DMF Staff Counting Eels at Pilgrim Lake in Orleans, MA

Department of Fish and Game

Massachusetts Division of Marine Fisheries 2022 Annual Report

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2022 Annual Report

Commonwealth of Massachusetts

Governor Charles D. Baker

Lieutenant Governor Karyn E. Polito

Executive Office of Energy and Environmental Affairs

Secretary Kathleen Theoharides

Department of Fish and Game

Commissioner Ronald Amidon

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
ALWTRP	Atlantic Large Whale Take Reduction Plan
ASMFC	Atlantic States Marine Fisheries Commission
BOEM	Bureau of Ocean Energy Management (Federal)
CCB	Cape Cod Bay
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
IBS	Industry-Based Survey
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*DAR	Massachusetts Department of Agricultural Resources
*Mass*DCR	Massachusetts Department of Conservation and Recreation
*Mass*DEP	Massachusetts Department of Environmental Protection
*Mass*DFG	Massachusetts Department of Fish and Game
*Mass*DOT	Massachusetts Department of Transportation
*Mass*DPH	Massachusetts Department of Public Health
*Mass*Wildlife	Massachusetts Division of Fisheries and Wildlife
MAFMC	Mid-Atlantic Fishery Management Council
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
OLE	Office of Law Enforcement (Massachusetts)
PCCS	Provincetown Center for Coastal Studies
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
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
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Jared Silva, State/Local Fisheries Policy Analyst
Kelly Whitmore, Federal Fisheries Policy Analyst
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, interstate, and federal fisheries management issues, and ensures adherence to administrative and regulatory protocols and procedures. This process also relies on our technical staff to provide biological analyses and other technical reviews of management options to ensure sustainable fisheries and fisheries habitat protection.

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

Advisory Groups

Following below is a summary of 2022 proceedings by groups advising DMF on fishery management issues.

Marine Fisheries Advisory Commission

The Massachusetts Marine Fisheries Advisory Commission (MFAC) is a nine-member board, representing recreational and commercial fishing interests 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 was convened for nine business meetings during 2022, eight of which were held virtually due to the Covid-19 pandemic. The June meeting, held outdoors in New Bedford, was also used to celebrate the MFAC's 60th Anniversary (Figure 1). Regulatory revisions and fishery specifications approved by the Commission and implemented during 2022 are included in the summary of fisheries management actions beginning on page 14. The MFAC's striped bass, law enforcement, and permitting subcommittees also met during the year. There were no changes to MFAC membership in 2022. The MFAC awarded former MFAC member and chair, Mark Amorello, the 2022 Belding Award for his lasting contributions to fisheries science and conservation (Figure 2).

Figure 1. Current and former MFAC members and DMF directors at the 60th Anniversary celebration of the MFAC on June 16, 2022.

Figure 2. Mark Amorello accepting the 2022 Belding Award.

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 2022. The first meeting focused on the Division's recommended spending plan for the expected FY2023 fund appropriation of roughly $1.85 million, while the second meeting focused on mid-year project updates. The panel endorsed the Division's FY2023 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; 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 2022. The committee received program updates from the seafood marketing coordinator; reviewed various local and national seafood marketing initiatives, including those by the New Bedford Fishing Heritage Center, the Seafood Nutrition Partnership, and NOAA Fisheries; and discussed trends in seafood production, value, and consumption, including the impact of sustainability listings by third-party entities. See Seafood Marketing (page 112) for more 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. To achieve these goals, the Panel meets at least twice annually to address ongoing matters of importance and emerging issues related to shellfish resources, fisheries, and management.

During 2022, the SAP met three times. The SAP endorsed a Special Review Process for Massachusetts Environmental Policy Act (MEPA) review of aquaculture siting and DMF's policy regarding the importation of non-conforming sized aquaculture reared quahogs for added value processing. A sub-committee was established to further investigate opportunities to accommodate bulk tagging of shellfish by commercial fishers. The SAP also received briefings on shellfish constable training; shellfish growing area classification issues, including work being conducted by SMAST to model wastewater treatment plant effluent; water quality sampling in remote areas; the state's Vibrio Control Plan and FDA's Risk Assessment and Risk Management Evaluation of the plan; and ongoing concerns regarding the municipal authority to regulate certain fishing gears in certain areas of municipal waters under the Wetlands Protection Act.

