conservation Management Area
MassBays	Massachusetts Bays National Estuarine Program
*Mass*CZM	Massachusetts Office of Coastal Zone Management
*Mass*DCR	Massachusetts Department of Conservation and Recreation
*Mass*DER	Massachusetts Division of Ecological Restoration
*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
*Mass*Wildlife	Massachusetts Division of Fisheries and Wildlife
MAFMC	Mid-Atlantic Fishery Management Council
MEP	Massachusetts Environmental Police
MEPA	Massachusetts Environmental Policy Act
MFAC	Marine Fisheries Advisory Commission (Massachusetts)
MRIP	Marine Recreational Information Program
NEFMC	New England Fishery Management Council
NOAA	National Oceanic and Atmospheric Administration (and NOAA Fisheries)
NSSP	National Shellfish Sanitation Program
OCC	Outer Cape Cod
PSP	Paralytic Shellfish Poisoning
RHL	Recreational Harvest Limit
SAFIS	Standard Atlantic Fisheries Information System
SMAST	School for Marine Science and Technology (at UMass Dartmouth)
SNE	Southern New England
USCG	United States Coast Guard
USFDA	United States Food and Drug Administration
USFWS	United States Fish and Wildlife Service
VTR	Vessel Trip Report
WEA	Wind Energy Area
YOY	Young-of-the-year

FISHERIES MANAGEMENT SECTION

Daniel J. McKiernan, Director, Section Leader

Fisheries Policy and Management Program

Personnel

Daniel McKiernan, Director
Melanie Griffin, Federal Fisheries Policy Analyst
Nichola Meserve, Interstate Fisheries Policy Analyst
Jared Silva, State/Local Fisheries Policy Analyst
Kelly Whitmore, Federal Fisheries Policy Analyst
Dr. Justin Bopp, Offshore Wind Specialist
Julia Kaplan, Communications Specialist

Overview

DMF is responsible for managing the Commonwealth's saltwater 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 public on state and regional fisheries management issues, and ensures adherence to administrative and regulatory 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). The MFAC and the Commissioner of the Department of Fish and Game must approve most regulatory changes that DMF proposes in order for them to be implemented.

Advisory Groups

Following below is a summary of 2023 proceedings by groups advising DMF on fishery management issues.

Marine Fisheries Advisory Commission

The Massachusetts Marine Fisheries Advisory Commission (MFAC) was established by the Legislature in 1961. It is a nine-member board, representing recreational and commercial fishing interests across 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. Extensive staff preparation occurs for these meeting including the development of recommendation memoranda on proposed regulatory changes that summarize public comment and review the biological and socio-economic impacts of alternatives; and preparation of informational presentations and written briefing on state, interstate, and federal fisheries management issues to keep the MFAC apprised of recent developments.

The MFAC convened for nine business meetings during 2023. Regulatory revisions and fishery specifications approved by the Commission and implemented during 2023 are included in the summary of fisheries management actions beginning on page 13. The MFAC's striped bass, law enforcement, and permitting subcommittees also met during the year. MFAC membership changed in 2023 with the appointment of Falmouth-based Christopher McGuire, director of the Massachusetts Ocean Program for The Nature Conservancy, to fill the seat vacated by Gloucester-based commercial fisherman Louis Williams. The MFAC posthumously awarded former DMF Shellfish Program Manager Michael J. Hickey the 2023 Belding Award for his lasting contributions to fisheries science and conservation (Figure 1). MFAC meeting summaries, minutes, and briefing materials are made available on the Division's website.

Figure 1. Members of the Hickey family accepting the 2023 Belding Award from DMF and the MFAC.

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 engage with the Division on 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 improving public access to marine recreational fisheries.

The panel held two meetings during 2023. The first meeting focused on the Division's recommended spending plan for the expected FY2024 fund appropriation of roughly $2.17 million, while the second meeting focused on mid-year project updates. The panel endorsed the Division's FY2024 spending plan, which included: construction costs for a replacement fishing pier in Salem Harbor at the historic Salem Willows Park; the Small Grants Program through which municipalities can compete for funds to finance public access improvement projects;

enhanced sampling and assessment of the recreational fishery; public informational and educational materials and programs; monitoring diadromous fish populations and a shad stocking effort in the Taunton River; monitoring fish populations at artificial reefs; and research into striped bass catch and release mortality rates.

Seafood Marketing Steering Committee

On August 13, 2014, "An Act Promoting Economic Growth across the Commonwealth" established a Seafood Marketing Program within DMF. The legislation laid out initial objectives of the program, required the appointment of a 19-member steering committee to guide DMF in the administration of the marketing program, and designated funding of up to $250,000 per fiscal year from commercial harvester and dealer permit revenues. The steering committee, chaired by the DMF Director, met virtually two times during 2023. At the June meeting, there was a focus on flatfish and Roger Berkowitz was a guest speaker. At the November meeting, Ellen Kahler and Joshua Stoll presented on the fisheries section of the New England Feeding New England Report. See Seafood Marketing (page 116) for additional programmatic information.

Shellfish Advisory Panel

The Shellfish Advisory Panel (SAP) was established by the Massachusetts legislature in 2021 (G.L. c. 130, §1C). Its purpose is to provide a public body to advise DMF on matters related to shellfish and create a forum for the dissemination of information relevant to shellfish resources and management and the discussion of emerging shellfish-related issues. This legislative action broadened and formalized an existing body, created by DMF in 2014 and meeting on an ad-hoc basis. A legislatively formed SAP was a primary objective of the Massachusetts Shellfish Initiative's 2021 Strategic Plan. The Panel meets at least twice annually to address ongoing matters of importance and emerging issues related to shellfish resources, fisheries, and management.

During 2023, the SAP met three times. In March, the SAP provided advice regarding proposals to be reviewed and discussed at the 2023 Biennial Interstate Shellfish Sanitation Conference (ISSC) meeting. Additionally, DMF informed the SAP it would not move forward a pilot program to further expand bulk tagging allowances for the commercial shellfish fishers and aquaculturists. In April, DMF and the SAP discussed seed supply issues, the potential for variances to be granted to municipalities to accommodate the primary sale of shellfish at municipally managed properties, the 2023 Control Plan for *Vibrio parahaemolyticis*, and outcomes from the 2023 ISSC meeting. Lastly, in November, the SAP was briefed on the status of the Special Review Process for the Massachusetts Environmental Policy Act's review of aquaculture siting; constable training; annual FDA reviews of DMF's management program; the redefinition and reclassification of certain shellfish growing areas; and a spatial monitoring pilot program for the surf clam dredge fishery to enhance the protection of sensitive marine habitats (e.g., eelgrass beds). Sub-committees on aquaculture license site transfers, seed supply, and bulk tagging remained in effect.

Public Input & Stakeholder Engagement

Input from commercial and recreational fishery participants and other stakeholder groups is integral to the Division's initiation, development, implementation, and monitoring of fisheries management initiatives. Stakeholder engagement is achieved through various structured processes including public hearings and comment periods; scoping and informational meetings; and the distribution of Advisories, the Division's newsletters, annual reports, and other publications. Such activities for 2023 are described below. Policy and Management staff also routinely participate in informal meetings with commercial, recreational, and non-traditional fisheries stakeholders at their request to discuss items of interest; and respond to constituent inquiries about fisheries management issues in the Commonwealth.

DMF Public Hearings & Comment Periods

State law requires DMF to conduct a public comment period and hold a public hearing(s) on most types of proposed amendments to the state's marine fisheries regulations. During 2023, four such comment periods were held including a total of five public hearings.

- March 31–May 1 comment period, with hearings on April 24 (Plymouth) and April 25 (Gloucester): Atlantic menhaden commercial quota management, and use of purse seines and carrier vessels; horseshoe crab commercial bait and biomedical fishery controls; summer flounder commercial trip limits; and groundfish maximum retention program.
- April 28–June 7, with a hearing on June 5 (virtual): emergency recreational fishery measures for scup and black sea bass.
- May 24–June 30, with a hearing on June 21 (virtual): emergency recreational size limit for striped bass.
- September 13–October 13, with a hearing on October 10 (virtual): emergency recreational fishery measures for cod and haddock.

Certain other actions, such as Director's Declaration to adjust commercial fishery limits for quota managed species, require a public comment period only. During 2023, written public comment was accepted on the following proposed actions:

- June 16–June 30: in-season adjustment to the 2023 commercial horseshoe crab bait harvest limit for mobile gear fishers.
- June 26–July 9: in-season adjustment to the 2023 commercial smooth dogfish trip limit.
- June 29–July 13: in-season adjustment to the 2023 Period II summertime commercial summer flounder trip limits.
- August 24–September 8: in-season adjustment to 2023 commercial menhaden trip limit triggers.
- October 26–November 9: in-season adjustment to the 2024 Period I commercial summer flounder trip limit.

DMF Scoping and Informational Meetings

DMF occasionally holds additional ad hoc meetings to inform the industry of and/or accept informal scoping comment on upcoming issues. During 2023, the following such events were held:

- January 19 scoping meeting (virtual) to collect input from shellfish dealers on a potential pilot program to expand the state's bulk tagging allowance for shellfish aquaculturists.
- January 12 scoping meeting (Gloucester) to discuss recent fishery performance and interstate management changes for Atlantic menhaden in order to inform regulatory proposals for the 2023 fishing season.
- March 13 scoping meeting (virtual) and February 28–March 15 scoping period to gather input on revising the recreational scup and black sea bass limits in accordance with ASMFC requirements.

Publications

Advisories: DMF released over 60 electronic notices to our subscriber list on various rule changes, public hearings, quota closures, and other important information. The use of our subscription service (Granicus' GovDelivery platform adopted in 2020) continued to prove effective in improving the quality and expanding the reach of our electronic communications with stakeholders. Advisories are also posted to the Division's website and social media platforms.

DMF News: DMF published its newsletter twice in 2023 (Figure 2). These publications serve to inform and

educate our constituents on major management, science, and administrative happenings at the Division. Distribution of the newsletter occurred in electronic format through the Division's website, listserv, and social media channels.

Annual Report: DMF published its *2022 Annual Report*.

Figure 2. The covers of the two 2023 editions of the DMF News.

Regional Councils and Interstate Commissions

New England Fishery Management Council

Some fisheries go beyond state level and are managed regionally in collaboration with the federal government. The Director of the Commonwealth's Division of Marine Fisheries serves as one of 18 voting members on the New England Fishery Management Council (NEFMC). One of eight regional fishery councils established in 1976 under the Magnuson-Stevens Fishery Conservation and Management Act, the NEFMC supports management of the living marine resources within the United States exclusive economic zone (EEZ), spanning from 3 to 200 miles offshore, from Maine through Connecticut. The regional councils develop federal fishery management plans (FMPs), which are implemented by NOAA Fisheries after it ensures that 10 National Standards within the Magnuson-Stevens Act have been met. The NEFMC has federal FMPs for: Northeast Multispecies (13 groundfish stocks), Atlantic Sea Scallop, Monkfish, Atlantic Herring, Northeast Skate Complex (seven species), Small-Mesh Multispecies (five groundfish stocks), Red Crab, Spiny Dogfish, Atlantic Salmon, and Habitat. Since regional fisheries don't recognize jurisdictional boundaries, the Division also seeks to balance state waters management of regional fisheries in a manner consistent with and in support of federal FMPs; in some cases, this is done with the ASMFC to coordinate management plans between federal and state waters.

Meetings: During 2023, staff represented Massachusetts at five NEFMC meetings; served on the Committees for Atlantic Herring, Atlantic Sea Scallop (Chair), Executive, Groundfish, Monkfish, Skate, and Spiny Dogfish (Vice

Chair); acted as NEFMC liaison to the MAFMC River Herring/Shad and Squid/Mackerel/Butterfish Committees; provided technical expertise to the Groundfish, Scallop, Atlantic Herring, and Habitat Plan Development Teams, the Northeast Trawl Advisory Panel, and Research Set-Aside (RSA) program for Atlantic Sea Scallops; and participated in over 100 Council related meetings, hearings, and workshops. In recognition of these cooperative activities and their benefit to the successful management of fisheries, the Council once again granted the Commonwealth funds to support management and technical assistance (see Grants section on page 112 for further details). Beginning in April, the Council began holding hybrid meetings allowing for in-person attendance by both members and the public.

Actions: Throughout 2023, the Council finalized specifications for access to its various managed fisheries and research priorities while advancing longer-term priorities including reducing Atlantic sturgeon bycatch in monkfish and spiny dogfish gillnet fisheries; identifying strategies for reducing gear interactions between on-demand gear and other fisheries, including mobile, fixed-gear, and recreational fleets; considering a scallop rotational harvest program within and/or around the Closed Area II Habitat Closure Area; transitioning management of Atlantic cod following redesignation of scientific stock structure; developing a scoping document to take comment on spatial and temporal allocation and management of Atlantic herring at the management unit level to minimize user conflicts, contribute to optimum yield, and support rebuilding of the resource; as well as revising the Council's overarching Risk Policy.

DMF staff continued to contribute to technical analyses and policy decisions at the NEFMC in support of 2023 work including habitat (offshore wind comments), Atlantic Sea Scallop Framework 38 (2024 specifications), Groundfish Framework 66 (2024–2026 specifications, uncertainty buffers, and triggers for accountability measures), and recreational recommendations to the Greater Atlantic Regional Fisheries Office for management of Gulf of Maine cod and haddock.

Coordination of NEFMC Nominations: DMF 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. Ms. Jackie Odell of Hamilton, MA was appointed by the Secretary of Commerce to replace outgoing Massachusetts member Ms. Libby Etrie, Esq. who had reached her term limit having served nine years on the Council. Mr. John Pappalardo of Chatham, MA was re-appointed by the Secretary of Commerce.

Executive Director Appointment: Long-serving Executive Director Tom Nies announced his retirement from the NEFMC in January 2023. Staff served on the Search Committee that oversaw the search and hiring of the next Executive Director over the next six months. The Council announced in June that it had selected Dr. Cate O'Keefe as its next Executive Director. With over 20 years of experience in fisheries science and management, including four years as a marine science and policy analyst at MA DMF, Dr. O'Keefe was expected to bring her extensive experience to bear advancing the work of the Council.

Atlantic States Marine Fisheries Commission

The Atlantic States Marine Fisheries Commission (ASMFC) coordinates the conservation and management of 27 nearshore, migratory fish and shellfish species along the Atlantic coast. The Commission was formed through an Interstate Compact, ratified by the states and approved by the U.S. Congress in 1942. Each member state from Maine through Florida is represented by three Commissioners—the director of the state's marine fisheries management agency, a state legislator, and an individual appointed by the state's governor to represent stakeholder interests—who collectively have one combined ballot on votes taken by the Commission's species management boards. These species management boards develop and adopt interstate FMPs, which are then implemented at the state level. Failure to implement interstate FMP requirements can result in a non-compliance determination triggering the U.S. Department of Commerce to close a state's fisheries until regulatory compliance occurs. In addition to interstate fisheries management, Commission deliberations also

address fisheries science, habitat conservation, and law enforcement.

Meetings: During 2023, Massachusetts had a declared interest and served on 16 species management boards, including American eel, American lobster/Jonah crab, Atlantic herring, Atlantic menhaden, Atlantic striped bass, Atlantic sturgeon, bluefish, coastal sharks, horseshoe crab, northern shrimp, shad/river herring, spiny dogfish (Chair), summer flounder/scup/black sea bass (Chair), tautog, weakfish, and winter flounder. DMF represented Massachusetts at the four routine quarterly meetings of the ASMFC, plus seven additional Board-specific meetings, two of which were held jointly with the MAFMC on co-managed species, and the East Coast Climate Change Scenario Planning Initiative. At the 2023 Annual Meeting, DMF Director McKiernan was elected Vice-Chair of the ASMFC. Management and Policy staff also served on several committees that were active in 2023 including the Striped Bass Plan Development Team (for Addendum II to Amendment 7), Spiny Dogfish Monitoring Committee (for specification setting), and the Northern Shrimp Work Group (addressing future assessment and management challenges), and also attended the meetings of various other technical, scientific, and monitoring committees to stay informed and contribute to the latest developments in interstate management issues.

Public Hearings: States are afforded the opportunity of a public hearing for any draft addendum or amendment to the ASMFC's interstate fishery management plans. DMF assists ASMFC in the scheduling and moderation of such hearings. During 2023, DMF hosted four ASMFC public hearings to collect stakeholder input on the following management actions: American Lobster Draft Addendum XXVII (March 15/virtual, March 29/Quincy); and Atlantic Striped Bass Draft Addendum II (December 5/Bourne, December 19/Gloucester).

Actions: Several of the more remarkable interstate fishery management actions that DMF management and policy staff played an integral role in 2023 included: the Striped Bass Management Board's emergency action to revise the 2023 recreational measures in response to a drastic harvest increase in 2022 that if continued threatened the stock's rebuilding timeline and the initiation and development of Draft Addendum II to reduce fishing mortality to the target level in 2024; the adoption of American Lobster Addendum XXVII to increase the protection of GOM/GBK lobster spawning stock biomass through the standardization of certain measures across management areas and a management trigger to enact additional conservation measures when triggered by declining recruitment indices; the Horseshoe Crab Management Board's updating of best management practices for the handing of horseshoe crabs for biomedical purposes; and the Policy Board's revisions to the Commission's guidance document on the use of Conservation Equivalency in management plans and recommendation to the MAFMC against renewing the Research Set-Aside Program for species managed jointly with ASMFC.

Fisheries Management Actions

Described below are the fishery management actions enacted by DMF during 2023. Actions fall into several categories: permanent regulatory changes to 322 CMR (Code of Massachusetts Regulations) which can occur only after a public hearing and comment period on the proposals and are subject to MFAC and DFG Commissioner approval of the Director's recommendation; temporary (90-day) regulatory changes to 322 CMR under the Director's Emergency Authority for the preservation of the public health, safety or general welfare; annual specifications and adjustments under the Director's Declaration Authority as established in pertinent regulations, some of which require public comment periods; time-specific authorizations or restrictions per Letters of Authorization, Permit Conditions, Pilot Programs, and Quota Transfers. This list does not include regulatory changes approved by the MFAC in 2023 but not codified until 2024; such items will be covered in the 2024 Annual Report.

Atlantic Herring

Area 1A Effort Control Permit Conditions: DMF implemented landing days, possession limits, and seasonal closures for the directed herring fishery in Area 1A (inshore Gulf of Maine) consistent with ASMFC Herring Management Board decisions. Letters of Authorization were issued to vessels which had declared into the directed fishery through DMF's opt-in process and according to their federal category permit. The Massachusetts/New Hampshire spawning area closure was also implemented per the FMP's default closure dates (September 23–November 3).

Atlantic Mackerel

Recreational Mackerel Regulations: Effective January 20, 2023, DMF established a new recreational mackerel limit of 20 fish per day. This limit applies both as a harvest limit and as a per person possession limit, except for lawfully caught mackerel aggregated shoreside for future use (e.g., in coolers or holding cars). This action complemented the MAFMC's adoption of a 20-fish recreational limit for federal waters. The MAFMC adopted a recreational possession limit and a federal commercial quota reduction as part of a revised rebuilding plan for mackerel responding to the 2021 stock assessment which indicated an overfished and experiencing overfishing stock status for the species.

Commercial Mackerel Regulations: As a complement to the new recreational possession limit (see above), DMF also adopted a new commercial mackerel endorsement for 2023. This endorsement is required to retain, possess, or land mackerel for sale or to catch, possess, or land more than the recreational limit, including the possession of mackerel to use as bait in another commercial fishery. This permit requirement enables DMF to distinguish between commercial and recreational fishing effort for mackerel and better monitor and collect data on the commercial fishery in Massachusetts.

Atlantic Menhaden

Commercial Permit Conditions and Regulations: For the 2023 season, DMF implemented new rules affecting the commercial menhaden fishery that responded to revisions of the interstate fishery management plan and aimed to improve other aspects of the state's management, with goals for a high level of compliance and accountability and minimizing user group conflict. Addendum I to Amendment 3 revised the state quota shares to reflect more recent landings (increasing Massachusetts' share from 1.27% to 2.12%), removed purse seines from the post-quota incidental catch and small-scale fishery (IC/SSF) allowance, and requires the ASMFC Menhaden Management Board to take further action to reduce IC/SSF landings if they cause the coastwide total allowable catch (TAC) to be exceeded. These revisions warranted modifications to the state's quota management system. The state's new rules were first established by permit condition on May 19 to ensure they went into effect at the start of the season, followed by final regulations that took effect on July 23.

The new rules: 1) adopted a June 15 season start date and restricted landings prior to this date to small-scale directed and non-directed gears (i.e., no purse seines) at a 6,000-pound limit harvested from state waters, with a continuation of the exception for limited entry weir fishers; 2) revised the limited access fishery's quota use triggers and trip limits to 120,000 pounds until 50% quota use, followed by 25,000 pounds until 90% quota use, and 6,000 pounds for the remaining 10% of quota; 3) moved into the regulations various restrictions on the use of purse seines and carrier vessels typically established in permit condition, with the addition of a prohibition on the use of purse seines on Fridays while the 120,000-lb limit is in place and a requirement for seine nets to be annually inspected for compliance with size restrictions beginning in 2024; 4) restricted landings after the quota is taken to small-scale directed and non-directed gears only (i.e., no purse seines) at a 6,000-pound limit harvested from state waters; 5) restricted landings during the Episodic Event Set Aside fishery to a 6,000-pound limit, adjustable by the Director up to 120,000 pounds; 6) established a vessel hold capacity certification and

marking requirement beginning in 2024 for any vessel to possess or carry menhaden at the limited entry fishery trip limits; 7) established daily electronic harvester reporting prior to landing from all limited entry permit holders, beginning in 2024; and 8) adopted a June 14, 2023 control date for menhaden permit endorsements and Coastal Access Permit-Purse Seine permit endorsements (the potential use of which would be subject to future rulemaking).

Commercial Declaration: Effective September 20, DMF waived the trigger that would have reduced the limited entry fishery trip limit from 120,000 pounds to 25,000 pounds were 50% of the quota to be taken. While the 50% quota use trigger was never reached, this waiver would have allowed the fishery to continue at the 120,000-pound limit until 90% of the quota were taken. This action responded to low quota utilization negating the need to reduce the trip limit to preserve season length. The inshore availability of menhaden in 2023 did not follow the trend of recent years in which a large biomass of menhaden concentrated in many of the state's coastal waters for an extended period of time. Environmental or ecosystem conditions may have contributed to reduced inshore availability, which along with the menhaden management measures newly implemented this year (including a later season start date, see above) contributed to the fishery's reduced landings in 2023.

Atlantic Striped Bass

Recreational Regulations: Effective May 26, DMF changed the maximum length for keeping recreational striped bass from less than 35" to less than 31". As a result, the new recreational slot limit became 28" to less than 31". This responded to an emergency action taken by the ASMFC on May 2. The basis for taking emergency action was that striped bass recreational harvest coastwide nearly doubled in 2022. This unexpectedly high harvest greatly reduced the probability of rebuilding the overfished striped bass stock by 2029, which is the goal of the interstate management plan. The main reason for the increase in harvest was that some striped bass from the abundant 2015 year-class, those fish born in 2015, had grown enough to be harvested under the 2022 slot limit (28" to <35"). In 2023, the 2015 year-class would be nearly entirely recruited into this size range, meaning this robust year class would be highly available for harvest if the slot remained 28" to <35", whereas the new slot limit was expected to protect more than 50% of the year class. The 2015 year-class is important to the future of striped bass because it is one of the few large year-classes that has been produced in the past 20 years. The ASMFC also initiated an addendum to examine if additional recreational and commercial measures would be needed in 2024 to stay on track for rebuilding and extended the emergency measures to stay in place until replaced by the addendum.

Groundfish

American plaice, cod, haddock, halibut, ocean pout, pollock, redfish, windowpane flounder, winter flounder, witch flounder, wolfish, and yellowtail flounder are managed as part of a federal multispecies FMP. DMF also includes monkfish in its definition of multispecies groundfish. Any management actions affecting these species are thus grouped.

Recreational Cod and Haddock Regulations. In mid-August 2023, NOAA Fisheries implemented its recreational fishing limits for Gulf of Maine cod and haddock and Georges Bank cod for the 2023 Fishing Year (May 1 – April 30). DMF complemented these limits through an emergency action effective September 15 and later adopted them as final regulations. For Gulf of Maine cod, the April 1–April 14 season was eliminated in favor of extending the fall season from September 1–October 7 to September 1–October 31; the 1-fish bag limit and 22" minimum size were maintained. For Georges Bank cod, the open season was shifted by one month from August 1–April 30 to September 1–May 31 and the 22–28" slot limit was eliminated in favor of a 23" minimum size; the 5-fish bag limit was maintained. For Gulf of Maine haddock, a split mode management approach was adopted providing distinct rules for private vessel anglers as compared to anglers on for-hire vessels. For private vessel anglers, the

bag limit was reduced from 20 fish to 10 fish and the April 1–February 28 open season and 17" minimum size were maintained. For for-hire anglers, the bag limit was reduced from 20 fish to 15 fish and the minimum size was increased from 17" to 18"; the open season of April 1–February 28 was maintained.

Complementary Regulations for Federal Groundfish Maximum Retention and Electronic Monitoring Program: Effective July 21, DMF adopted regulatory language to complement the federal FMP's groundfish maximum retention and electronic monitoring (MREM) program, which was formalized into the federal plan in January 2023 as part of Amendment 23. These allow authorized commercial fishers and dealers to possess and sell groundfish that do not conform to the state's minimum size standards provided they were lawfully caught in federal waters by sector vessels participating in the MREM program.

Horseshoe Crab

Commercial Regulations: For 2023, DMF capped total commercial harvest and mortality by the commercial horseshoe crab fishery. This was accomplished through the adoption of the first-ever biomedical quota (separate from the existing bait quota), eliminating the potential for uncontrolled growth in the biomedical fishery which could negatively impact the resource moving forward. The biomedical quota was set at 200,000 horseshoe crabs annually, to be divided evenly among active biomedical processors; this is slightly above 2022 harvest levels (~175,000 horseshoe crabs). This was offset by a 25,000-crab reduction in the bait quota from 165,000 horseshoe crabs annually to 140,000, which reflects the importance of the biomedical production of limulus amebocyte lysate for human health and safety. DMF also enacted several measures to enhance the transparency of the biomedical fishery management program. This included establishing the best management practices adopted by the ASMFC as regulation, and for 2024, creating new permit categories specific to biomedical harvesters, dealers, and processors. These rules were effective July 21.

Commercial Declaration: DMF implemented an in-season adjustment affecting the trip limits in the 2023 horseshoe crab bait fishery to slow quota consumption, delay an early season quota closure, and reduce regulatory discarding in mixed species mobile gear fisheries. Effective July 11 (and until the fishery was ultimately closed on August 6), this in-season adjustment reduced the limited access horseshoe crab trip limit for mobile gear from 300 crabs to 200 crabs and the open access trip limit from 75 crabs to 50 crabs.

Lobster

Electronic Monitoring Devices in Commercial Lobster Trap Fishery: Effective May 1, Massachusetts commercial lobster permit holders who also hold a federal lobster trap permit were required to install and have operational electronic monitoring devices on their vessels. This was required by the ASMFC through Addendum XXIX to Interstate Fishery Management Plan for American Lobster and Addendum IV to the Interstate Fishery Management Plan for Jonah Crabs. The purpose of the requirement is to enhance the collection of high resolution spatio-temporal data to address a variety of ongoing and emerging issues relevant to marine spatial planning (e.g., wind energy, aquaculture, marine protected areas) and fisheries management (e.g., protected species risk assessment and stock assessments).

Protected Species

Recreational and Commercial Trap Gear Regulations: Effective January 20, DMF rescinded the requirement that recreational and commercial trap gear be rigged with a weak link at the buoy that is capable of breaking at 600 pounds of pressure. Weak links were designed to allow for a buoy line to part should it entangle a right whale. However, the entanglement record shows little evidence the gear modification works as intended and ultimately does not lead to risk reduction. While no longer required, fishers may continue to deploy buoy lines with the device installed if they so choose. Additionally, DMF modified the November 1–May 15 seasonal closure to

recreational trap gear such that the closure may be extended beyond May 15 or rescinded after April 30 by Declaration based on the presence or absence of right whales. This dynamic management approach had been successfully utilized for the commercial fixed gear closures for several years, leading to its application to recreational fixed gear as well.

Seasonal Fixed Gear Closure Declaration: To reduce the risk of right whale entanglement in fixed gear buoy lines, state regulations establish seasonal closures for gillnets and trap gear that may be adjusted (as described above). In 2023, these gear closures were lifted effective May 8 as a result of aerial surveys demonstrating right whales had migrated out of state waters.

Vessel Speed Limit Declaration: To reduce the risk of ship strikes on right whales, state regulations establish a speed limit of 10 knots for small vessels (<65' overall length) operating within Cape Cod Bay during March and April, although this timing may be adjusted by Declaration as reasonably necessary to prevent vessel strikes. In 2023, the speed limit was extended through May 7 given the continued presence of right whales in the area.

Sharks

Short Fin Mako Regulations: Effective January 20, DMF prohibited the retention, possession, and landing of shortfin mako sharks from Massachusetts' state waters, with an exemption for the possession and landing of shortfin mako caught legally in federal waters (should it be allowed in the future). This action was taken to comply with the ASMFC's approval of a zero-retention limit in state waters, a complimentary action to NOAA Fisheries' plans to rebuild the overfished stock of shortfin mako consistent with recommendations of the International Commission on the Conservation of Atlantic Tunas. Because most shortfin makos are caught in federal waters or by federal permit holders, the state waters prohibition with federal exemption will avoid unnecessary administrative burden from potential retention limit changes.

Smooth Dogfish Commercial Declaration: To reduce regulatory discarding and enhance utilization of the state's 2023 smooth dogfish quota, DMF increased the daily trip limit from 100 pounds to 300 pounds through an in-season adjustment effective July 11. DMF intended to review the performance of the 2023 fishery in early 2024 to determine if it would be appropriate to adopt this trip limit increase by regulation moving forward.

Spiny Dogfish Quota Transfers: The Northern Region states of Maine–Connecticut transferred 1.5 million pounds of FY 2022 quota to Virginia in February 2023, and 1.0 million pounds of FY 2023 quota to Virginia in December 2023. These transfers assisted Virginia in avoiding an early quota closure without impacting the Northern Region fishery. All such transfers require multi-state agreement and ASMFC approval per FMP requirements.

Summer Flounder, Scup, and Black Sea Bass

Summer flounder (fluke), scup, and black sea bass are managed as part of a multispecies FMP; their management actions are thus grouped.

Summer Flounder Commercial Period I Declaration: DMF made a temporary adjustment to the Summer Flounder Period I (January 1–April 22) commercial trip limit to increase the fleet's access to the state's available quota, which had been underutilized since 2019. A Director's Declaration was used to increase the limit for the whole of the 2023 Period I fishery from the regulatorily-set 3,000 pounds to 10,000 pounds.

Summer Flounder Commercial Period II Regulations: DMF made several regulatory adjustments to its commercial summer flounder rules effective July 21 to take advantage of the available commercial quota. This included increasing the April 23–August 31 trip limit from 500 pounds to 600 pounds for net fishers and from 300 pounds to 400 pounds for hook fishers; increasing the trip limit that applies on October 1 (through December 31) should more than 5% of the annual quota remain from 3,000 pounds to 10,000 pounds;

lengthening the "landing window" when vessels are allowed to possess and land summer flounder by two hours, from 6AM–8PM to 6AM to 10PM; and revising the small-mesh trip limit language to clarify that only vessels fishing with small mesh are subject to the 100-pound incidental catch limit.

Summer Flounder Commercial Period II Declaration: To expedite the implementation of the above-described regulatory increase to the Period II summertime trip limits, DMF used a declaration to set a 600-pound net trip limit and 400-pound hook trip limit effective July 11.

Summer Flounder Commercial Multi-State Possession Limit Pilot Program: DMF renewed its seasonal wintertime summer flounder pilot program for 2023. Under this program (begun in 2020), vessels fishing offshore in the federal zone during the Period I fishery (January 1–April 22) that are also permitted to land summer flounder in any other Atlantic coast state were authorized to possess multiple states' trip limits when offloading in Massachusetts. Participation in the pilot program was granted through Letters of Authorization issued to eligible harvesters. Where properly permitted, the program also included black sea bass. This allowance, which provides additional flexibility and efficiency to the fleet, is contingent on the vessel properly labeling the catch destined for each state, not exceeding the aggregate trip limit for the participating states where they are permitted, and not offloading more than the state's applicable landing limit. Additionally, participating vessels must be equipped with a Vessel Monitoring System authorized by NOAA Fisheries.

Summer Flounder Commercial Trawl Fishery Consecutive Daily Trip Limit Pilot Program: Via Letters of Authorization effective June 1 through September 30, DMF renewed the pilot program begun in 2019 allowing trawlers during the summertime fishery to retain and land two consecutive days' limits of summer flounder (and black sea bass and whelk where properly permitted to avoid unnecessary discarding in the mixed-species trawl fishery). The program contains provisions that require the vessel operator to segregate the first day's catch into a sealed container (fastened with a DMF-issued tag) and provide documentation regarding each day's fishing activity in a DMF-issued logbook. This program was designed to provide small-scale trawlers increased flexibility, safety, and efficiency in targeting the available fluke quota.

Scup Recreational Regulations: The recreational scup limits were amended by emergency regulation to contribute to a coastwide 10% harvest reduction, as required under the interstate fishery management plan. The Northern Region of Massachusetts–New York achieved this reduction by removing January–April from the open season; reducing the bag limit from 50 fish to 40 fish during the for-hire bonus season (May–June in Massachusetts); and increasing the minimum size from 10" to 10.5" for vessel-based anglers (both for-hire and private). Out of environmental justice concerns, the minimum size for shore-based anglers was reduced from 10" to 9.5", as larger fish tend to be less available to this mode. The possession limit otherwise remained at 30 fish during May–December. These emergency regulations were later adopted as final regulations.

Black Sea Bass Recreational Regulations: The recreational black sea bass limits were amended by emergency regulation to contribute to a coastwide 10% harvest reduction, as required under the interstate fishery management plan. Massachusetts achieved this reduction through increasing the minimum size by ½" from 16" to 16.5". The season was minimally adjusted from May 21–September 4 to May 20–September 7, and the bag limit remained at 4 fish per angler. These emergency regulations were later adopted as final regulations.

Commercial Quota Transfers: DMF accepted a transfer of commercial summer flounder quota (529 pounds) from North Carolina in September to account for landings made by a vessel bound for that state but granted safe harbor in Massachusetts due to mechanical issues. DMF also transferred 25,000 pounds of summer flounder to Rhode Island in December, to assist that state in avoiding a quota overage without impacting the Massachusetts fishery. Additionally, DMF transferred commercial Summer Period scup quota to two states to help augment their allocations and avoid premature fishery closures with no impact on Massachusetts' fishery: 200,000 pounds to Connecticut in April, and another 150,000 pounds in July; and 1,000 pounds to Maryland in August. All such transfers require multi-state agreement and ASMFC and/or NOAA Fisheries approval per FMP

requirements.

Tautog

Recreational Regulations: For 2023, DMF adopted a 21” maximum size for the recreational tautog fishery, resulting in a slot limit of 16” to 21”. Under this slot limit, there is an allowance for an angler to retain one “trophy” fish measuring greater than 21” per calendar day, and high grading is prohibited. This action aligned Massachusetts’ recreational tautog size limits with Rhode Island’s, as the two states comprise a single management region under the Interstate Fishery Management Plan. Having consistent rules across jurisdictions should enhance compliance and enforcement and limit the impact of potential eastward movement of fishing effort into Massachusetts and Rhode Island to target the region’s relatively healthy stock of tautog.

Whelk

Commercial Regulations: DMF revised the schedule to increase the whelk gauge minimum width. The prior schedule had the whelk gauge width increasing by ⅛" every other year until a terminal gauge width of 3 ⅝" would be reached in 2029. The revised schedule delayed the ⅛" increase due in 2023 until 2024, and re-assigned the remaining ⅛" increases to occur every third year thereafter (rather than every other year). The terminal gauge width remains 3 ⅝", but this will not be reached until 2033 under the revised schedule. A 3 ⅝" gauge width corresponds to the shell size where 50% of female whelks reach sexual maturity in the primary harvest area of Nantucket Sound. This action was taken in response to an industry petition expressing concerns about diminished fishery performance and its potential impact on shoreside infrastructure.

General Matters

Area 1A Mobile Gear Fishing Season Regulations and Declaration: Beginning in 2023, DMF extended the open season for the mobile gear exemption area off Gloucester and Rockport (Area 1A). The North Shore (Area 1A from Winthrop to the New Hampshire border) is closed to mobile gear year-round to prevent gear conflict with inshore trap fisheries, with the exception of the Area 1A mobile gear exemption area. April 1–May 15 was added to the prior season of February 1–March 31 and June 15–September on the basis of this area having recently been closed to trap gear fishing (for right whale protection) and an industry request for greater sea scallop access. Mobile gear access may be rescinded sooner than May 15 by Director’s Declaration should the fixed gear closure open early in response to right whales migrating out of state waters. This occurred on May 8 in 2023.

Free Saltwater Fishing Days Declaration: DMF declared June 17 and 18 as the Commonwealth’s free saltwater fishing days for 2023. By statute, the Division may establish two such days per year when anglers need not have a saltwater recreational fishing permit to fish the marine waters of the state, out to 3 miles.

Adjudicatory Proceedings

Under state law, DMF may take administrative action to sanction commercial and recreational fishing permits for violations of the state’s marine fishery laws and regulations subject to a due process adjudicatory proceeding. These adjudicatory proceedings are held before a magistrate. They may be initiated by the agency, the Environmental Police, or municipal officials authorized to enforce the marine fishery laws of the Commonwealth.

In 2023, DMF initiated five proceedings based on violations that occurred during 2022 and 2023. The first proceeding addressed menhaden trip limit, reporting, owner-operator, and primary purchase violations. This matter was settled prior to the hearing resulting in the individual permanently transferring out of the state’s menhaden fishery. The second proceeding addressed fishing during the recreational trap closure and the

possession of egg-bearing female lobsters. This matter was concluded by a default judgment allowing the agency to not renew and permanently revoke the recreational lobster license and deny the issuance of a recreational lobster license to any person residing with the individual. The third matter addressed the harvest of shellfish from a contaminated area and the mistagging of the unlawfully harvested shellfish. This matter was settled prior to hearing resulting in a suspension of the commercial shellfish permit through 2024 and a three-year probationary period should the license be reinstated in 2025 or thereafter. The fourth matter dealt with violations of the state's lobster trap tag and trap allocation rules and involved two Coastal Lobster Permits. This matter was settled prior to hearing with one permit holder agreeing to not renew and thereby retire their Coastal Lobster Permit and the other permit being transferred to family member with limitations on who may fish the permit and how many traps may be fished. The last matter dealt with the mistagging and misreporting of shellfish and direct-to-public sales and this matter remains ongoing.

One adjudicatory proceeding initiated in 2022 was concluded in 2023. This matter addressed violations of the state's February 1–May 15 Commercial Trap Gear Closure to Protect Right Whales. This matter was settled before going to hearing. The settlement required the permit holder annually remove all gear from the water by December 1 annually from 2024–2027 and established various requirements to enhance conformity with protected species regulations.

Offshore Wind

The Commonwealth of Massachusetts supports the co-existence of the offshore wind industry and the fishing community. DMF engages in offshore wind development by working directly with developers to minimize impacts during project siting and layout, reviewing offshore wind project fisheries and habitat monitoring plans, organizing and participating in state and regional working groups to improve regional research efforts, contributing to preparation of federal guidelines for monitoring and fisheries compensation, and providing best management recommendations to state and federal agencies in response to developer permitting submissions.

Massachusetts Fisheries Working Group on Offshore Wind

The Massachusetts Fisheries Working Group provides an important forum for maintaining a dialogue with key stakeholders, getting their feedback and guidance, and identify issues and concerns regarding offshore wind development and operation on the Atlantic outer continental shelf. The Group is convened and managed by the Massachusetts Office of Coastal Zone Management (*Mass*CZM) and DMF in coordination with the Massachusetts Clean Energy Center, and includes a range of commercial and recreational fishery representatives, scientists, and state and federal agencies. Following the siting and leasing process, the Fisheries Working Group evolved into a forum for developers, state and federal agencies, and the fishing community to discuss topics relating to the offshore wind projects proposed for Lease Areas within the Wind Energy Areas (WEAs). Held quarterly, Fisheries Working Group meetings in 2023 covered topics including permitting, navigation and transit, habitat and fisheries monitoring, construction updates, fisheries economic exposure/compensation and gear loss claims, boulder relocation mitigation, unexploded ordnance detection, Gulf of Maine wind energy planning, and the regional fund administrator fisheries compensation initiative among 11 Atlantic U.S. States.