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 2022 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 2022, eight such comment periods

were held including a total of eight public hearings. This includes two public comment periods that were initiated during late 2021 but documented here because their hearings and comment period deadlines occurred in 2022. Proposals taken to public comment in late 2022 cannot possibly take effect until 2023; pending approval and implementation, they will appear in the 2023 Annual Report's Fisheries Management Actions section.

- December 9 (2021)–January 14 comment period, with a hearing on January 5 (virtual): buoy line marking requirements for trap gear; lobster trap tag installation deadline; and seasonal lobster permit residency requirement.
- December 9 (2021)–January 14 comment period, with a hearing on January 6 (virtual): seasonal sink gillnet closure expansion; commercial groundfish closures and trip limits; small mesh squid trawl season; and commercial scup Winter I and II trip limits.
- February 18–March 20 comment period, with a hearing on March 14 (virtual): Atlantic menhaden commercial season; bluefish commercial minimum size; striped bass commercial permitting control date; and regulatory clarifications on existing owner-operator rules, limited entry permit endorsement renewal rules, violations onboard for-hire vessels, and use of recreational traps for Cancer crabs.
- February 18–March 20 comment period, with a hearing on March 16 (virtual): summer flounder commercial seasons and possession limits for quota management; black sea bass commercial seasons and possession limits for quota management; spiny dogfish commercial trip limit; and regulatory clarifications (same as described in prior bullet).
- April 29–June 10 comment period, with a hearing on June 6 (virtual): recreational season, possession limit, and size limits for Atlantic cod (Southern New England and Gulf of Maine stocks), haddock (Gulf of Maine stock), summer flounder, scup, and black sea bass. An additional August 5–September 12 comment period and June 13 hearing (virtual) was held on the same cod and haddock measures due to a delay in federal rule-making.
- September 30–November 11 comment period, with a hearing on November 1 (virtual): Atlantic mackerel recreational possession limit and commercial permitting; tautog recreational size limit; shortfin mako prohibition; groundfish commercial size limit exemptions for maximum retention program; and regulatory corrections.
- September 30–November 11 comment period, with a hearing on November 3 (virtual): electronic tracking requirement for the federal commercial lobster and Jonah crab trap fishery; protected species regulations for commercial and recreational trap fisheries; Area 1A mobile gear open fishing season; whelk minimum gauge size increase schedule; and regulatory corrections.

  Certain other actions, such as Director's Declaration to adjust commercial fishery limits for quota managed species, require a public comment period only. During 2022, written public comment was accepted on the following proposed actions:
- August 29–September 12: in-season adjustment to the 2022 Period II fall season commercial summer flounder trip limit.
- November 29–December 14: in-season adjustment to the 2023 Period I winter season 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 2022, the following such events were held:

- February 17 scoping meeting (virtual) and February 14–21 scoping period to gather input on revising the recreational summer flounder and black sea bass limits in accordance with ASMFC requirements.

- September 14 scoping meeting (Gloucester) to discuss the state's management of the commercial menhaden fishery and the impact of potential 2023 interstate management plan revisions.
- December 13 scoping meeting (New Bedford) to collect input on better utilizing the state's summer flounder commercial quota and discuss issued raised during the year with the state's commercial horseshoe crab fishery.

Publications

Advisories: DMF released 88 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 2022 (Figure 3). 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 and listserv.

Annual Report: DMF published its *2021 Annual Report*.

Figure 3. The covers of the two 2022 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 2022, 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 (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, page 105, 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 2022, the Council finalized specifications for access to its various managed fisheries while advancing longer-term priorities including scoping for leasing in the limited access scallop fishery (decided not to pursue in September), developing a transition plan pending the final scientific determinations of cod stock structure, engaging in offshore wind and aquaculture developments, advancing ecosystem based fishery management considerations, and planning for climate change scenarios, among many other priorities.

DMF staff continued to contribute to technical analyses and policy decisions at the NEFMC in support of 2022 work on spiny dogfish specifications (increased trip limits), habitat (offshore wind comments and a new Habitat Area of Particular Concern in Southern New England), Atlantic herring specifications (2023–2025), Atlantic Sea Scallop Framework 36 (2023 specifications), Groundfish Framework 65 (2023–2025 specifications and new GOM cod rebuilding plan, revised GB cod recreational catch target and measures, provisional removal of sector management uncertainty buffers for haddock and white hake), 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. Mr. Eric Hansen of Marion, MA was appointed by the Secretary of Commerce to replace outgoing Massachusetts member Dr. Michael Sissenwine who had reached his term limit having served 9 years on the Council.