Commercial Fisheries Commission

In Chapter 179 of the Acts of 2022, "An Act Driving Clean Energy and Offshore Wind," Section 79 established a Commercial Fisheries Commission to develop and recommend strategies, methods, and tools to promote the long-term sustainability of the Commonwealth's commercial fishing industry amidst the development of offshore energy projects. This public body is co-chaired by DMF and *Mass*CZM. Throughout 2023, Governor

Healey appointed the 16 members of the public. The Commission was expected to begin meeting in 2024. The Commission is charged with meeting at least four times per year through 2030 and producing an annual report.

Wind Energy Area Developments

In 2023, DMF continued to participate in ongoing coordination with the Department of the Interior's Bureau of Ocean Energy Management (BOEM) and the states of Maine and New Hampshire to establish siting principles for potential WEAs in the Gulf of Maine. In October, BOEM announced a draft WEA in the Gulf of Maine consisting of 3.5 million acres off the coasts of Massachusetts, New Hampshire, and Maine (Figure 3)—a 64% reduction from the original Call Area. BOEM partnered with NOAA's National Centers for Coastal Ocean Science to develop a spatial suitability model for identifying the most versus least suitable areas to potentially lease for wind energy development in the draft WEA. The model included over 90 data layers across four sub-models that represented the wind energy industry, fishing industries, natural and cultural resources, and shipping/navigation routes. DMF filed a comment letter on the Gulf of Maine draft WEA in November during the BOEM public comment period. In the letter, DMF recommended that some sections of the draft WEA be removed from offshore wind leasing, particularly with concern to the potential impact to the groundfish fishery. DMF also identified concerns for the draft WEA regarding the maintenance of fleet diversity, major fisheries transit areas, fishery independent surveys, and shoreside port impacts.

In 2012, the Bureau of Ocean Energy Management (BOEM) established two Wind Energy Areas (WEAs) south of Martha's Vineyard and Nantucket. By 2022, these WEAs had been divided into nine Lease Areas held by six developers. Projects in these WEAs, including three in the Rhode Island–Massachusetts area and six in the Massachusetts area, were undergoing varying stages of construction, site assessment and permit review in 2023 (Table 1). South Fork Wind completed construction of its 12 wind turbine generators and Vineyard Wind began monopile foundation installation in 2023, constructing 10 if its 64 wind turbine generators. Revolution Wind was expected to be the next MA/RI wind area to start offshore wind construction (anticipated mid-to-late 2024).

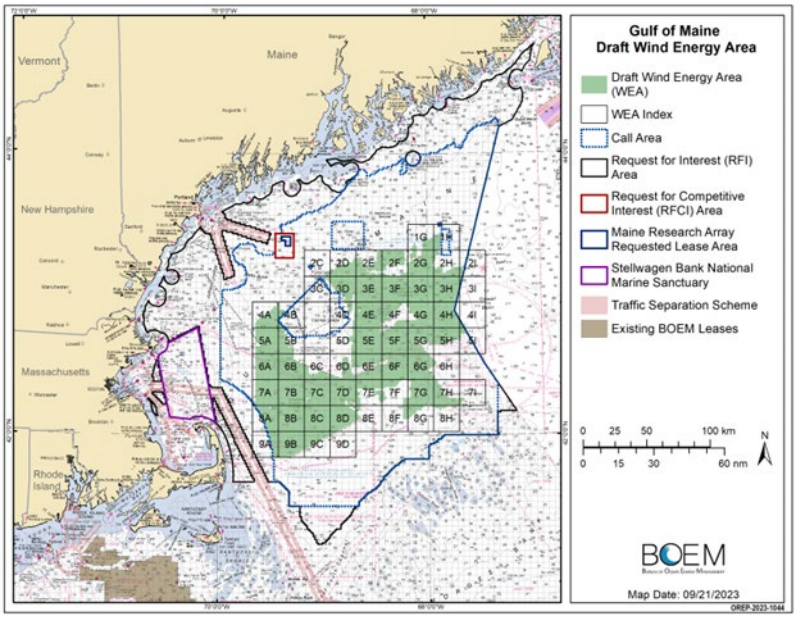

Figure 3. Gulf of Maine Draft Wind Energy Areas (Credit: BOEM).

In 2023, Notice of Intents (NOIs) were announced to prepare Draft Environmental Impact Statements (DEIS) that were submitted for New England Wind and SouthCoast Wind (formally Mayflower Wind). DMF performed environmental review of applications to the Massachusetts Environmental Policy Act (MEPA) as well as town, state, and federal permitting agencies for several offshore wind-related projects. Export cable projects in Massachusetts state waters associated with the WEA that underwent environmental review in 2023 included Park City Wind's New England Wind 2 Connector project, and South Coast Wind LLC. Topics of concern included impact-producing factors (e.g. noise from pile-driving) associated with project construction, species vulnerabilities in Muskeget Channel, Nantucket Sound, and Mt. Hope Bay, benthic and finfish monitoring design, and compensatory mitigation for affected fisheries.

Table 1. Leasing & Permitting Status of Massachusetts and Rhode Island Wind Energy Areas (WEAs) as of December 31, 2023.*

Lease Number	Project Name	Developer(s)	Site Assessment Plan Status	Construction & Operations Plan Status	Enviro. Impact Statement Status	Record of Decision Status
RI OCS-A 0486	Revolution Wind	Ørstead/ Eversource	Approved	Approved	Final Published	Approved
RI OCS-A 0517 (Formerly 0486)	South Fork	Ørstead/ Eversource	Approved	Approved	Final Published	Approved
RI OCS-A 0487	Sunrise Wind	Ørstead/ Eversource	Approved	Approved	Final Published	Approved
MA OCS-A 0500	Bay State Wind	Ørstead/ Eversource	Approved	N/A	N/A	N/A
MA OCS-A 0534 (Formerly 0501)	New England Wind (Park City Wind & Commonwealth Wind)	Avangrid	Approved	Submitted	Final Published	Pending- Expected April 2024
MA OCS-A 0501	Vineyard Wind 1	Avangrid/ Copenhagen Infrastructure Partners	Approved	Approved	Final Published	Approved
MA OCS-A 0520	Beacon Wind	BP	Approved	N/A	N/A	N/A
MA OCS-A 0521	SouthCoast Wind	Shell	Approved	Submitted	DEIS	N/A
MA OCS-A 0522	Vineyard offshore	Avangrid/ Copenhagen Infrastructure Partners	Approved	Submitted	NOI	N/A

Source: State Activities | Bureau of Ocean Energy Management (boem.gov)
*Table does not provide an exhaustive list of permitting and consultation activities.

DMF assisted *Mass*CZM with review of Fisheries Economic Exposure analyses to determine projected fisheries impact/losses associated from construction, operation, and decommissioning in multiple lease areas in Southern New England. Following these reviews, fisheries compensatory mitigation packages were developed for three wind projects: Revolution Wind, Sunrise Wind, and New England Wind (Park City and Commonwealth Wind). DMF reviewed these compensation packages and made recommendations to help *Mass*CZM make informed negotiation decisions for each package. Direct compensation claims programs for the Revolution Wind, Sunrise Wind, and New England Wind will be administered by an independent third-party administrator. Massachusetts commercial and for-hire fishers will be eligible for funds from these three offshore wind projects if they experience impacts from phases of offshore wind development (construction, operations, and decommissioning).

Other Activities

Marine Fisheries Institute

The Massachusetts Marine Fisheries Institute (MFI) is a cooperative venture between DMF and the University of Massachusetts Dartmouth School for Marine Science and Technology (SMAST). Founded in 2002, 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. DMF's Director and SMAST's Dean co-chair the MFI with additional agency and university staff serving as research, education, and policy directors.

In 2023, the MFI continued its record of providing independent scientific research applied to regional, national, and international marine fisheries with an emphasis on cooperative research between scientists and fishermen. Expanding beyond traditional areas of focus on Northeast multispecies and Atlantic sea scallops, MFI researchers have been highly productive in a variety of areas, including a new emphasis on shellfish modeling and fisheries economics.

In addition to MFI contributions to research, MFI has also been a vehicle for advancing graduate education in fisheries-related fields. This includes direct involvement by and support for students in MFI research and workshop activities, participation by DMF scientists in graduate and post-doctoral advising and development of courses, enrollment of DMF personnel in graduate programs, as well as other educational efforts. Additional details can be found in the 2022-2023 MFI Annual Report.

Striped Bass Conservation License Plate

During 2019, DMF and the Massachusetts Environmental Trust (MET) collaborated to develop a new Striped Bass Conservation Plate, from which the proceeds ($40 per issued plate every other year) would be dedicated to striped bass studies, fish passage improvement projects, and angler education. The plate became available in 2022, and through the end of 2023, over 1500 plates have been issued. A grant review panel has been populated that will advise the MET is determining project priorities and grant award recipients for the funds generated by the Striped Bass Conservation Plate, once they grow to a sufficient amount, likely in 2024.

Derelict Gear Task Force

In July of 2022, DMF created the Massachusetts Derelict Gear Task Force to study the issue of abandoned, lost, or otherwise discarded fishing gear (ALDFG) in Massachusetts waters and to develop solutions for the removal and disposal of such gear. The Task Force included individuals from government, industry, and NGOs with experience in commercial fishing, fisheries policy and management, law enforcement, conservation, and derelict fishing gear research and retrieval. In April 2023, the Task Force completed a white paper that describes the challenges posed by ALDFG; the existing legal framework for managing ALDFG; how this existing legal framework impedes removal and disposal; and recommends statutory and regulatory amendments to create an effective ALDFG clean-up program. This white paper was subsequently submitted to the Massachusetts Legislature and statutory amendments were expected to be filed in 2024 based on the paper's recommendations.

Stellwagen Bank Sanctuary Advisory Council

Staff served as state representative to the Stellwagen Bank Sanctuary Advisory Council (SAC), which included attendance at three SAC meetings in 2023. The SAC is a community-based body, established by the Secretary of Commerce per the National Marine Sanctuaries Act, that advises the sanctuary superintendent on issues relevant to the effective implementation of the Sanctuary management plan. In 2023, the SAC discussed its work plan, charter revisions, and recruitment and received updates on the Sanctuary management plan, research, mapping initiative, and development of a visitor center. Staff reported on DMF activities relevant to Sanctuary resources (e.g., right whale conservation, cod and winter flounder research, and fishery management actions) and served on the SAC's subcommittee on offshore wind. The subcommittee met four times in 2023 to develop recommendations to the superintendent regarding offshore wind development in the Gulf of Maine and potential impacts to Sanctuary resources.

Permitting and Statistics Program

Personnel

Story Reed, Assistant Director
Anna Webb, Fisheries Statistics Program Leader
Kerry Allard, Permitting Program Coordinator
Kim Lundy, Dealer Reporting Coordination & Quota Monitoring
Erich Druskat, Fisheries Data Analyst
Scott Schaffer, Fixed Gear Data Analyst
Nicholas Buchan, Harvester Reporting & VMS Coordination
Mary Ann Fletcher, Fisheries Statistics Support
Matthew McLaughlin, Harvester Reporting Data Entry
Kiera Lawlor, Vessel Tracking Support (started in May)
Matthew Duggan, Permitting Specialist
Lynne Besse, Permitting Receiving Teller
George Davis, Permitting & Support for Fisheries Reporting
Luke Putaansuu, Permitting & Support for Fisheries Reporting
Vicky Oliviera, Permitting Receiving Teller
Ivy Guyotte, Permitting Receiving Teller & Support for Fisheries Reporting (started in December)
Thomas Hoopes, Contractor

Overview

The **Permitting Project** is responsible for the issuance of commercial fishing, seafood dealer, recreational fishing, scientific, and other types of Division-issued permits; overseeing and approving the transfer of limited entry fishing permits and endorsements; issuing trap and fish tags; and issuing Letters of Authorization as needed. The project follows applicable laws, regulations, and policies relative to these activities. Project staff fulfill public data requests for non-confidential permit data and provide support to administrative staff as needed. Project staff also interact with the public on a routine basis to answer questions on permitting and regulations.

The **Fisheries Statistics Program** collects fisheries dependent data from both commercial harvesters and dealers involved in the initial sale of food and shellfish, and designated as primary buyers. Both data sets are collected in a standardized trip-level format from all commercial permit holders. These data have broad applications and uses, both within DMF and to fulfill requests made from outside the agency. Personnel also participate in the planning and development of the Atlantic Coastal Cooperative Statistics Program (ACCSP) and provide support to administrative staff for policy and permitting. In addition, staff act as a liaison to the Administration's Energy & Environmental Affairs Information Technology Group for the Division and the Gloucester facility and, along with other agency personnel, continue to maintain the agency's websites and Oracle databases.

Permitting Project

Commercial Fishing Permits

Anyone who lands and sells finfish, shellfish, lobsters, edible crabs, or other living marine resources in Massachusetts must have a DMF commercial fishing permit and must sell only to permitted Massachusetts dealers. DMF's new FISH permitting system went online in January 2023. All 2023 commercial and dealer permits were issued through this system. DMF issued a total of 7,883 commercial fishing permits in 2023 (Table

2). Over the past decade, DMF has seen a general increase in commercial fishing permit sales, particularly for small Boat 0–59' in length (Figure 4).

Table 2. 2023 commercial fishing permit issuance.

Permit Type	Permits Issued (#)	
	Residents	Non-residents
Coastal Lobster	983	5
Offshore Lobster	280	74
Seasonal Lobster	78	2
Boat 99+'	18	10
Boat 60-99'	84	199
Boat 0-59'	3,894	455
Individual	194	4
Shellfish and Seaworm	753	0
Shellfish and Rod & Reel	398	0
Rod & Reel	423	29
Total	**7,105**	**778**

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

Individual Permit allows the holder only to take, land, and sell finfish and may be endorsed for shellfish. No lobster or edible crabs may be taken.

Shellfish Permit allows an individual to take, land, and sell shellfish and seaworms. A Shellfish Transaction Card from DMF 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.

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

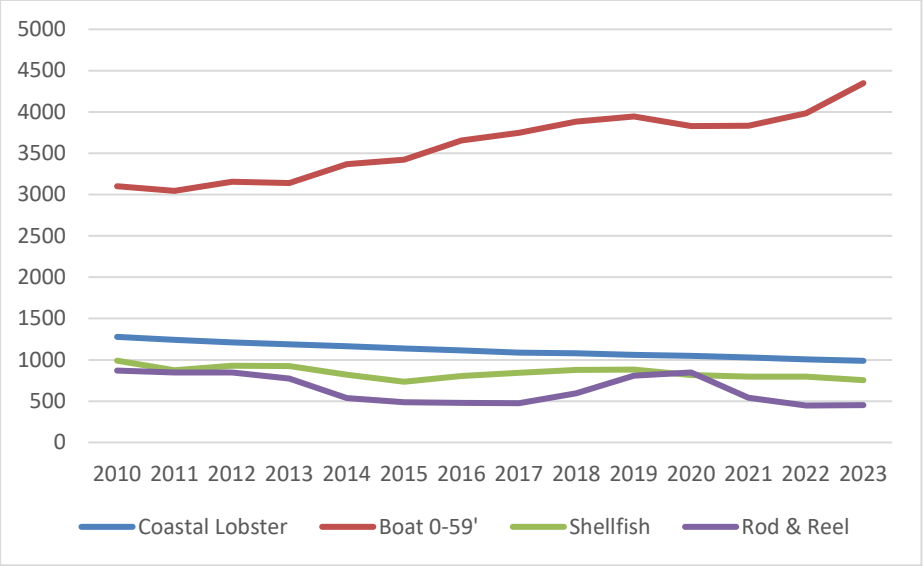

Figure 4. Trend in sales of four frequently issued commercial fishing permits, 2010–2023.

Dealer Permits

Anyone engaged in the wholesale or retail trade of raw fish, shellfish, lobsters, or bait, whether frozen or fresh, must have a DMF 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 fishers are considered primary buyers, and must be so endorsed on their dealer permits. DMF issued a total of 1,876 seafood dealer permits in 2023 (Table 3), a number relatively unchanged over the past ten years. One trend of note, after issuing a record 303 Retail Boat Seafood Dealer Permits in 2020 due to COVID-related market conditions, 193 were issued in 2023 as market conditions continued to return to normal.

Table 3. 2023 dealer permit issuance.

Permit Type	Permits Issued (#)	
	Resident	Non-resident
Wholesale Dealer	361	4
Wholesale Truck	73	123
Wholesale Broker	28	8
Retail Dealer	895	0
Retail Truck	33	1
Retail Boat	190	3
Bait Dealer	135	13
Retail Farmer's Market	7	2
Total	**1,722**	**154**

Wholesale Seafood Dealer Permit allows the holder to acquire, handle, store, distribute, process, fillet, ship, or sell raw fish and 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 *Mass*DPH must be submitted with the application to DMF. 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 plan is also required.

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

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 (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 a certified out-of-state wholesale dealer. 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 DMF. 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 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) may apply.

Retail Seafood Farmer's Market Dealer Permit allows the holder to sell certain raw fish and fish products at a farmer's market subject to written approval by the Department of Public Health, or the municipal or county board of health.

Special Permits & Regulated Fishery Endorsements

Special Permits are required for certain activities in the marine environment, as described below. DMF issued a total of 25,016 special permits and regulated fishery endorsements in 2023 (Table 4).

Table 4. 2023 special permit & regulated fishery endorsement issuance.

Permit Type	Permits Issued (#)	
	Resident	Non-resident
Non-commercial Lobster	5,445	109
Regulated Fishery Endorsements	17,625	1,324
Master Digger	3	1
Subordinate Digger	22	1
Scientific Collection	75	17
Shellfish Propagation & Aquaculture	394	0
Total	**23,564**	**1,452**

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 holder's 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 certain commercial fishing activities in addition to a commercial fishing permit. Regulated Fishery Endorsements are required for dragging, gillnetting, netting in inshore net areas, setting fish pots in waters under the jurisdiction of the Commonwealth, and the commercial harvest of northern shrimp, surf clam/ocean quahog, sea herring, sea urchins, summer flounder, black sea bass, scup, striped bass, dogfish, American eel, horseshoe crab, groundfish, tautog, menhaden, and—new to 2023—Atlantic mackerel.

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 the application form, applicants must 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 activities including aquaculture, scientific collection, shellfish propagation, and shellfish relay.

Recreational Saltwater Fishing Permits

DMF began issuing recreational saltwater fishing permits in 2011. DMF issued a total of 185,845 recreational saltwater fishing permits in 2023 (Table 5).

Table 5. 2023 recreational saltwater fishing permit issuance.

Permit Type	Permits Issued (#)	
	Resident	Non-resident
Recreational Saltwater, Age 16–59	105,946	16,350
Recreational Saltwater, Age 60+	55,881	6,801
Charter Boat	745	72
Head Boat	44	6
Total	**162,616**	**23,229**

Recreational Saltwater Fishing Permit is required of all fishermen aged 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 (NH, RI, and CT) that has entered into a reciprocity agreement with Massachusetts. The permit is free for fishermen aged 60 and over.

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

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

Limited Entry Permit Transfer Program

State regulations prohibit the transfer, loan, lease, exchange, barter, or sale of any permit without DMF permission. Limited entry permits (commercial permits and endorsements that are restricted in distribution to renewals) may be 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 and endorsements 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, summer flounder, horseshoe crab, groundfish, black sea bass, and menhaden.

The transfer process begins with pre- application forms through which the permit holder and potential transfer recipient can determine their eligibility to participate in a transfer. Pre-approval is followed by the completion of a transfer packet, and final approval. See Table 6 for a summary of transfers administered by DMF during 2023.

Table 6. 2023 Preliminary Limited Entry Permit Transfer Statistics.

Permit/Endorsement Type	Permits Transferred (#)	
	Resident	Non-resident
Coastal Lobster	25	0
Mobile Gear Coastal Access	7	7
Fish Pot	4	0
Fluke	17	6
Black Sea Bass	17	8
Groundfish	3	0
Surf Clam/ Ocean Quahog	1	0
Quahog Dredge	0	0
Horseshoe Crab	2	1
Menhaden	0	1
Tautog	3	0
Inshore Net	0	0
Total	79	23

Fisheries Statistics Program

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. Through 2019, all data from these state-reporting dealers were submitted to DMF via paper forms and entered into the ACCSP Standard Atlantic Fisheries Information System (SAFIS) database by project personnel or entered directly into SAFIS electronically by the dealers. A mobile SAFIS eDR application was also used by a few small dealers who buy from a handful of harvesters. This application utilizes a harvester's shellfish transaction card to consummate a point-of-sale transaction between the harvester and dealer, promoting a single-ticket commercial data collection system. Beginning January 1, 2020, all state-reporting dealers were required to submit data electronically via SAFIS

applications, the file upload method, and/or a certified third-party vendor.

In 2023, 1,873 businesses obtained a Massachusetts seafood dealer permit. Of those, 538 (or 29%) 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 538 dealers, 262 had a federal dealer permit and the remaining 276 dealers were categorized as "state-reporting." Compared to 2022, there were 3% more primary buyers in 2023. The number of primary buyers has relatively stabilized since its peak in 2020.

As is the case every year, all primary buyers 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, 122,653 dealer reports were entered into the SAFIS database, an approximate 1% decrease over 2022. Total landings (in whole pounds), as reported through the SAFIS database or other federal reporting programs, amounted to 471 million pounds valued at $573 million (ex-vessel; calculated from price paid to harvesters). The top five species in order of value were sea scallop, American lobster, Eastern oyster, haddock, and Atlantic surf clam, totaling $469 million or 82% of the total value.

The ex-vessel value of seafood landed in Massachusetts in 2021 was 34% higher than 2020 and 19% higher than 2019 (not adjusted for inflation); however in 2022, levels declined to those seen in 2019 and 2023 declined further (Figure 5). Total landings were also considerably lower in 2022 and 2023 (Figure 6), and the decline was driven primarily by a reduction in sea scallop landings. Though sea scallop prices remained consistent with 2021, the reduction in landings contributed heavily to the reduction in overall value in both years. Furthermore, in 2022, this decline in value was also due to documented declines in prices of other top species, particularly American lobster which reduced in average price from almost $7.50 per pound in 2021 to approximately $5.50 per pound in 2022. In 2023 however, lobster prices rebounded to $6.23 per pound on average and declines in value were primarily driven by reductions in sea scallop landings.

In 2023, offshore shellfish (sea scallop, Atlantic surf clam, and ocean quahog) made up 59% 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 8% of total value landed. Landings of invertebrate species (lobster, crabs, and whelk) amounted to 26 million pounds, valued at $113 million, or 20% of the total value landed. Cumulative finfish landings, including both pelagic and benthic species, made up 14% of the total value with the multispecies groundfish species complex amounting to 5% of the total value. Landed species with an individual gross value over $2 million are shown in Table 7; in aggregate, these species accounted for approximately 96% of the total value of all species landed.

Species managed by quota in Massachusetts were monitored using the dealer-reported landings in the SAFIS database. Automated analyses ran on a nightly basis and the results were displayed on both the DMF internet website (Figure 7) and the Statistics Project intranet website. On a weekly basis during the open season, staff reviewed compliance and estimated projections for each quota-managed species. An estimated closure date was calculated based on a regression analysis run at least once per week for each open fishery.

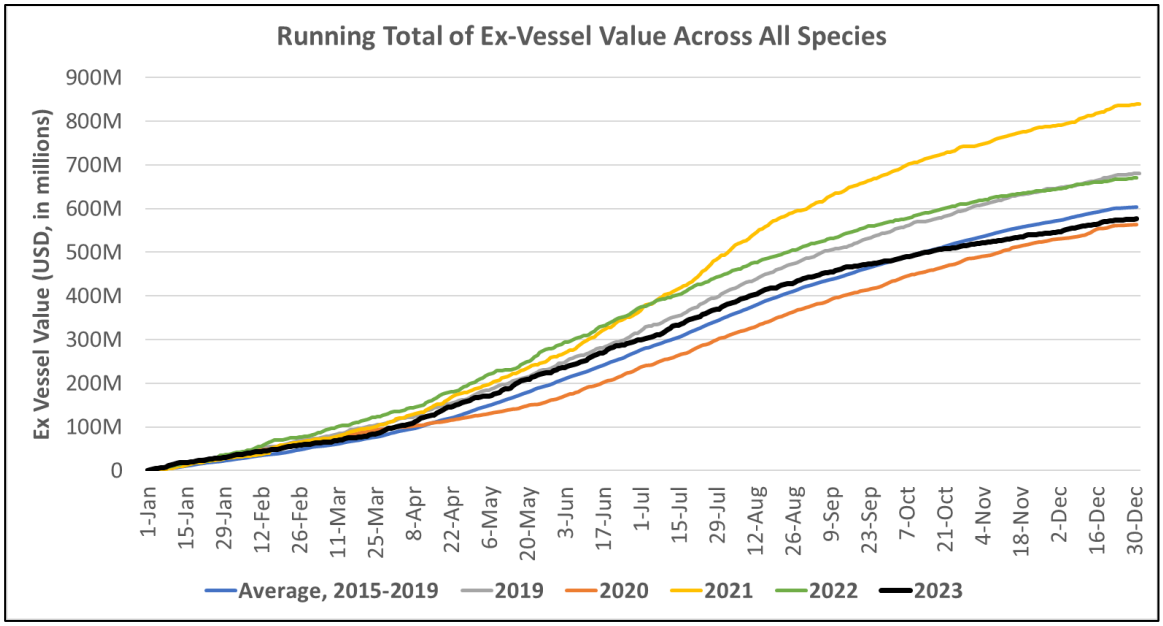

Figure 5. Daily running total ex-vessel value for 2019-2023 and the average of 2015-2019. Value is not adjusted for inflation.
Source: ACCSP Data Warehouse; 4/17/2024.

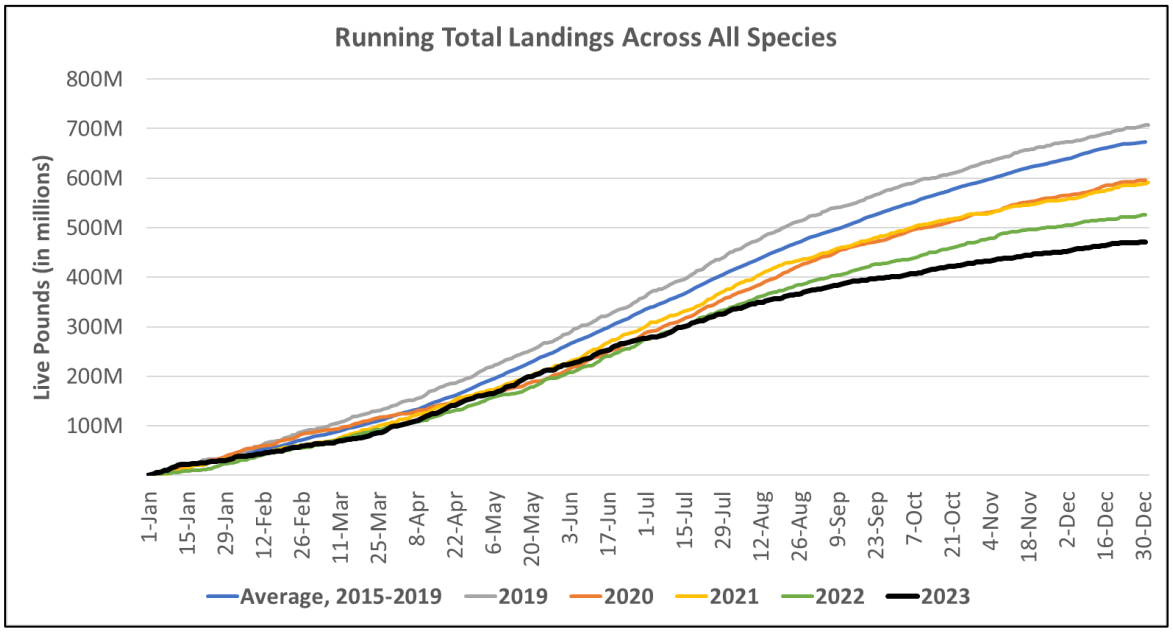

Figure 6. Daily running total landings in live pounds for 2019-2023 and the average of 2015-2019.
Source: ACCSP Data Warehouse; 4/17/2024.

Table 7. 2023 MA-landed species with ex-vessel value greater than $2 million.
Source: ACCSP Data Warehouse, 4/17/24.

Species*	Landings (whole pounds)	Ex-Vessel Value (USD)
Sea Scallop	200,965,366	$316,548,175
American Lobster	15,744,757	$98,364,971
Eastern Oyster	8,675,169	$30,224,803
Haddock	9,804,221	$12,101,829
Atlantic Surf Clam	37,786,530	$11,706,647
Ocean Quahog	102,296,618	$8,316,668
Pollock	7,104,568	$8,162,205
Goosefish	10,922,172	$8,101,514
Jonah Crab	5,336,973	$6,674,572
Northern Quahog	4,026,520	$5,568,769
Bluefin Tuna	1,082,677	$5,474,538
Silver Hake	5,175,682	$4,922,346
Acadian Redfish	6,860,051	$4,777,494
Soft Clam	2,192,270	$4,656,887
White Hake	3,866,283	$4,450,835
Channeled Whelk	925,373	$3,014,805
American Plaice	2,146,017	$2,888,725
Longfin Squid	2,858,997	$2,823,576
Striped Bass	677,328	$2,561,630
Witch Flounder	1,790,309	$2,460,059
Summer Flounder (Fluke)	981,115	$2,093,866
Winter Skate	7,287,544	$2,076,207

* Deep-sea red crab is also in this list, but the data are confidential.

QUOTA MANAGED SPECIES
2023 Landings and Quota Information
as of Mar 19, 2024 - 12:54 P.M.

Species	2023 MA Landings	2023 Quota	Quota Type	Percent Landed
Black Sea Bass	813,102	816,071	MA	99.6%
Bluefish	309,904	329,578	MA	94.0%
Dogfish	2,769,826	6,967,525	CW	to NMFS
Fluke	981,115	1,334,363	MA	73.5%
Horseshoe Crab*	139,746	140,000	MA	99.8%
Menhaden *(Quota)*	2,980,815	10,838,902	MA	27.5%
Scup *(Winter I)*	40,608	6,319,911	CW	to NMFS
Scup *(Summer)*	547,175	826,996	MA	66.2%
Scup *(Winter II)*	177,068	3,037,824	CW	to NMFS
Striped Bass	676,955	700,379	MA	96.7%
Tautog	60,296	55,541	MA	108.6%

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 7. Example of quota monitoring data available on DMF's website.

Fisherman Catch and Effort Data Collection

Trip Reporting: 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 fishing 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 DMF for those activities occurring on their federally-permitted vessel as were those vessels commercially fishing solely for bluefin tuna who were already required to report landings to NOAA Fisheries Highly Migratory Species Division. All other individuals were required to report to DMF.

Fishermen either submitted their trip-level reports in paper form or entered their fishing activities themselves using a SAFIS eTRIPS application. SAFIS eTRIPS Online is a web-based program, while SAFIS eTRIPS Mobile is an application available on all major platforms for phones and tablets, as well as Windows. Project staff used the online 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, was the SAFIS database. However, in late 2023, NOAA Fisheries VTR data began to be pushed to SAFIS nightly, creating a comprehensive real-time dataset available to managers. Data were easily accessed from the SAFIS database and used for compliance and fisheries analyses by project staff; fishermen also have easy access to their own landings within SAFIS. Since 2021, eTRIPS Online has collected additional fixed gear specific fields including but not limited to effort specific ten-minute squares and number of buoy lines, enabling DMF and other partners to meet the requirements set forth in recent addenda to both the lobster and Jonah crab interstate FMPs.

In 2023, DMF issued 7,880 commercial harvester permits, of which 17% were for federal reporting vessels, and the remaining 6,541 commercial permits were designated as “state-reporting.” Forty-one percent of all permit holders chose to report electronically using the SAFIS eTRIPS Online or Mobile applications, which was a slight increase over 2022. This left 42% of all harvesters submitting paper reports to DMF. Of the greater than 80,000 commercial trips that were entered into the SAFIS database to date for state reporting harvesters for the 2023 calendar year, approximately 39% were entered by commercial permit holders using one of the SAFIS eTRIPS applications, with the remaining trips entered by DMF staff. This percentage of electronically entered trips is expected to decrease as the final reports submitted for 2023 are entered and is expected to fall between 35% and 37%. Compared to 2022, the total number of trips reported for 2023 is expected to be slightly reduced, in line with the reduction in landings highlighted in Figure 6.

Vessel Tracking: In April 2022, Addendum XXIX to Amendment 3 to the Interstate FMP for American Lobster and Addendum IV to the Jonah Crab Interstate FMP were approved, requiring approved vessel tracking devices to be deployed on federally permitted lobster vessels by December 2023. The administration of vessel tracking devices is conducted by vessels’ principal port state fisheries agency. Massachusetts was the first state to implement the ASMFC mandated program, with a start date of May 1, 2023. Federal funding opportunities were announced as well to allow state partners to fund the industry start-up costs and to hire additional staff to assist managing the program.

DMF created an outreach program for vessel tracking including a dedicated website, phone line, and information card. Throughout much of the year, project staff spent significant time communicating directly with industry members to alleviate concerns about the implementation of a location tracking program and discuss the details of the new requirements. Initial outreach to federal lobster permit holders with their principal port listed in Massachusetts began in early 2023 with start-up packages mailed in March 2023. These packages included information about the program, an affidavit to return to DMF, and an application for device purchase reimbursement. Permit holders were required to return the signed affidavit stating they understood the requirement, intended or did not intend to fish lobster traps, and if they intended to fish, document the installation of a tracking device. Also, in March 2023, staff attended the Massachusetts Lobstermen’s

Association trade show to present the vessel tracking project and meet with commercial fishers.

Vessels were required to have a device installed prior to conducting a federal lobster trap fishing trip on or after May 1, 2023. Monitoring compliance with this regulation and the Addenda required intensive work. Additionally, this project required frequent communication with ACCSP regarding the front-end application built to provide an administrative interface for managing the program. In May, DMF hired an additional team member to assist managing this program.

As of December 2023, the tracking program received 287 completed affidavits. 253 permit holders purchased and installed a vessel tracking device, and 34 permit holders indicated that they did not intend to fish lobster traps. Staff administered receipts to harvesters confirming successful data reception from their tracking device. Location data were reviewed regularly for inconsistencies, and harvesters were notified if their device failed.

Twenty-six permit holders did not submit an affidavit for fishing year 2023, but most did not appear to be fishing trap gear. Trip reports and dealer reports from all permit holders in the program were monitored daily for compliance with the regulations. Harvesters identified as fishing lobster trap gear without an approved tracking device aboard their vessel were contacted and advised to come into compliance. New federal lobster permit holders were also identified via this process, and they received the start-up package notifying them of their vessel tracking requirement.

Additionally, project staff served on the ASMFC tracking device approval committee. In 2023, this work was reduced compared to 2022 but included routine review of new vendor applications, ultimately approving two additional tracking devices. Staff worked closely with the vendors during the initial project set up in 2023 and continued throughout the year as additional issues arose and were addressed.

Data Analysis and Dissemination

Project staff were frequently asked to present on in-season trends throughout the year, not only on quota managed species, but often also including overall trends or trends in high value species. Additionally, significant time was dedicated to routine activities such as ensuring correct harvester reporting methods and maintaining compliance metrics for harvester and dealer reporting. Lastly, significant time was spent working with ACCSP to validate landings for a variety of species throughout this time as stock assessments and other data heavy projects continued. A few additional projects are highlighted below.

Vertical Line Data Demands: Vertical line data have become increasingly more important in discussions involving conservation of protected species. 2023 was the third year in which vertical line data were collected from fixed gear fishermen at the trip and effort level (defined by gear and area fished), rather than through an annual recall report. The recall data required a significant amount of extrapolation to analyze spatially, while the newer trip-level reporting method inherently collects line data at the area fished level. In 2021, harvesters reported their vertical lines via both methods, and in 2023, staff completed a comparison analysis for data reported for that year that reviewed discrepancies and resolved issues with individual harvesters. The results gave insight into both methods and showed that reported lines from both collection methods converged. While the trip level reporting is generally most accurate, this analysis gave confidence that using the full time series, including results from the recall report in earlier years and the trip-level report in more current years, will continue to be possible.

Port Profile Updates: The Port Profile Project report utilized data through 2018 and was published in 2021. Leaders from many ports reached out to DMF in 2023 requesting updated statistics for the years 2019–2022. The datasets provided updated landings and ex-vessel value for both the port's top species and the entire catch grouped by species category (finfish, invertebrates, shellfish). Also included were a broad summary of permitting and activity levels for the port. The increase in this type of request led project staff to plan to update all ports

through calendar year 2023 beginning in late 2024.

Ten-Minute Square Lobster Analysis: In 2023, project staff initiated review of the additional data elements that began to be collected from fixed gear harvester reports in 2021. This included an analysis of spatially-explicit effort at the 10-minute square level as seen in Figure 8. This exercise only encompassed federal waters as the 10-minute square field requirement only applied to those trips occurring in federal waters. Ten-minute square data were explicitly reported by state reporting harvesters and calculated from the latitude and longitude reported by federally reporting vessels. Prior to 10-minute square data collection, analyses involving spatial distribution of effort was restricted to the larger statistical areas shown by the bold lines in Figure 8, which range from hundreds to thousands of square miles in area. Analyses using 10-minute square data resulted in spatially refined trends in trap gear effort that supported ongoing management efforts surrounding marine spatial planning and protected species interactions.

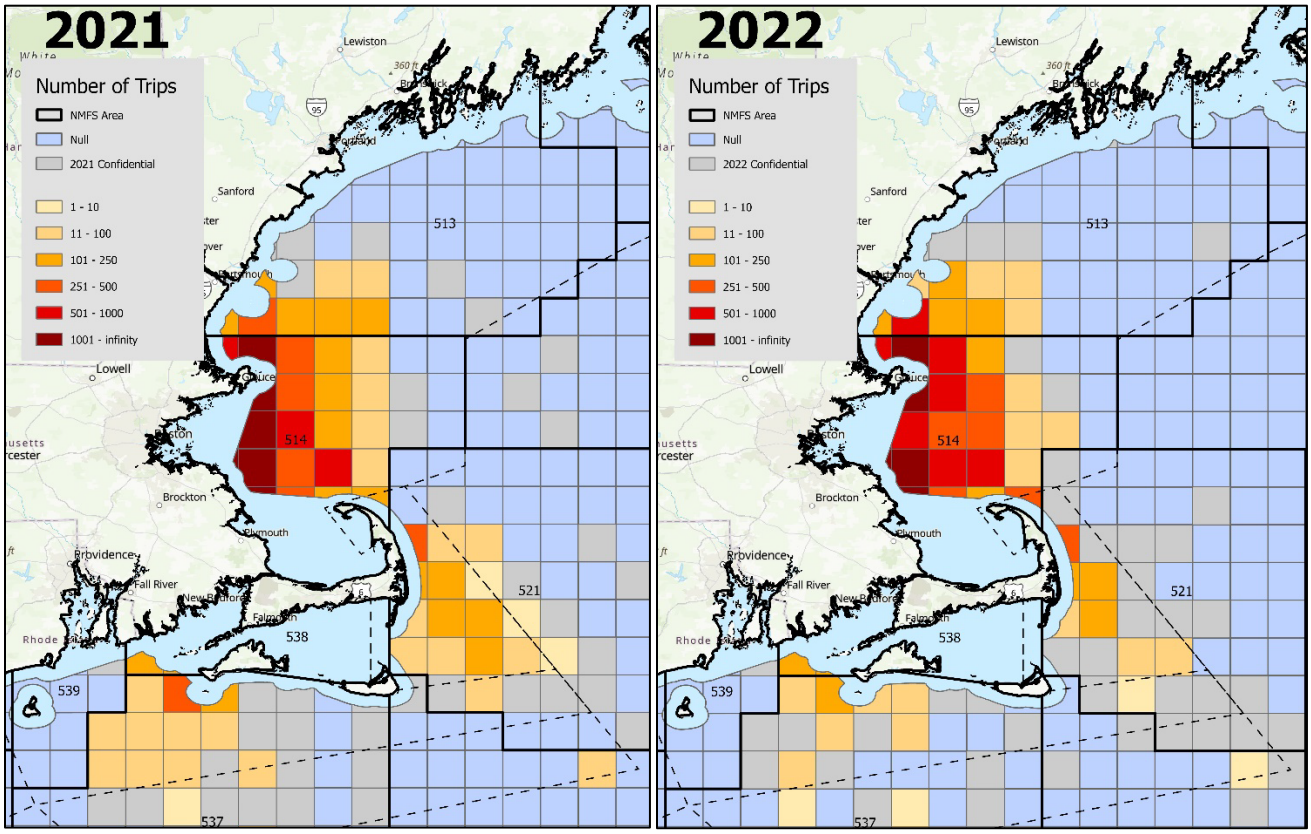

Figure 8. Heat maps of the number of lobster trap trips occurring in federal waters and landing in MA in 2021 and 2022. Number of trips was used as a general proxy of effort; however, additional more accurate metrics for describing effort were in development. Statistical Reporting Areas east of 521 are excluded.
Source: ACCSP SAFIS eTRIPS and federal VTR data; 10/2023.

Striped Bass Tagging Program: 2023 was the tenth year of a commercial striped bass fishery tagging program mandated by ASMFC to reduce poaching coast-wide. This program is conducted at the dealer level in Massachusetts (Table 8). Program staff estimated the 2023 tags required for individual dealers and distributed tags prior to the season and throughout as needed. At the end of the season, unused tags and an accounting report were required to be submitted to DMF. Program staff were responsible for identifying any discrepancies and following up with dealers as needed.

Table 8. 2023 striped bass tagging statistics (as of April 2024)**.**

# of Dealers Receiving Tags	# of Tags Purchased by DMF	# of Tags Distributed	# of Tags Returned	# of Tags Used	# of Tags Missing
128	65,000	54,560	24,086	29,900	574

Tautog Tagging Program: 2023 was the fourth year of a commercial tautog fishery tagging program mandated by ASMFC to reduce poaching coast-wide. Per the FMP, this program is conducted at the harvester level in all states (Table 9). Commercial fishermen must tag their commercial tautog catch through the operculum prior to offloading the fish from the fishing vessel and selling the fish into commerce. The tautog tags are single use metal tags inscribed with the calendar year, state of issuance, and sequential tag number. Program staff are responsible for program oversight from tag distribution to tagging accountability and reporting to ASMFC.

Table 9. 2023 tautog tagging statistics (as of April 2023)**.**

# of Eligible Fishermen	# of Fishermen Receiving Tags	# of Tags Purchased by DMF	# of Tags Distributed	# of Tags Returned	# of Tags Used
204	155	35,000	33,025	13,423	19,185

ACCSP Participation and Planning

DMF staff continued to participate in all partner-based committees within ACCSP. Staff served on the Operations (as vice-chair), Information Systems, Commercial Technical (as vice-chair), and Standard Codes committees, while staff from the recreational program served on the Recreational Technical committee and staff from the Fish Biology Program served on the Biological and Bycatch Technical committees. Staff worked with programmers to address application bugs and long-term solutions to ongoing issues as well as provided technical advice in areas such as data quality and standards, application design, outreach, policies, and vessel monitoring (as described above). ACCSP tasks demanded even more time from project staff throughout the year, and this is expected to continue moving forward as their applications continue to expand.

In May 2023, project staff participated in ACCSP's Data Validation Workshop. Representatives from all partners met in Charleston, SC to analyze and develop requirements for implementation of data validations within the SAFIS applications with a primary focus on eTRIPS Online and Mobile. This workshop was critical to attend, and the report generated by the attendees was invaluable during initial scoping of the development necessary to implement the changes to the applications. The implementation of this new administrative module with the SAFIS applications will provide administrators flexibility and freedom to catch and correct bad data prior to committing it to the database. This effort will make electronic reporting of catch reports cleaner and simpler to manage by administrators and more comprehensive and intuitive for end users. The application enhancements are expected to go into production in late 2024.

Local IT Management

Information systems/technology is primarily conducted through the Executive Office of Energy and Environmental Affairs' Information Technology Group (EOEEA-IT) under the larger direction of the Executive Office of Technology Services and Security (EOTSS). During 2023, project staff provided assistance to EOEEA-IT on local information systems issues when needed and worked on several specific tasks outlined below.

Website Maintenance: The Quota Monitoring webpage is one of the agencies top-visited pages. Quota information is also displayed on a Statistics Project intranet site, along with reporting compliance and both harvester and dealer reporting information. Maintaining the automated process that updates the data displayed on both sites and accommodating changing requirements was an ongoing task, made more time consuming due

to automation failures. The project intended to modernize this platform beginning in 2024.

Oracle Database/Application Development & Maintenance: While DMF continued to use two production Oracle databases and associated applications during 2023: Lobster Sampling and Shellfish Sampling & Area Management, the third Permitting Oracle application was discontinued on January 6, 2023, when the new SQL Server-based permitting application went live after two years of development in collaboration with EOEEA-IT. The new permitting application included all details of commercial, seafood dealer, and special (e.g., aquaculture, propagation, scientific collection) permit categories, incorporated online credit card permit sales (though no live credit card transactions occurred in 2023), in-office sales, reporting options, and administrative tools.

A permitting lead, a statistics lead (acting as DMF's project manager), an aquaculture lead, and the CFO were heavily involved in the commercial and aquaculture permitting application project and met with EOEEA-IT daily for the early part of 2023, often multiple times per day. Additionally, DMF's project manager frequently met independently with developers to discuss questions on the requirements for various pieces of the application. Testing each application release prior to new version going live in production was labor intensive and all permitting, aquaculture, and statistics staff contributed.

The scope of the full permitting and sampling application redesign project was much broader than originally realized and important items were pushed to a second phase which began in mid-2023 after the initial launch stabilized. Phase 2 included certain permitting elements and the redesign of the sampling modules that remained in Oracle through 2023. In the latter half of the year and as Phase 2 got underway, this meeting frequency was reduced to three times per week. Phase 2 enhancements to FISH continued through the end of the calendar year resulting in a more streamlined application for the 2023 permit renewal season and the release of the full suite of special permits available in the application. This did not include the launch of the external facing module as was expected in 2023, but the enhancements included ensured that data integrity will be maintained when that module is released in 2024.

Additionally, a new database was developed in Oracle to accept a data stream from the new permitting SQL Server database along with the existing data streams from GARFO and SAFIS. This Oracle database, GADUS, went live simultaneously with the permitting application on January 6, 2023. Development and testing of the enhancements to the database required weekly meetings with project staff familiar with Oracle and database design or management through mid-2023 reducing to monthly thereafter. Following an initial stabilization period, GADUS underwent several updates aimed at improving data quality and performance of the database and data flows. The most significant change involved transformations applied to federal VTR data to assign a statistical reporting area (SRA) based on harvester reported latitude and longitude. Previously a PostgreSQL spatial database was utilized but in 2023, transitioned to ArcGIS Pro which simplified the process and allowed for improved data auditing abilities.

SHELLFISH AND HABITAT SECTION

Robert Glenn, Deputy Director, Section Leader

Shellfish Sanitation and Management Program

Personnel

Jeff Kennedy, Environmental Analyst V/Program Lead (through July, retired)

Gloucester
Gregory Bettencourt, Environmental Analyst IV: Regional Supervisor
Florence Cenci, Bacteriologist III: Shellfish Lab Supervisor
Ryan Joyce, Aquatic Biologist III
Melissa Campbell, Aquatic Biologist II
Brooke Dejadon, Aquatic Biologist II
Ashley Lawson, Bacteriologist I (0.5 FTE)
Amber Woolfenden, Bacteriologist I (0.5 FTE)

New Bedford
Dr. Christian Petitpas, Environmental Analyst IV: Regional Supervisor/Biologist III: Aquaculture Specialist
Thomas Shields, Environmental Analyst IV (through August, retired)
Matthew Camisa, Aquatic Biologist III: Shellfish Classification Supervisor
Brianne Shanks, Bacteriologist III: Shellfish Lab Supervisor
Margaret Leary, Aquatic Biologist II
John Mendes, Aquatic Biologist II
Terry O'Neil, Aquatic Biologist II
Kaley Towns, Aquatic Biologist II
Holly Williams, Aquatic Biologist II
Simone Wright, Aquatic Biologist II (through August)
Gabriel Lundgren, Aquatic Biologist I
Alyson Mello, Bacteriologist I

Newburyport
Diane Regan, Bacteriologist III: Shellfish Lab Supervisor (through July, retired)
Jacob Madden, Bacteriologist II
Conor Byrne, Depuration Coordinator I: Process Area Supervisor
Peter Kimball, Wildlife Technician II
Shaun Wallace, Wildlife Technician II

Overview

The Shellfish Sanitation and Management Program focuses on public health protection, as well as the management of the Commonwealth's molluscan shellfish resources. Public health protection is ensured through sanitary classification, monitoring of marine biotoxins and implementation of a *Vibrio parahaemolyticus* Control Plan 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 U.S. Public Health Service and is

administered today by the United States Food and Drug Administration (USFDA) and the Interstate Shellfish Sanitation Conference (ISSC), a federal/state cooperative. Massachusetts is a voting member of the ISSC.

Shellfisheries management is accomplished by a multipronged approach including direct DMF regulation of the commercial surf clam, ocean quahog, and quahog dredge boat fisheries; and indirectly managing other shellfish resources through partnerships with coastal communities by providing technical assistance to local management authorities in the development of management plans and local regulations for control and conservation. In addition, DMF regulations cover safe harvest and handling practices for market-bound shellfish, the harvest of contaminated shellfish for depuration and relay, and establish minimum size, trip limit, and season for many shellfish species. DMF also 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.

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 meteorological, hydrodynamic, and geographic 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 report to maintain a classification allowing shellfish harvest. Minimum requirements are set by the ISSC and outlined in Section II Chapter IV of the NSSP *Guide for the Control of Molluscan Shellfish* (a.k.a., Model Ordinance).

To satisfy NSSP requirements in 2023, staff biologists completed 278 annual reports, 83 triennial evaluations, and 11 sanitary surveys (Table 10). One hundred and thirty-one conditional area management plans/MOUs were re-evaluated. A total of 9,365 water samples were collected and analyzed for fecal coliform bacteria from 249 shellfish growing areas in 63 cities and towns of the Commonwealth. All samples were tested at one of the Division's shellfish laboratories using the mTEC method. During the annual USFDA evaluation for compliance with NSSP requirements, shellfish growing area files were reviewed with regards to standards for sampling frequency, completion of required reports, conditional area management plan updates, and conformity with appropriate water quality criteria.

Table 10. Summary of 2023 shellfish growing area report and sampling activity.

	Total
Annual Reports	278
Triennial Evaluations	83
Sanitary Surveys	11
Management Plans/MOUs Reviewed	131
Total Water Samples	9365
Shellfish Growing Areas Sampled	249
Classification Sub-Areas sampled	662
Cities/Towns Sampled	63

Classification and Status: The Shellfish Program uses two methods to control harvest access to shellfish growing areas. Classification is assigned according to the NSSP's five categories: Approved, Conditionally Approved, Restricted, Conditionally Restricted, and Prohibited (defined below). If water quality within a growing area

trends toward permanent improvement or impairment, its Classification is upgraded or downgraded based on that data. If water quality within a growing area suddenly demonstrates degradation from emergency or unexpected conditions, the growing area can be closed until water quality improves and the contamination has abated. All Classifications except Prohibited may be in the Open status or placed in the Closed status for cause.

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, harmful algal bloom/biotoxin event).
2. CONDITIONALLY APPROVED: Closed some of the time due to rainfall, 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 and with a contaminated relay permit, shellfish can be relayed by municipalities to a less contaminated area (Approved or Conditionally Approved) for natural contaminant reduction or harvested for depuration processing.
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. When open, it is treated as a Restricted area.
5. PROHIBITED: Closed to the harvest of shellfish under all conditions, except the gathering and culture of seed for commercial shellfish aquaculture and municipal propagation programs under a DMF permit.

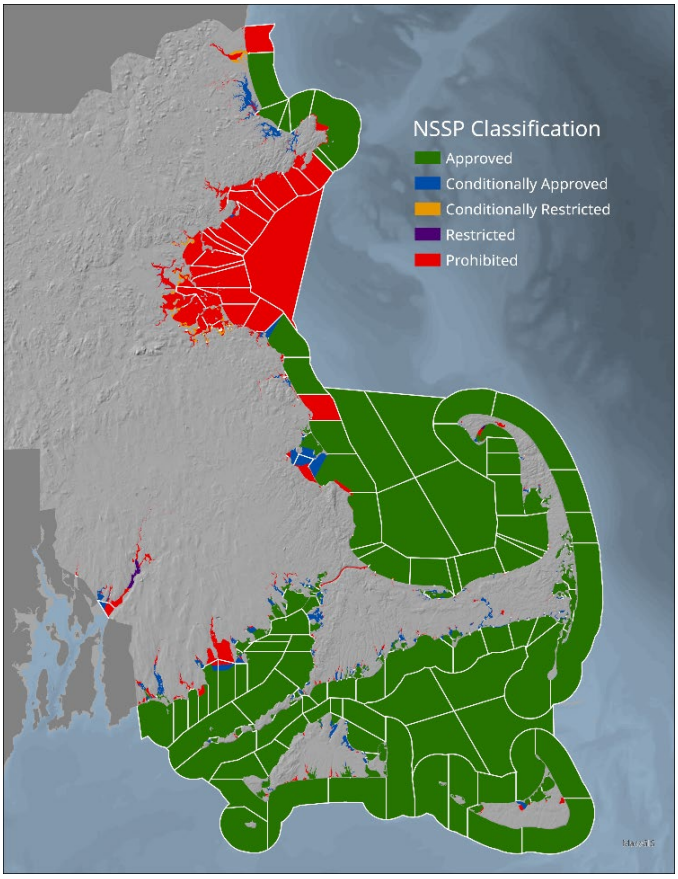

Figure 9. 2023 Classification of MA Growing Areas

In 2023, a total of 1,743,996 acres were assigned a Classification (Figure 9, Table 11). The total acreage of Approved and Conditionally Approved areas decreased, and the total acreage of Restricted and Prohibited areas increased in 2023. Much of this change can be attributed to a more accurate shoreline delineation methodology implemented in 2023 rather than classification changes. Some of the areas that were downgraded were affected by new NSSP requirements for classifying mooring areas (shellfish growing areas with >20 moored boats).

Classification of shellfish growing areas around wastewater treatment plant (WWTP) outfalls has proven to be a challenge. Because wastewater treatment plant effluents pose a potential threat to public health from both microbiological and chemical contaminants, the NSSP requires state shellfish authorities to perform dilution analyses on shellfish growing area waters directly receiving effluent discharges, as well as adjacent waters potentially impacted. In addition to assessing WWTP performance (e.g. peak flow, contaminant concentrations), the dilution analyses must determine the hydrodynamics that characterize the assessment area. Because DMF lacks the necessary physical oceanographic expertise, we successfully sought funding through the Marine Fisheries Institute to partner with SMAST faculty Dr. Changsheng Chen to model WWTP effluent discharges and inform DMF decisions when assigning shellfish growing area classifications. This collaboration was ongoing at year's end, but in 2022 Dr. Chen's modeling work supported the reopening to harvest of >150 acres of

recreational shellfishing areas in the North and South River System in the towns of Scituate and Marshfield. Preliminary Model results for dilution and dispersion around the New Bedford and Fairhaven WWTP discharges were received in October 2023.

A legal notice is required for each change in a shellfish growing area's classification, and in most cases also required for a change in status. These notices reflect the type of opening or closure, the dates, the reason, and other pertinent descriptive information. Copies are sent to municipal managers, Massachusetts Environmental Police (MEP), *Mass*DPH, USFDA, and other interested parties. In 2023, staff generated 466 legal notices which were distributed for sanitary reclassification, rainfall closures and re-openings, paralytic shellfish poisoning events, oil spills, and more typical emergency closures (e.g., extreme rainfall, flooding, sewage discharge).

Table 11. Change in Massachusetts shellfish growing area classification, 2022 to 2023.

Area Classification	Acreage		
	2022	2023	Change
Approved	1,445,267	1,443,308	-1,959
Conditionally Approved	34,731	32,528	-2,203
Restricted	2,543	1,452	-1,091
Conditionally Restricted	4,430	4,498	67
Prohibited	257,222	262,408	5,186
Total	1,744,193	1,744,193	

Biotoxin Monitoring

Phytoplankton Monitoring: There are many kinds of microscopic algae that potentially pose a public health risk due to production of potent biotoxins. Though Paralytic Shellfish Poisoning (PSP), caused by the dinoflagellate *Alexandrium*, has historically been the primary threat in the northeast and is the subject of routine toxin monitoring in shellfish meats, DMF monitors the phytoplankton community for the presence of many other potentially toxic algae and/or nuisance species that can form Harmful Algal Blooms (HABs). Phytoplankton monitoring occurs year-round on both the North Shore (4 primary stations) and South Shore (8 primary stations; Figure 10).

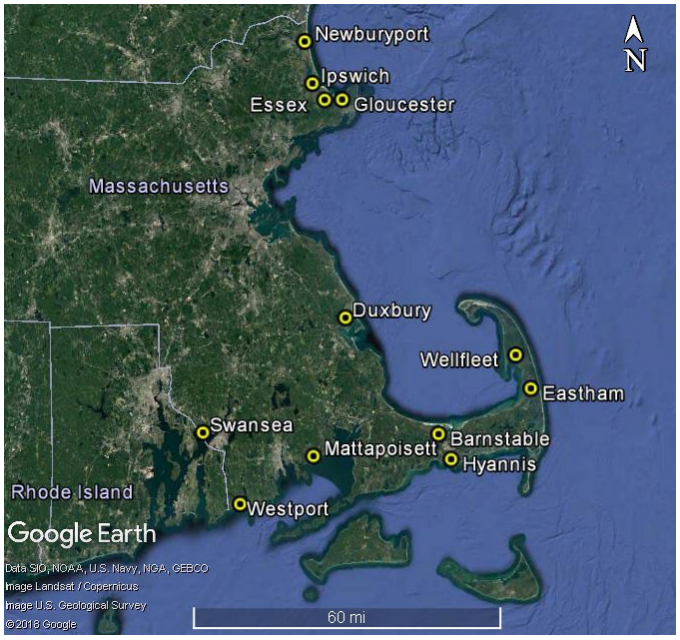

Figure 10. Map of phytoplankton monitoring stations.

The South Shore region's eight routine phytoplankton monitoring stations are sampled bi-weekly year-round, alternating between Duxbury, Barnstable (Cape Cod Bay side), Wellfleet and Westport one week, and Barnstable (Hyannis Harbor), Eastham (Nauset), Mattapoisett, and Swansea the following week. When elevated concentrations of HAB cells are observed, the sampling frequency at a given monitoring station increases and adjacent areas are sampled. In 2023, 236 phytoplankton samples were collected at primary

stations for analysis at the New Bedford office. An additional 119 samples were collected in response to high cell counts at primary stations or reports of discolored water or potential cyanobacteria blooms throughout the region.

An anomalously early winter *Alexandrium* bloom (525 cells/L) was detected in the Nauset System on Cape Cod in late December 2022 with steady presence observed through May 2023. Peak concentration of >75,000 cells/L was observed on April 10. This continued the trend of an early winter bloom start in the Nauset system which closes annually due to PSP. Toxicity in shellfish was not detected in early winter, presumably due to cold water temperatures (33–45°F) and low likelihood of substantial shellfish pumping activity. A large *Alexandrium* bloom likely spread from cyst beds in the Nauset and Pleasant Bay systems, impacting outer Cape Cod and Martha's Vineyard with few cells appearing in Buzzards Bay stations (Swansea from April–June, Westport in May, Mattapoisett from July–August).

Varying abundances of small and large *Pseudo-nitzschia* which produce domoic acid (Amnesic Shellfish Poisoning; ASP) were observed at all South Shore monitoring stations. Generally, small cells were more abundant. On several occasions, abundances exceeded 30,000 cells/L: Hyannis (max >127,000 cells/L) and Mattapoisett (max >39,000 cells/L) spanning from January to February; Eastham (>500,000 cells/L) in May (system was already closed due to PSP) and Hyannis again (>41,000 cells/L) in December. Replicate Scotia rapid screening kits for ASP were used to test water samples from Mattapoisett and Hyannis in January and results were positive for both areas. Gold Standard ELISA kits were run on seawater with results below the limit of detection in Mattapoisett and trace amounts of domoic acid detected in Hyannis. No closures were required.

Dinophysis is a phytoplankton genus responsible for Diarrhetic Shellfish Poisoning (DSP). *Dinophysis* presence was observed in low abundances at all South Shore stations and at various times/seasons throughout year. The Nauset System experienced a bloom in June, with peak concentration at >24,000 cells/L. The area was still under a PSP closure at the time and this prolonged reopening until mid-July.

Some HAB organisms do not pose a threat to human health but can have adverse impacts on ecosystem and fish/shellfish health. Some of these organisms identified in South Shore samples include *Margalefidinium polykrikoides* (formerly genus *Cochlodinium*), *Karenia mikimotoi*, *Akashiwo sanguinia* and *Amphidinium* species. These observations are noteworthy given recent communications from aquaculturists of high seed mortality.

North Shore biologists collected 209 samples from the four primary regional stations in Newburyport, Ipswich, Essex, and Gloucester. Due to low abundance of all HAB species, secondary and tertiary sites were not initiated in 2023 on the North Shore. In 2023, we began seeing low numbers of *Alexandrium*-like cells in North Shore stations in mid-April, but there was no associated toxicity leading us to believe these were a non-toxic look-alike. Varying abundances of both small and large *Pseudo-nitzschia* cells were observed throughout the year; however, not in large enough concentrations to trigger increased phytoplankton monitoring or initiate toxin screening. *Dinophysis* cell concentrations were relatively low throughout the year as well. There were no other noteworthy species seen on the North Shore in 2023.

In addition to monitoring of primary stations for biotoxins and potentially toxic algae, Shellfish staff respond to reports of discolored water and potential cyanobacteria blooms throughout the state. In most cases, non-toxic algal blooms are identified, and no further action is necessary. Staff presented a synopsis of 2022 MA HAB/biotoxin events at the 2023 Gulf of Maine HAB Science Symposium.

Paralytic Shellfish Poisoning Monitoring in Shellfish: A major aspect of the Shellfish Program is monitoring for PSP biotoxins in shellfish. Consumption of shellfish containing high levels of PSP toxin can cause severe illness and even death. Blue mussels are used as our sentinel species, because they tend to take up and bioaccumulate toxins quicker than other shellfish species. Staff collects shellfish from 11 primary stations weekly March

through October. Samples are analyzed at the DMF 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 approach or exceed safe limits. A total of 389 shellfish samples from state waters were processed for PSP during 2023.

A PSP closure of the Nauset system on Cape Cod is a nearly annual event, whereas PSP closures elsewhere in Massachusetts occur more sporadically. In 2023, the Nauset system closure (Figure 11) was issued on March 8 and remained in effect for all areas in Nauset until June 15, except for Salt Pond which reopened approximately one month later on July 21. The 2023 *Alexandrium* bloom in Nauset was a particularly intense one in terms of both toxin levels and duration. Toxicity in blue mussels peaked at > 4800 µg/100 g.

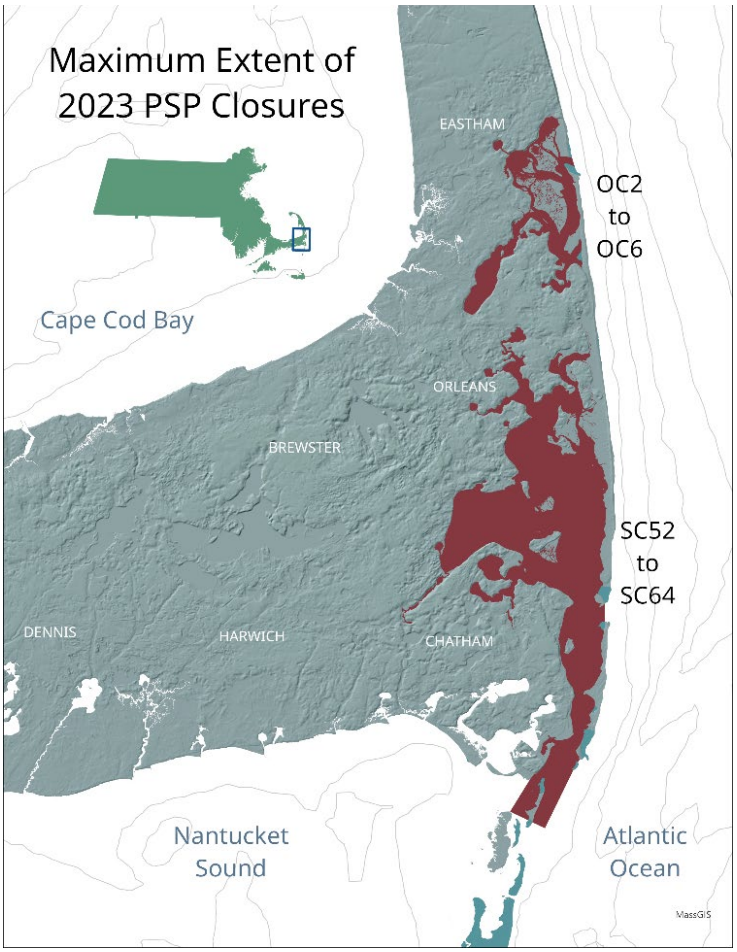

Figure 11. Map of 2023 PSP Closures.

In addition to the bloom occurring in Nauset, low levels of toxicity were detected at our Chatham Harbor monitoring station on April 10, leading to a precautionary PSP closure for blue mussels in all Chatham Harbor and Pleasant Bay growing areas. Further testing of additional areas and shellfish species throughout Pleasant Bay in the following days led to the closure of the entire system for all shellfish species on April 14. The closure remained in effect until testing allowed for a staggered opening of areas by species with the last areas reopened to all species on June 7.

The intensity of the 2023 Nauset bloom combined with the expansion southward into Chatham Harbor and Pleasant Bay led to a significant increase in sampling of shellfish from areas south of Cape Cod and on Nantucket in order to monitor the leading edge of the bloom. Although relatively low numbers of *Alexandrium* cells were observed along the south side of the Cape and even into Buzzards Bay, testing of shellfish meats showed no toxicity and no additional closures were warranted. In recent years the North Shore closures associated with coastal cell populations have been less frequent. Regardless, when closures occur the economic impacts can be devastating given the number of harvesters impacted in multiple communities. Fortunately, the 2023 season saw no toxicity detected at any of our coastal monitoring stations outside of outer Cape Cod and no additional shellfish closures were enacted. All PSP closure notices from 2011 through the current year are available on the DMF website. Current year toxicity data are also published.

Shellfisheries Management Project

Contaminated Shellfish Resources

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

Commercial Bait Harvest: Dredge boat permits were issued for the contaminated surf clam bait fishery off Nantasket Beach in Hull; however, because fewer than three vessels participated in this small fishery, landings cannot be reported for confidentiality reasons.

Contaminated Relay: DMF permits municipalities to relocate (between and within communities) bacterially contaminated shellfish to Approved and Conditionally Approved waters for natural purification (depuration) and municipal propagation. All activities are conducted under strict NSSP guidelines and are heavily supervised by state and local enforcement authorities. No shellfish can be harvested from the receiving relay sites until bacterial (fecal coliform) testing of the shellfish meats has been completed. Generally, after the completion of the transplant, the Division requires shellfish remain in the water for a minimum of 60 days but recommends they stay in the water through at least one spawning season.

Quahogs (*Mercenaria mercenaria*) were the only shellfish species transplanted throughout 2023 (Table 12). A single dredge boat was contracted by 11 permitted towns to harvest quahogs from Restricted areas in the Taunton River for contaminated relay planting. Prior to harvest, shellfish veterinary disease testing was conducted on quahogs from several locations within the donor site (pathology conducted by Kennebec River Biosciences in Richmond, Maine). Relay harvesting in the Taunton River began on April 19 and the spawning season requirement for post-transplant harvest was waived, with a minimum 60-day depuration period required prior to harvest. Acceptable fecal coliform levels in shellfish meat samples were required prior to reopening for harvest. The dredge boat harvested a total of 9,578.5 bushels of quahogs for the 11 communities during the season which ended on November 9 when all orders were filled. Barnstable conducted in-town contaminated relay, transplanting quahogs from Bumps River to East Bay.

Table 12. 2023 Municipal Relays of contaminated quahogs.

Harvest Site	Receiving Municipality	Transplant Site	Classification Area	Bushels	Last Day Planted
Taunton River	Truro	Pamet Harbor	CCB7.1	222	May 24
Taunton River	Dennis	Bass River Center	SC34.23	140	June 9
Taunton River	Wellfleet	Inner Harbor & Harbor	CCB11, CCB13	1,156	May 16
Taunton River	Swansea	Outer Cole River	MHB4.12	300	June 1
Taunton River	Fairhaven	Round Cove	BB21.20	800.5	August 28
Taunton River	Sandwich	Sandwich Harbor	CCB37.0	300	June 21
Taunton River	Yarmouth	Lewis Pond	SC28.7	700	June 28
Taunton River	Marshfield	North/South Rivers	MB5, MB6	80	August 22
Taunton River	Scituate	North/South Rivers	MB5, MB6	80	August 21
Taunton River	Wareham	Broad Cove	BB42.2	800	August 4
Taunton River	Westport	East Branch	BB4	5,000	November 9
Bumps River	Barnstable	East Bay	SC24	250	May 12

Depuration: DMF has operated the Shellfish Purification Plant in Newburyport since 1961. The commercial harvest of mildly contaminated softshell clams 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 activity for the Division.

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 a 130-foot deep well; the in-coming seawater maintains a constant temperature and salinity and continuously disinfected with ultraviolet light as it is recirculated within each tank unit. 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.

In 2023, the Purification Plant received clams on 125 days out of the year. The plant allowed harvesters to dig five days per week. Four Master Digger Permits were active throughout 2023 although one did not harvest. In the last three years, the plant has processed between 2–9% of all softshell clam landings in Massachusetts. The Shellfish Plant was shut down indefinitely on November 24 following the destruction of its lone operating seawater supply well due to erosion from a coastal storm. On December 14, the plant itself was inundated by seawater from another coastal storm calling into question the long-term sustainability of the operation at this location. As a result, DMF commissioned a study from an engineering firm which will report on the feasibility of re-locating the water supply wells and the long-term viability of the plant to be completed in mid-2024. For obvious reasons, the plant closure has been devastating to participants in the depuration industry as it is the only viable outlet for softshell clams harvested from Restricted areas in Massachusetts.

Shellfish Purification Plant Laboratory

The Shellfish Purification Plant's laboratory analyzed 335 shellfish samples from the 125 lots of shellfish received at the plant. The samples were analyzed for fecal coliform in compliance with federal and state depuration standards. In addition, 837 UV effluent, sea water, tap water and control samples were bacteriologically tested for the more stringent drinking water standard of total coliform.

The laboratory also tested 266 shellfish and water samples for the presence of Male Specific Coliphage (MSC). MSC are a group of bacteriophage that infect piliated *Escherichia coli* bacteria and have been utilized within the NSSP as an indicator to evaluate the potential viral contamination of shellfish and their associated growing areas impacted by wastewater treatment plant outfalls. The plant's MSC testing included 213 wastewater treatment plant samples, analyzed at the influent, pre-disinfection, and effluent stages, and 53 shellfish samples.

Laboratory staff continued to participate in monthly ISSC Laboratory Committee and Laboratory subcommittee conference calls, laboratory maintenance, quality control, and preparation of laboratory supporting documentation.

Aquaculture and Propagation Project

The management of marine aquaculture and shellfish propagation activities is a major responsibility of DMF. This includes managing the introduction, culture, and harvest of all marine species in the Commonwealth. Currently the vast majority of marine aquaculture in Massachusetts consists of municipally licensed private molluscan shellfish aquaculture. DMF's duties involve three major areas of concern: 1) certifying the issuance of aquaculture licenses by municipalities; 2) permitting of aquaculturists, towns, and hatcheries to obtain, possess, and sell sub-legal shellfish (seed) for transplant and grow-out to legal size; and 3) reviewing shellfish pathology reports to add hatcheries to DMF's list of approved seed sources to prevent new introductions and spread of shellfish diseases in Massachusetts waters.

Shellfish License Certification

Under state statute, DMF is required to certify that municipally issued aquaculture licenses and associated culture activities will cause no substantial adverse effects on the shellfish or other natural marine resources of the city or town where they are located. Project staff review proposed aquaculture projects and survey sites to determine a project's potential to impact important or protected marine resources. Staff also review projects to evaluate potential conflicts with existing recreational and commercial fisheries and other public uses. If it is determined that a project presents a risk to marine resources or may limit public access, DMF may deny certification or require the town to condition the license to minimize such impacts.

Table 13. New License Certifications in 2023.

Town	License Sites	Acres
Mashpee	1	1.98
Plymouth	3	11.3
Scituate	3	3
Wellfleet	3	3.03
Total	**10**	**19.31**

In 2023, Project staff certified 10 sites for new shellfish aquaculture licenses or extensions to existing sites. This involved surveying 19.31 acres of tidelands (Table 13).

Permitting

DMF issues permits for all marine aquaculture activities in the Commonwealth. Permits require holders to manage their culture activities in a manner that minimizes impacts to the environment and other user groups, and prevents the introduction of diseases, non-native species, and other pests or predators that could decimate natural populations and harm both aquaculture and wild commercial fisheries. Additionally, permits may be conditioned to ensure food safety standards are met.

In the case of shellfish, a propagation permit is issued annually to both private growers and municipalities conducting shellfish planting activities. The permit allows the possession, transplant, and grow-out of seed shellfish from approved sources. In 2023, DMF issued shellfish propagation permits to 393 private aquaculture license site holders (Table 14), and 29 municipalities (for public propagation activities) operating shellfish aquaculture projects in 37 coastal municipalities throughout the Commonwealth. In 2023, DMF also issued aquaculture permits for the culture of sugar kelp and horseshoe crabs (solely for the purpose of wild population enhancement).

Aquaculture Program staff dedicated an extensive amount of time assisting with the development of a new DMF permitting system and database. A goal of the enhanced permitting system is to eventually offer the option of electronic filing of propagation and aquaculture permit applications and requisite annual reports.

Table 14. 2023 private aquaculture and shellfish propagation permits and acreage under cultivation by municipality.

Municipality	# Propagation Permit Holders	Acres*	Species Cultivated
Aquinnah	1	2.6	Quahog
Barnstable	51	158	Oyster, Quahog, Softshell Clam, Surf Clam
Bourne	7	17	Oyster, Quahog, Softshell Clam, Bay Scallop, Sugar Kelp
Brewster	11	11.5	Oyster, Quahog, Softshell Clam, Surf Clam
Chatham	2	7	Oyster, Quahog, Sugar Kelp
Chilmark	7	20	Oyster, Blue Mussel, Bay Scallop
Dartmouth	2	1	Oyster
Dennis	24	32	Oyster, Quahog, Softshell Clam, Surf Clam
Duxbury	28	79.1	Oyster, Quahog, Softshell Clam, Surf Clam, Bay Scallop
Eastham	28	49.6	Oyster, Quahog, Blue Mussel, Softshell Clam, Surf Clam
Edgartown	12	20	Oyster
Fairhaven	4	44	Oyster, Quahog
Falmouth	9	54	Oyster, Quahog, Surf Clam, Bay Scallop, Horseshoe Crab
Gosnold	1	32	Oyster
Harwich	1	0.01	Bay Scallop
Ipswich	1	1	Softshell Clam
Kingston	3	8.5	Oyster, Quahog
Marion	3	1.5	Oyster, Quahog
Mashpee	4	20.9	Oyster, Quahog, Bay Scallop
Mattapoisett	3	60.4	Oyster, Bay Scallop
Nantucket	7	73	Oyster, Quahog
Oak Bluffs	1	4	Oyster, Quahog, Sugar Kelp
Orleans	13	18.5	Oyster, Quahog, Blue Mussel, Surf Clam
Plymouth	34	92.8	Oyster, Quahog, Softshell Clam, Surf Clam, Bay Scallop
Provincetown	14	40	Oyster, Quahog, Softshell Clam, Surf Clam
Rowley	2	24	Oyster, Quahog, Softshell Clam
Scituate	3	3	Oyster
Tisbury	3	4	Oyster, Bay Scallop
Truro	4	20	Oyster
Wareham	6	83	Oyster, Quahog, Sugar Kelp
Wellfleet	91	270.6	Oyster, Quahog, Softshell Clam, Surf Clam, Blood Arc
Westport	5	80	Oyster, Quahog
Yarmouth	7	36	Oyster, Quahog, Sugar Kelp
Grand Total	**393**	**1,369**	

*Acreage based on best available data. DMF intends to verify and ground truth grant acreage in coming years.

Aquaculture Landings

Aquaculture landings and value for oysters and quahogs are presented in Table 15. Oyster culture continued to dominate the aquaculture industry in Massachusetts. Landings value of aquacultured oysters in 2023 decreased by 10% compared to 2022. Quahog aquaculture revenue continued to be dominated by landings from growers

in Barnstable and Wellfleet and increased more than 15% from 2022, to $1,741,560 in 2023. The value of other cultured shellfish species including bay scallops, softshell clams, and surf clams, and kelp does not substantially add to aquaculture landings value and are not reported here due to confidentiality issues.

Table 15. 2023 Aquaculture Landings and Value for Oysters and Quahogs.

Eastern Oyster		
Town or Region	**Pieces**	**Reported Value**
Barnstable	12,886,135	$7,385,271
Brewster	914,650	$529,840
Dennis	1,972,380	$1,142,903
Duxbury	8,675,381	$4,979,773
Eastham	1,436,518	$828,287
Edgartown	1,395,312	$865,146
Falmouth	2,299,656	$1,241,637
Nantucket	753,080	$582,429
Orleans	545,280	$336,968
Other Buzzards Bay Towns	2,435,748	$1,295,239
Other Cape Cod Towns	606,008	$357,613
Other Island Towns	588,185	$507,271
Plymouth/Kingston	2,035,648	$1,111,144
Provincetown	83,500	$50,628
Rowley	*	*
Truro	122,242	$75,353
Wareham	860,700	$546,968
Wellfleet	10,170,201	$6,064,458
Yarmouth	193,925	$110,292
TOTAL	**47,974,548**	**$28,011,217**
Quahog		
Town or Region	**Pieces**	**Reported Value**
Barnstable	1,949,729	$567,245
Duxbury/Mashpee/Orleans	235,196	$88,673
Eastham	92,259	$30,817
Wellfleet	3,664,672	$1,054,824
TOTAL	**5,941,856**	**$1,741,560**
Total Aquaculture Landings Value		**$29,752,777**

*Confidential data; totals reflect only displayed values. Source: SAFIS Dealer Reports as of April 2024 and staff edits.

Aquaculture staff engaged in additional external outreach activities including providing guest lectures/ presentations for the Fundamentals of Shellfish Farming course sponsored by Cape Cod Cooperative Extension and Woods Hole Sea Grant; serving on the Woods Hole Sea Grant Marine Outreach Guidance Group (MOGG) and MIT Sea Grant Aquaculture Advisory Panel (MITSGAAP); serving on several competitive grant review panels (MIT Sea Grant, Woods Hole Sea Grant); and providing peer review for several scientific journal publications.

Vibrio Management

A major component of the Shellfish Program's public health protection responsibilities is the implementation of control measures intended to limit the human health risks associated with exposure to *Vibrio parahaemolyticus* bacteria (*Vp*; *Vibrio*) from the consumption of raw oysters. Consumption of raw shellfish exposed to high levels of *Vibrio* can cause severe gastrointestinal illness, and in rare cases can be lethal. As a result, the USFDA requires NSSP member states with a history of *Vibrio* illness outbreaks to monitor conditions in oyster harvest areas, implement *Vibrio* control measures, and respond in the event of a *Vibrio* illness associated with shellfish consumption. DMF is also responsible for the closure of harvest areas following the notification of a *Vibrio* outbreak from *Mass*DPH.

DMF first implemented its Vibrio Control Plan in 2012, after two confirmed cases of illness in 2011 (Table 16). DMF and *Mass*DPH continually evaluate the effectiveness of the *Vibrio* controls and work with industry and other stakeholders to make improvements and incorporate state-specific data where possible. The only change to the *Vibrio* regulations or Vibrio Control Plan in 2023 was a minor change to the Plan involved revising the very prescriptive definition of adequate icing to allow harvesters some latitude in determining how much ice to use.

Table 16. Single-source *Vibrio* cases related to the consumption of MA-harvested shellfish.

Year	# of Cases
2011	2
2012	9
2013	33
2014	11
2015	28
2016	10
2017	14
2018	10
2019	8
2020	11
2021	16
2022	16
2023	15

The *Vibrio* Control Season in Massachusetts currently runs from May 19 to October 19, when the risk of *Vibrio* illness is highest. During this period, commercial oyster harvesters are required to ice oysters to prevent the post-harvest growth of *Vibrio* bacteria; tag containers of oysters with the time of harvest and time of icing; shade oysters during harvest and transportation; and maintain a harvest logbook. Additionally, certain aquaculture activities related to the culling and processing of oysters are subject to *Vibrio* related restrictions. DMF, in cooperation with local Shellfish Constables and the Massachusetts Environmental Police, work with harvesters and growers to educate them on and verify compliance with the *Vibrio* Control Plan through routine compliance monitoring and industry training meetings. With the exception of the pandemic anomaly in 2020, oyster landings have exhibited an increasing trend over the last decade but the number of illnesses per million oysters landed has remained relatively constant since 2016 (Figure 12).