Atlantic Mackerel Fishery Management: Atlantic mackerel is managed by the Mid-Atlantic Council; however, the fishery (both commercial and recreational) has shifted northward to New England waters. This shift along with continuing rebuilding concerns pulled the Commonwealth more directly into regional management. Previously in 2021, staff (DMF and MAFMC) analyses and public informational webinars helped support New England stakeholders' deeper understanding of survey coverage, potential stock geographic shift, and uncertainties in available data. This set the stage for final regional and state management action in 2022,

including Massachusetts' expected adoption of a recreational possession limit and species-specific commercial permitting requirement for implementation in 2023.

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 2022, 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, tautog, weakfish, and winter flounder. DMF represented Massachusetts at the four routine quarterly meetings of the ASMFC, plus nine additional Board-specific meetings, three of which were held jointly with the MAFMC on co-managed species. Many of these meetings transitioned into a hybrid attendance mode in 2022, offering both remote and in-person options for participants. State representation was also provided at frequent virtual meetings of the ASMFC Executive Committee. Management and Policy staff also served on several committees that were active in 2022 including the Striped Bass Plan Development Team (for Amendment 7 and Addendum I to Amendment 7) 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 2022, DMF hosted (or co-hosted with other states) five ASMFC public hearings to collect stakeholder input on the following management actions: American Lobster Draft Addendum XXIX/Jonah Crab Addendum IV (January 20); Striped Bass Draft Amendment 7 (March 21); Summer Flounder, Scup, and Black Sea Bass Draft Addendum XXXIV/Bluefish Draft Addenda II (April 13); Atlantic Menhaden Draft Addendum I (September 14, Gloucester); and Striped Bass Draft Addendum I (December 19). Unless otherwise indicated above, all hearings were held virtually.

Actions: Several of the more remarkable interstate fishery management actions that DMF management and policy staff played an integral role in 2022 included: the development and adoption of Striped Bass Amendment 7 which updating the management triggers, use of conservation equivalency, and rebuilding plan to recognize reduced recruitment; the Menhaden Board's adoption of revised commercial state allocations and increased accountability for all landings; a new electronic tracker requirement for federally-permitted lobster and Jonah crab vessels beginning in 2023 to collect high resolution effort data; joint action by the ASMFC and MAFMC on an improved approach to recreational specification setting for fluke, scup, black sea bass and bluefish; and avoiding a proposed federal recreational scup closure.

Fisheries Management Actions

Described below are the fishery management actions enacted by DMF during 2022. 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 the MFAC and Commissioner of DFG's 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 2022 but not codified until 2023; such items will be covered in the 2023 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 Menhaden

Commercial Regulations: For the 2022 commercial menhaden fishery, DMF established a June 1 start date for the limited entry fishery to better align the harvest of the menhaden quota with local bait demand from the state's commercial lobster trap fishery. The start date limits all commercial menhaden harvesters to the 6,000-pound small-scale limit prior to June 1, with an exception for weir fishermen given that they may encounter menhaden in their multi-species gear during the spring.

Episodic Event Set-Aside (EESA) Permit Conditions: For the third year, Massachusetts participated in the Episodic Event Set-Aside Fishery, a program within the interstate FMP that provides 1% of the coastwide quota for additional directed harvest in Maine–New York once their state quota is taken and under certain conditions. DMF closed the state's quota managed fishery effective June 20, and was subsequently granted enrollment in the program through a request to the ASMFC, landing approximately 1.74-million pounds of the 4.28-million pound set aside during June 23–July 7. To control the pace of landings from this shared quota set-aside, DMF issued permit conditions restricting limited entry participants to a 25,000-pound trip limit and open access participants to a 6,000-pound limit (rather than the FMP's 120,000-pound trip limit).