*Mass*DPH and DMF investigated 25 confirmed *Vp* illnesses involving consumption of raw oysters in 2023 (Table 17). Seven of these illness investigations were single-source trace backs to a MA shellfish growing area. The 2023 *Vibrio* season was somewhat anomalous in that the Katama Bay (V20) growing area was not implicated in any single-source confirmed *Vp* illnesses and only one single-source *Vibrio* sp. (species not determined) illness. Typically, V20 is implicated in the most illnesses. Sporadic single-source illnesses from other areas include areas in Cape Cod Bay (CCB9, CCB23, CCB45), south of Cape Cod (SC21 and SC50), and the head of Buzzards Bay (BB37). Four multi-source confirmed *Vp* illness tracebacks involved oysters from only MA growing areas, 12 cases implicated both in-state and out-of-state growing areas, and two illnesses involved only out-of-state oysters.

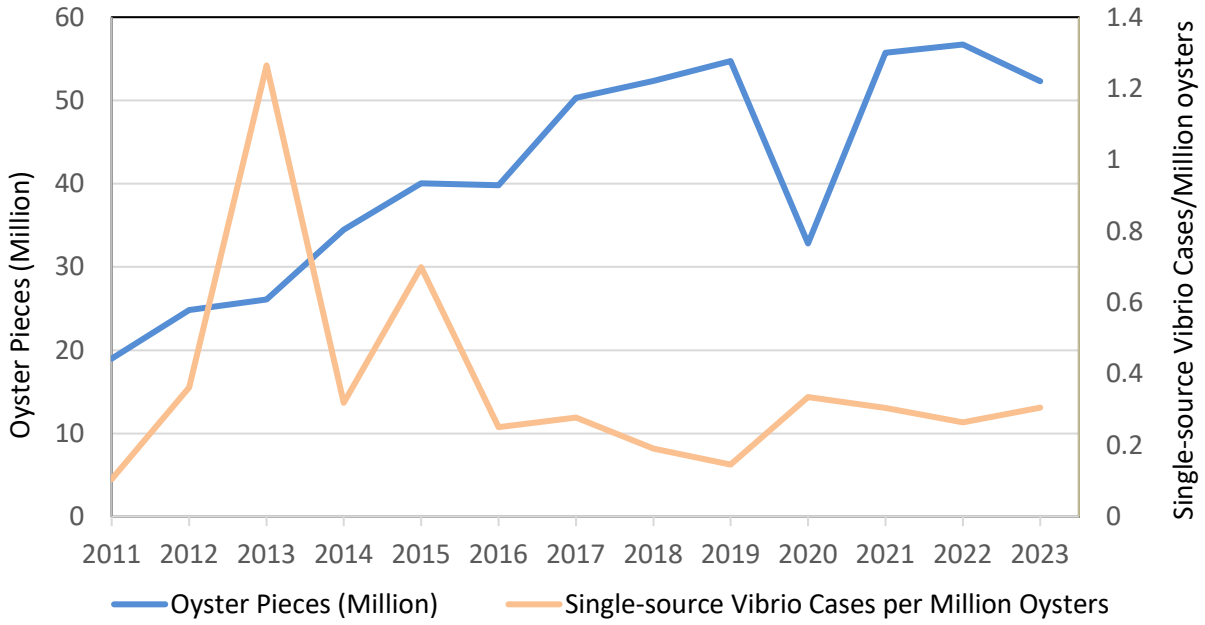

Figure 12. Trends in *Vibrio* Illnesses Relative to Quantity of Oysters Landed.

Table 17. 2023 Vp Illnesses (Raw Oysters) Traced Back to Specific Growing Areas.

	MA Growing Areas or State/Country for Out-of-state Traceback
MA Single-source (7)	BB37 (1 case); CCB9 (1 case); CCB23 (2 cases); CCB45 (1 case); SC21 (1 case); SC50 (1 case)
MA Multi-source (4)	[BB31 & SC61]; [BB37 & CCB23]; [BB37 & SC21]; [V2 & V20]
Both Out-of-state and In-state Multi-source (12)	[CCB11, ME & Canada]; [CCB23 & Canada]; [SC21, CT & RI]*; [CCB23, VA & Canada]; [CCB11, CCB31 & CT]; [CCB11, ME & RI]; [BB50, CCB11 & Canada]; [CCB9, SC21 & RI]; [CCB45, NH, WA & Canada]; [CCB23, WA & Canada]; [CCB45 & CT]; [BB37, CCB23, CCB31, CCB45, SC22, RI & Canada]
Out-of-state Only (2)	[RI]; [ME & Canada]

*Multi-species case with confirmed *Vp*, *Vv* and *Vc.*

An additional 24 investigations and trace backs were completed for illnesses associated with raw oyster consumption that were confirmed *Vibrio* genus, but species was not identified. Eight involved single-source trace backs to MA growing areas (CCB11, CCB14, CCB31, SC50 and V20), four implicated multiple in-state growing areas, nine involved in-state and out-of-state sources, two were multi-source out-of-state, and one was recreational harvest lost to follow-up. CCB11 and CCB14 represent one hydrographically connected area that is managed as a single-source for the purposes of Vibrio tracebacks. Five of the 8 single-source *Vibrio* sp. cases were from CCB11/CCB14 in the Wellfleet Harbor System. Additionally, Wellfleet Harbor areas were in the mix for 8 of the *Vp* and *Vibrio* sp. multi-source illness tracebacks. Of the multi-source tracebacks involving Wellfleet Harbor and only in-state growing areas, in all but one case the other MA growing areas had also been implicated in single-source confirmed *Vp* illnesses (CCB9, CCB23 & SC50). In 2023, there were two confirmed *V. vulnificus* cases associated with oyster consumption. Both were multi-source cases that included out-of-state oysters and one of the cases were positive for *Vp* and *V. cholera* in addition to *V. vulnificus*.

Confirmed *Vp* and *Vibrio* sp. illness cases were highest for oysters harvested in the month of August, but illness cases remained sporadic in nature in 2023 and the number of cases did not reach thresholds that required shellfish growing area closures during the 2023 *Vibrio* Control Season. The last year in which shellfish growing area closures were required due to *Vibrio* illnesses was 2018.

Other Activities

Staff participated in professional organizations and meetings including the 2023 Interstate Shellfish Sanitation Conference (DMF and *Mass*DPH are voting delegates), Shellfish Advisory Panel, the Massachusetts Shellfish Officers Association, the 2023 Northeast Aquaculture Conference & Exposition, and several in-state conferences/events (e.g., Plymouth Blue Future Conference and Wellfleet Oyster Fest).

In 2023, DMF applied for and was awarded a fifth FDA Milk and Shellfish Grant to purchase shellfish program equipment. DMF used the $20,000 received to purchase needed supplies and equipment for the laboratory. Lab equipment and supplies consisted of a refrigerated centrifuge, a centrifuge rotor, a pH meter, and filter funnels. DMF is grateful for the support of the FDA, ISSC, NCIMS, and AFDO National Shellfish Sanitation Grant Program for providing over $80,000 to the Shellfish Sanitation and Management Program in equipment and educational funding over the last several years.

In August 2023, DMF applied for and was awarded $472,424 through the FY24 State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) Implementation Funding for the project “Coastal Marine Biotoxin Monitoring and Seafood Safety.” These funds were utilized to purchase four High Performance Liquid Chromatography instruments, to pay for the installation of the units and training on their use, as well as the reagents and standards necessary to run the intended method. This purchase was divided evenly between the New Bedford and Gloucester laboratories to expand their biotoxin testing toolkit to include the Post-Column Oxidation (PCOX) Method for the Determination of Paralytic Shellfish Toxins, which will eventually replace the currently used mouse bioassay.

Habitat Program

Personnel

Mark Rousseau, Program Manager

Gloucester
Kate Frew, Marine Fisheries Biologist
Dr. Forest Schenck, Marine Fisheries Biologist
Iris Seto, Marine Fisheries Biologist (beginning in February)
Anna Halilaj, High School Intern (April–June)
Sean Young, UMASS Undergraduate Student Intern (June–December)
Cori Carlston, NEU 3Seas Graduate Student Intern (May–December)

New Bedford
Dr. John Logan, Marine Fisheries Biologist
Steve Voss, Marine Fisheries Biologist
Amanda Davis, Marine Fisheries Biologist
Emma Gallagher, Contract Assistant (January–August)
Malik Neron, Contract Assistant (beginning in August)
Kara Falvey, Contract Assistant (beginning in August)
Mike Blanco, Seasonal Contract Technician (January–May)

Overview

The Habitat Program protects and enhances marine fisheries resources through its Technical Review and Fisheries Habitat Research projects. The **Technical Review Project** reviews permits submitted to municipalities, the Commonwealth, and the federal government for construction projects occurring in waters with fisheries and habitats under DMF jurisdiction. The reviewers provide recommendations to avoid and minimize impacts to marine fisheries resources. In addition, staff participates on various working groups to provide technical analysis and policy input on a variety of topics including ocean planning and offshore wind development. The **Fisheries Habitat Research Project** conducts state- and grant-funded research related to marine fisheries habitats. Research studies focus on marshes, embayments, artificial reefs, eelgrass, and food webs.

Technical Review Project

Technical Review

DMF reviews coastal construction projects and provides information to municipal, state, and federal agencies to ensure projects avoid, minimize, or mitigate potential impacts to marine fisheries resources and habitats. In October 2023, Habitat permit review regions were realigned, with coverage of coastal alteration project review for municipalities from Cohasset to Plymouth transferred to the Annisquam office. Projects from the Town of Plymouth north to the New Hampshire border are now reviewed by program staff stationed at the Annisquam River facility, while South Coast office staff review projects from the Town of Bourne south to the Rhode Island border, including the Islands.

In 2023, staff reviewed 784 permit filings associated with 597 projects in 95 municipalities (Figure 13). Of these, 357 were new projects, which is consistent with the average of 384 new projects per year over the past decade. The dominant new project type was residential docks. Not all projects reviewed represent new construction or

new impacts; 234 projects (39%) were specific to replacements or repairs of previously permitted structures. For example, 104/121 hardened shoreline, 82/200 residential dock, and 42/73 commercial/public dock projects addressed the replacement of existing structures. Of all projects reviewed, 117 projects (20%) occurred in or near salt marsh habitat and 46 projects (8%) in or near eelgrass habitat. In 2023, DMF recommended time-of-year restrictions (TOYs) for 189 projects (22%) and received waiver requests for 12 of those projects.

Notable projects reviewed in 2023 include Herring River Restoration in Wellfleet, Ipswich Mills Dam Removal, Talbot Mills Dam Removal and Concord River Restoration, and the Decommissioning of the Neptune LNG Port. Major dredging projects included the Cape Cod Canal, Cotuit Bay in Barnstable, multiple sites along the Essex River, and around Nantasket Pier in Hull. Erosion control and nourishment projects included Bay Avenue in Marshfield and seawall repairs to various stretches of coastline along Scituate. Information about offshore wind and supporting onshore infrastructure projects are outlined previously (page 21).

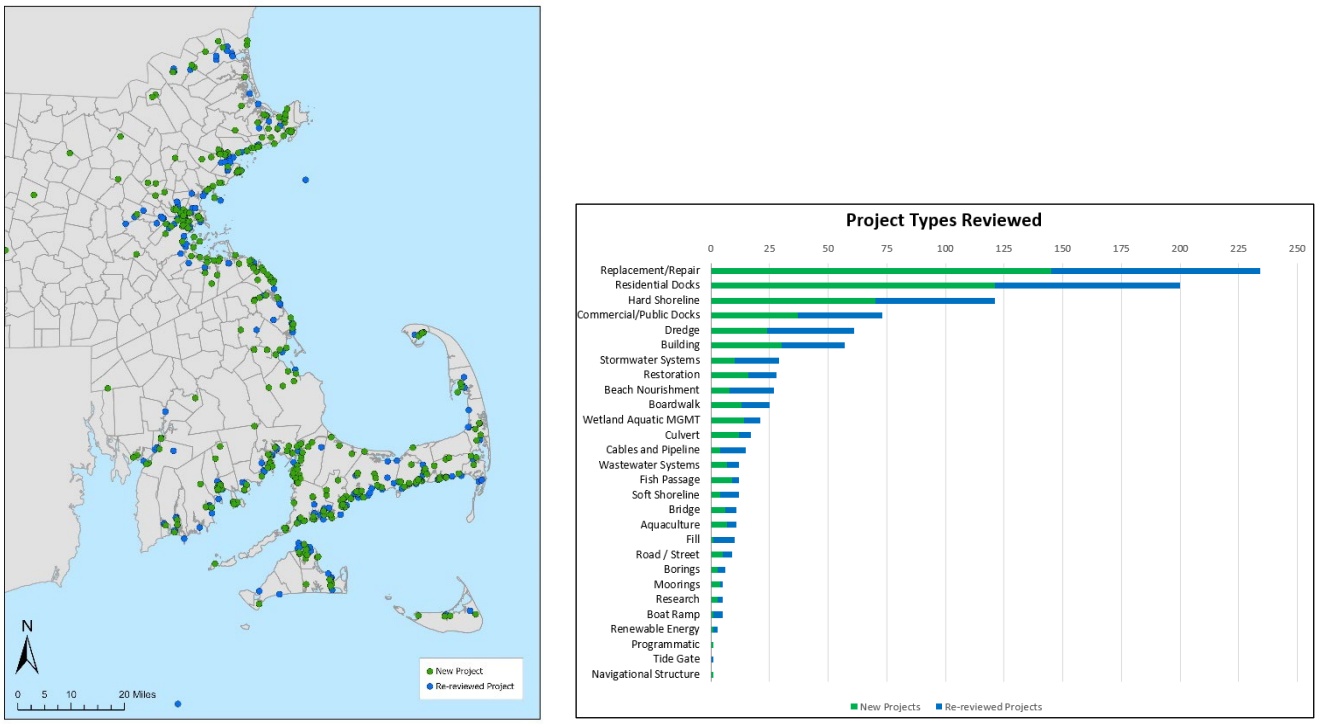

Figure 13. Coastal alteration projects reviewed in 2023 by location (left) and type (right). A single project can include multiple project types.

Data Management

Data management and archiving are important parts of Technical Review. Program staff continue to improve these systems as technologies improve. In 2023, Habitat Program staff continued to use the DMF Review Database (v. 2.1) to track project location, type, impact size, potential habitat impacts, and other project attributes. Program staff utilize the database to track the number of projects reviewed and the number of reviews associated with each project (Table 18).

Table 18. Number of applications or documents reviewed by Habitat staff in 2023.

Document Type	Permit Associated	Count (% of total)	Comments are Due To
Notice of Intent	Order of Conditions	296 (38%)	City/Town Conservation Commission
Public Notice of Chapter 91 Waterways License or Permit Application	Waterways License or Permit	159 (20%)	MA Department of Environmental Protection (DEP)
Preconstruction Notification Form	General Permit	112 (14%)	U.S. Army Corps of Engineers (ACOE)
Environmental Notification Form	Secretary's Certificate*	84 (11%)	MA Environmental Policy Act (MEPA) Office
Notice of Project Change		17 (2%)	MEPA Office or ACOE
Environmental Impact Report or Reviews**		39 (5%)	MEPA Office
Public Notice	Individual Permit	14 (1.8%)	ACOE
401 Water Quality Certification Public Notice	401 Water Quality Certification	1 (0.1%)	DEP
Other (information or pre-app meeting requests)		58 (7%)	

*The MEPA review is not a permitting process but is instead a forum for public study of a proposed project.
**MEPA Review may result in the issuance of a Certificate with a Scope for Environmental Impact Reports or Reviews.

In Lieu Fee Program

The In Lieu Fee (ILF) Program is the mechanism by which the U.S. Army Corps of Engineers (USACE) can mitigate for unavoidable impacts on natural resources from the construction activities they regulate. From 2009–2014, DMF was the sponsor for the first ILF program in Massachusetts, the Coastal ILF Program, which addressed authorized impacts of less than one acre in extent to coastal aquatic resources. In 2014, a new Massachusetts-wide ILF program sponsored by *Mass*DFG was developed to include unavoidable resource impacts statewide under both the USACE General Permit and Individual Permit. Staff participate in the ILF Program's proposal review for projects submitted for funding consideration, the tracking of payments received, and credits sold, and the development and review of the Department's annual reports on the program.

Coastal ILF Program: The Draka Dam fishway in Taunton is the final project to be completed under the Coastal ILF Program. The fishway was partially funded through the Coastal ILF Program with additional support from Save the Bay, the Massachusetts Environmental Trust, and the US Fish and Wildlife Service. Construction was completed on the project in 2019 and seasonal monitoring and stocking remains ongoing. ACOE/*Mass*DFG credit release for the project will be finalized upon completion of monitoring through 2024.

***Mass*DFG ILF Program:** In 2020, *Mass*DFG initiated an annual selection process for identifying coastal restoration projects to submit to the USACE for funding approval. Projects approved for funding are typically required to include monitoring for five years or more. While no new DMF proposals were funded in 2023, the Habitat Program worked on three active ILF-funded projects during the year. Additional information on Eelgrass Restoration/Middle Ground-Salem, MA project can be found on page 58; MA Eelgrass Site Selection Model and Targeted Planting Study is further described on page 59; and Marine Habitat enhancement, Artificial Reef-Yarmouth on page 56.

Ocean Planning

In 2021, the Massachusetts Ocean Management Plan (the Commonwealth's blueprint for the protection and sustainable use of state ocean waters) completed the plan's five-year review and revision. In 2023, Program staff participated in the Science Advisory Council and the Ocean Advisory Commission meetings. DMF continued to participate on the Northeast Regional Ocean Council and the Northeast Habitat Assessment team. Both entities work to improve regional coordination of the management and permitting of offshore activities.

DMF staff participate in an interagency ocean management team to inform *Mass*CZM's expenditure of funds from the Ocean Resources and Waterways Trust established for the Plan. In 2023, the team approved a $200,000 expenditure from the Trust to advance the characterization of five offshore sand resource areas in Commonwealth waters as potentially viable sources of sand for beach nourishment. Characterization work will commence in 2024.

Fisheries Habitat Research Project

Artificial Reefs

Massachusetts has five permitted artificial reefs in its waters. Staff perform surveys to identify new reef sites for permitting, conducts compliance and biological monitoring, coordinates materials acquisitions and deployments, and provides technical guidance to advance responsible artificial reef development and uses in MA coastal waters.

Reef Monitoring: In 2023, all reef sites were monitored for community composition, biomass, invasive species presence, permit compliance, and temperature. Acoustic receivers were utilized year-round to assess the patterns of tagged fish. We documented fish visiting multiple reef sites and returning to the same reef site over multiple years. Work continued on the development of protocols to guide future reef monitoring efforts.

DMF continued a study using Baited Remote Underwater Video Stations (BRUVS) comparing reef productivity of artificial reefs in Nantucket Sound (Figure 14). The BRUVS were used to measure species richness, diversity, abundance, and age structure of black sea bass and scup and compare fish aggregations on artificial reefs to those on nearby natural reefs and sand bottom habitats. Staff utilize BRUVS to assess structured habitat connectivity to determine appropriate spacing of new artificial reefs.

Side scan sonar surveys were conducted for pre- and post-artificial reef deployments and for selecting sites to permit. The surveys are used to demonstrate compliance with permit conditions and provide a snapshot of material footprints of new materials added to the reef sites.

Figure 14. DMF divers prepare to monitor the Yarmouth Artificial Reef.

Material Storage and Procurement: The DMF lease agreement utilizing the Massachusetts Clean Energy Center New Bedford Commerce Terminal to stage artificial reef material expired in 2022. Efforts to obtain and store surplus materials from *Mass*DOT, *Mass*DER, MBTA, and other parties were ongoing in 2023.

Deployments: There were no artificial reef deployments in 2023.

Cape Cod Bay Site Selection: In 2018, DMF began exploring the potential for four to five new artificial reef locations in lower Cape Cod Bay between Sandwich and Barnstable. In 2021, project staff met with Massachusetts Environmental Policy Act (MEPA) representatives from EEA to discuss the appropriate permitting pathway for these sites. During 2023, proposed sites in Brewster and Dennis were under review as potential sites to explore for permitting.

Outreach: Habitat staff presented updates on DMF artificial reef activities to various groups, including DMF's Marine Recreational Fisheries Development Panel, the Cape Cod Commercial Charter Boat Association, and the Cape Cod Salties. Project staff collaborated with NOAA Fisheries staff and other state reef program managers on an assessment of artificial reefs in the US; the release date was projected to be January 2024.

Climate Change

Climate change is an area of active research and policy development in New England. DMF's primary focus is on harnessing existing research efforts and ensuring that data relevant to climate change are being collected in a standardized way and made accessible to all research entities.

Temperature: Project staff compile all marine and coastal continuous bottom temperature monitoring records collected by DMF. The database contains over 7 million records from 1986 to present, inventorying more than 30 seafloor stations and over 40 estuarine and riverine sites where bottom temperature data are collected seasonally, typically March to October. Approximately 200,000 temperature records statewide are collected annually. Efforts to advance the database to a publicly accessible platform were ongoing in 2023.

MA Climate Assessment: Program staff contributed to the 2022 EEA State Hazard Mitigation and Climate Adaptation Plan leading to the development of the EEA ResilientMass plan released in 2023. The ResilientMass Plan evaluates climate impacts across five sectors: Human, Infrastructure, Natural Environment, Governance, and Economy; and seven regions of the Commonwealth to inform how Massachusetts people, environments, and infrastructure may be affected by climate change through the end of the century. A key finding of the report identifies decreases in marine fisheries and aquaculture productivity as high priority focus areas for the Commonwealth.

In August, DMF received $472,00 in FY24 ResilientMass Implementation Funding for "Coastal Marine Biotoxin Monitoring and Seafood Safety" to purchase High-Performance Liquid Chromatography (HPLC) to replace the Mouse Bioassay for detection and quantification of marine biotoxins in shellfish and seawater. HPLC capabilities will be implemented in New Bedford and Gloucester shellfish labs to increase public health protection, minimize the need for precautionary shellfish closures, and increase the efficiency by which shellfish growing areas impacted by harmful algal bloom biotoxins can be reopened. DMF planned to request additional FY25 ResilientMass funding to address staff training and laboratory certifications for the new equipment.

Food Webs: Project staff have been researching the processes by which ocean warming and other physiological changes from climate change may alter food webs. Staff have been involved in diet and stable isotope studies of tunas in New England shelf and offshore waters in collaboration with the University of Maine and Gulf of Maine Research Institute. DMF staff assisted with drafting a manuscript that explores recent changes in Atlantic bluefin tuna diet in the Gulf of Maine; it was undergoing peer review at year's end.

A study initiated in 2012 to examine the interplay between eutrophication and transfer of contaminants into Cape Cod estuarine food webs continued in 2023. Undergraduate students and faculty from the Harvard T.H. Chan School of Public Health performed additional lab and data analyses to measure the total mercury concentration of Atlantic silversides and mummichogs collected from estuaries with different nitrogen loads in Falmouth, MA. Harvard and DMF Habitat Program staff began preparing a scientific manuscript of these results to be submitted for peer review in 2024.

DFG Climate and Biodiversity Strategic Planning Initiative: In 2023, Program staff contributed to a strategic planning initiative undertaken by DFG to develop long term goals for addressing biodiversity and climate change throughout the Commonwealth. A climate change working group of representatives from each Division was tasked with identifying and prioritizing goals to address biodiversity and climate change through the development of a DFG Strategic Plan. Finalization of the Plan was scheduled for 2024.

Eelgrass Monitoring and Restoration

Eelgrass (*Zostera marina*) is a critical marine fisheries habitat. Project staff conduct research, monitoring, and restoration of eelgrass in Massachusetts. The eelgrass experts at DMF also play an important role advising other groups studying eelgrass and protecting eelgrass through technical review of construction projects.

Eelgrass Monitoring: Project staff completed the 16th year of dive surveys at a site off West Beach, Beverly in Salem Sound as part of the international SeagrassNet monitoring program and Mass CZM's Marine Invader Monitoring and Information Collaborative. Long term monitoring at this site provides the region with data on the response of eelgrass to changing temperature and resilience to storms, algal blooms, and eelgrass wasting disease. In response to increased regional interest in seed-based eelgrass restoration, staff started quantifying eelgrass seed abundance from sediment cores in 2023.

Project staff completed coordination of a 6th year of the Citizen Science Eelgrass Rapid Assessment Program. The program primarily relies on volunteers to collect eelgrass presence and condition data using a standardized protocol and the iSeaGrass web app to document eelgrass distribution and health at locations throughout the state. The program's focus in 2023 remained in the Duxbury-Kingston-Plymouth embayment (DKP), where there is an ongoing collaboration with the Massachusetts Bay National Estuarine Partnership, EPA, and North and South Rivers Watershed Association supported by mitigation funding from *Mass*DEP and Veolia. A total of 20 volunteers contributed to the eelgrass assessment in DKP, sampling at 104 locations in August. Overall, these data continue to suggest eelgrass area remains well below the historic baseline with most losses incurred at the innermost portions of the historic distribution of eelgrass in DKP. The program was expected to continue in 2024.

Project staff collaborated with researchers from Northeastern University to monitor the distribution of seagrass seed pathogens in Massachusetts. The results were presented by intern Cori Carlston for her graduate thesis. Staff began preparing a scientific manuscript of these results to submit for peer review.

Project staff received grants from the EPA Southern New England Program and WHOI Sea Grant to assess the timing and distribution of eelgrass seed production in Massachusetts over two years in partnership with Rhode Island Division of Marine Fisheries, Massachusetts Bay National Estuary Partnership, and Salem Sound Coast Watch. Monitoring was scheduled to begin in 2024.

Salem Sound Eelgrass Restoration: In 2023, staff completed the final year of required annual monitoring at our eelgrass restoration site at Middle Ground in Salem Sound (Figure 15). This was the first ILF funded eelgrass restoration project in Massachusetts. A half-acre site was planted with eelgrass in 2017 with an additional quarter-acre planted in 2018. By 2023 eelgrass area had stabilized at approximately a sixth of an acre distributed throughout the three-quarter acre site. The patchy distribution and relatively short canopy of eelgrass at the restoration site was similar to the nearby Aquavitae reference site, but differed from the continuous, tall eelgrass at the West Beach reference site. We belive these differences are due to the greater exposure of the Aquavitae reference site and restoration site to disturbance from winter storms and highlights the importance of considering environmental context when evaluating eelgrass restoration success.

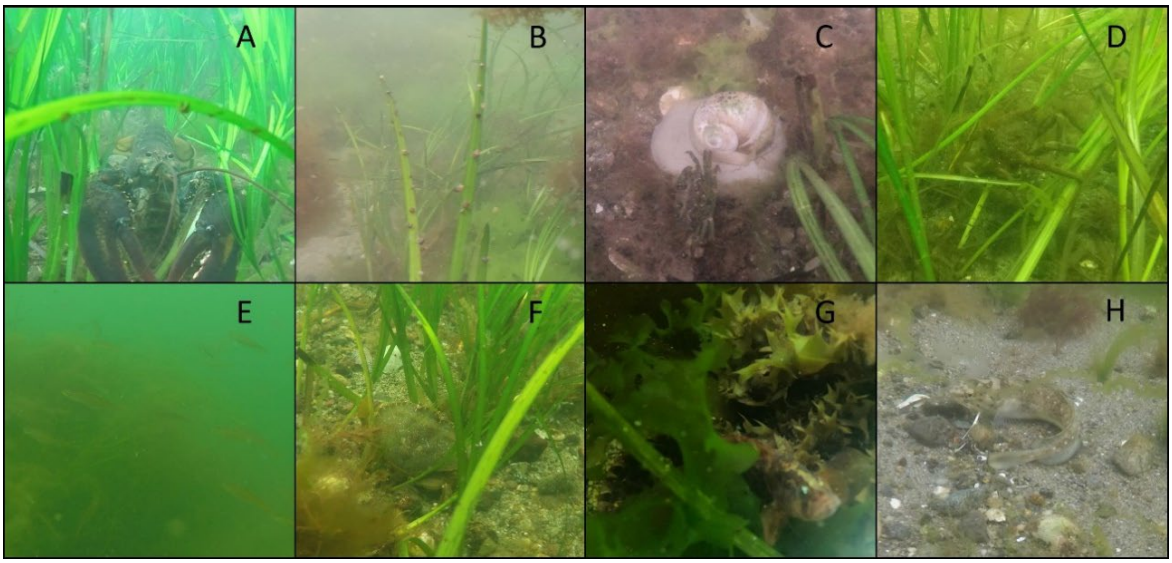

Figure 15. Finfish, crustacean, and mollusk species observed utilizing the eelgrass habitat at the Salem Sound Eelgrass Restoration. (A) American lobster; (B) banded chink shell; (C) northern moon snail and European green crab; (D) common spider crab; (E) juvenile Atlantic pollock; (F) Atlantic rock crab; (G) rock gunnel; and (H) juvenile spotted hake.

Eelgrass Restoration Site Selection Project: Project staff continued efforts to identify suitable locations for future eelgrass restoration with funding from the *Mass*DFG ILF Program. In 2023, this work included permitting, planting, and monitoring test plots where field monitoring suggested suitability (Figure 16). Project staff planned to continue these efforts in 2024.

Figure 16. DMF's Iris Seto monitoring an eelgrass test plot planted off Toby's Island in Bourne.

Developing Capacity for Seed-Based Eelgrass Restoration: Project staff received funding through the Massachusetts Bay National Estuary Partnership to develop capacity to support seed-based eelgrass restoration utilizing the seawater system and tanks at the Division's Cat Cove Lab in Salem. Project staff collaborated with researchers from Massachusetts Bay National Estuarine Partnership, Salem State University, and Northeastern University to trial seed storage and processing methodologies, producing over 50,000 seeds. This work was planned to continue in 2024.

Mooring impacts to Eelgrass: Project staff submitted a scientific manuscript for peer review on the recovery of eelgrass following conversion of conventional chain moorings to conservation mooring systems in Massachusetts. Publication is anticipated for 2024.

Float Impacts to Eelgrass: Project staff continued to participate as partners in an ongoing project led by Salem Sound Coast Watch to assess the impact of floats on eelgrass. This work will inform our environmental review comment letters pertaining to dock and pier construction. In 2023, project staff conducted data analyses and assisted in the drafting of a scientific manuscript associated with the project to be submitted for peer review in 2024. Project staff also conducted side scan sonar surveys along the Marblehead coastline with the objective of assessing eelgrass presence before and after the installation of floats.

Town Neck Beach, Sandwich Eelgrass Surveys: Project staff, in a partnership with the Woods Hole Group continued its annual eelgrass survey along Town Neck Beach in Sandwich. This partnership is entering its tenth year with annual surveys going back to 2015. DMF is responsible for the boat-based side-scan sonar and drop camera surveys for the deeper eelgrass extents, while Woods Hole Group conducts the wading survey for the near shore shallow areas. This site is of particular interest due to continued beach nourishment activities and the potential impacts to eelgrass and habitat in the area. The surveyed eelgrass bed has persisted following nourishment based on surveys to date (Figure 17).

Figure 17. 2023 site map with mapped eelgrass (Woods Hole Group produced map).

Bay Scalloping Impacts to Eelgrass

Bay scallops are found predominantly in eelgrass meadows. To better understand if a winter bay scallop fishery was impacting eelgrass, DMF started studying the impact of dragging for bay scallops on eelgrass in 2018 and has conducted field work multiple times per year since then. The first study relies on a natural experiment. In 2017, the Westport River supported a large and prolonged bay scallop harvest for the first time in decades, presenting a unique opportunity to characterize eelgrass meadows during the growing season following a single season of scalloping. From 2018–2021, the Habitat team surveyed an eelgrass meadow that was the site of intensive scallop dragging as well as several nearby unfished beds that served as references for comparison. Data were still being analyzed at year's end, but preliminary work has not demonstrated any declines in eelgrass clearly linked to scalloping activity.

The second study is a controlled impact assessment whereby DMF established experimental scallop dragging sites in an eelgrass meadow in Nasketucket Bay in Fairhaven and in the West Branch of the Westport River. In each area, high and low intensity dragging was conducted during the November–December bay scalloping season for three consecutive years (beginning in 2018 in Fairhaven and in 2019 in Westport), followed by subsequent summer season measuring of eelgrass density in both the fished sites and adjacent unfished reference sites. The final round of eelgrass monitoring for Westport was conducted in summer 2022 to complete all field work for the study. During 2023, analysis of side-scan sonar was completed while bottom image analysis continued with a 2024 target for completion.

Environmental DNA (eDNA)

Winter Flounder: Winter flounder spawn demersal, adhesive eggs in winter months. These eggs are sensitive to turbidity and burial so dredging projects in all Massachusetts embayments are limited by time of year (TOY) restrictions during the spawning and larval development periods as an impact minimization strategy. Because detailed information regarding the timing and location of spawning within embayments is lacking, the winter flounder TOY spawning recommendation is broad and long. When combined with user conflicts during summer months, this generally restricts the dredging window to the fall and early winter. There is great interest in better understanding how to adequately protect winter flounder while providing more flexibility for dredge projects.

In 2021–2022, the Habitat team initiated a pilot winter flounder eDNA study. The study consisted of collecting monthly to bi-monthly bottom water samples from six Cape Cod embayments: Sesuit Harbor, Wellfleet Harbor, and Pamet Harbor on the north side and Green Pond, Waquoit Bay, and the Bass River on the south side. The pilot study was a partnership with the Gloucester Marine Genomics Institute (GMGI), which is using qPCR techniques to detect winter flounder eDNA in bottom water samples from these sites. At the conclusion of the 12-month sampling effort, DMF had collected approximately 1,000 water samples for eDNA analysis. GMGI completed processing of these samples in 2023 and results were being synthesized for a scientific publication to be submitted for peer review in 2024.

To build upon the eDNA pilot study, DMF initiated a combined eDNA and fyke net survey of winter flounder in Waquoit Bay in 2023. Fyke nets were installed in four locations in Waquoit Bay in January and monitored weekly through April (Figure 18). Winter flounder collected in fykes were counted, measured, and assessed externally for reproductive status prior to release. During this same time period, eDNA samples were collected biweekly from the same 13 sampling stations established in the pilot eDNA study to directly compare eDNA data with fyke net catch-per-unit-effort. The majority of winter flounder were caught in January and February with the highest percentage of fish caught at the station at the head of Waquoit Bay. Timing of peak catches aligned with the periods of peak eDNA detections from the previous winter (Figure 19). eDNA samples collected in 2023 were expected to be processed in 2024 to allow for direct comparison to catch data from the same year. Both male and female winter flounder in active spawning condition were observed during the first year of this survey providing direct evidence of spawning within this estuarine environment.

Figure 18. Habitat Program staff Michael Blanco and Amanda Davis tend to one of the four fyke net stations in Waquoit Bay.

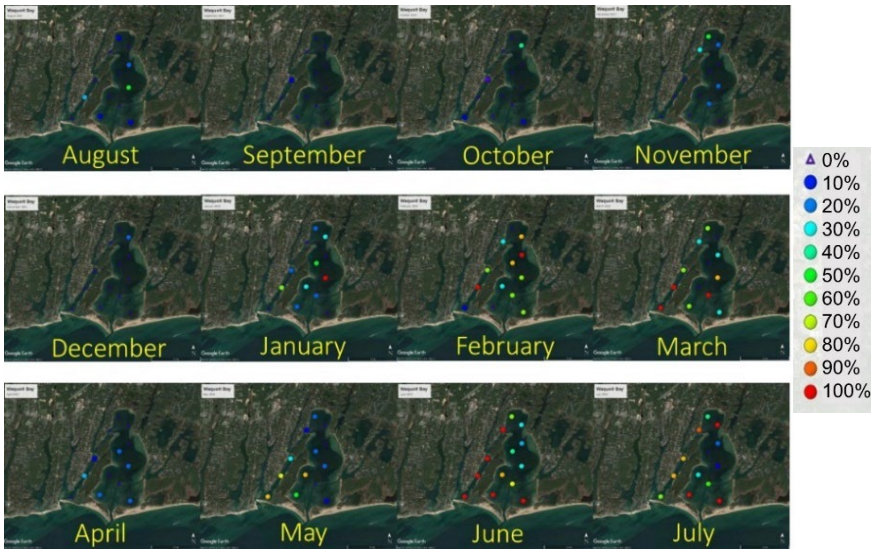

Figure 19. Monthly eDNA results from Waquoit Bay from the pilot study. Values reflect the percent of replicates with positive winter flounder eDNA detections, with warmer colors corresponding to higher detections.

Additional water samples for winter flounder eDNA analysis in Waquoit Bay were collected in June during DMF's young-of-year winter flounder seine survey and in subsequent sampling events in July and August to assess temporal trends in abundance across summer months. The July and August seining efforts revealed a substantial decline in YOY winter flounder compared to June, which was consistent with declining eDNA detections across these same summer months collected during 2021–2022. Analysis and comparison of eDNA results with seine catch data was planned for 2024. In partnership with Rhode Island Department of Environmental Management, monthly water samples were also collected from Ninigret Pond in Charlestown, RI where pre-existing fyke and

beach seine surveys for winter flounder provide complementary survey data for comparison with eDNA results. Results were expected to aid in interpretation of eDNA data from Massachusetts estuaries.

Offshore Wind: DMF Habitat Program staff collaborated with GMGI on a pilot eDNA study focused on the offshore wind lease areas off the Massachusetts coast. From May to November, Habitat Program staff collected monthly surface and bottom water samples from 40 fixed stations both within lease areas permitted for development and in nearby reference areas not currently under development (Figure 20). Stations in active development were located within the South Fork and Revolution Wind lease areas as well as the Vineyard Wind 1 lease area with most stations aligned in close proximity to an existing acoustic telemetry array maintained by the New England Aquarium's Anderson Cabot Center for Ocean Life to allow for comparison of eDNA results with the presence of acoustically tagged fish species. Sample analysis by GMGI began in late 2023 and was planned for completion in 2024. eDNA metabarcoding methods are being used to characterize the biodiversity of fishes, invertebrates, marine mammals, sea birds, and sea turtles in these offshore wind lease areas. These data will provide an important baseline of marine biodiversity prior to large-scale construction in this region.

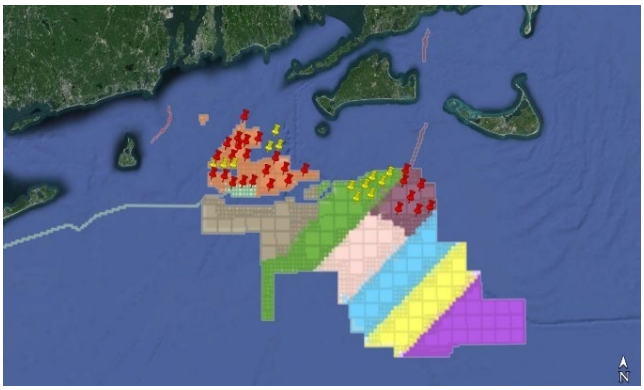

Figure 20. Map showing the offshore wind lease areas south of Massachusetts. Stations sampled in 2023 for eDNA are marked by pins: red for areas of active construction, and yellow for undeveloped reference sites.

MA DMF Monitoring Surveys: Habitat Program staff partnered with the Resource Assessment Survey to continue collecting water samples on the annual state bottom trawl survey. Samples were collected at 110 stations across the Spring and Fall surveys in 2023. eDNA analysis began at GMGI in late 2023 with all results expected in 2024. eDNA metabarcoding analysis of fishes is being conducted to estimate fish biodiversity for comparison with trawl catches.

Water samples for eDNA analysis were also collected alongside the Habitat Program's artificial reef monitoring program (Figure 21). Surface and bottom water samples were collected in association with baited remote underwater video (BRUV) surveys conducted at artificial reefs off Yarmouth and Harwich as well as reference hard and soft bottom sites in Nantucket Sound during three sampling events in Spring and Summer 2023.

Figure 21. UMASS intern Sean Young retrieving a BRUV unit from the Yarmouth artificial reef.

Other Activities

Technical Committees: Program staff continued to serve on a variety of habitat-related committees, including the ASMFC Habitat and Artificial Reef Committees, the Atlantic Coastal Fish Habitat Partnership (ACFHP), the ACFHP Science and Data Committee, the NEFMC Habitat Plan Development Team, the NROC Ocean Planning Committee and Habitat Classification and Ocean Mapping Subcommittee, the MA State Interagency Aerial Spraying Technical Committee, NEFMC/MAFMC Northeast Regional Habitat Assessment Team, MA Climate Change Vulnerability Assessment Team, the Massachusetts Bay Management Committee, the Buzzards Bay

National Estuary Program, the Boston Harbor Habitat Coalition, the Gulf of Maine Climate Network's Sentinel Monitoring Project, the Marine Invader Monitoring and Information Collaborative, the MA DFG ILF Steering Committee and Project Proposal Review Team, DEP salt marsh restoration working group, and the MIT Sea Grant Advisory Committee.

Executive Order 618 on Biodiversity Conservation in Massachusetts: In 2023 Governor Healey signed Executive Order 618, directing *Mass*DFG to conduct a review of existing biodiversity conservation efforts and establish goals and strategies to achieve a nature-positive future for Massachusetts. In August, DMF staff began working with representatives from MassWildlife, *Mass*DER, OFBA and other agencies in the development of a plan for the Commonwealth to address biodiversity conservation. Final report and recommendations were expected to be completed and released in 2024.

Publications: In 2023, the Habitat Program continued to develop a Fisheries Habitat Publications webpage to provide access to white papers, standard operating procedures, and peer reviewed publications written by program staff. Topics covered by the Publications page include artificial reefs, climate change, eelgrass, ILF project reports, ocean planning, offshore wind, salt marshes and estuaries, and seafloor studies. Additionally, staff authored several peer-reviewed articles.

Support Activities: Staff reviewed proposals for NOAA, MIT Sea Grant, ACFHP, and performed peer review for four academic journals and served as an editor for two papers of Frontiers in Marine Science. Staff represented the agency at the EEA Summer Internship Speaker series, DMF seminar series, and DEP permitting workshop. Staff provided presentations to MFAC, MSOA, and the SAC. Staff also participated on thesis committees for PhD and master's candidates at UMass Boston, MIT and UNH. Project staff advised one Masconomet, MA high school student intern during summer 2023 and one UMass-Amherst undergraduate intern through the UMass CAFE Internship Program.

FISHERIES BIOLOGY SECTION

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Robert Glenn, Deputy Director, Section Co-Leader

Fish Biology Program

Personnel

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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, 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. Staff also contribute to and assist with field and laboratory activities of other DMF programs. These activities are organized under five projects: Age and Growth, Fisheries Research and Monitoring, Resource Assessment, Fish Stock Assessment, and the Striped Bass Project.

Age and Growth Project

In 2023, staff aged hard-part structures from many species important to Massachusetts recreational and commercial fisheries. Table 19 shows the number of samples processed and aged by species. Several focus areas for 2023 are highlighted below.

Increased Resource Assessment Sample Ageing: In 2023, the Age and Growth project took over the ageing of scup, summer flounder, haddock, and cod samples collected by the Division's Resource Assessment trawl survey. These samples were previously aged by NOAA's Northeast Fisheries Science Center, but were not considered a priority and were thus prone to delays.

Daily Age Analysis of Winter Flounder: In 2023, Age and Growth staff extracted otoliths from young-of-year winter flounder, with 259 being polished and examined for daily age analysis (Figure 22). The ages of these young-of-year fish will be used to back-calculate their hatch date and thereby gain more information about the spawning season of adults.

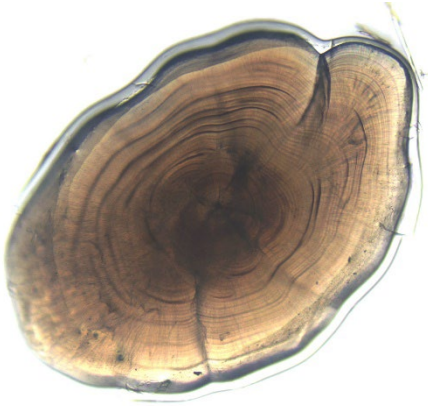

Figure 22. A polished young-of-year winter flounder otolith. Although difficult to see at this scale, marks are laid down daily as the fish grows. This fish is about 75 days old.

Other Activities: In 2023, the ASMFC accepted ages derived from tautog pelvic fin spines for the first time. This technique was pioneered by Age and Growth over ten years ago. Spines have been included in the annual ASMFC quality assurance and quality control ageing meetings where all the participating states have demonstrated good precision between structures. Project staff attend these meetings yearly.

Along with the regular duties of the Age and Growth project, staff has continued to be a resource for researchers globally. Assistance and/or guidance were provided to researchers from Southern Connecticut University (wrasse species), University of Connecticut (black sea bass), University of New England (rainbow smelt), and the Institute of Marine Research in Bergen, Norway (wolffish).

Table 19. Samples processed for ageing in 2023.

Species	Structure	Process	Number
American Shad	Otoliths, scales	Otoliths aged, scales checked for spawning marks	295
Black Sea Bass	Otolith, scales	Otoliths sectioned & aged, scales pressed and aged	349
Bluefish	Otoliths	Baked, sectioned, aged	107
Atlantic Cod	Otoliths	Sectioned, aged, measured	27
Fluke	Scales	Cleaned, pressed	130
Menhaden	Scales	Cleaned, mounted, sent to NMFS	100
Rainbow Smelt	Scales	Cleaned, mounted, aged	484
River Herring	Otoliths	Cleaned, aged	3298
Scup	Scales	Cleaned, pressed	218
Striped Bass	Otoliths	Sectioned, aged	302
Striped Bass	Scales	Cleaned, pressed, aged	1435
Tautog	Otoliths, fin spines	Cleaned, sectioned, aged	262
Weakfish	Otoliths	Sectioned, aged	21
Winter Flounder	Otoliths	Sectioned, aged	947

Fisheries Research and Monitoring Project

The Fisheries Research and Monitoring Project is responsible for the at-sea and shore-side sampling of commercial fisheries that occur in and adjacent to Massachusetts territorial waters, as well as conducting applied fisheries research to improve the management and assessment of the Commonwealth's marine resources. These tasks are completed through collaboration with various industry, state, university, non-profit and federal organizations. The Project also provides substantial field and vessel support to other DMF projects and conducts fisheries data analysis and summarization for fisheries policy staff.

Commercial Fisheries Monitoring

Project staff collect data and biological samples from commercial fisheries to document and characterize fishery performance, support stock assessments and research, and address specific management questions. These data also strengthen DMF's participation on, and contributions to, the regional fishery management councils and the Atlantic States Marine Fisheries Commission. Project staff maintain close contact with commercial industry members, stakeholders, and managers in order to gather and document important fisheries information outside of sampling activities.

In late 2021, DMF allocated resources to bolster port and sea sampling of the Commonwealth's commercially harvested marine resources. In late 2022, two biologists were hired to join the project. Traditional port sampling of commercial catches, primarily menhaden, Atlantic herring, winter flounder and striped bass, was conducted in partnership with Recreational Fisheries Program staff (Table 20). Project staff collected striped bass scales, otoliths, fin clips, and biological data from landed fish at seafood dealers along the coast. Additional biological sampling of Atlantic cod (including otoliths and fin clips) was conducted as well. Port sampling of winter flounder landings during the spring spawning period was prioritized and expanded, in support of the larger Boston Harbor Winter Flounder Study (see more on page 68). From early February through early May, 29 trips and 732 fish were sampled for sex, maturity, and spawning status, and 532 fin clips were taken for future genetic analysis. The menhaden fishery saw reduced catch rates in 2023 due to reduced nearshore availability, which was reflected in the sample numbers; overall, 70 samples were collected from seven trips to meet ASMFC sampling requirements.

Table 20. Number of port sampling events, or trips, made to intercept commercial vessels or seafood dealers where information was collected in 2023.

Species	Intercepts	Number individuals	Number of samples
Menhaden	**7**	**70**	**70 (scales)**
Winter flounder	**29**	**732**	**532 (fin clips)**
Striped Bass	**22**	**400**	**400 (scales & otoliths)**
Atlantic herring	**4**	**400**	**100 (maturity observations)**
Atlantic cod	**14**	**464**	**326 (otoliths)**

In 2023, Project staff worked extensively to cultivate a state-federal partnership with NMFS Greater Atlantic Regional Fisheries Office's (GARFO) Northeast Port Biological Sampling Program (NEPBSP) in order to supplement biological samples available for federal stock assessments. Additional support was provided by NMFS Northeast Fisheries Science Center (NEFSC) staff to grant database access, familiarize staff with sampling software and protocols, and advise on sampling strategies. This effort was in response to multiple years of flat-funding and insufficient samples being collected for some NEFSC stock assessments. On October 1, Project biologists began sampling for the NEPBSP, guided by the sample requests of species/stock/market categories provided by NEFSC Population Dynamics Branch.

At the end of the quarter, Project biologists had conducted 32 trips to four different fish dealers, collecting 1,288 individual lengths and weights and 641 otoliths in support of federal stock assessments. Seven different species, consisting of up to three different stock areas and five different market categories were sampled (Table 21). The Project received very positive feedback and has developed a productive working relationship with NEPBSP and its new federal partners. In late 2023, discussions about increasing the sample load or scope of the partnership began.

Table 21. Summary of sampling completed by the Project for the Northeast Port Biological Sampling Program in Quarter 4, 2023.

Species	# Lengths/ Weights	# Otoliths	# Length Strata Complete	# Otolith Strata Complete
Atlantic Cod	164	69	3/13	3/13
Haddock	304	200	6/6	6/6
Pollock	227	60	3/3	3/3
Winter Flounder	159	69	3/4	3/4
Yellowtail Flounder	175	100	3/4	3/4
American Plaice	163	75	4/4	4/4
Witch Flounder	96	68	3/3	3/3
Total	**1,288**	**641**	**25/37**	**25/37**

At-sea sampling activities by Project staff were increased compared to past years. Monitoring of the state's coastal lobster fishery was a major priority. Sampling occurred between June and November and was conducted out of five ports: Rockport, Gloucester, Beverly, Quincy, and Boston. A summary of 2023 commercial sampling efforts is covered in the Invertebrate Fisheries Project section.

Project staff conducted seven sea sampling trips aboard contracted bottom trawl vessels out of Gloucester, Scituate, and Sandwich to characterize the spawning seasonality of winter flounder during spring in Massachusetts coastal waters. Biological data on length, weight, sex, and maturity of winter flounder were collected from individuals caught in standard commercial and survey-style tows. In addition, otoliths and fin clips were taken from sampled fish. Similar data were also collected for Atlantic cod.

Multiple sea days were spent aboard the R/V *Michael Craven* and R/V *Alosa* to support other Division projects and external collaborations. These efforts included collecting water quality samples for the Shellfish Program, supporting dive operations for the Habitat Program, setting and hauling acoustic receivers dedicated for white sharks, and supporting Massachusetts Environmental Police remove non-compliant commercial fishing gear as well as supporting on-the-water lobster fishery enforcement training.

Commercial Fisheries Data Analysis

Project staff provided commercial fisheries sampling data and analyses to support efforts by the Diadromous Fisheries Project, Invertebrate Fisheries Project, and other agency initiatives. In addition, staff compiled commercial herring catch and sampling data to inform management initiatives, including planning for distribution of 2019 Atlantic herring fishery Disaster Relief Funds.

Spawning Cod in Wind Energy Areas

Many electronic tagging studies (including several conducted by DMF) have demonstrated that individual Atlantic cod return to the same precise seafloor features each spawning season. These unique spawning sites

support dense aggregations of cod for several months at a time and represent a highly vulnerable part of their life cycle. Once a spawning site becomes depleted through targeted fishing or disrupting activities, there is little evidence that aggregations will form at that location in the future. For this reason, DMF has conducted extensive research over the past two decades to identify and describe cod spawning sites to develop regulations that prevent their depletion and loss.

Several offshore wind energy development areas south of Martha's Vineyard are located near the southernmost cod spawning ground in an area known as Coxes Ledge. DMF staff are collaborating with researchers from UMass-Dartmouth, Woods Hole Oceanographic Institution, the NEFSC, and The Nature Conservancy to study the distribution and timing of these cod spawning in Southern New England. The research team is using a combination of electronic tagging, passive acoustic monitoring (to listen for cod spawning grunts), and autonomous underwater vehicles to conduct this work. Through 2023, 81 cod have been tagged with acoustic transmitters, and their movements and residency on the spawning ground is being recorded via an array of 10 fixed station receivers and mobile autonomous underwater vehicles (AUVs). Passive acoustic recorders are also listening for cod spawning grunts via both fixed stations and mobile AUV surveys.

Results suggest that cod spawning in Southern New England have similar seasonal and lunar patterns as winter-spawning cod in Massachusetts Bay, albeit with some finer-scale differences. A scientific paper describing these results was published in 2023. Expected outcomes from this five-year project (2019–2024) include a description of the spawning dynamics of cod in Southern New England, an assessment of their connectivity with other cod populations, and an understanding of seasonal habitat usage to help evaluate the potential impacts of offshore wind development.

Atlantic Cod Stock Assessments

A major overhaul of the assessment of US stocks of Atlantic cod was completed in 2023, the first in more than a decade. This two-year process began by first implementing the recommendations of a recent review of the population structure of Atlantic cod, which determined that there were five separate stocks (not two, as previously thought). However, because two of these stocks overlapped in space (yet spawned at opposite times of year), the stocks were assessed as four units: Western Gulf of Maine (WGOM), Eastern Gulf of Maine (EGOM), Georges Bank (GBK), and Southern New England (SNE) (Figure 23). In addition to better accounting for the biological population structure, many advancements were incorporated into these updated assessments. All stocks were modeled using a new state-space framework known as the Woods Hole Assessment Model (WHAM) that allowed for the inclusion of environmental effects, as well as observation and process errors. Many new data sources were incorporated, including the DMF industry-based survey and discard mortality studies. DMF scientists were instrumental in each step of this process, from redefining the population structure, to serving as the assessment lead for the EGOM stock. All four stocks passed a peer review in August 2023 and were accepted for use in fishery management.

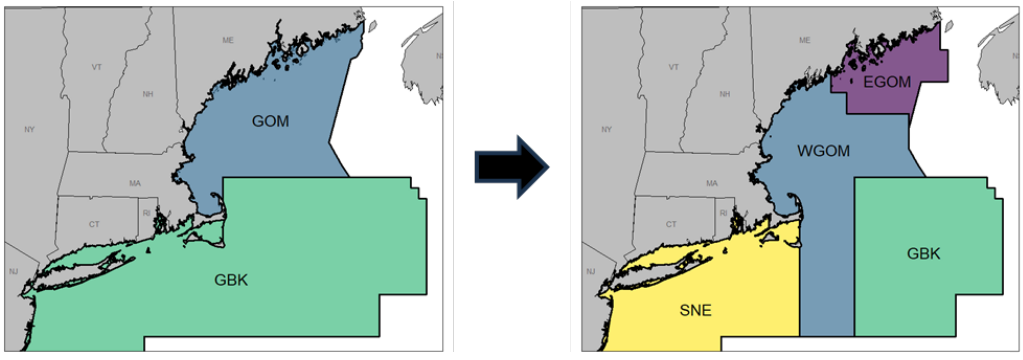

Figure 23. The former (left) and updated (right) cod stock units.

Boston Harbor Winter Flounder Study

Winter flounder is an important commercial and recreational species throughout its range, from Maine to Delaware, and is the most common shallow water flounder in the Gulf of Maine. While DMF conducted comprehensive habitat studies on winter flounder during the 1960s–1970s, vast habitat changes, urbanization, climate change, and a decrease in flounder populations have created a need for updated science. In particular, data on GOM winter flounder within coastal embayment are incomplete and outdated, likely impacting the efficacy and efficiency of current broad-scale time-of-year restrictions on coastal projects.

A multi-year study between DMF and UMass-Amherst began in 2021 with the objectives to generate additional information on the spatial and temporal habitat use, distribution, and residency of juvenile and adult winter flounder in Boston Harbor. To fully characterize the distribution of winter flounder in Boston Harbor, DMF and UMass-Amherst will: 1) determine the time and location of spawning using acoustic telemetry; 2) conduct a beam-trawl survey to understand the distribution of young-of-year (YOY) and juvenile winter flounder throughout the harbor; and 3) determine the hatch and spawning date through daily aging (see Age and Growth, page 64). Together, these tasks will characterize the distribution of all life stages of winter flounder in relation to available habitats defined by depth, substrate, salinity, and temperature.

In 2023, Project staff continued to maintain an array of 49 acoustic receivers in the Boston Harbor estuary with the objective to track movements of adult winter flounder and document immigration, emigration, and residence time inside the estuary. In addition, a coastal array of 22 receivers were maintained to document movements outside the study area. This array, along with the DMF Large Pelagic Project's array, provides comprehensive coverage of Massachusetts state waters and is instrumental in tracking year-round movements of adult winter flounder.

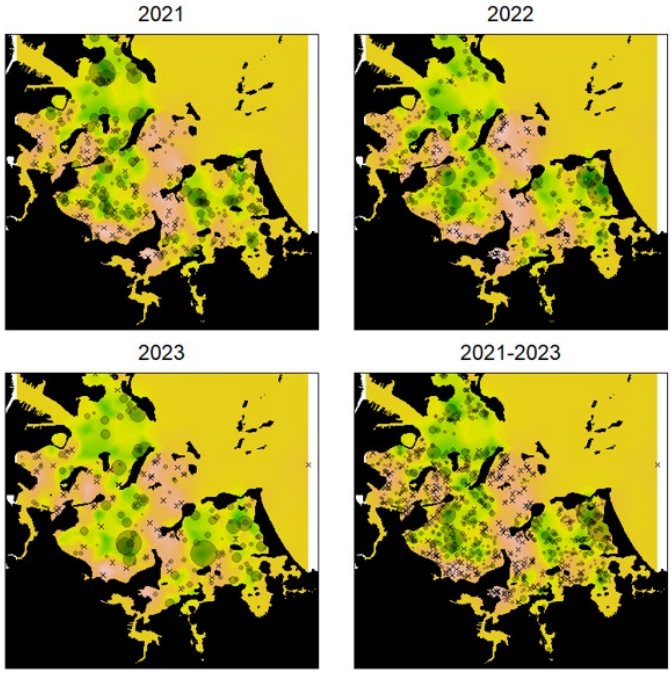

Figure 24. YOY winter flounder distribution in Boston Harbor, 2021–2023. Catch per unit effort standardized to 300 meter tow. The larger circle indicates higher catch rates, "x" equals no catch.

Thanks to additional funding through a collaborative grant with the NEFSC, an additional 45 adult winter flounder were tagged with acoustic transmitters in late April and early May, bolstering the total of tagged winter flounder to 196. Additionally, eight Innovasea acoustic release receivers (VR2AR) were deployed in the Stellwagen Bank National Marine Sanctuary to act as an additional array to detect tagged flounder after they leave Boston Harbor. These buoy-less receivers can be deployed year-round during times when right whales are present and winter flounder spawn.

In 2023, staff conducted the third and final year of the beam-trawl survey that started in late-June and ran through October. Based on a remarkably consistent spatial pattern, it was determined that the number of survey cruises could be decreased while maintaining comprehensive estimates of YOY relative abundance (Figure 24). A total of 20 trips were conducted on the research vessel R/V *Alosa* and University of Massachusetts-Amherst skiff R/V *Sweet Caroline*.

Resource Assessment Project

2023 Trawl Survey

The 45th annual spring and fall surveys were successfully completed aboard NOAA's *R/V Gloria Michelle* in 2023. The spring survey completed 101 stations from May 8–23 and the fall survey completed 91 stations from September 5–24 (Figure 25). Both surveys provided weights, counts and measurements for over 100 different species of fish and invertebrates. The collections of over 2,000 otoliths and over 3,000 sex and maturity observations from cod, haddock, summer flounder, winter flounder, yellowtail flounder, black sea bass, scup, tautog, weakfish, American lobster, and Jonah crabs will aid cooperative fisheries assessments.

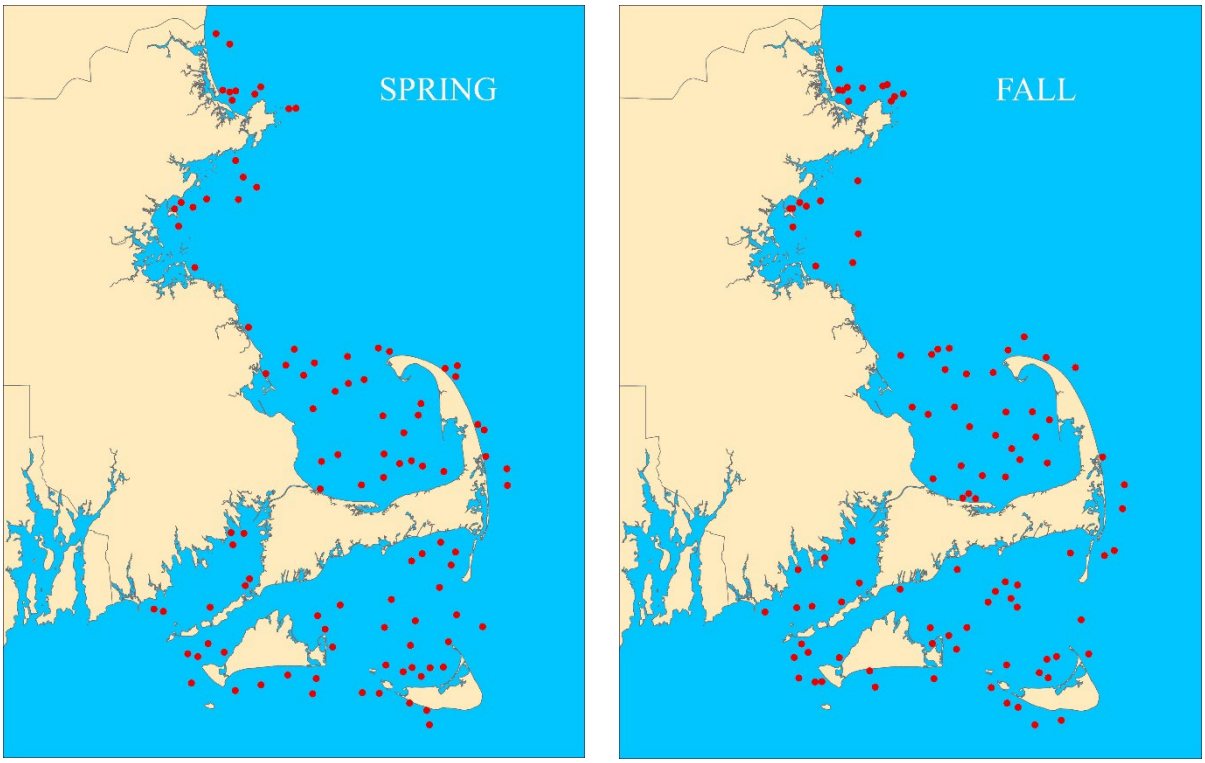

Figure 25. Completed 2023 spring (left) and fall (right) trawl survey station locations.

Many volunteer scientists assisted in making both trawl surveys successful this year (Figure 26). Thirty-two DMF employees participated in the spring survey as part of the scientific party along with one biologist from UMass–Amherst, one biologist from NOAA, and one biologist from Responsible Offshore Science Alliance. Thirty-four DMF employees, four biologists from NOAA, one biologist from UMass–Amherst, and one biologist from Responsible Offshore Science Alliance participated in the fall survey. Full survey staffing allowed for increased otolith extraction and collection as well as the documentation of additional sex and maturity observations.

The spring survey had some noteworthy records. A large tow of bay anchovy and kingfish was observed at the same station in Buzzards Bay. The largest Atlantic halibut and Atlantic sturgeon recorded in the survey's history were captured west of Race Point and in Cape Cod Bay, respectively. Atlantic cod and little skate abundance and biomass in tows were the lowest on record. The catches of longfin squid were the highest recorded in the survey history. Scup dominated the catches south of Cape Cod and accounted for 43% of all catch by number and 60% of all biomass throughout the survey.

In the fall, three species were captured for the first time in survey history: two Weitzman's pearlsides taken in

Mass Bay, a mahogany snapper taken in Buzzards Bay, and a fringed filefish captured in Nantucket Sound. This is the first time three or more new species were observed in a single survey since 2006. Other fall survey highlights included several station level and survey wide records. Station records for abundance and biomass included a tow in Nantucket Sound for clearnose skate and a station south of Martha's Vineyard for striped cusk eel. Single station biomass records included red hake in Cape Cod Bay, spotted hake in outer Vineyard Sound, hickory shad south of Martha's Vineyard, and pinfish in Nantucket Sound. The survey-wide abundance of Atlantic cod was the lowest recorded in the timeseries. Abundance and biomass of winter skate and little skate were also at record lows. The biomass and abundance of spotted hake were the highest and second highest, respectively, recorded to date. Scup again dominated the catches south of Cape Cod and accounted for 42% of all catch by number and 23% of all biomass.

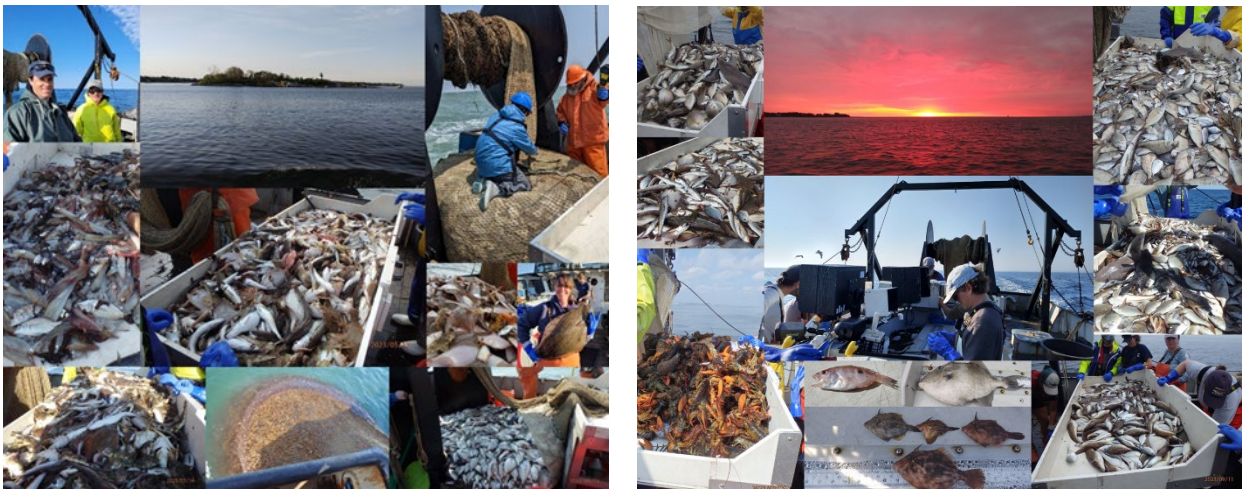

Figure 26. Photo collage from the 2023 spring (left) and fall (right) trawl surveys.

2023 Seine Survey

The 48th Nantucket Sound Estuarine Winter Flounder Young-of-Year (YOY) Seine Survey was conducted from June 12–28. This survey provides an index of abundance for YOY winter flounder in the Southern New England/Mid-Atlantic stock. All commercially and recreationally important finfish and invertebrates were enumerated, and presence of all other species was recorded. Thirty-seven species were encountered in this year's seine survey hauls. The 2023 stratified mean index for YOY winter flounder abundance was above the timeseries median for the fourth consecutive year (Figure 27). This was the third highest value since 1976, and YOY winter flounder were particularly numerous in Waquoit Bay. The 2023 stratified mean index for YOY summer flounder for all sites combined was the highest in the time series.

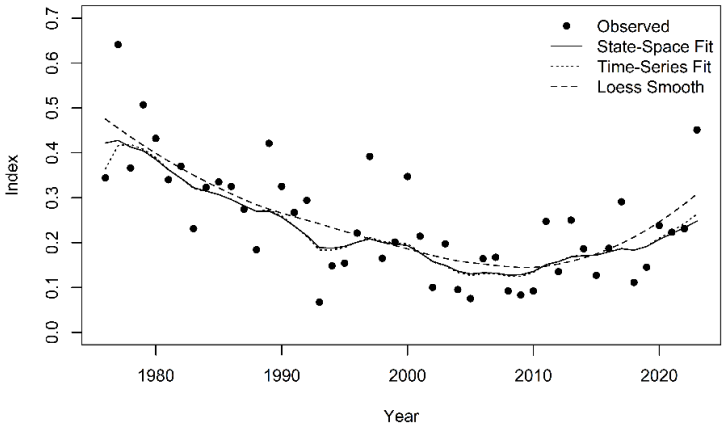

Figure 27. YOY winter flounder index from the seine survey.

Over the last few years, DMF's Habitat Program has collected water samples to analyze for eDNA at some of our beach seine locations. Work from 2022 showed a sharp decline in the presence of winter flounder eDNA throughout the summer period. Waquoit Bay showed the highest abundance of winter flounder in our initial

seine survey index in June this year. Efforts were made to re-seine and collect additional corresponding eDNA water samples in July and August at three sites in Waquoit Bay to further assess temporal trends in abundance across summer months. These additional sampling results were not used in our abundance estimates. See the eDNA section on page 60 for more information.

Fish Stock Assessment Project

Staff represented DMF on ASMFC and MAFMC Technical Committees and Monitoring Committees for bluefish (chair of Technical Committee), black sea bass, scup, summer flounder, winter flounder, tautog (vice chair of Technical Committee), and weakfish. These assignments included conducting analyses and bringing proposals to the groups in support of adjustments to Massachusetts fishery regulations as well as evaluating potential regulatory changes in other states and in federal waters. In addition, staff served on the NEFMC's Groundfish Advisory Panel, Monkfish Advisory Panel, Groundfish Plan Development Team, Monkfish Plan Development Team, Transboundary Resource Assessment Committee, groundfish assessment peer reviews, Atlantic Herring Plan Development Team and Technical Committees, and ASMFC's Striped Bass Technical and Stock Assessment Committees, Menhaden Technical Committee, Multispecies Committee, Age and Growth Committee and the MAFMC Summer Flounder, Scup, Black Sea Bass, and Bluefish Recreational Measures Setting Process Plan Development Team.

DMF's black sea bass spawning survey continued during May–July 2023, marking the sixth year of this program. The objective of this rod-and-reel sampling is to collect data on Buzzards Bay black sea bass as the spawning season progresses. Biological data collected on this survey include length, weight, age, sex and spawning condition. The information supports our understanding of black sea bass life history (i.e., how they grow and reproduce) and allows us to monitor the progression of individual year classes over time. The age-size data that were collected were expected to be used in upcoming black sea bass federal stock assessments.

Staff participated in research track stock assessments led by NMFS scientists for black sea bass, yellowtail flounder (ongoing), and Atlantic cod. Specific contributions included survey index standardization, facilitating stakeholder engagement workshops, compiling coast-wide recreational fisheries catch data, and preparing working papers for formal review. Staff supervised two UMass–Dartmouth graduate students in a practicum independent study connected to the black sea bass research track stock assessment; these students prepared index standardizations. Staff served on the graduate committees of two students from UMass–Amherst and Stony Brook University, studying the ecology and population structure of winter flounder and weakfish, respectively. DMF staff also participated in the NEFMC's Scientific and Statistical Committee, recommending management measures for fisheries in the northeast as well as commenting on documents and analyses that required quantitative review.

Striped Bass Research Project

Without a doubt, Atlantic striped bass are the backbone of the Massachusetts recreational fishing industry and provide enjoyment to hundreds of thousands of recreational anglers each year. The Commonwealth is also home to one of the largest commercial fisheries for striped bass in the country. 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.

Striped Bass Circle Hook Study

In response to declining striped bass stocks, the ASMFC mandated states require all recreational anglers use an in-line circle hook when targeting striped bass with natural bait beginning in 2021 (which DMF had already

adopted for anglers fishing from shore and private vessels in 2020 and expanded to anglers aboard for-hire vessels in 2021). Circle hooks have been shown to have a positive effect on post-release mortality in many small and big game fisheries, but surprisingly little work has been done estimating their benefit in the striped bass fishery.

Recognizing this paucity of information, DMF initiated a multi-year study in 2020 using acoustic telemetry to monitor the fate of recreationally caught striped bass caught via circle hooks and conventional "j" hooks. This approach was designed to assess several widely used hook types, as well as calculate post-release mortality rates for fish caught and released in the striped bass recreational fishery using specific hook types.

Striped bass field studies were concluded in 2021 and analyses were completed in 2023. Preliminary results demonstrated that a semi-quantitative score of fish release condition was the best predictor of post-release survival. A broader dataset that included untagged fish (n = 716) was used to identify the best predictors of fish release condition, which included hook location and handling time. A manuscript of the study was pending publication in a peer reviewed journal at year's end.

Striped Bass Citizen Science

Due to regulations and conservation-minded anglers, most striped bass are released back to the water after being caught. Even though most of these fish survive, post-release mortality from recreational anglers causes more striped bass deaths than any other source. As a follow-up to the circle hook study, DMF has expanded its investigation of release mortality to include striped bass caught via artificial lures and flies. During the summer of 2023, we partnered with volunteer anglers to collect information when they go striped bass fishing to help us understand what factors influence post-release mortality. The ultimate goals of this project are to identify the causes of release mortality, and to provide an updated mortality rate estimate that is representative of the entire recreational fishery.

Nearly 700 people signed up to participate in the program in 2023, greatly exceeding our expectations (Figure 28). Volunteer anglers were supplied with some basic equipment (a digital thermometer, a stopwatch, and a tape measure) and asked to record a variety of data, including air and water temperature, fish size and hooking location, injury and swimming ability, fight and handling time, as well as some details about the tackle used. Active participants were entered into a weekly raffle drawing from June through October, and 22 lucky anglers took home some Hogy fishing lures, and either a Shimano spinning combo or a pair of Costa sunglasses. Between April and November, these citizen scientists collected valuable information from over 3,700 bass.

Some initial observations from the data that have been submitted so far are: 1) 75% of striped bass were caught via artificial lures, 25% via baited hooks; 2) the greatest level of injury resulted from baited hooks, and lures with multiple treble hooks; 3) fish were much weaker when kept out of water for more than two minutes; and 4) fish caught in water over 75 degrees had a much harder time recovering. These and many other preliminary results can be found on a live data portal sponsored by our partners at Backcountry Hunters & Anglers.

Figure 28. A schoolie striped bass caught by one of the younger participants in the Citizen Science project.

Migration and Residence Study

During 2015–2019 staff conducted a study that examined how mortality of striped bass is influenced by habitat selection and migratory routes to and from Massachusetts waters. The design combined analysis of fish tagged with acoustic transmitters and estimates of population composition of summering aggregations derived from genetics. DMF was awarded a grant from ACCSP in the fall of 2021 to analyze 5,000 DNA samples collected from Massachusetts recreational and commercial fisheries during 2015–2019. In late 2023, DMF received the genetic data for the fish tagged in the acoustic telemetry study and the 5,000 fish samples. Initial analyses and diagnostic work have shown that the 233 Single Nucleotide Polymorphism panel developed with collaborators at the University of New Brunswick–Saint John performs exceptionally well and is able to estimate mixture proportions and make individual assignments at high degrees of confidence with modest sample sizes. Preliminary mixture estimates have shown that the striped bass from Massachusetts waters predominately originate from the Chesapeake and Delaware watersheds (these fish are genetically indistinct) with most of the remainder born in the Hudson River, although a small number of fish from North Carolina are also present (Figure 29). Further, mixture simulations indicate that the panel could feasibly be used for an estimate of coast-wide harvest with an investment in adequate sampling.

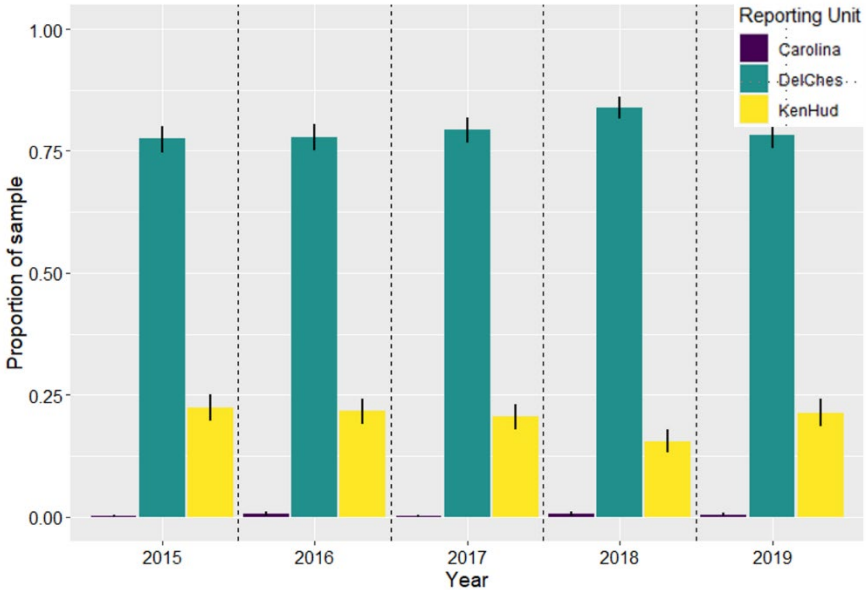

Figure 29. Population reporting unit proportions of 5,000 striped bass landed in Massachusetts between 2015 and 2019, by year. Reporting units are groups of rivers that are genetically similar. Rivers from North Carolina are represented by the purple bars, the Delaware River and Chesapeake Bay rivers by teal bars, and the Kennebec and Hudson Rivers by yellow bars. The thin black lines at the top of the bars represent the 95% credible intervals.

Coastwide Tagging Study

DMF has participated in the Striped Bass Cooperative State-Federal Coastwide 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. In 2023, 374 striped bass were tagged. These fish ranged in size from 24–41 inches total length and were collected during September–October southeast of Cape Cod off Monomoy and Nantucket Shoals.

Market Sampling

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. Length, weight, and age structures (scales

and otoliths) are collected during market sampling trips, in accordance with ASMFC target sampling levels. During 2023, staff conducted 18 market sampling trips and collected data on 390 striped bass.

Volunteer Recreational Angler Data Collection Program

The Sportfish Angler Data Collection Team (SADCT) program was implemented in 2002 to generate a time series database of biological characteristics of Massachusetts' striped bass recreational catch. Black sea bass, summer flounder, and scup were added to the program in 2023, and bluefish in 2021. During 2023, 31 participating anglers returned 866 paired length/age samples from striped bass. The size composition of striped bass reported by participating anglers is shown in Figure 30. Participating anglers also collected 478 black sea bass samples, 128 summer flounder samples, 333 scup samples, and 292 bluefish samples. The striped bass carcass collection program also continued in 2023, through which volunteer anglers donated 108 carcasses.

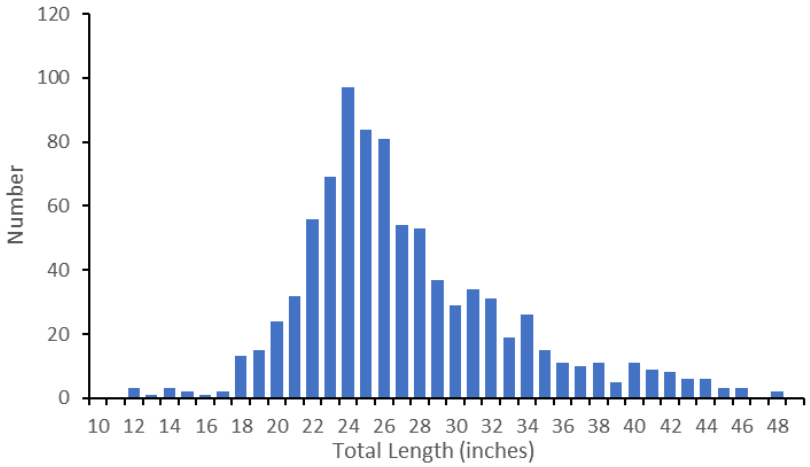

Figure 30. Size composition of striped bass measured by SADCT anglers in 2023.

Striped Bass Stock Assessment

Staff conducted simulation analyses for the ASMFC Striped Bass Technical Committee exploring the impacts of regulation changes on the recreational and commercial fisheries. An EXCEL application was developed to assist Atlantic coastal states in developing commercial quota reductions with size limit changes.

Other Activities

Assessment and Management Support: Program staff provided technical expertise to other governmental organizations, private groups, and individuals with concerns about marine fisheries via on-line meetings and served on technical and advisory committees to support management efforts of important marine species. Several presentations were given by staff to other governmental organizations and private groups. Staff served as a virtual ASMFC representative to the NEFSC Assessment Operation Panel in Woods Hole, MA.

Additional Publications: Staff authored one DMF Technical Report Series report, the Massachusetts Striped Bass Monitoring Report for 2022.

Invertebrate Fisheries Program

Personnel

Dr. Tracy Pugh, Program Manager
Derek Perry, Senior Marine Fisheries Biologist
Alex Boeri, Marine Fisheries Biologist
Brendan Reilly, Assistant Marine Fisheries Biologist
Jacob Dorothy, Assistant Marine Fisheries Biologist
Rachel Vollemans, Assistant Marine Fisheries Biologist (through November)
Laura Tomlinson, Seasonal Fisheries Technician (beginning in May)

Overview

In 2023, the Invertebrate Fisheries Project was promoted to Program status to account for substantial increases in work and responsibilities. These increases include considerable enhancement of efforts towards monitoring and engagement surrounding the horseshoe crab resource and fishery, along with continuation of the longer-standing research and monitoring work for American lobster, Jonah crab, northern shrimp, and whelk. 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.

Activities

American Lobster Research and Monitoring

Commercial Lobster Trap Sampling: DMF has worked cooperatively with Massachusetts commercial lobster trap fishermen to sample their catch since 1981. In 2023, the 43rd year of operation, a total of 61 trips were conducted by staff members of the Invertebrate Fisheries Program (31 trips) and the Fisheries Research and Monitoring Project (30 trips), during which 28,078 lobsters were sampled from 12,024 trap hauls. Data from the commercial trap sampling program are used to characterize the sex ratio and size distribution of the commercial catch, as well as to track conservation discards (including sublegal-sized lobsters, egg-bearing females, and v-notched females). This effort also includes shell disease monitoring, which tracks the prevalence of shell disease symptoms on lobsters in Massachusetts coastal waters. In 2023, a total of 5,677 lobsters were sampled for shell disease.

Staff completed and shared with respective individual captains the first series of new annual data reports, describing each captain's sampled catch data. This is a new initiative, and we hope that captains who participate in the sea sampling program will be interested in receiving these summaries of the lobster data collected by DMF biologists aboard their boats. We continue to refine the reports' content and presentation based on feedback from the captains.

Staff continued to conduct bycatch sampling during the commercial lobster trap sampling program to better characterize the incidental catch of several commercially important finfish species in lobster gear. For each sampled species (e.g., black sea bass, tautog, scup, cod, haddock, various flounders), samplers collect size and disposition information (including presence/absence of barotrauma wounds).

Ventless Lobster Trap Survey: This survey is a cooperative effort between DMF and the lobster fishing industry to monitor the abundance of lobster and several bycatch species and is funded by commercial and recreational

lobster permit fees. Data from the Ventless Trap Survey are used to generate indices of lobster relative abundance, to monitor various population characteristics (such as sex ratio, abundance of egg-bearing females, and disease), and to examine spatial patterns in abundance (Figure 31). The ASMFC Lobster Technical Committee continually monitors the results of the various states' ventless trap surveys as indicators of stock status in both the GOM/GB and SNE stocks.

The 2023 Ventless Trap Survey took place from June through September (June through August in SNE, see below) with six contracted vessels. Project staff completed a total of 43 sea days in 2023. A total of 8,926 lobsters were sampled from 2,779 trap hauls in the northern survey area (MA territorial waters from Cape Cod Bay to the NH border). In the southern survey area (MA territorial waters including Buzzards Bay and south of the Elizabeth Islands), a total of 504 lobsters were sampled from 264 trap hauls.

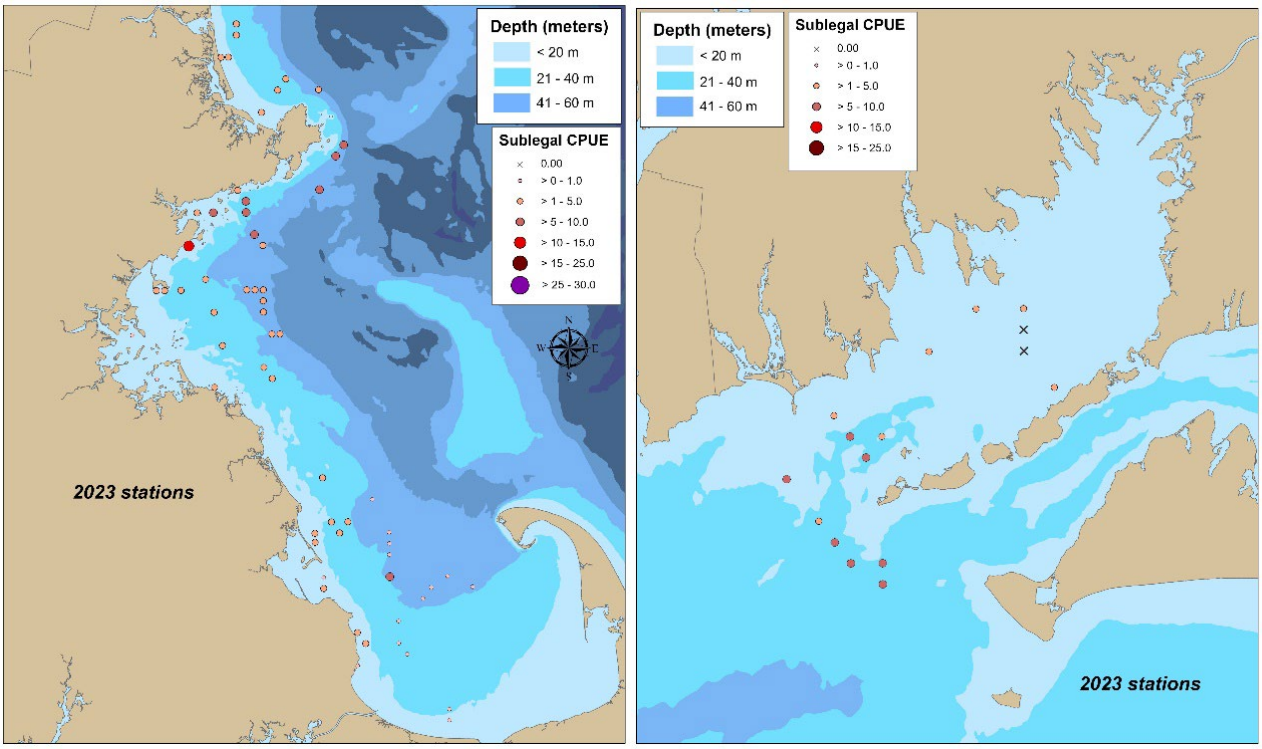

Figure 31. Average catch per trap haul (CPUE) of sublegal-sized lobsters at the 2023 ventless trap survey stations in the northern (left) and southern (right) survey areas.

Additional biological sampling of bycatch species was continued in 2023, which increases the available data on commercially important crab and finfish species. In both survey areas, samplers collected length and sex for *Cancer* crabs (Jonah and rock crabs), and length information for various finfish species. Additionally, staff collected age structures for black sea bass and tautog captured in the southern survey area, which were analyzed by the Age and Growth Project.

Annually, significant time is dedicated to maintenance of the DMF-owned gear needed to conduct the survey. Over 600 traps and 6-plus miles of groundline must be checked, repaired, and standardized each year. Trap maintenance includes twine and wire mesh repair, runner and bungee replacement, and minor wire mesh patches. Each ground line is checked for wear and damage and repaired as needed, while also assuring proper spacing between gangions (to maintain the survey's standardized trap spacing). To minimize data loss, spare traps and groundlines must be ready to replace any survey gear that is lost or damaged throughout the season. In addition to the gear maintenance, a total of 12 days each year are dedicated to trap delivery and retrieval to

and from participating captains. Finally, all gear needs to comply with current vertical line configuration and marking standards which enhance precautions for protected species. DMF continued to provide the necessary vertical lines and marking materials for the survey gear to participating captains to ensure compliance.

Annual Early-Benthic-Phase Lobster Suction Sampling: Project staff completed the 29th year of this sampling program in 2023. The survey tracks year-class strength of newly settled post-larval American lobsters (young-of-year or "YOY") and delineates coastal habitat important to the settlement of these juveniles. Project staff conducted the SCUBA-based survey (Figure 32) over 10 field days in August, September, and October, sampling 16 coastal sites spanning Cape Ann to Buzzards Bay. Two new sites added to the Cape Ann region in 2021, Hodgkins Cove and Brace Cove, have not yet been incorporated into the time series due to the limited years they've been sampled. The two new Cape Ann sites had an average density of 0.67 YOY/m^2, which is greater than the two historical sites (0.17/m^2). Average density of YOY lobster was at or below time series averages for each region (Table 22). No YOY lobster were observed in the two southern-most regions, South Shore and Buzzards Bay. Data from this survey contribute annually to the American Lobster Settlement Index, an international research collaborative that compiles data and tracks changes in the recruitment of American lobsters in U.S. and Canadian waters.

Figure 32. DMF biologists conducting the annual early benthic-phase lobster suction sampling survey.

Table 22. Comparison of 2023 YOY lobster densities to time series averages, by region.

Region	# years sampled	2023 YOY Average (#/m^2)	Time Series Average (#/m^2)
Cape Ann	14	0.17	0.40
Salem Sound	28	0.39	0.55
Boston	27	0.06	0.20
South Shore	12	0.00	0.08
Buzzards Bay	29	0.00	0.07

Assessment and Management Support: In the fall of 2023 staff took over as the Chair of the ASMFC American Lobster Technical Committee and will serve as Chair for the 2025 ASMFC American Lobster Benchmark Stock Assessment for which work started in the fall of 2023. Related work focused primarily on data updates and meetings to support the continued development of Draft Addendum XXVII to increase protection of the GOM/GB spawning stock.

Applied Research: Staff continued work with the Lobster Foundation of Massachusetts' Cape Cod Bay Study Fleet to monitor temperature and dissolved oxygen (DO) conditions in Cape Cod Bay. DMF covered the costs of annual maintenance on the Fleet's monitoring equipment, and the six Fleet participants deployed 30 sensors to monitor conditions during July–November 2023. Staff monitored the Fleet's incoming data, and continued work with the *Mass*DFG team to improve GIS tools for monitoring, summarizing, and sharing data. The data from the Study Fleet are publicly accessible, including maps of existing and recent DO and temperature conditions (Figure 33), plus downloadable annual files of the data. Based on conditions detected by the Study Fleet's data, DMF issued an advisory to the public in August 2023 to call attention to declining DO levels in the northeastern portion of the Bay. Low DO in this area persisted sporadically until the fall.

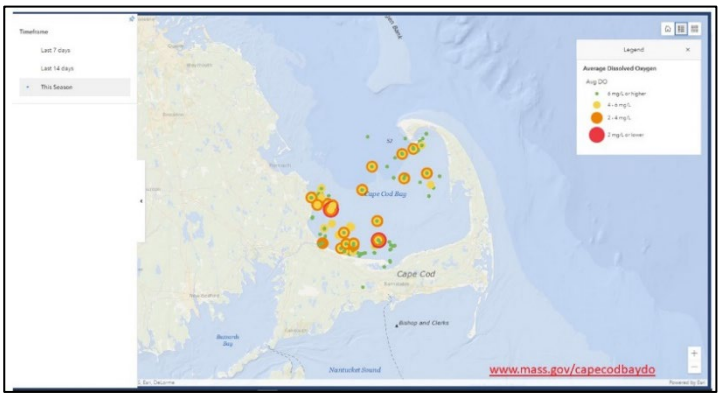

Figure 33. Example of online 2023 Study Fleet data.

Staff also continued work on a large Sea Grant funded project to understand how changing DO conditions affect lobster catch in the region. Four "sentinel stations" were deployed, using Ventless Trap Survey gear equipped with DO/temperature sensors, in four distinct locations in the southern half of Cape Cod Bay to supplement the Study Fleet monitoring locations. Sampling of these sentinel stations was incorporated into the monthly Ventless Trap Survey sampling conducted by program staff, and continued at these four stations beyond the normal survey season, into October. Data from work in 2022 and 2023 will be examined for any patterns in total lobsters, or the characteristics of the lobster catch (size, sex ratio, etc.), relative to environmental conditions. The species composition and quantity of bycatch will also be examined relative to the DO and temperature conditions. Final analyses are planned to wrap up this Sea Grant study in 2024.

Outreach: Program staff attended the annual Massachusetts Lobstermen's Association Trade Show in Hyannis, presenting information during three sessions and interacting with industry members at the DMF booth and on the trade show floor. Staff presented two talks at the 12th International Conference and Workshop on Lobster Biology and Management. The first was a summary of the ongoing Cape Cod Bay dissolved oxygen research, and the second was a summary of completed research on the sublethal effects of shell disease on reproductive output in Southern New England lobsters. Staff were invited to present a talk on the Cape Cod Bay Study Fleet dissolved oxygen monitoring at a workshop titled "Building a Cost-effective Coastal Biogeochemical Observing Network in Collaboration with the Commercial Fishing Community" hosted by the Ocean Carbon & Biogeochemistry group at Woods Hole Oceanographic Institute. Staff addressed media requests related to the dissolved oxygen monitoring work in Cape Cod Bay, and challenges faced by the lobster resource relative to climate change. Staff served on the planning committee for the U.S.-Canada Lobster Town Meeting, an annual event that brings industry, researchers, and managers from the two countries together to discuss topics of mutual interest and concern. This event is hosted by the Lobster Institute, based at the University of Maine. Staff also served on the Advisory Board for the Lobster Institute.

Horseshoe Crab Monitoring

Commercial Fishery Sampling: DMF monitors the commercial bait and biomedical harvests of horseshoe crab in accordance with the Interstate FMP. At the request of the public and participants in the biomedical fishery, DMF greatly increased sampling of the biomedical fishery in 2023. The public was concerned about increased pressure on the resource due to a second biomedical facility that opened in Massachusetts in 2022, and the biomedical industry expressed a desire for increased sampling effort due to their frustration over what they felt was misinformation being spread about their operations.

DMF has collected prosomal width measurements from horseshoe crabs during market sampling trips at bait and biomedical facilities since 2000. However, source data (harvest location, method, sampling location, and whether it was harvested for bait or biomedical) weren't collected until 2008, so data prior to 2008 are rarely used. There are known differences in crab size by area within the state, so harvest location is a critical data component for understanding the resource. While DMF has conducted market sampling trips since 2000, in 2023, DMF also collected data from at-sea biomedical collection trips, sampled crab in-water holding systems, and observed biomedical release trips.

Fifty-one horseshoe crab sampling trips were conducted in 2023 (Table 23), which is more sampling effort than for any other species except lobster (61 trips). Forty-six of the horseshoe crab sampling events were biomedical sampling trips. For all biomedical sampling trips, the number of live and dead crabs were recorded by sex. For bait market sampling, biomedical market sampling, and biomedical collection trips, data collected also included sex, prosomal width, maturity stage (males only), molt stage, and injuries. Pre-bleeding mortality (from collection until arrival at the biomedical labs) observed in our biomedical sampling was 0.7% and 1.0% for males and females, respectively.

Table 23. Fisheries dependent sampling trips for horseshoe crabs conducted by DMF staff in 2023.

	# Trips	# Observed Crabs
Bait market sampling	5	1,139
Biomedical market sampling	9	2,854
Biomedical collection rips	9	2,399
Biomedical pen checks	14	2,655
Biomedical release trips	14	2,898
Total	51	11,945

Fisheries-Independent Surveys: DMF and numerous volunteer organizations conducted spawning beach surveys at 14 beaches along the South Coast, Cape Cod, and the islands in 2023 (Figure 34). Surveys were not completed at three historically sampled sites—Stage Harbor (site 11), Tashmoo (site 15), and Tahanto (site 16)—due to a lack of volunteers. Surveys were conducted at high tide two days prior, the day of, and two days after the new and full moons from May through June. DMF staff conducted 23 surveys at Swift's Beach in Wareham. The number of female crabs observed in the survey was below time series medians for 59% of beaches in 2023 (Table 24), but 71% of beaches have an increasing trend over the last five years, and 77% are increasing over the last ten years.

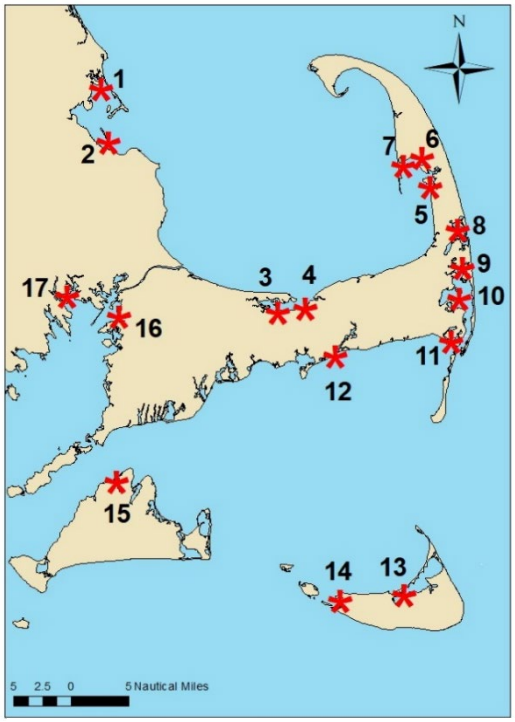

Figure 34. Map of sites monitored for the Massachusetts Horseshoe Crab Spawning Beach Survey.

Applied Research: Staff began to develop a research proposal to address two outstanding areas of interest with the horseshoe crab fishery. The first goal of this work will be to examine discard mortality during commercial harvest. The second goal will be to gain a better understanding of any lethal and sublethal effects resulting from biomedical bleeding, ensuring that methodology accurately represents the biomedical handling procedures. We plan to finalize this proposal and identify an appropriate funding source for this work in 2024.

Assessment, Management Support, and Outreach: In 2023, staff served on the ASMFC Horseshoe Crab Technical Committee, Biomedical Best Management Practices Working Group, and Horseshoe Crab Stock Assessment Committee. Staff gave presentations on the status of horseshoe crabs to *Mass*Wildlife's Natural Heritage and Endangered Species Program. Staff hosted a hybrid symposium for the 2023 Massachusetts Horseshoe Crab Science Meeting, which is held annually to review horseshoe crab survey trends and other relevant information.

Table 24. Summary of 2023 Massachusetts Horseshoe Crab Spawning Beach Survey. Survey beaches are grouped by region with day and night surveys treated independently for beaches that conduct surveys at both time periods. The five-year (2018–2022) mean of bait landings for a given region is given for reference. Survey results for 2023 are compared to respective survey time series medians; if the 2023 data point was above the time series median, it is shaded green and if it was below, it is shaded red. Linear trend lines were also applied to the last 10 and 5 years of survey data for each beach; those with a positive trend are shaded green, and those with a negative trend are shaded red. N/A denotes surveys with insufficient data (not surveyed in 2023 or not surveyed long enough for trend analysis).

Region (% of bait landings)	Beach	Time of Day	2023 vs Median	10-year trend	5-year trend
Cape Cod Bay (8%)	Duxbury	Day	below	decreasing	increasing
	Duxbury	Night	above	decreasing	increasing
	Long Beach	Day	below	NA	decreasing
	Long Beach	Night	below	NA	increasing
	Millway Beach	Day	below	increasing	increasing
	Millway Beach	Night	above	increasing	increasing
	Long Pasture	Day	above	increasing	increasing
	Sanctuary Beach	Day	below	increasing	increasing
	Indian Neck	Day	below	decreasing	decreasing
	Indian Neck	Night	below	increasing	decreasing
	Great Island	Day	below	increasing	increasing
Outer Cape Cod (0%*)	Priscillas Landing	Day	above	increasing	decreasing
	Marsh 2-3	Day	above	increasing	increasing
	Erica's Beach	Day	below	increasing	decreasing
Nantucket Sound (84%*)	Stage Harbor	Day	NA	NA	NA
	Stage Harbor	Night	NA	NA	NA
	Bass River	Day	below	NA	increasing
	Bass River	Night	above	NA	increasing
	Monomoy	Day	equal	increasing	NA
	Monomoy	Night	below	increasing	NA
	Warrens Landing	Day	above	increasing	increasing
	Warrens Landing	Night	above	increasing	increasing
	Tashmoo	Day	NA	increasing	NA
	Tashmoo	Night	NA	increasing	NA
Buzzards Bay (2%)	Tahanto	Day	NA	increasing	increasing
	Tahanto	Night	NA	increasing	NA
	Swifts Beach	Day	below	decreasing	decreasing
	Swifts Beach	Night	below	decreasing	increasing

* region also has biomedical retention

Jonah Crab Research and Monitoring

Commercial Fishery Sampling: Monitoring of the commercial Jonah crab catch has been required by the interstate FMP since 2015 (Figure 35). Most crabs landed in Massachusetts are harvested in waters south of Martha's Vineyard and east to Georges Bank (NMFS statistical areas 537, 525, and 526). Project biologists conducted 10 port sampling trips with seven individual boats to collect length frequency and sex ratio data from the commercial fishery in 2023. These trips sampled a total of 6,689 crabs from NMFS statistical areas 537, 526, 525, and 562. A decline in the Jonah crab market made it more challenging to conduct port sampling trips because the commercial fleet was making fewer trips than past years. The median size in these areas was similar to prior years.

Assessment and Management Support: Staff represented Massachusetts on the ASMFC Jonah Crab Plan Review Team and Stock Assessment Subcommittee, and chaired the Technical Committee. Staff provided landings data, spatial information, commercial size distribution data, survey indices, and biological information (e.g., maturity and movement data) for the assessment, which was released for management use by ASMFC in 2023.

Figure 35. Massachusetts offshore lobster/crab trap with Jonah crab catch.

Whelk Research and Monitoring

Figure 36. A channeled whelk on a measuring board during at-sea sampling.

Commercial Fishery Sampling: Staff conducted one sampling trip aboard a commercial vessel fishing whelk pots in the Buzzards Bay region in the spring of 2023, and three trips in Nantucket Sound—one spring and two fall (Figure 36). We continued to have some challenges associated with staff transitions and finding willing vessels with whom to sample, which resulted in fewer whelk sampling trips than normal. Over the last three years (2021–2023), staff have sampled 14,881 whelk from four different commercial trap fishery vessels; 98% of the sampled whelk were channeled whelk and only 2% were knobbed whelk.

Assessment and Management Support: Staff provided data in support of policy discussions related to the scheduled gauge size increases and participated in meetings and with SMAST researchers regarding whelk-related research priorities.

Northern Shrimp Research and Monitoring

Assessment and Management Support: Staff served on the ASMFC Northern Shrimp Technical Committee. The fishery remains closed until 2024 due to depleted stock conditions and lack of recruitment. In 2023, the Technical Committee provided an update on stock conditions using a simple "traffic light" approach based solely on survey data. Additional work focused on conversations around a potential "wake-up" index using recruitment

indicators, intended to reinitiate more in-depth analyses should recruitment conditions suggest some improvement in the stock, and challenges should the ASMFC-NOAA Summer “Shrimp” Survey be eliminated.

Other Activities

Invertebrate Fisheries Program Staff acted as reviewers for peer-reviewed journals and were co-authors on three published articles.

Staff continued to work on development of a comprehensive new database to house data collected from multiple Invertebrate Fisheries sampling programs. Work with the DMF Statistics Program staff to vet and improve the design plan continued.

Protected Species Program

Personnel

Erin Burke, Program Manager
David Chosid, Marine Fisheries Biologist
Brendan Reilly, Marine Fisheries Biologist
David Chosid, Marine Fisheries Biologist

Overview

In 2023, the Protected Species Project was promoted to Program status to account for substantial increases in scope of work and responsibilities. This includes the expansion of monitoring of North Atlantic right whales through increased aerial surveillance and the upcoming development of a passive acoustic monitoring network, along with the initiation of an on-demand gear research initiative. As part of this re-organization, the Division's Conservation Engineering Project was brought into the Program and re-focused to work on emerging issues related primarily to fixed gear fisheries interactions with protected species. This work will focus on ropeless fishing technology, research on weak rope and contrivances, compliance assistance and outreach work with fixed gear fisheries, and developing strategies to reduce the amount and minimize the impacts of derelict fishing gear. The overall Program is focused on research, management, applied conservation projects, and policy development to minimize and mitigate entanglement risk of protected species in fixed fishing gear. Additional tasks include research grant writing and administration, and participation in Take Reduction Teams and committees related to offshore wind energy development.

Activities

Right Whale Surveillance

In 2023, DMF partnered with the Center for Coastal Studies (CCS) and NOAA Fisheries to carry out the 25th year of the Right Whale Surveillance Program. The program conducts aerial surveillance and habitat monitoring of right whales in Cape Cod Bay, Massachusetts Bay, and adjacent areas during the winter and spring. Our understand of the real-time distribution and abundance of right whales in Massachusetts waters informs critical management decisions, including the dynamic management of fixed gear closures and speed restrictions. Surveillance primarily occurs in the Massachusetts Restricted Area (MRA), a season trap closure to protect aggregations of right whales from entanglement. In 2023, the team documented 56% (n=198) of the known right whale population in Cape Cod Bay and adjacent waters, including Massachusetts Bay (Figure 37). These coastal waters continue to be an important seasonal habitat for right whales, which is especially significant given that the population currently numbers around 356 individuals.

There were two known right whale mortalities in 2023: one was a vessel strike off Virginia and one was a perinatal mortality off North Carolina. Mortalities have been low in recent years in comparison to the high mortality seen in 2017 and 2019, although serious injuries due to entanglement have remained steady. During the 2023 right whale calving season, 12 calves were identified, of which 10 mother/calf pairs were documented in Cape Cod Bay. Based on the lingering presence of right whales, DMF extended the MRA closure and small vessel speed restriction in state waters through May 8. The high abundance of right whales visiting Cape Cod Bay and adjacent areas demonstrates how critical Massachusetts waters are to the North Atlantic population and the importance of protecting them.

Project Staff administered the grant from NOAA Fisheries that supports aerial surveillance and habitat monitoring and assisted in coordination of all large whale conservation activities.

Large Whale and Sea Turtle Disentanglement

DMF and CCS cooperatively administer large whale and sea turtle disentanglement efforts around Massachusetts through grants from NOAA Fisheries and the Massachusetts Environmental Trust. The 24-hour hotline and rapid response program is critical to reducing the potential for injury and mortality caused by entanglements, while also collecting information on entangling gear for management purposes. In 2023, Division staff assisted in disentanglement efforts, gear analysis, and performed all grant management activities. A confirmed 16 whales were reported as entangled within the CCS response area, including two right whales, 11 humpback whales, and two minke whales. The team either partially or fully disentangled four humpback whales and one right whale. Additionally, CCS confirmed seven leatherback sea turtle entanglements, of which four were disentangled.

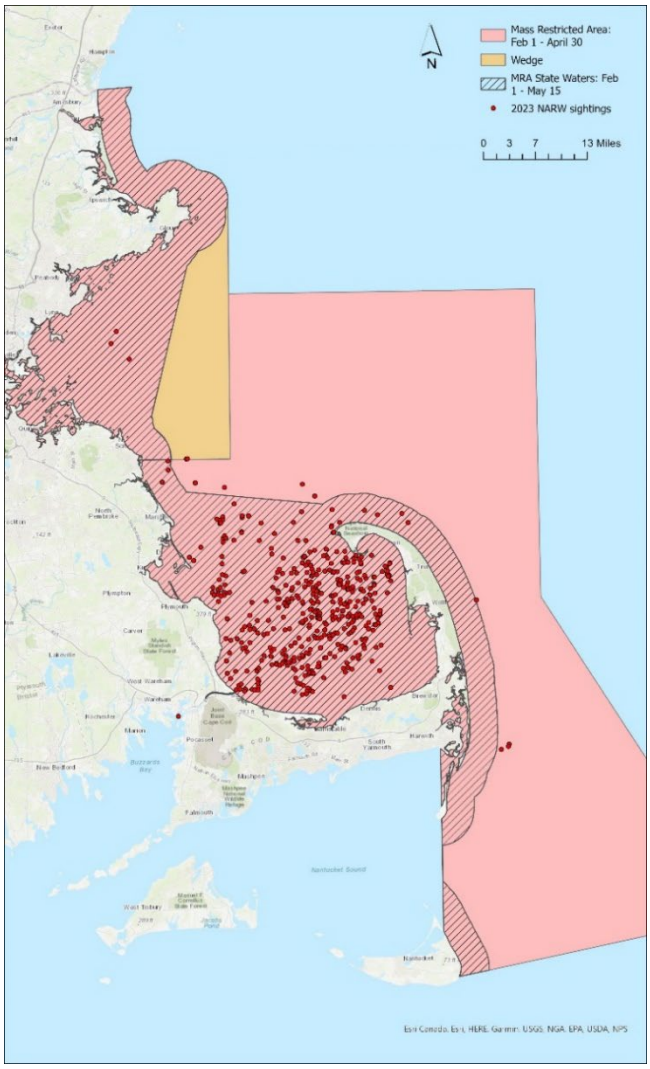

Figure 37. Map of right whale spottings from aerial surveillance monitoring in 2023.

Incidental Take Permit Application

DMF is applying for a federal Endangered Species Act Section 10 Incidental Take Permit (ITP) for fixed gear fisheries in state waters that might interact with endangered species, specifically North Atlantic right whales, leatherback sea turtles, and loggerhead sea turtles. In 2023, staff finished drafting the Habitat Conservation Plan (HCP), a key component of the ITP application. The HCP encompasses the history of fishing activity for fixed gear fisheries in Massachusetts, the presence of endangered species in state waters, an analysis of their co-occurrence, and conservation and mitigation measures DMF has implemented to protect endangered species during the fishing season. The final draft HCP was submitted to NOAA Fisheries in February 2023 for internal comment and review. Feedback from NOAA Fisheries on the draft has been instrumental in DMF's development of a final HCP and completed ITP application (expected to be submitted to NOAA Fisheries in summer 2024). It will likely take one year for NOAA Fisheries to review and conduct environmental analyses of the final ITP application.

Protected Species Regulations

At DMF's request, NOAA Fisheries implemented an emergency trap closure in the MRA "wedge" (see Figure 37) under the Atlantic Large Whale Take Reduction Plan to protect against entanglement. The wedge closure was adjacent to current MRA closed areas and was put in place to address gaps in protection resulting from the presence of buoy lines and whales in this area. The emergency closure occurred February 1– April 30, 2023.

Derelict Fishing Gear Removal

In 2023, DMF continued an on-going cooperative program to locate and remove abandoned, lost, and illegally fished gear (collectively referred to as derelict fishing gear) in the MRA prior to the arrival of right whales. DMF partners with MEP, commercial fishermen, and CCS to locate and remove all buoyed derelict trap gear within the Massachusetts state waters portions of the MRA. Through 14 sea days during February–April 2023 (and including one the prior November), the team hauled 138 single traps and 43 trap trawls from the MRA (Figure 38). In total, 481 traps and 267 buoy lines were successfully recovered. Of the traps recovered, approximately 144 were identified as recreational gear, 317 as commercial gear, and 20 unknown.

The derelict gear removal efforts not only ensured that the seasonal state waters closure was effective in eliminating entanglement risks for whales, but it also provided an opportunity to monitor compliance with the closure and requirements for weak rope/contrivances, maximum rope diameter, and gear marking. Staff also participated in the Massachusetts Derelict Fishing Gear Task Force to study the issue of derelict gear in Massachusetts waters and to develop solutions for the removal of such gear. Additional information on the task force is provided in the Fishery Policy and Management Program (page 23).

Figure 38. Lobster vessel crew and DMF staff collecting derelict trap gear during the 2023 MRA Closure with the collaborating MEP vessel in the background.

On-Demand ("Ropeless") Gear

On-demand fishing gear replaces traditional, static buoy lines in the water column with a stowed buoy line which is released via an acoustic command triggered by the harvester. This eliminates the presence of buoy lines in the water column and reduced the risk of entanglement, which is a primary conservation focus of efforts to reduce impacts to right whales. On-demand gear offers an innovative solution to the threat of entanglement and could be an important conservation tool, particularly in areas with seasonal gear closures. However, research of on-demand gear is on-going and presents many challenges such as functionality testing, awareness of this gear to stakeholders, communication standards, and more.

On-Demand Gear Testing: The NOAA Northeast Fisheries Science Center (NEFSC) is conducting on-demand gear research in federal waters under an Exempted Fishing Permit. The goals of this research include: demonstrating successful retrievals of multi-trap trawls on a variety of experimental on-demand components; collecting additional operational data on fishing, efficiency, gear location awareness, cloud storage and data sharing; assess and improve the ease and accuracy of data collection itself; improve virtual displays of fishing activity for managers and enforcement to inform future regulatory decisions; demonstrate and develop the EarthRanger platform as an affordable and efficient interim solution to gear conflicts by integrating deployments from multiple manufacturers into a centralized cloud database and plot relevant data for the mobile and fixed gear fleet operating in the area; and provide additional feedback and recommendations to manufacturers of on-demand gear and related industries (i.e., database developers, geolocation technologies) on improvements that increase their performance under commercial fishing conditions.

In order for the NEFSC Gear Research Team to conduct this research in Massachusetts state waters (in addition to federal waters), DMF issued the NEFSC a Letter of Authorization (LOA) in February 2023 to accommodate

work being conducted by the Gear Research Team with federally permitted commercial lobster vessels during the MRA seasonal closure. From February–April 2023, five industry lobster vessels conducted this work in Massachusetts waters and 187 on-demand hauls were completed. Of those, 174 hauls were successful (93.05%), 2,446 lobsters were retained, and 1,634 were discarded. During this work, 14 North Atlantic right whales were sighted from the participating vessels. The NEFSC provided a report of this work to DMF titled, "MA State Waters 2023 Closed Area Summary NOAA NEFSC Gear Research Team". DMF also provided an LOA to the NEFSC in December 2023 to continue to conduct their on-demand work in MA waters during the open season. Thirteen lobster vessels were approved on the LOA and 22 trips (assuming no overnight trips) were conducted in Massachusetts waters during the remainder of the year by seven vessels, with 41 sets made and 24 hauls. DMF, in partnership with the NEFSC, agreed to dedicate staff as research observers towards a limited number of on-demand trips working in Massachusetts waters in 2024 to collect additional through-put data of the gear.

On-Demand Gear Density Study: Gear conflicts are a major nuisance to fixed-gear fishers and can usually be avoided while using standard gear with buoys. However, we are still in the beginning stages of knowing how easily and accurately on-demand gear can be set and retrieved. Set on-demand gear, which is largely only detected through chart marks or with expensive acoustic equipment, may require considerably greater spacing between neighboring trawls than standard trawls to avoid gear conflicts. Once the effective distances of trawls using on-demand gear are better understood, we can then assess the impacts to the industry with regards to time, space, and cost needs. DMF staff developed a research plan to conduct lobster trawl density testing of on-demand gear. The purpose of this research is to identify the minimum effective distance possible to fish on-demand trawls without fixed-gear conflicts.

DMF staff began familiarizing themselves with operating on-demand technology. To increase our understanding of on-demand technology and surrounding issues, meetings were attended, such as the Ropeless Consortium Meeting and the North Atlantic Right Whale Consortium Meeting, and included topics on interoperability, functionality and purpose of on-demand gear, on-demand gear conflicts (hosted by the "On-Demand Fishing Gear Conflict Working Group"), data standards, and the status of the North Atlantic right whales.

On-Demand Gear Fishing Economic Model: Staff helped complete the second phase of an on-demand gear implementation scoping to develop an economic model to evaluate the operational costs of on-demand gear implementation in the Massachusetts lobster fishery. The implementation of on-demand fishing could have significant impacts on the economics of the lobster industry such as the cost of the new gear, changes in hauling efficiency and catch rates, and the implications of gear conflict and gear loss. DMF partnered with contractor Noah Oppenheim of Homarus Strategies LLC, Dr. Rob Griffin of UMass-SMAST, and Dr. Andrew Goode of the University of Maine to develop a model to estimate operational costs of on-demand fishing under a range of implementation scenarios. The model is based on available fishery-dependent reporting and economic data and a series of stakeholder surveys/interviews. The outputs from this modeling approach will allow DMF to provide economic and cost impact estimates for the state's lobster fishery under various on-demand fishing gear management and implementation scenarios for the first time. The final report titled "Estimating the Costs of Using On-Demand Gear in Massachusetts Lobster Fisheries" can be found on DMF's website.

Staff also applied for and were awarded funding in 2023 from the National Fish and Wildlife Foundation to continue developing the economic model using more sophisticated fishery-dependent data, more on-demand testing data, and enhanced socioeconomic information from the Massachusetts lobster fishery. This updated model will be able to provide a more comprehensive assessment of the impacts of on-demand implementation across a wider range of fishing scenarios, such as fishing in seasonal restricted areas, hybrid fishing with traditional gear and on-demand gear, and potential future fishing closures.

Compliance Assistance

The severity of injuries to right whales caused by entanglement can be reduced by using line that breaks at 1,700 pounds or less. DMF and NOAA Fisheries have implemented regulations requiring the use of reduced breaking strength ropes ("weak rope") in the lobster fishery. DMF requires fishermen to use fully formed weak rope for their buoy lines or to use weak contrivances every 60 feet, as well as requiring color-coded marking of buoy lines to identify gear as originating from Massachusetts. To assist fishermen in complying with these requirements, DMF staff conducted outreach to distribute gear to fishers, through events such as the Massachusetts Lobstermen's Association meeting, and direct deliveries to organizations and individual permit holders. Items purchased for distribution included various types of weak ropes for the Massachusetts inshore fleet, plastic break-away links and other contrivances, marking materials, and whale-safe rope for Massachusetts Lobster Conservation Management Area (LCMA) 3 fishers. Inventory distributed in 2023 was approximately:

Figure 39. Rope break testing device with red and candy cane ropes.

- 132 coils of LCMA 3 whale-safe rope,
- 160 coils of MA inshore whale-safe rope of various types,
- 1,500 weak contrivance plastic links,
- 40 weak contrivance Southshore sleeves, and
- 30 spools of red twine and 2,000 ft of red heat shrink for marking buoy lines.

Based on feedback from fixed-gear industry members, DMF began pursuing the bulk purchases of new whale-safe buoy ropes with an added plastic ribbon woven into each rope. These ribbons contain the printed text, "MASS LOBSTER" to clearly identify this gear as rope purchased and used in the Massachusetts fixed gear fisheries. Staff also began pursuing new regulatory changes to allow for the use of rope with the labeled ribbons, fully formed, in place of additional marking requirements.

To confirm the rope with the labeled ribbons still meet the weak contrivance conditions of a 1,700-lb breaking strength, DMF staff worked in conjunction with the NEFSC to test the gear (Figure 39). Two rope types with ribbons were tested: the candy cane and red rope. Both succeeded in meeting the requirement. DMF staff encouraged another rope manufacturer to also begin the process of adding the labeled ribbon into their MA inshore whale-safe ropes.

DMF conducted a web poll to all Massachusetts fixed gear permit holders to request users report their preferred weak contrivances and rope marking materials. Additional rope was purchased in accordance with identified preferences. New rope inventory was ordered from local suppliers and most new ropes will include the "MASS LOBSTER" ribbon. Give-aways were planned for 2024.

Additional tasks included progress towards improving facility infrastructure for gear compliance needs and responding to public inquiries about regulation requirements of buoy line markings and whale-safe contrivances.

Other Activities

Partner in the Spotlight Award: In 2023, NOAA Fisheries recognized DMF for their work on right whale conservation by awarding us the Partner in the Spotlight Award, which is presented biennially to an outstanding partner who has expanded and enhanced recovery of our most imperiled marine species. This award highlights

DMF's commitment to protecting right whales through our state regulatory mechanisms and illustrates the importance of those measures and the sacrifices made by commercial fishermen to the recovery of right whales.

Committee Work: Staff participated as a member of the Massachusetts Habitat Working Group. This body assists EOEEA, 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 potential impact of wind energy development on marine mammals that inhabit the area south of Martha's Vineyard and Nantucket. Staff are also a member of the Sea Turtle Subcommittee for the Regional Wildlife Science Collaborative for Offshore Wind which serves as a coordination hub for offshore wind research to increase collaboration and data sharing. Project staff also consult on review of subtidal aquaculture projects to minimize potential impacts to protected species.

Staff participated in two NOAA Gulf of Maine Marine Debris Action Plan working groups, "Fishing Gear" and "Research, Information, and Risk Assessment for Wildlife and Habitat", which re-evaluated and updated the action plan. The Gulf of Maine Marine Debris Action Plan, originally published in November 2019, establishes a comprehensive framework for strategic action to ensure the Gulf of Maine and its coasts, people, and wildlife are free from the impacts of marine debris. This Action Plan is one of several being implemented in coastal regions across the country.

Conservation Engineering

Staff collaborate with commercial fishing industry members and others to improve the design and performance of fishing gear and fishing practices in order to reduce impacts on non-target species. With the refocus of conservation engineering to the above reported activities, this section largely summarizes traditional finfish by-catch reduction research activities finalized in 2023.

Complementary Testing of Off-Bottom Trawls to Target Georges Bank Haddock: This project, funded by the NMFS Saltonstall-Kennedy Program and conducted cooperatively with industry and academic partners, tested the effectiveness of two different off-bottom, mid-water trawls (OBTs) to target Georges Bank haddock and redfish. The OBT nets have very large meshes at the front end, made with innovative "helix" twine that produces lateral hydraulic forces while towing, resulting in self-spreading of the meshes. We established optimal gear configurations to achieve the target OBT net shape and distance to the seafloor by using an assortment of mensuration sensors/loggers and cameras. Haddock catches in both nets successfully matched the catch of haddock in the Eliminator/Ruhle trawl in weight and in size, despite a smaller mesh codend on the OBTs. Generally, lower bycatch of bottom-oriented species was seen in the OBTs. This work was finalized in 2023 with final data analyses and a published manuscript. Staff responded to additional requests for information regarding the project's gear design to be considered for future research by other organizations.

Bycatch Reduction of Red Hake in the Southern New England Silver Hake Trawl Fishery: The NOAA Fisheries Bycatch Reduction Engineering Program awarded DMF this project in 2019 (along with SMAST and an industry representative) to test a large mesh belly panel as a bycatch reduction method for red hake in the whiting/silver hake fishery in southern New England. Red hake populations in SNE continue to decline despite effort reduction measures. Fieldwork for this project was completed in 2022, along with the grant completion requirement. In 2023, three participants' meetings were held, the data analyses were completed, with primary collaborations by SMAST, the Responsible Offshore Science Alliance, and the National Institute of Aquatic Resources, and a final report was submitted. Staff represented the research at the New England Cooperative Research Summit.

Other CE Activities: Staff acted as a reviewer for grant applicants of the Massachusetts Environmental Economic Innovation and Resiliency in Marine Fisheries Grant Program. The goal of this Grant Program is to develop, utilize, or promote innovative approaches that enhance environmental benefits and encourage increased economic activity in Massachusetts.

DMF maintains a large video library, in multiple formats, collected over a long period. Efforts are on-going to digitize all media, catalog it, and to make it available to users. Staff worked with EOEEA and DFG to transition video archives to SharePoint from local drives. New equipment was acquired through EOEEA to backup video and act as a staging area for editing needs. QA/QC were conducted to mirror files.

Staff contributed to the ICES Working Group on Fishing Technology and Fish Behavior National Report on topics concerning the development of a small whelk bycatch reduction device, the testing of an off-bottom trawl to target Georges Bank haddock, and bycatch reduction of red hake in the Southern New England silver hake fishery.

At the New England Cooperative Research Summit annual meeting, staff acted as a panelist for the session, “Fishing Smarter Not Harder: Engaging Industry in Conservation Gear Engineering”.

Staff responded to requests for information from outside research institutions, fishing industry companies, and internally on topics including the technical specifications of a tested dogfish excluder grate, a tested sorting grid used in the squid fishery, the progresses in using lights to attract squid, and sediment impacts from hydraulic clam dredges and rock hoppers. Two dogfish excluder grates were provided to Reidar’s Manufacturing, along with copies of the grate’s schematics, to aid in continued use in the trawl fishery to reduce bycatch and further research. These schematics were also provided to Cornell University. A whiting trawl schematic, used in a past project, was provided to Levin Nets. Two videos were developed and posted to encourage the whelk fishing industry to incorporate vents into their whelk traps to improve size selectivity and reduce mortality of undersized whelk.

Recreational Fisheries Program

Personnel

Ben Gahagan, Program Manager
John Boardman, Marine Fisheries Biologist
Matt Ayer, Marine Fisheries Biologist
Ross Kessler, Public Access Coordinator
David Martins, MRIP Coordinator
Kristen Thiebault, MRIP/FHTS Sampler
Neil McCoy, Information & Education Coordinator (beginning March)
Kim Fine, Angler Education Coordinator

Overview

In recognition of the importance of recreational fisheries in Massachusetts, the Division elevated the Recreational Fisheries Project to Program status in 2023. The Recreational Fisheries Program continues the excellent legacy of the Project but will focus on increasing offerings and partnerships with anglers and stakeholders to ensure Massachusetts' recreational fisheries are well managed and recognized as the spectacular resources they are. The Program works to preserve, enhance, and promote the Commonwealth's marine recreational fisheries. Its goals are to conserve key recreational species through science-based monitoring and management; support the recreational fishing community, including local recreational fishing businesses; and educate the Commonwealth's citizens on the features and benefits of local recreational fishery resources. Program personnel participate in Division-led research; measure abundance, length frequency, and age classes of key finfish populations; measure harvest and release of key species; facilitate purchase and maintenance of access sites, much of which is funded by recreational fishing permit sales; and disseminate information on all aspects of recreational species and fisheries to the public.

Activities

MRIP Sampling

Since 1983, recreational fisheries catch and effort data have been collected along the Atlantic Coast through NOAA Fisheries' Marine Recreational Information Program (MRIP). MRIP is vitally important to both fisheries scientists and managers who use the information to assess how catch levels affect fish population size and to develop measures for sustainable recreational fisheries. DMF has managed the at-sea sampling of head boats in Massachusetts since 2003 and the shore-side Access Point Angler Intercept Survey (APAIS) sampling of charter vessels, shore anglers, and private/rental vessel anglers since 2013 (Figure 39). The benefits of doing so include the ability to increase sample sizes and improve the precision of catch estimates. In 2020, DMF began the administration of the For-Hire Telephone Survey (FHTS) in Massachusetts to estimate fishing effort by charter and headboat vessels operating in Massachusetts.

DMF continued its coordination of APAIS surveys in 2023—training 20 seasonal field interviewers, scheduling trips, logging data, maintaining equipment, attending data review meetings, and maintaining regular communication with the Atlantic Coastal Cooperative Statistics Program (ACCSP) regarding survey performance and sampling. (ACCSP administers the program for NOAA Fisheries.) In 2023, MRIP field interviewers completed 1,280 shore-side assignments out of 1,329 scheduled for a total of 4,037 angler intercepts (slightly less than the year prior): 2,636 from private vessels, 524 from charter vessels, and 877 from shore anglers. DMF also collected

head boat harvest and discard data during 60 at-sea head boat trips in which 1,080 anglers were interviewed (an increase from 2022). Poor weather conditions and less fishing activity contributed to lower numbers of shoreside interviews compared to the previous year. According to meteorological records, 2023 was the second rainiest on record in Massachusetts. Overall fishing activity was down approximately 15% compared with 2022. The FHTS completed 1,691 calls to charter and head boat representatives from March through December to collect for-hire vessel effort information. FHTS staff also worked to update and improve the federal charter and head boat vessel directory to ensure survey precision and accuracy as well as sampling efficiency each year.

Figure 39. MRIP staff collect recreational fisheries catch information during shore-side intercepts of private vessel, charter boat, and shore-based anglers, and from head boat anglers while at sea during their trips.

Public Access

The Public Access Coordinator position, which is funded from the Marine Recreational Fisheries Development Fund, manages all DMF saltwater fishing access projects, working closely with the *Mass*DFG Office of Fishing and Boating Access (OFBA), non-governmental organizations, towns, and other state and federal agencies to identify, plan, and implement projects that will enhance 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 2023, final permits were obtained to replace the historic Salem Willows Park Pier. DMF entered a partnership with the City of Salem in 2020 to initiate this work, beginning with the demolition of the old pier in late 2021. The pier had been a mainstay in Salem, serving the fishing public for over 100 years, prior to being condemned as unsafe. Like the old pier, the new pier will extend 330 feet into Salem Sound; however, the end of the new pier will have a 60 x 16 foot 'T' section which will accommodate far more anglers than its predecessor. A major improvement over the old pier will be Americans with Disabilities Act accessibility. In 2022, the project was expanded to include a new seawall and approach to the pier. With final permits in hand, construction was scheduled to begin in the Spring of 2024, with an estimated duration of six to nine months.

DMF's annual small grants public access program provides $50,000 to assist municipalities with projects that promote or support local recreational fishing activities and access. Two projects were approved for funding in 2023: (1) Beverly – finishing re-decking of the City's multi-use pier, a popular spot for anglers with access to Beverly Harbor; (2) Chappaquiddick – the creation of a new pathway to maintain access to Tom's Neck. Three projects approved for funding in 2022 were ready for use in 2023 (Figure 40).

At the agency's Craven's Landing access site on Scorton Creek in Sandwich, periodic site monitoring and maintenance were required. Seasonal contractors were hired for site patrol and coordinated for weekly summer assignments. Every year, staff works closely with official plover monitors to comply with USFWS regulations.

Access is limited at Craven's Landing after plover chicks are born and re-opens when young plovers fledge or migrate out of a federally established buffer zone. Staff also continued to collaborate with the Massachusetts Natural Heritage Program and many other organizations to implement a Habitat Conservation Plan (HCP) for alternative management options in piping plover habitat.

Figure 40. Three small grant public access projects funded in 2022 and ready for use in 2023 (from left to right): one of two canoe/kayak floats installed in downtown Cohasset; solar lighting and washdown system installed at Cashman Park pier, Newburyport; and repairs to Blish Point ramp in Barnstable.

The agency also owns Leland Beach on Cape Poge in Edgartown, Martha's Vineyard. The Trustees of Reservations (TTOR) provides management of that parcel through a Memorandum of Understanding. The Division participated in the drafting of a new Beach Management Plan with TTOR and other user groups. Going forward, the Division will now work with the TTOR to aid in public access management decisions on an ongoing basis. Our focus will be to protect and enhance public access for anglers wherever legal and reasonable.

During 2023, staff worked with various entities to develop proposals for the development and enhancement of public access sites; responded to inquiries regarding shoreside fishing sites, public access rights, and future access projects; and represented the agency remotely at multiple meetings of various sportsmen's gatherings.

Recreational Fishing Derby

Project staff administered the state's Saltwater Fishing Derby. Formally known as the Governor's Cup and hosted by the Division of Tourism, the derby was moved to DMF in 1983. In 2023, there were 75 entries in the derby, including 40 winners and two Anglers of the Year. The Junior Angler of the Year had nine winning fish. There were no Skillful Skippers winners in 2023 and no new state records were set. Other activities in 2023 included creating, printing, and distributing derby rule pamphlets and entry forms. Project staff had regular communications with weigh stations, prepared press releases, distributed outreach materials, and tracked derby standings. The Derby winners received their awards at the New England Boat Show on January 13, 2024 (Figure 41).

Figure 41. Lola Crisp, 2023 Junior Angler of the Year, with Director McKiernan.

Information & Education

The Division's Information & Education activities are focused on establishing and maintaining meaningful connections with Massachusetts recreational saltwater anglers to provide them with needed information. Activities are supported in large part by the sale of recreational saltwater fishing permits.

Communications: Staff routinely answered public inquiries regarding recreational fisheries and attended meetings of the recreational fishing community by request. Staff also continued to create and maintain online content and resources on the Mass.gov website. Existing Recreational Fishing web content was updated, new web pages such as Frequently Asked Questions and project pages were built, and website analytics were tracked. Staff used GovDelivery email bulletins to regularly communicate with an audience of almost 90,000 subscribers. Bulletins were used to communicate information that impacted recreational anglers, including advisories, updated regulations, upcoming events, public hearings, surveys, and citizen science.

Social Media: Social media was an important communication tool to connect with our audiences in 2023. We actively shared content through our social media platforms on Facebook, Instagram, and Twitter/X. Followers and engagement increased across all platforms, but especially on Instagram where we increased our followers from about 5,000 to more than 6,200 (a 25% increase). Content across platforms included regulatory advisories, recreational fishing topics, saltwater derby activity, highlights from field research, angler education events, and more. The Striped Bass Citizen Science project was often featured in our social media, where we recruited participants and posted highlights and celebrated raffle winners. In 2023, social media analytics, including followers, engagement, impressions, and top posts, were tracked monthly.

Publications and Design: The 2023 Massachusetts Saltwater Recreational Fishing Guide (Figure 42) was prepared and distributed to over 140 bait and tackle shops and to requesting anglers by mail and website downloads. New features included the Striped Bass Citizen Science Project and a Striped Bass Status Update.

The latter was part of a larger information campaign launched in 2023 to increase awareness and understanding about the status of the striped bass recreational fishery and a new emergency management action. Several new print pieces were designed and distributed, including a Striped Bass 2023 Recreational Regulations infographic (Figure 43). New striped bass regulation signs were produced and posted with five additional languages to improve accessibility. We also produced a new popular handout called *How Old is My Striper?* (featuring an easily understood age-length key created from DMF fish samples) and promotional materials for the striper license plate.

Recruitment materials were designed, printed, and distributed for our public science initiatives, including the Sportfish Angler Data Collection Team and the Striped Bass Citizen Science Project (Figure 43). Routine reorders of existing I&E program materials, including shark and saltwater fish activity books, were completed to fulfill distribution needs at events. Additional educational materials and promotional items for the Take Me Saltwater Fishing initiative were designed and produced.

Figure 42. Cover of the 2023 Saltwater Recreational Fishing Guide.

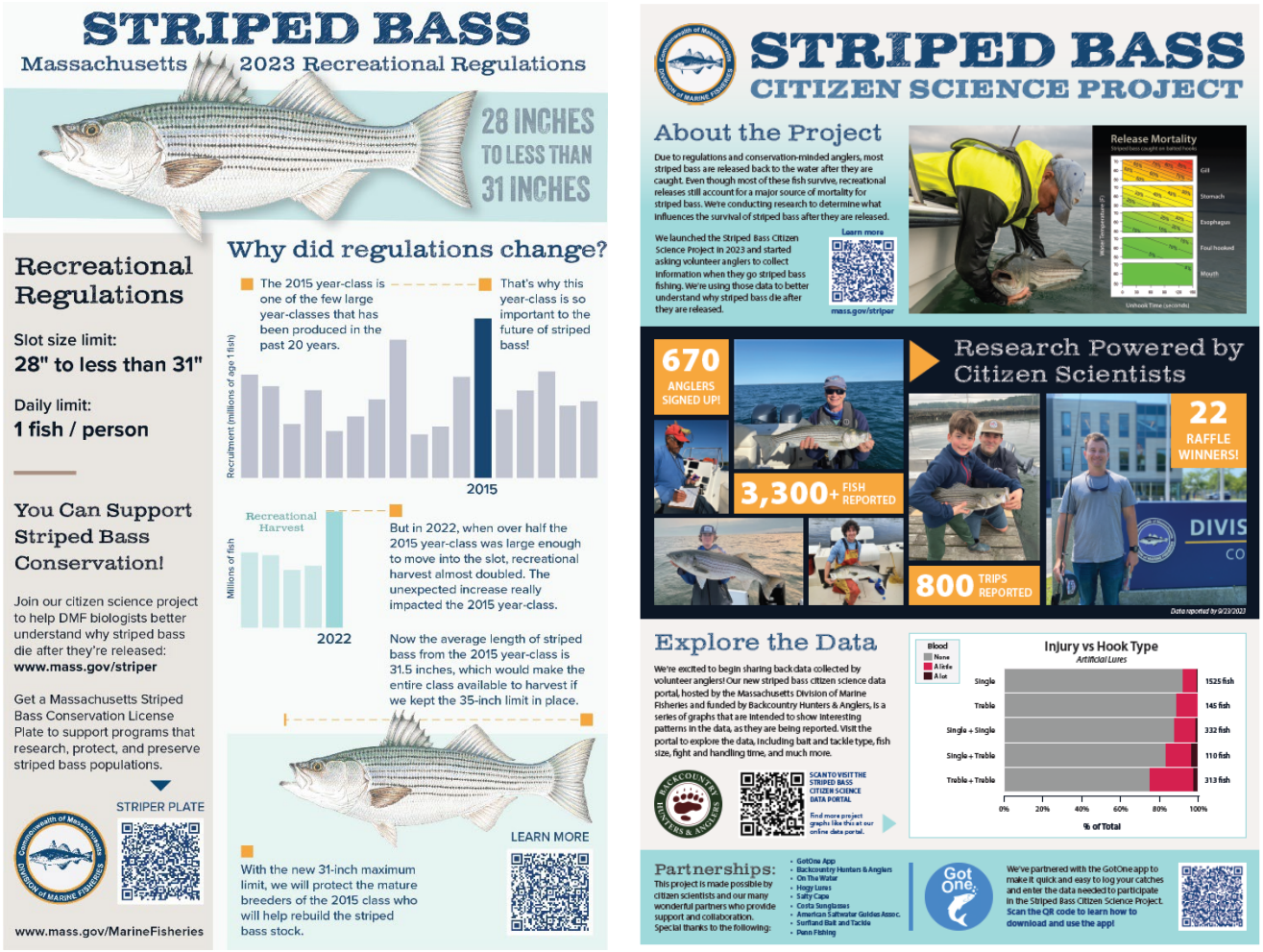

Figure 43. Posters created in 2023 to inform anglers about new emergency conservation measures for striped bass (left) and a collaborative research project into striped bass release mortality (right).

Events: Our staff kicked off 2023 by hosting the annual Saltwater Derby Awards Ceremony during the New England Boat Show. Staff also attended and provided outreach materials for several events throughout the year, including the New England Saltwater Fishing Show, StriperFest, and the Topsfield Fair (which has an annual attendance of roughly 500,000 people). Event materials included marine activity books, posters, recreational fishing guides, youth fishing field guides, citizen science project materials, How Old is My Striper? handouts, and promotional striper license plate instructions. In 2023, we promoted our annual Free Saltwater Fishing Days on outdoor billboards and digital signage, with plans to expand our use of this medium for other events and projects. We also had the opportunity to host Salem Public School 4th graders at our Cat Cove facility, where students learned how to build a fish weir and got an up-close look at some local marine species.

Saltwater Angler Education

Our Saltwater Angler Education initiative works to promote responsible fishing in an enthusiastic environment, recruit new anglers, and make saltwater fishing accessible to everyone. We engage the public by providing learning opportunities and educational materials for new anglers. Our program includes free fishing clinics, informational booths at festivals and events, training seminars, video tutorials, a fishing field guide, and other educational handouts. Activities are supported in large part by the sale of recreational saltwater fishing permits.

In 2023, the Saltwater Angler Education Program hosted or participated in eight events open to all ages, one adult training seminar, one multi-day summer camp fishing clinic, and four fishing festivals. These events occurred from May through October (Table 25). DMF staff taught basic angling skills, how to responsibly handle fish, and led other fun activities such as knot tying and fish identification (Figure 44). Educational handouts were distributed to participants, as were mini tackle kits—including circle hooks and measuring tapes. Our goal is to provide participants with the skills and confidence to go saltwater fishing on their own. Providing them with tackle to do so greatly increases those odds. Angler education materials were provided for additional events upon request.

Members of our staff also attended the Massachusetts Recreation and Park Associations Annual Exhibition to network and advertise the Take Me Saltwater Fishing Angler Education clinics and to form and strengthen new and existing partnerships.

Figure 44. DMF staff providing a lesson to new anglers at a 2023 fishing clinic.

Table 25. 2023 Saltwater Angler Education Fishing Events.

Event	Partnering Organization(s)	Participants
Boston Harbor Island Summer Series, Deer Island	National Park Service, Boston Harbor Now, MWRA, Fish and Wildlife	100
Fort Taber Take Me Saltwater Fishing Clinic, New Bedford	Journey Christian Youth Group	30
Water Safety Day, Sandwich	Cape Cod Canal Visitor Center	90
Provincetown Fishing Festival	Mass Beach Buggy Assoc. & National Park Service	65
Swampscott Harborfest	City of Swampscott	50
Cops and Kids, Gloucester	City of Gloucester Police Department	80
Evening Family Fishing Clinic, Sandwich	Cape Cod Canal Visitor Center	100
Discovery Camp Staff Training Seminar, Charlestown	Naval Shipyard	12
Hill to Harbor Discovery Camp, Peddocks Island	National Parks of Boston, YMCA	185
Fort Taber Take Me Saltwater Fishing Clinic, New Bedford	Straight Ahead	8*
Evening Family Fishing Clinic, New Bedford	City of New Bedford	30
Boston Harbor Island Summer Series, Castle Island	National Park Service, Boston Harbor Now, Fish and Wildlife, Elevate Youth, Trustees	150
Cops and Bobbers, Bicentennial Park, Fall River	Fall River Police Department	60
Boston Harbor Island Summer Series, Nut Island	National Park Service, Boston Harbor Now, MWRA, Fish and Wildlife, Trustees	100

* Participation affected by weather-related delay to clinic start time.

Large Pelagics and Diadromous Fisheries Program

Personnel

Dr. Gregory Skomal, Program Manager
Brad Chase, Diadromous Fisheries Project Leader
John Sheppard, Diadromous Fisheries Biologist
Stephanie Berkman, Diadromous Fisheries Biologist
Edward Clark, Fishway Crew
James Rossignol, Fishway Crew

Overview

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

The **Diadromous Fisheries Project** works to sustain and improve sea-run fish passage, habitat, and populations. The project also conducts fish biology monitoring and research that contributes to fisheries management. Fish passage and habitat restoration is accomplished through coordinated efforts of DMF staff, state and federal agencies, municipalities, and private groups to facilitate, design, and execute projects to enhance diadromous fish populations. Technical assistance is provided as needed for individual restoration projects and coastal watersheds. Project efforts cover 10 species of diadromous fish stocks in Massachusetts, with a focus on river herring, American shad, rainbow smelt, and American eel. These species are monitored for run counts, indices of population abundance, size and age composition, harvest, and restoration potential. The information generated by this project is necessary for the sustainable management of diadromous fish populations as required by state and federal laws.

Large Pelagics Research Project

Shark Research

DMF began shark research in 1987 to better understand the ecology, distribution, and relative abundance of sharks that are subject to fisheries off the coast of Massachusetts. Staff conduct field research and opportunistically collect data from recreational and commercial fishermen's catch. Biological parameters are examined through the dissection and tagging of sharks. The goals are to foster cooperative shark research; participate in state, regional, federal, and international management processes; and provide public education and technical information on the biology, management, and utilization of sharks.

White Sharks: The aggregation of white sharks off the coast of Massachusetts is one of only a handful of hotspots in the world and unique along the east coast of the US. Consequently, the state of Massachusetts, and in particular, the towns on Cape Cod are faced with a growing potential for negative interactions between this species and people utilizing our coastal waters. As a result, DMF has intensified its research on the fine-scale predatory behavior of white sharks off the coast of Massachusetts using a variety of high-tech tags, including acoustic telemetry, satellite-linked tags, and acceleration data loggers. Our acoustic receiver array has been

expanded to fill gaps around Cape Cod and to include most towns along the Massachusetts coastline. In collaboration with the Center for Coastal Studies, five gridded acoustic arrays were deployed off beaches of the Outer Cape to examine fine-scale movements of sharks as they relate to habitat. To notify public safety officials of the presence of tagged white sharks, four real-time acoustic receivers were deployed off popular Outer Cape swimming beaches including Newcomb Hollow and Lecounts (Wellfleet), Nauset Beach (Orleans), and North Beach (Chatham). These receivers provided beach managers and lifeguards with immediate notifications when acoustically tagged white sharks were detected close to these beaches. Acceleration data logging camera tags were deployed on white sharks to record very fine-scale movements at sub-second intervals, including tailbeat frequency, amplitude, body posture, and swimming depth. These data are being used to examine predatory patterns (e.g., traveling, resting, hunting, foraging, mating), bioenergetics, and, ultimately, provide estimates of the intensity of white shark predation on gray seals. Lastly, drone camera systems were utilized off the Outer Cape to observe nearshore white shark behavior.

As a result, 34 white sharks were tagged with acoustic transmitters off the Outer Cape in 2023; two of these also carried acceleration data logging camera tags for up to two days. When combined with collaborative tagging efforts off Canada (1), New York (1), New Jersey (1), North Carolina (3), South Carolina (36), and Florida (1), this brings the total to 357 individuals tagged since 2009. These efforts were conducted with funding and logistical support from local nonprofits, primarily the Atlantic White Shark Conservancy. Data collected in 2023 will be used to enhance our understanding of white shark predatory behavior in these areas of high shark-human overlap to better inform public safety practices.

In collaboration with Atlantic White Shark Conservancy biologist Megan Winton, the first population estimate for the white shark off Cape Cod was published in the journal Marine Ecology Progress Series. Based on an intensive mark-recapture survey conducted from 2015-2018, the study estimated that approximately 800 individuals visited the waters off Cape Cod during this period (Figure 45). Mark-recapture methods use repeated surveys of uniquely marked animals to estimate population size. In the case of white sharks, individuals can be distinguished based on unique markings and notches in their dorsal fins. From almost 3,000 videos collected during 137 research trips conducted off Cape Cod's beaches, the researchers identified 393 individual white sharks, which formed the basis for the population estimate. This study showed that white shark numbers off Cape Cod peak in the late summer and early fall, when water temperatures are warmest, and decline as sharks migrate out of the area for the winter. When compared to

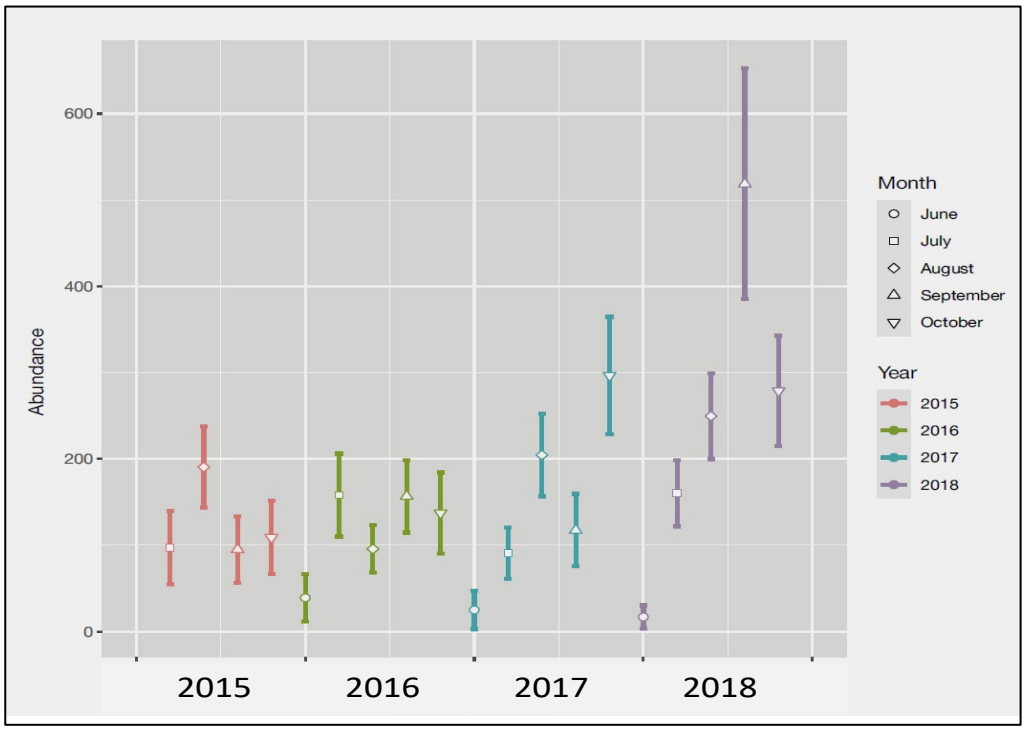

Figure 45. White shark monthly population estimates off Cape Cod, 2015-2018.

other white shark hotspots in the world, Cape Cod's population ranks among the highest. This research represents the first estimate of white shark abundance ever produced in the North Atlantic Ocean.

Shark Management: Staff participated in state, interstate, federal, and international shark management processes. During 2023, staff served on the ASMFC Coastal Sharks and Spiny Dogfish Technical Committees; ICCAT Advisory Committee, Swordfish and Shark Working Group; and NMFS Highly Migratory Species Advisory Panel.

Outreach and Media: To meet the public demand for information on sharks, especially white sharks, numerous presentations were delivered. Technical information on sharks was also provided to several media outlets.

As adjunct faculty to SMAST, the UMass Biology Department, and the Woods Hole Oceanographic Institution, staff co-advised and served on the committees of 13 graduate students who are working with DMF to study the relative abundance, life history, movements, and physiology of sharks.

Publications: Staff co-authored three articles published in scholarly journals in 2023. Topics included: a population estimate for white sharks off Cape Cod (see above); building species distribution models from multiple data sources; and linking vertical behavior of pelagic predators with the distribution of biomass in the open ocean.

Diadromous Fisheries Project

Diadromous fish migrate between fresh and marine waters to complete their life history. They are valued for the forage they provide to a wide range of wildlife and were formerly important for traditional small-scale fisheries in coastal towns. DMF is not only responsible for the management of diadromous fish populations in coastal rivers of Massachusetts, but also the restoration, improvement, and maintenance of their migratory pathways.

Biological Assessments for River Herring

The alewife is the most abundant and well-known anadromous fish in Massachusetts. Along with the closely related blueback herring, 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. As a result, DMF has increased monitoring efforts over the past decade to meet management goals of restoring populations and harvest in coastal towns.

Current monitoring coverage includes at least one station targeting river herring spawning run counts and biological data for each of the major coastal drainage areas. Project staff provide assistance to towns and watershed groups for electronic and video counting systems as well as the design and data processing for volunteer visual counts of river herring. DMF staff have designed, fabricated, and installed over 20 electronic and video counting systems in river herring runs (Table 26). In addition, DMF collects biological samples of river herring at eight rivers while maintaining three video stations and seven electronic stations with technical assistance provided to the remaining stations.

In 2023, river herring counts ranged from 0 fish (Concord River, North Billerica) to 568,877 fish (Herring Brook, Pembroke) at 45 rivers in 35 towns where counts occurred. The counting stations not listed in Table 26 were volunteer visual counts managed by local groups. River herring counts increased at most herring runs in 2023. Some locations posted time-series highs, including the Parker River in Newbury, Herring Brookin in Pembroke, Herring River in Wellfleet, and the Marstons Mills River in Barnstable. The Herring Brook in Pembroke and Herring River in Harwich had counts that exceeded a half million river herring in 2023.

Table 26. River herring monitoring stations managed or supported by DMF.

River	Biological	Counts
Merrimack River, Lawrence	Yes	Fish Lift/Video
Concord River, North Billerica	No	Video
Parker River, Newbury	Yes	Video
Essex River, Essex	No	Electronic
Mystic River, Medford	Yes	Video
Back River, Weymouth	Yes	Electronic
Herring Brook, Pembroke	No	Electronic
Town Brook, Plymouth	Yes	Video/Visual (*Volunteer*)
Town River, West Bridgewater	No	Electronic
Nemasket River, Middleboro	Yes	Visual *(Volunteer)*
Sippican River, Rochester	No	Electronic
Mattapoisett River, Mattapoisett	No	Electronic
Acushnet River, Acushnet	No	Electronic
Agawam River, Wareham	No	Electronic
Wankinco River, Wareham	No	Electronic
Monument River, Bournedale	Yes	Electronic
Cedar Lake, Falmouth	No	Electronic
Stony Brook, Brewster	No	Electronic
Herring River, Harwich	Yes	Electronic
Pilgrim Lake, Orleans	No	Video/Visual (*Volunteer*)
Herring Creek, Aquinnah	No	Video
Mill River, Taunton	No	Video

River Herring Stocking

DMF collects and transports river herring to assist efforts to re-establish and enhance river herring runs, subject to the guidance of our Stocking Protocol. In 2023, ten stocking trips transferred approximately 4,378 adult river herring as follows: 550 herring from the Monument and Santuit Rivers to Tom Matthews Pond, Yarmouth; 1,000 herring from Town Brook, Plymouth to Island Creek, Duxbury; 1,000 herring from the Monument River to Mill Pond, Barnstable; 500 herring from the Monument River to Little Sandy Pond, Yarmouth; 500 herring from the Coonamessett River to Bourne Pond, Falmouth; 640 herring from the Parker River in Byfield to Hood Pond, Topsfield; and 188 herring from the Parker River, Byfield to the Ipswich River, Ipswich. Additionally, 247 herring were transferred upstream within the Parker River, Byfield.

Technical Assistance

Project staff provided technical assistance to local authorities, private organizations, the DMF Habitat Program on environmental permit review, 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 associated with larger requests in 2023 are described below.

River Herring Habitat Assessment: DMF river herring habitat assessments are conducted for two years during May–September to assess the suitability of habitats for restoration potential and to contribute to habitat and water quality remediation efforts. Two habitat assessments commenced in 2023 at Billington Sea, Plymouth and Pilgrim Lake, Orleans. Data processing continued with the goal of preparing assessment summary reports. A DMF Technical Report was submitted on the Acushnet River assessment.

Diadromous Fish Restoration Priority List/*Mass*DOT Diadromous Fish GIS Data Layer: Ongoing efforts continued to update the GIS data layer documenting the status of diadromous fish passageways and prioritizing restoration projects. The list focuses on passageways for river herring, but also considers other diadromous fish species and watershed connectivity. It contains over 490 fishways, impediments, and potential restoration sites, ranked by restoration potential within the major coastal regions of Massachusetts. The GIS data layer was designed to support transportation infrastructure planning and environmental review activities conducted by *Mass*DOT and DMF, and also supports DMF and *Mass*DEP restoration planning. The data layer origins go back to the DMF fish passage survey of 2001/2002 that resulted in the first restoration priority list in 2005. After years of preparation, the data layer was published by *Mass*GIS in 2023.

Environmental Review: DMF staff biologists routinely provide technical assistance to the DMF Habitat Program's review of environmental permit applications in diadromous fish runs. This activity includes field site visits and can involve extensive reviews of project designs and permit applications for larger projects and depends on many years of institutional knowledge within the Diadromous Fisheries Project on aquatic resources in coastal river watersheds.

Diadromous Fish Research Studies

River Herring Monitoring, Mill River: Project staff monitored migrations of multiple diadromous species at Taunton's Lake Sabbatia dam and fishway, as part of a continuing cooperative restoration effort in the Mill River watershed. An underwater video camera at the fishway exit recorded fish passage and a collection tank at an eel ramp was checked daily from spring through summer. In the summer of 2023, an ongoing mark/recapture study was conducted in Lake Sabbatia to estimate the eel population size using eel pot sampling and PIT tags.

American Shad Monitoring

Charles River Monitoring: In 2023, project staff worked with colleagues at *Mass*Wildlife to collect adult American shad from the Charles River to characterize the population and identify fish marked with oxytetracycline in year-specific patterns. This was the final year of collection. These marks will help validate otolith ageing for American shad and provide important information for coast-wide population assessments.

Merrimack River Monitoring: American shad are monitored in cooperation with *Mass*Wildlife each spring/summer at the Essex Dam fish lift on the Merrimack River in Lawrence, per ASMFC's Fishery Management Plan requirements. The count of American shad in 2023 decreased in comparison to 2022. This monitoring also includes other diadromous fish species. Project staff led an acoustic tagging project of American shad examining the passage efficiency of the fish ladder at the hydroelectric dam in Lowell.

Taunton River Monitoring: A cooperative American shad stocking project was initiated in the Taunton River with USFWS and *Mass*Wildlife in 2022. American shad were stocked again by USFWS in 2023 with a total of 5,776,784 larval shad stocked from May to June in five locations in the Taunton River and 77,579 juvenile shad (3-4 inches in length) stocked on two occasions at the Water Street boat ramp, Taunton. Taunton River monitoring for American shad continued in 2023 as part of the shad stocking project. This work included a continuation of pre-stocking beach seine and boat electrofishing monitoring for shad in the Taunton River. The beach seine survey targeting juvenile American shad was conducted monthly at five fixed locations along the Taunton River from June through October. Juvenile American shad were not caught during the 2023 seine survey, with low fish abundance and diversity observed throughout the season. Shad were not caught during five years of pre-stocking seining; however juvenile shad were caught in the first season of post-stocking seining in 2022 during three of the five seining trips. In addition, efforts to collect genetic samples from native adult American shad began this spring with a rod and reel fishing trip and boat electrofishing surveys led by *Mass*Wildlife.

American Shad Electrofishing Survey: In the spring of 2023, project staff completed the eighth season of monitoring the presence and abundance of American shad in the South River, Marshfield and Indian Head River, Pembroke. Monitoring was conducted in each river from the head of tide to the first obstruction using stream electroshocking surveys to detect the presence of spawning adult shad. During 2023, 17 sampling trips in the South River and 18 sampling trips in the Indian Head River were conducted between April and June; 40 and 58 shad were collected, respectively, for size, age, and genetic sampling. Scale-based aging indicated that these shad ranged from 4–9 years with some fish having spawned up to four times previously. Catch-per-unit-effort indices of abundance were calculated for each river. Monitoring is expected to continue in 2024 with the interest to develop biological and catch-per-unit-effort indices of population abundance.

American Eel Young-of-Year Monitoring

All U.S. east coast states conduct standardized monitoring of YOY American eels under mandatory ASMFC protocols. DMF has monitored the spring migration of YOY eels in the Jones River (Kingston) using a Sheldon trap since 2001 and in the Essex River (Essex) with a fyke net since 2014 to contribute to a coast-wide index of eel population relative abundance. The Jones River trap catch in 2023 improved to 340 eels per haul, with a total catch of 15,288. Catches peaked in mid-April with 14,017 eels caught over three consecutive hauls. The Essex River fyke net catch continued with the high rates seen since 2019 with 1,685 eels per haul and a total of 70,784 eels in 2023, which is by far the most we have ever captured at this site.

Project staff have fabricated and installed 12 eel ramps in coastal rivers since 2007 to provide eel passage over barriers. Most ramps are managed cooperatively with local groups and include a collection tank to evaluate the performance of the eel ramp and to monitor counts of YOY or older eels. Collectively, between the deployment of eel ramps and an increase in coastal river dam removals, juvenile eel passage has improved in some watersheds in the last 15 years. The Jones River YOY dataset was accepted as an index of abundance for the ASMFC eel stock assessment in 2012 and had been the only eel population index in Massachusetts until 2022. Data for the Saugus River eel ramp, the first eel ramp in coastal MA, were accepted by ASMFC as an age-1+ index of abundance for the 2022 eel stock assessment.

Rainbow Smelt Population and Habitat Monitoring

Rainbow smelt population declines since the 1980s prompted DMF to initiate spawning run monitoring using in-stream fyke nets in 2004. This monitoring continues as an annual data series to provide a relative index of abundance and size and age data. The project presently maintains four stations at the Parker River in Newbury, the Fore River in Braintree, the Jones River in Kingston, and the Weweantic River in Wareham. The smelt catches in the Fore River continued to be the highest among stations in 2023 with 1,623 smelt but were lower than the series average (2,026 smelt). The Jones River had catches increase slightly from 2022 (126 smelt) to 2023 (148 smelt) but remained below the time series average. Very low smelt catches in the Weweantic River and the Parker River continued after relatively high catches at the start of the time series. Collectively, the fyke nets have caught over 40 species of fish in total, including 10 diadromous species, with potential indices of abundance for eel, white perch, Atlantic tomcod, and lamprey. The American eel bycatch data from the Fore River fyke net were accepted by ASMFC as a yellow eel index of abundance for the 2022 eel stock assessment.

Fish Passage and Habitat Restoration Projects

Numerous projects to improve and maintain diadromous fish passage, habitats, and populations are underway each year. In 2023, project staff devoted time to over 20 individual projects in various stages of development and implementation. It was a busy year for project development for several larger projects with technical

assistance provided to 15 contracted, cooperative fish passage improvements. Additionally, six DMF Fishway Crew jobs were completed in 2023: three small, one-day projects and three larger fishway repairs/installations.

Elm Street Dam Fishway, Indian Head River, Pembroke/Hanover: A four-year effort to rehabilitate the fishway at the Elm Street Dam (also known as Luddam's Ford Park dam) was completed by the DMF Fishway Crew in 2023. This large concrete fishway was built by DMF in the 1970s. It was found to be impassible in 2020, with four Denil baffles missing, shrub growth in the fishway, and large amounts of logs and debris blocking passage. Passage was restored in 2020 and a custom trash rack was installed at the exit. Site work was completed in 2023 with the replacement of 13 wood baffles and water control boards (Figure 46). Materials costs of roughly $3,500 for this multi-year project were funded by DMF.

Figure 46. DMF Fishway Crew replacing Denil baffles at Elm Street Dam on the Indian Head River, Pembroke/Hanover.

Great Herring Pond, Bourne: The outlet fishway at Great Herring Pond was serviced in 2023 to tune the water control boards and to add a locking bracket. Twice during the spring of 2023, boards were added to the outlet resulting in dewatered downstream channels during the peak of the river herring spawning run. After consultation with the property owner and Town of Bourne, the DMF Fishway Crew custom fabricated the locking bracket and installed it at the outlet to prevent further unauthorized tampering.

Furnace Brook, Kingston: Soules Pond provides river herring spawning habitat in the Furnace Brook tributary to the Jones River in Kingston. The Soules Pond Dam fishway water control boards and boards for the auxiliary spillway were severely degraded and in jeopardy of failing. The DMF Fishway Crew removed the old boards and installed new lumber in 2023 and tuned and repaired the fishway control boards at the upstream Slyvia Place Pond Dam while removing a root ball that obstructed fish passage at the fishway entrance.

Gorham Mill Pond Dam Fishway, Pembroke: The DMF Fishway Crew teamed up with the Pembroke Herring Fisheries Commission to install an Alaskan Steepass fishway at the Gorham Mill Pond Dam. The custom wood Denil fishway was in poor shape at the start of the spring spawning run in 2023, but the Fishway Crew patched together the rotted wood to get through the season. To everyone's amazement, the fishway had a spectacular run of over a half million herring passing through the old fishway. Like the Stump Brook fishway, the project used recycled sections of steeppass from the Elm Street Dam removal in Kingston. Over a week of shop time was needed to customize the steeppass, followed by a one-day installation that occurred with only minor material costs.

Stump Brook Reservoir Bog Dam, East Bridgewater: The long-considered concept of providing fish passage to Monponsett Pond via Stump Brook was realized in 2023 with the installation of a new fishway at the Stump Brook Bog Reservoir Dam (Figure 47). The DMF Fishway Crew conducted a site survey and water level investigations during 2019–2021 to support the design of a fishway at this impassible dam. A grant from the Taunton River Stewardship Council funded DMF to hire GZA to finalize the design and permitting. The time needed for project design, preparation, and shop fabrication greatly exceeded the field installation, which was done in one day working with the dam owner. Alaskan steeppass sections recycled from the Elm Street Dam removal in Kingston were used along with a custom welded, aluminum chute and attachment brackets. Design and permitting costs were approximately $25,000 and DMF funded material costs of $7,000, mostly for stock aluminum.

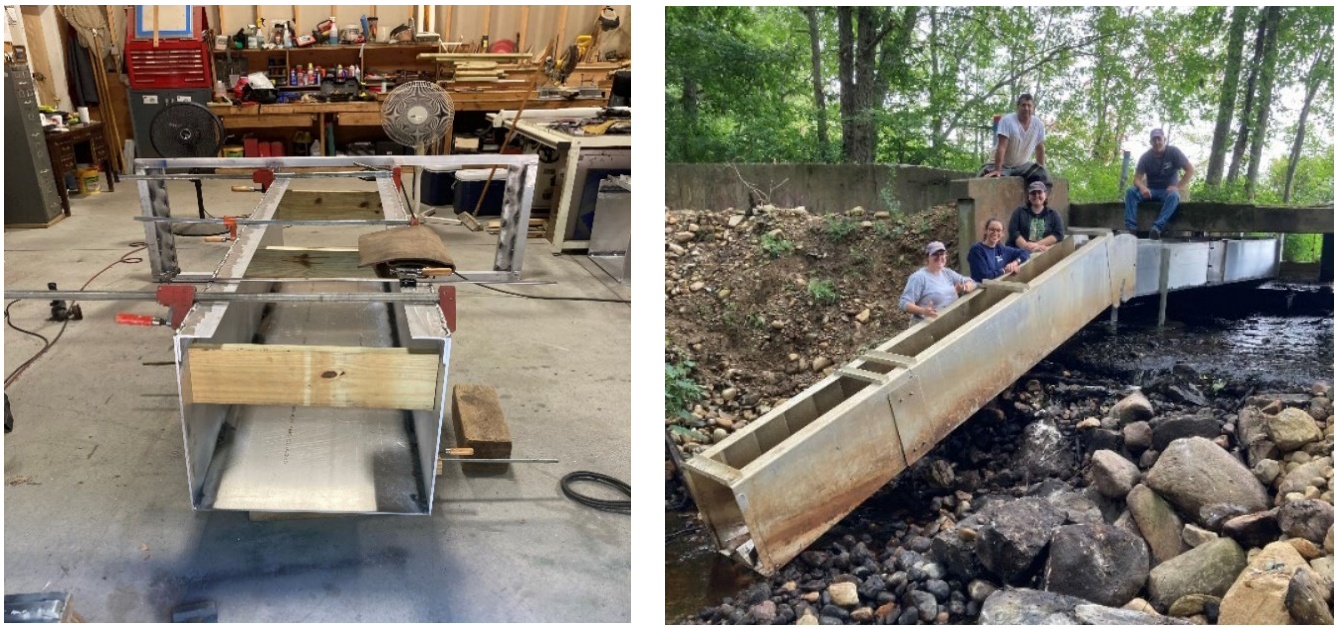

Figure 47. The new fishway is fabricated at the Fishway Crew shop in New Bedford (left) and installed (right) at the Stump Brook Bog Reservoir Dam, East Bridgewater.

Howlett Brook, Topsfield: A new fishway was installed at the Howlett Brook Dam within the Ipswich River watershed in 2023 (Figure 48). This project was led by the Ipswich River Watershed Association (IRWA) with substantial design and development assistance from DMF. The project is part of an IRWA initiative to improve fish passage at several sites in the watershed. IRWA contracted SumCo for the project in 2023 and they completed a concrete weir and pool fishway that has the historic and pleasant appearance of a nature-like bypass with a stone masonry exterior.

Forge Pond Dam, Westport River, Westport: The migration of diadromous fish to the 165-acre Lake Nochoquoke in Westport has been blocked by two dams for decades. DMF conducted diadromous fish monitoring and a river herring habitat assessment in Lake Nochoquoke to confirm species status and habitat conditions. DMF contracted the USFWS Fish Passage Engineering Team in 2021 to prepare a scoping design for a fishway at Forge Pond Dam. DMF next funded a fish passage improvement study in 2022 that was completed by GZA, which was contracted again in 2023 to advance the feasibility and preliminary design of a fishway at Forge Pond Dam. This study was ongoing in 2023 as was communications with the upstream dam owner at Lake Nochoquoke on an agreement to install a fishway.

Figure 48. The new fishway at Howlett Brook in Topsfield.

Fore River Watershed, Braintree: The summer of 2023 brought a milestone to the multi-decade effort to restore diadromous fish to the Fore River Watershed. The Armstrong and Ames Pond dams were removed on the Monatiquot River. The Town of Braintree, with assistance from the MA Division of Ecological Restoration

(*Mass*DER) and federal funding partners, hired SLR for engineering services and the construction company Maverick to remove the two dams, build a fishway at the Rock Falls, and restore the river channel in the former Hollingsworth Pond. The project formally began with a DMF-funded feasibility study in 2009 but has roots back over 30 years that included DMF field investigations and communications with property owners. By the end of 2023, all major project components were completed except for the Rock Falls fishway. With that fishway completion, river herring will have a chance to access Great Pond Reservoir for the first time in over 200 years.

Town River, Bridgewater: A second dam removal of regional significance occurred in 2023, as the High Street Dam on the Town River came out. The Town of Bridgewater led the project with much assistance from *Mass*DER and federal funding partners. SLR was hired for engineering services and Manafort was the construction firm. The vintage dam comprised of wood, earth, stone and concrete came out in a matter of days. This eliminated the need for the 1919 fishway that bypassed the dam. The project included substantial river channel reconstruction and improved public access. DMF staff contributed with weekly construction site visits, technical review of project design, and original discussions and written agreements with the property owner on improving fish passage. Additionally, ongoing design work continued in 2023 for a new nature-like fishway at War Memorial Park, the next stop upstream for river herring in the Town River.

Stillwater Pond Fishway Repair, Chatham: The Lover's Lake/Stillwater Pond herring run in Chatham is one of only two river herring runs in Massachusetts that enter Pleasant Bay via the Atlantic Ocean on the east side of Cape Cod. DMF reconstructed two concrete fishways at the pond outlets in 2011 working with the Town of Chatham. In 2023, the DMF Fishway Crew joined up with Chatham again to repair fishway weirs and the stream channel downstream of Stillwater Pond. Stream flow had eroded channel banks and around four concrete fishway weirs, reducing their capability to maintain water depth for fish passage. Two concrete weirs were reformed with concrete and two others were stabilized with fiber rolls (Figure 49). Additional fiber rolls were deployed to stabilize the channel banks along with wetland shrub plantings to improve the buffer zone and reduce lawn encroachment on the channel. The DMF Fishway Crew did not use the project excavator to avoid damaging the homeowner's lawn. The Crew had their share of hand digging as the project was completed in five days. Project costs were approximately $3,000 and funded by the Town of Chatham.

Figure 49. Repair to concrete fishway weir at Stillwater Pond, Chatham (left), fiber roll installation (middle), and final site appearance.

Large Fish Passage Collaborations: There was much activity in 2023, in part due to large federal funding sources, on large fish passage collaborations, several of these involving significant dam removals in coastal rivers. DMF staff held a range of roles in these projects from minor technical assistance related to fish passage requirements to active participation as project partners. For the Cape Cod region, the NRCS Cape Cod Watershed Restoration Plan had several projects under design in 2023. Large dam removal projects were ongoing at the Talbot Mills Dam, Concord River, North Billerica and Larkin Mill Dam, Parker River, Byfield. Large fishway projects were at advanced stages of design at Horn Pond in Woburn, Sesuit Creek in Dennis, Elm Street Dam in Kingston, and the South River in Marshfield.

Diadromous Fish Coast-Wide Survey

DMF began a survey of diadromous fish passage in Massachusetts coastal rivers in 2021 with survey efforts ongoing in 2023. The survey is an update of sea-run fish surveys first conducted by DMF's precursor, the Division of Fisheries and Game, and reported in Dr. David L. Belding's seminal report "Alewife Fisheries of Massachusetts" in 1921. The survey was next conducted in 1967 by DMF and repeated in 2001–2002. These surveys focused on fishways and dams in river herring runs. The surveys have been invaluable for documenting the status of sea-run fish in coastal rivers and making recommendations on improvements. The present survey update will broaden the focus to include additional types of fishways and more information on migratory habitats and other species. Further, the survey will be directly integrated into DMF's Diadromous Fish Restoration Priority List and the Diadromous Fish GIS data layer that was developed by DMF and *Mass*DOT and published in 2023 by *Mass*GIS. The integrated survey, priority list, and GIS Data Layer should become valuable tools for aquatic restoration, resiliency, and transportation planning at local, state, and federal levels.

River Herring Stream Channel Maintenance

Project staff routinely encounter stream channel blockages during field investigations and receive requests from towns to assist maintaining passageways for river herring. The work can involve developing cooperative 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. Our Stream Maintenance Protocol for Diadromous Fish Passage provides coastwide guidance for these practices. A large cooperative effort was made with *Mass*DEP to develop a policy to connect the Wetland Protection Act to stream maintenance for diadromous fish runs; this policy was issued in 2022. New plans were prepared for Ryders Cove in Chatham, Palmer River in Rehoboth, and Acushnet River in Acushnet in 2023. Project staff worked in 10 rivers with local partners in 2023, with substantial efforts and improvements made in the Fore River in Braintree, the Acushnet River in Acushnet, the Jones River in Kingston, and the Sesuit Creek in Dennis.

Fishway Operation and Maintenance Plans, Permits and Memorandum of Understanding

The DMF Director issues Fishway Operation and Maintenance (O&M) Plans for all new and reconstructed fishways per the authority granted under Chapter 130, Section 19 of Massachusetts General Laws. The following O&M plans were issued in 2023: Old Oaken Bucket Dam fishway, First Herring Brook, Scituate (working draft); Foundry Pond Dam, Weir River, Hingham (update); and Elm Street Dam, Indian Head River, Pembroke/Hanover (Final). DMF issues Fishway Construction Permits following the review of engineering plans to construct, rebuild, or alter fishways. During 2023, Fishway Construction Permits were issued for the Rock Falls fishway, Monatiquot River, Braintree; High Street Dam, Town River, Bridgewater; Howlett Brook Dam, Ipswich; Stillwater Pond, Chatham; and Stump Brook Bog Reservoir Dam, East Bridgewater. A single Fishway Memorandum of Understanding was drafted in 2023 for Lake Nochoquoke on the Westport River, which was under review by the dam owner and the City of Fall River at year's end.

Other Activities

Technical Committee Participation: Staff actively participated on management and technical committees related to diadromous fish including the ASMFC technical committees for river herring, American shad, American eel, sturgeon, and fish passage. Annual ASMFC compliance reports were prepared for American eel, river herring, American shad, and Atlantic sturgeon. Staff also served on the NMFS River Herring Technical Expert Working Group, technical committees for the Connecticut River Atlantic Salmon Commission, Anadromous Fishery Management of the Merrimack River Basin, and ASFMC River Herring and Shad Stock Assessment Sub-Committee.

Presentations & Publications: Project staff are routinely requested to provide presentations related to education, outreach, and constituency groups. Approximately 20 formal presentations were given by project staff in 2023, with participation in several other education/outreach events.

ADMINISTRATION

Kevin Creighton, Chief Fiscal Operator, Section Leader

Personnel

Finance
Darlene Pari, Accounts Payable Coordinator
Kim Trotto, Accountant III
Jeanne Hayes, Accounts Receivable Coordinator
Shannon Davis, Program Coordinator
Whitney Sargent, Procurement Coordinator

Administrative Support
Lynne Besse, Administrative Support
Vicki Oliveira, Administrative Support

Grants Management
Stephanie Cunningham, Fiscal Administration and Operations Manager
Cecil French, Project Leader – Clean Vessel Act and Boating Infrastructure Grant
Maren Budrow, Assistant Federal Aid and Grants Coordinator
Melanie Griffin, Project Leader – Revolving Loan Fund and State Fishery Management & Technical Assistance
Amanda Meli, Program Coordinator – Grants Specialist

Seafood Marketing
Wendy Mainardi, Marketing Coordinator
Audrey MacLellan, Summer Intern

Scientific Diving
Vincent Malkoski, Diving Safety Officer

Capital Assets and Facilities Management
Brian Castonguay, Gloucester Office, Head of Facilities and Capital Assets
Lucas Cunningham, Gloucester Office, Facilities Support
Vincent Malkoski, New Bedford Office, Facilities and Capital Assets
Conor Byrne, Shellfish Purification Plant, Facilities and Capital Assets

Overview

DMF Administration is responsible for the Division's fiscal functions, grants management, capital assets, scientific diver management, and seafood marketing. Staff develops, analyzes, and manages the Division's financial planning and resource allocation activities, including budget submission to the Legislature. The program is responsible for collecting fees and reconciling revenue. Staff also provide all fiscal oversight and reporting on grants, contracts, and mitigation projects. Facilities and capital assets are procured, inventoried, managed, and maintained with the intent to provide a healthy and productive working environment. Seafood Marketing efforts support and promote Massachusetts seafood and the commercial industry.

Budget

Overall, state-appropriated funds saw an increase of 4.45% from Fiscal Year (FY) 2022 to FY2023 (Table 27). The increase to these appropriations can be attributed to a few small projects that were approved for funding in the budget including: $100,000 to expand the shark monitoring program, $50,000 to continue a study on a plume of water with low dissolved oxygen that formed in lower Cape Cod Bay, and $150,000 to enhance the aerial surveillance and abandoned gear removal programs designed to further protect right whales in Massachusetts.

The Legislature has created three retained revenue accounts for DMF, whereby funds from a particular funding source may be retained by the Agency to expend for a particular purpose. The Sportfish Restoration account allows for the deposit of federal Wallop-Breaux reimbursements (a sportfish restoration program), which may then be spent on other Wallop-Breaux reimbursable projects. The Shellfish Purification Plant account allows for the deposit of funds collected from shellfish depuration and de-sanding at the Division's Newburyport facility, which may then be spent on the maintenance and operation of the plant. The Ventless Trap account allows for the deposit of funds generated from the sale of lobster permits, which are then used to fund research on commercially important invertebrate species in the Commonwealth. Funding from retained revenue accounts decreased by 2.27% in FY23, resulting from the continued decline of shellfish depuration at the Shellfish Purification Plant.

Appropriations from special fund accounts increased by just over 0.5%. The Legislature slightly increased the appropriation on the Saltwater Sport Fish Licensing account to adjust for increased personnel and research costs. This account is funded by recreational saltwater fishing permit sales and supports recreational fishery improvements. The Seafood Marketing Program, funded by revenue collected from the issuance of commercial fisherman and seafood dealer permits, remained level-funded.

Table 28 provides the breakdown of costs by primary spending category for the DMF operating accounts.

Table 27. Fiscal Year 2022 and 2023 appropriations (available funds for operations).

Title	Acct. Number	FY2022	FY2023	Change
General Fund Accounts				
General Operating	2330-0100	[1]$7,370,488	[4]$7,835,313	+16.98%
Sportfish Program	2330-0120	[2]$884,326	$901,879	+1.98%
General Fund Total		$8,254,814	$8,737,192	+5.84%
Retained Revenue Accounts				
Sportfish Retained Revenue	2330-0121	$217,989	$217,989	0.00%
Purification Retained Revenue	2330-0150	$22,654	$11,509	-49.20%
Ventless Trap Retained Revenue	2330-0199	$250,000	$250,000	0.00%
Retained Revenue Total		$490,552	$479,407	-2.27%
Special Fund Accounts				
Saltwater Sport Fish Licensing	2330-0300	[3]$1,843,006	$1,854,417	+0.62%
Seafood Marketing	2330-0104	$250,000	$250,000	0.00%
Special Fund Total		$2,093,006	$2,104,417	+0.55%
Appropriations Grand Total		**$10,838,372**	**$11,321,016**	**+4.45%**

[1] The final budget FY2022 in Chapter 24 of the Acts of 2021 for appropriation 2330-0100 was $7,913,891. DMF's general operating budget was affected by: 1) earmarks totaling $1,172,000 ($550,000 to SMAST; $100,000 for the Great Marsh Green Crab Trapping and Coastal Marsh Restoration Program; $150,000 for shellfish propagation in Barnstable, Dukes, and Nantucket counties; $75,000 to the Provincetown Center for Coastal Studies for study of great white shark presence in nearshore areas of Cape Cod; $100,000 for the Massachusetts Seafood Collaborative for a grant program; and $197,000 for eDNA research with the Gloucester Marine Genomics Institute); 2) $428,365 made available from a reserve draw account to cover employee COVID payments; 3) $200,938 from a Prior Appropriation Continued (PAC from 2021 funds); 4) $706 that was moved by ANF for the purpose of debt reduction. *[Continued]*

[2] The final budget FY2022 in Chapter 24 of the Acts of 2021 for appropriation 2330-0120 budget was affected by $35,136 that was moved by ANF for the purpose of debt reduction.

[3] The final budget FY2022 in Chapter 24 of the Acts of 2021 for appropriation 2330-0300 was affected by $47,957 made available from a reserve draw account to cover employee COVID payments.

[4] The final budget FY2023 in Chapter 126 of the Acts of 2022 for appropriation 2330-0100 was $9,523,813. DMF's general operating budget was affected by: 1) earmarks totaling $1,688,500 ($500,000 to SMAST; $175,000 for the Great Marsh Green Crab Trapping and Coastal Marsh Restoration Program; $150,000 for shellfish propagation in Barnstable, Dukes, and Nantucket counties; $80,000 to the Provincetown Center for Coastal Studies for study of great white shark presence in nearshore areas of Cape Cod; $195,000 for the Gloucester Marine Genomics Institute for the study of harmful algal blooms; $75,000 For the Cape Cod Commercial Fishermen's Alliance to study winter flounder in partnership with DMF; $30,000 for sediment removal in the upper Nemasket River; $500,000 for a program to assist commercial lobster fishery participants with the costs of equipment associated with the protection of right whales.

Table 28. FY2023 expenditures (including earmarks) by account type and primary spending category.

	General Fund	Retained Revenue	Special Fund	Total
Salaries	$7,005,964	$130,002	$694,373	$7,664,800
Employee Expenses	$25,840	$2,632	$2,730	$59,059
Contracted Employees	$43,688	$20,479	$226,890	$375,344
Contracts	$241,422	$229,120	$97,487	$508,127
Facility Maintenance	$61,350	$26,139	$37,572	$178,099
Field & Lab Supplies	$296,510	$26,513	$64,927	$498,258
Fringe Costs	$163,651	$2,937	$17,337	$181,163
Fuel	$58,887	$6,667	$700	$60,154
Utilities	$87,464	$0	$0	$87,464
Lease/Rent	$216,762	$0	$0	$216,762
Maintenance/Repair	$121,660	$4,978	$0	$139,096
Office & Administrative	$312,397	$31,399	$59,820	$351,588
Outside Agencies	$73,027	$3,598	$72	$75,170
Grants	$1,656,784	$0	$81,814	$1,755,185
TOTAL	**$10,365,407**	**$484,464**	**$1,283,721**	**$12,150,267**

Staffing

Staffing levels were static over the past year when comparing all account types (Table 29).

Table 29. Calendar Year 2022 and 2023 Authorized Personnel Levels.

Title	Acct. Number	CY2022	CY2023
DMF General Operating	2330-0100	72	75
Sport Fish Program	2330-0120	9	9
Saltwater Sport Fish Licensing	2330-0300	6	7
Federal Grants and Trust Account	2330-xxxx*	18	14
Total Employees in All Appropriations		**105**	**105**

*Multiple account numbers

Revenue

General Fund Revenue

DMF collects fees primarily from permit issuance and processing racks of soft-shell clams at the Shellfish Purification Plant. A total of 34,775 permits and endorsements were issued by the Permitting Project for the categories of commercial fishing, seafood dealers, and special permit types, producing General Fund revenue of $2,232,975 in 2023 (Table 30). Overall, there was an increase in permit revenue collected by approximately 5% as compared to 2022.

The Shellfish Purification Plant processed 1,434 racks of softshell clams in 2023, resulting in General Fund revenues of $8,605. This represents a 37% decrease in revenue from 2022 and is the lowest amount ever recorded. There has been a declining trend in racks processed and resulting revenues since 2009; as of 2023, Plant revenue is down by more than 90% as compared to 2009. Coastal erosion greatly impacted the Shellfish Plant in 2023, and the loss of both saltwater wells required the shutdown of the plant by November.

Table 30. Calendar Year 2022 and 2023 General Fund Permitting Revenue.

Permit Categories	CY2022	CY2023	Change
Commercial Fishing	$1,228,205	$1,254,325	+2.1%
Seafood Dealer	$186,420	$179,530	-3.7%
Special	$708,465	$799,120	+1.3%
Total General Fund Permit Revenue	**$2,123,090**	**$2,232,975**	**+5.2%**

Dedicated Fund Revenue

In addition to General Fund revenue, DMF generated $1,805,298 in revenue for the Marine Recreational Fisheries Development Fund in 2023 (Table 31). Revenue is primarily from the issuance of recreational saltwater fishing permits, but also includes direct donations to the fund and miscellaneous funds for programs such as the Marine Recreational Information Program (MRIP). By law, all fees collected from the sale of recreational saltwater fishing permits, including permits issued to the for-hire fleet, are dedicated to the improvement of recreational saltwater fishing in Massachusetts. In 2023, the count of recreational permits issued was almost the same as in 2022; however, as issuance went up in the free permit category of age 60+, a drop was realized in the paid permit category. This resulted in a decrease in permit revenue of almost 4%. The largest increase to the fund was due to a new MRIP contract with the federal government through the ASMFC.

Table 31. CY2022 and CY2023 Marine Recreational Fisheries Development Fund Revenue.

Revenue Category	CY2022	CY2023	Change
Recreational Saltwater	$1,273,170	$1,222,485	-3.98%
For-Hire (charter & head boat)	$60,905	$65,065	+6.83%
Recreational Fund Donations	$17,313	$16,723	-3.41%
Other Sources (MRIP, Misc.)	$432,752	$501,025	+15.78%
Total Rec. Fisheries Fund Revenue	**$1,784,140**	**$1,805,298**	**+1.19%**

Grants

In FY2023, DMF spent approximately $7 million on federal grants and mitigation projects operating out of the DMF Trust Account. This was an increase of just over 88% as compared to FY2022 (Table 32). The increase was primarily the result of a one-time food safety grant with payments totaling just over $1 million, and a one-time

sea herring relief program in the Marine Fisheries Trust with total payments of just over $3 million.

Table 32. Fiscal Year 2022 and 2023 Expenditures.

Title of Federal Grant or Trust	Account No.	FY2022	FY2023
Clean Vessel Act	2330-9222	$909,000	$901,958
Fisheries Statistics	2330-9712	$129,000	$211,643
Interstate Fisheries	2330-9730	$143,000	$219,220
ACCSP	2330-9732	$87,000	$15,282
Turtle Disentanglement/Protected Species	2330-9739	$959,000	$735,321
Fish Age & Growth	2330-9742	$240,000	$244,146
Sport Fish Coordination	2330-9743	$51,000	$72,083
Sea Grant Lobster	2330-9745	$145,000	$69,059
Seafood Safety Program	2330-9746	$0	$1,104,721
Marine Fisheries Research Trust	2330-0101	$599,000	$3,404,820
Total		**$3,708,000**	**$6,978,000**

Massachusetts Lobster Gear Relief Program for Dual Permit Holders

The Massachusetts Lobster Gear Relief Program for Dual Permit Holders was created to help defray the cost of requiring two sets of fishing gear to protect endangered North Atlantic right whales. The Massachusetts Legislature allocated $500,000 for eligible Massachusetts commercial lobster permit holders pursuant to c. 126 of the Acts of 2022. Due to fisheries management requirements, commercial trap fishers are subject to different buoy line marking requirements based on the jurisdiction where the gear is being fished. This creates a unique problem for trap fishers who have a single fishing business authorized to fish trap gear in both state and federal waters (dual permit holders). Effectively, these permit holders are now required to alter their buoy lines when moving trap gear from state to federal waters or vice versa. This may be accommodated by either adding or removing marks and weak points from the buoy line when moving the gear from one jurisdiction to another, or more likely, carrying separate buoy lines marked and configured for each jurisdiction and then removing and replacing buoy lines when gear is moved across jurisdictional boundaries.

The Massachusetts Division of Marine Fisheries worked with the Lobster Foundation of Massachusetts in cooperation with the Massachusetts Lobstermen's Association to efficiently distribute these funds to eligible fishers. To be eligible for this program, lobster fishers must have had both state and federal lobster trap permits in 2022 and renewed both state and federal lobster trap permits for 2023, in addition to a history of ordering MA/EEZ tags. Catch report data from 2021 were used to show proof of dual fishing and the number of traps fished. There were 162 eligible lobster fishers in this program; 155 qualified for the maximum tier of funding and seven qualified for the minimum tier of funding. Maximum and minimum tiers were based on the number of traps historically dual fished, and the amounts per tier were determined by the available funds dispersed across the eligible applicants.

Atlantic Herring Disaster Relief Program

In 2021, the federal government provided $150 million in fisheries disaster assistance through the 2019 Additional Supplemental Appropriation for Disaster Relief Act (P.L. 116-20). In 2022, NOAA allocated $11,247,893 of these funds to respond to the impacts of the 2019 Atlantic herring fishery disaster in the northeast, of which Massachusetts was allocated $3,180,030. After a public process, the Massachusetts Spend Plan was approved on February 28, 2023.

The Massachusetts program distributed funds through direct payments to eligible participants in two sectors as

financial relief to compensate for losses due to stock declines and quota reductions: commercial fishing vessels were allotted 60% of available funds and Wholesale Dealers (primary buyers) received 40%. Some administrative funds were retained by DMF to execute the program (0.5% of the funds available to Massachusetts).

Payment for each sector under the Massachusetts Atlantic Herring Disaster Relief Program was proportioned based on how many pounds of herring a fisher sold or dealer purchased aggregated from the harvest years of 2014–2018, inclusive. The Division's Fisheries Statistics Program used dealer reports, Vessel Trip Reports (VTRs), and other relevant information to assign an estimated poundage sold/purchased to each permit holder.

DMF sent notice to all permit holders informing them of the relief program and its eligibility requirements, and developed a website containing detailed programmatic information including who to contact with questions. The Division direct-mailed applications to all permit holders with details on their eligibility and poundage recorded through mandatory reporting on April 14, 2023. Eligibility in the program included a minimum $1,000 payment threshold. DMF also established an appeals process for any permit holder that did not agree with the information we had on file to ensure program integrity. In total, 14 payments were distributed to commercial fishers, and 5 payments to wholesale dealers. Individual payments ranged from $1,300 to $830,000 based on the sector and assigned herring landings of each applicant. All payments were issued by July 13, 2023.

State Fishery Management & Technical Assistance

Staff provide technical assistance and support to the New England Fishery Management Council in the development, implementation, and monitoring of FMPs and Amendments. These cooperative activities enhance the management of fisheries occurring in the Territorial Sea and Exclusive Economic Zone. Since 2018, the Council has provided the Commonwealth with $80,000 biennially, split evenly between the two years. Beginning in 2022, the Council increased the biennial allocation to $90,000. The $45,000 allocated to state fiscal year 2023 (July 2022–June 2023) supported the Commonwealth's participation in Council meetings and other Committee meetings as well as in working groups, technical groups, and plan development teams. Some of this work is summarized in this annual report's Fisheries Policy and Management section. DMF also submitted to the Council a summary report of the State's technical assistance activities during the year.

The Revolving Loan Fund

The Massachusetts Commercial Fisheries Revolving Loan Fund (RLF) Program, operating under a Memorandum of Agreement between NOAA Fisheries and DMF, seeks to promote the effective implementation of catch share management in New England while minimizing the potential adverse socio-economic impacts to fishing communities and small-scale fishing businesses sometimes attributed to them. Under the program, DMF contracted with two financial institutions, Tremont Credit Union and Community Development Partnership (CDP), to provide approved loan services to eligible applicants throughout the Commonwealth, and with a third organization, the Gloucester-based Northeast Fishery Sector (NEFS) II, to administer funds for groundfish quota leasing.

Over the years, DMF implemented a variety of amendments to the Memorandum of Agreement in order to address fishermen concerns and receive a larger pool of applicants to better serve smaller groundfishermen adversely affected by the catch share management plan. However, despite continued modifications to the RLF and Revolving ACE Leasing Fund (RALF) programs, a significant underutilization of loan funds and lack of new participation persisted. This continued lack of loan utilization demonstrated that the RLF and RALF programs did not have their intended impacts, especially at the envisioned scale of small vessel owners in the groundfish fishery. Therefore, at the end of CY2019, DMF recalled funds from its three RLF partners and, in CY2020, began to receive unused funds from its RLF lending partners.

Calendar year 2022 saw DMF pivot from closing out the program and garnering funds to collaborative work to revitalize use of funds. DMF formed an industry advisory panel that included representatives from the Massachusetts Fishing Partnership, Fishing Partnership Support Services, Northeast Seafood Coalition, Cape Cod Commercial Fishermen's Alliance, various groundfish sectors (managers and fishermen), as well as NOAA Fisheries. The Groundfish RLF Advisory Group met in July of 2022 to first review previous program objectives and performance and then advise DMF on a final repurposing proposal to be submitted to NOAA. The group met again on several occasions over the course of 2023 and agreed on an industry proposal to allocate the remaining funds directly to active sector members that meet the criteria of the original RLF plan. The final plan is scheduled to be approved in early 2024 and DMF will distribute funds based on participant eligibility.

The Clean Vessel Act Program

DMF administers the Clean Vessel Act Program (*Mass*CVA) to ensure that adequate, convenient pumpout facilities are provided to meet the needs of recreational boaters in Massachusetts coastal waters. This is achieved by monitoring the need for new or replacement coastal pumpout equipment and providing operation and maintenance funds to pumpout facilities offering free pumpout service to recreational boaters. Responsibilities include the identification of appropriate sites for needed pumpout equipment, providing technical assistance and information to boaters and others in need of *Mass*CVA information, and agency coordination with public and private parties.

In 2023, the 29th year of our participation, *Mass*CVA continued to support Massachusetts' status as a No Discharge Zone (NDZ). With the Massachusetts coastline's hundreds of bays, coves, and inlets, it is challenging to provide adequate shore-side pumpout support, especially with our short, intense New England boating season. Consequently, we have been a leader in the implementation of pumpout vessel use. Our matrix of pumpout vessels and shore-side pumpouts, along with dump stations, has created much wider boater access along the coast than twice the number of conventional shore-side facilities could have provided, and has been instrumental in Massachusetts' establishment of a statewide NDZ. To date, the *Mass*CVA Program has kept over 10 million gallons of effluent from state coastal waters.

Our capital reinvestment program has enabled *Mass*CVA to expand with minimal cost to new pumpout operators that lack the capital for investment in new infrastructure. Through this program, when an operator replaces an existing *Mass*CVA pumpout boat or fixed-location station, the replaced equipment can be provided to another new or existing operator who can pay to have it refurbished at a fraction of the cost of new equipment.

Table 33. New and Replacement *Mass*CVA Infrastructure, 2023.

Recipient	Equipment
Barnstable	Replacement pumpout boat engine
Bourne	Replacement pumpout tight tank
Constitution Marina	Replacement pumpout boat engine
Danvers	Replacement pumpout boat pump
Hingham	Replacement pumpout boat engine
Newburyport	Replacement pumpout boat station

In 2023, our CVA-funded pumpout facilities included 46 private marinas, one non-profit organization, and 49 cities and towns. *Mass*CVA staff stayed in close contact with all our pumpout operators, assessing programmatic needs. We addressed existing equipment concerns and facility growth requests as allowed by available federal funds (Table 33). Total reimbursement for all new and replacement equipment was $74,425. An additional $664,334 was spent on facility operation and maintenance costs in support of 65 pumpout boats, 83 fixed-location pumpout stations, and 13 mobile pumpout carts available to the recreational boating public along the Massachusetts coastline. Recreational boater outreach remained a critical component of *Mass*CVA. Over 8,000 pumpout location guides were distributed to the public at marinas and other boating or fishing-related outreach events.

Boating Infrastructure Grant Program

The Massachusetts Boating Infrastructure Grant Program (*Mass*BIG) is a two-tiered federal grant program, directed through the USFWS and administered by DMF. *Mass*BIG is funded by the Sport Fish Restoration Fund which in turn is funded by a small percentage of the Federal Gasoline Tax (an amount representing fuel purchased by boaters across the nation). *Mass*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.

Under Tier I, *Mass*BIG may receive funding for eligible projects up to $200,000 annually. Proposed projects filed under Tier II can be much larger in scope, but 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.

During 2023, one Tier II BIG grant was awarded to the town of Manchester by the Sea to extend the existing *Mass*BIG-funded dock to accommodate additional transient boaters. The $600,000, three-year grant proposal project includes the construction of an additional 500 feet of transient boater dock, including electrical service and water service (to both old and new tie ups), and an additional fixed pump-out station at the facility. This project helps address the ongoing significant lack of transient docking opportunities available in Manchester Harbor, and the greater Cape Ann region.

Seafood Marketing

DMF's Seafood Marketing Program seeks to increase consumer awareness and preference for local seafood products. The program supports the state's commercial fishing and seafood industries and communities. Its programming is supported in large part by revenue collected from the issuance of commercial fisherman and seafood dealer permits.

Marketing and Outreach

Seafood Expo North America: 2023 began with our organization and promotion of "Mass Ave" at the Seafood Expo North America held in Boston during March. We collaborated with the Massachusetts Department of Agricultural Resources and Diversified Communications to bring together a cluster of local businesses who received a 50% cost-share through a USDA program, and then the Seafood Marketing Program promotes Mass. Ave (Figure 50).

Figure 50. Staff from DMF, *Mass*DFG, MDAR, and EOEEA and others at the Seafood Expo 2023.

New England Food Show: The Seafood Marketing Program spearheaded a Massachusetts Seafood Pavilion at the New England Food Show in April for the second year in a row. Our booths were fully sponsored by the Massachusetts Convention Center Authority. The businesses are encouraged to attend and sample for all three days of the event. We were given permission to decorate the adjacent lounge space with seafood trivia cards and additional educational material this year. The 2023 MA Seafood Pavilion included 13 businesses (up from nine in 2022).

Teaching the Teachers: The Seafood Marketing Program prioritized "teaching the teachers" about Massachusetts seafood health benefits, history, economy, and industry in 2023. We held two workshops. In April, we co-hosted a webinar with Massachusetts Farm and Sea to School, which included interviews with fishing industry members Denice Lapierre and Eric Lorentzen. In July, we partnered with Massachusetts Agriculture in the Classroom for an in-person event at Red's Best on the Fish Pier, featuring a tour by owner Jared Auerbach (Figure 51).

Farmers' Markets: The Seafood Marketing Program attended six farmers' markets across the Commonwealth in September and October in support of in-person educational interactions with the public (Figure 52). We targeted markets that were non-coastal, weekday, robust, and without a charge. We provided a children's sensory bin, a fish identification game, and most notably gyotaku (fish printing) for all ages.

Other Events: The Seafood Marketing Program participated in other events including the Gloucester Fishing Heritage Festival, the Boston Seafood Festival, Marshfield Lobsterfest, and Seafood Day at the State House.

Mixed Media Advertising: The Seafood Marketing Program produced a second message-from-the-director video released during October, National Seafood Month. "Recognizing the Conservation Efforts of Our Massachusetts Lobster Harvesters" was released on four main social media platforms and was very appreciated by the industry.

The Seafood Marketing Program produced language-inclusive marketing materials with stakeholder input from those trying to open new market channels. We chose scup, flatfish, and whiting and translated the message in Spanish, Portuguese (Brazilian), Chinese (Mandarin & Cantonese), and Vietnamese. The files are available for easy download and print on our website.

The Seafood Marketing Program bought two sessions of holiday radio advertising. Both sessions spanned the entire state and were done through iHeartRadio. We ran one ad for Fourth of July and one in mid-December. Both ads encourage people to celebrate with Massachusetts seafood.

Figure 51. Teaching the teachers tour of Red's Best.

Figure 52. DMF booth at a farmers' market in Franklin.

Grant Program

The latest cycle of the Seafood Marketing Grant Program, in which eight businesses received awards in 2022, came to a close in 2023. The final projects were circulated to our steering committee and posted on our website. The Seafood Marketing Steering Committee was expected to provide input on the direction of the grant program in 2024 for the next funding cycle.

Scientific Diving

Scientific Diving is responsible for managing all scientific diving activities conducted by the Division. 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 DMF's training and dive operations, affording Division divers greater protection from accidental injury and helping to ensure the success of research performed by diving.

DMF's scientific divers conducted over 340 research dives 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, polychlorinated biphenyl monitoring sample collection, and dive program training (Figure 53). In addition to DMF divers, staff manages the activities of scientific divers from the Division of Fish and Wildlife, the Office of Coastal Zone Management, the Massachusetts Board of Underwater Archeology, and UMass Dartmouth. DMF Scientific Diving Program also maintains reciprocity agreements with the U.S. EPA, Boston University, the Marine Biological Laboratory, NOAA, Northeastern University, and Woods Hole Oceanographic Institution, permitting cooperative diving research.

Figure 53. DMF's Vin Malkoski with a recovered acoustic receiver.

Routine maintenance and replacement of DMF diving equipment continued in 2023 at a cost of nearly $10,000. Sixty air cylinders were inspected in-house, a savings of $1,500. Additionally, in-house first responder training was provided for 35 DMF & SMAST divers, dive tenders, and boat operators, as well as 8 DFG staff. This represents a cost savings of $9,000.

The Diving Safety Officer contributed to DMF educational and outreach efforts and continued to serve on the boards of the American Academy of Underwater Sciences Foundation, Bay State Council of Divers, the Foundation for Underwater Research and Education, and the Our World Underwater Scholarship Society.

Work continued on a multi-year effort to collect marine life in and around New Bedford Harbor in partnership with *Mass*DEP to support EPA's Superfund monitoring efforts; collection includes SCUBA, deployment of fish pots, and use of other common gear for collection of both finfish and invertebrate species. In addition, the DSO served on the EEA Health and Safety Team, the Pilgrim Nuclear Power Station Decommissioning Committee, and as a DFG representative to EEA's MA Ingestion Pathway Team for responses to potential releases from Seabrook Station in NH.

Capital Assets and Facilities Management

Facilities

DMF maintains facilities at several locations throughout the state. The Boston Headquarters officially closed in 2023 and personnel were moved to other DMF offices. The two primary field stations are in Gloucester and New Bedford, with smaller facilities that include the Shellfish Purification Plant in Newburyport, the Cat Cove Marine Laboratory in Salem, a storage and field support facility in New Bedford, and a subsidiary field office and storage facility in Sandwich.

In FY2023, DMF continued the buildout and renovations of the 50-year-old Cat Cove Marine Laboratory, which included new offices, flooring, and upgrades to the seawater system. Other major projects at the Gloucester

facility included the upgrade and replacement of the HVAC system, repaving of the parking lot, office renovations, and installation of EV charging stations. Both facilities installed new electronic security gates. In total, DMF spent over $400,000 in facility planning, infrastructure maintenance, and emergency repairs.

Vehicles and Boats

DMF maintains a fleet of 35 vehicles and 16 boats. In 2023, $67,000 was paid to the Office of Vehicle Management (OVM) for lease vehicles, and an additional $46,000 was spent on maintenance and repair for all stock. OVM is working to both reduce and "green" the overall size and composition of the fleet of vehicles operated by the Commonwealth in compliance with Executive Order 594. To meet those goals, benchmarks have been established that require 5% of the Commonwealth fleet of vehicles be EV by the end of FY2025 and 20% by the end of FY2030. To meet those goals, DMF reduced its fleet by six vehicles in 2023 and is switching from combustion engines to EV wherever practical and possible. After several years of limited stock, DMF was able to replace 10 vehicles in 2023, including eight all-electric cars and trucks (over 22% of the DMF fleet of vehicles).

DMF continued the vessel maintenance program that began in 2019. The total cost of upgrades, replacements and general maintenance was in excess of $51,000 for 2023.

Appendix A. 2023 Publications

DMF Technical Reports

Nelson, G. A. 2023. Massachusetts Striped Bass Monitoring Report for 2022. Massachusetts Division of Marine Fisheries Technical Report TR-81.

Sheppard, J.J., C. Reusch, C. Rhodes, M. Gendron, and E. Perry. 2023. River Herring Spawning and Nursery Habitat Assessment: Acushnet River Watershed, 2019-2020. Massachusetts Division of Marine Fisheries Technical Report TR-80.

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