Commercial Quota Transfers & Fishery Permit Conditions: Massachusetts received eight transfers of commercial menhaden quota totaling 3.02 million pounds and transferred 64,000 pounds to the EESA, bringing the state's final quota to roughly 8.37 million pounds. The eight transfers from Connecticut, North Carolina, South Carolina, Georgia, Pennsylvania, Florida, Maryland, and Rhode Island were made in response to persistent high inshore availability of menhaden after the state's quota and the EESA were taken in early-July, and enabled the fleet to continue landing fish accountable to the quota, rather than under the small scale/incidental catch limit which is not accountable to the quota. DMF issued permit conditions to restrict landings by limited access permit holders to no more than 25,000-pounds per day under the re-opened fishery. The transfer to the EESA helped reduce an incidental overage of the set-aside amount, which would otherwise need to be paid back from the following year's EESA. Menhaden quota transfers require multi-state agreement and ASMFC approval per

FMP requirements.

Bluefish

Commercial Minimum Size: Effective May 13, DMF established a 16" minimum size for the commercial bluefish fishery. This was done to prevent the commercial permit from being misused to allow anglers to retain snapper bluefish in excess of the recreational bag limit for personal use. This misuse of the commercial permit was brought to DMF's attention by the Massachusetts Environmental Police as a growing enforcement issue following the reduction in the recreational bag limit in 2020. DMF's initial proposal for an 18" commercial minimum size limit was amended based on public comment received.

Fluke, Scup, and Black Sea Bass

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

Fluke Commercial Period I Declaration: DMF made a temporary adjustment to the Fluke Period I (January 1–April 22) commercial trip limit to increase the fleet's access to the state's available quota, which was increasing 37% from the prior year. Due to timing issues, a Director's Declaration was used to increase the limit for the whole of the Period I fishery from the regulatorily-set 1,000 pounds to 2,500 pounds.

Fluke Commercial Multi-State Possession Limit Pilot Program: DMF renewed its seasonal wintertime summer flounder pilot program for 2022. 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 Rhode Island, Connecticut, and New York 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.

Fluke Commercial Regulations: In response to increases in the commercial quota and fishery performance in recent years, DMF adjusted the commercial summer flounder seasons, trip limits, and fishing days. These new regulations went into effect on May 13, meaning not all affected the entire 2022 fishing season. For the Period I fishery (January 1–April 22), the trip limit was increased from 1,000 pounds to 3,000 pounds, and the quota trigger to reduce to a 100-pound trip limit moved from 25% quota use to 30% (consistent with the period's allocation). During Period II, the spring bycatch season (April 23–June 9) was eliminated in favor of starting the directed fishery on April 23. From April 23–August 31, the trip limit for trawlers using large mesh was set at 500 pounds and the trip limit for hook and line fishermen at 300 pounds, and the closed fishing days on Fridays and Saturdays were eliminated thereby allowing commercial fishing seven days per week. If on September 1 more than 20% of the quota remains, the trip limit is increased to 800 pounds for all gear types (otherwise status quo), and if on October 1 more than 5% of the quota remains, the trip limit increases to 3,000 pounds for all gear types (otherwise 800 pounds for all gear types). These triggered trip limit increases were similar to adjustments made via Declaration in 2021. The small-mesh bycatch allowance was modified such that, throughout Period II, if a trawl vessel is fishing with net meshes less than 5.5" diamond or 6" square or is in possession of more than 250 pounds of squid, then the summer flounder limit is 100 pounds. Additionally, DMF adopted the multi-state possession limit pilot program (see above) in regulation; moving ahead, the allowance will apply to both the Period I fishery as well as the Period II fall fishing season of October 1–December 31. Participating vessels will still be required to annually obtain a Letter of Authorization from the Director.

Fluke Commercial Trawl Fishery Consecutive Daily Trip Limit Pilot Program: Via Letters of Authorization, DMF renewed the pilot program begun in 2019 allowing trawlers during the summertime fishery (previously June 10–October 31, but revised to April 23–September 30) to retain and land two consecutive days' limits of fluke (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.

Fluke Commercial Period II Declarations: In response to quota utilization, DMF adjusted the Period II fall season commercial summer flounder limit from 3,000 pounds to 10,000 pounds by Director's Declaration. This in-season adjustment effective October 1–December 31 was meant to make the state's trip limit comparable in scale to other states along the Atlantic coast and thereby encourage Massachusetts permit holders fishing along the northeast coast to land their catch in-state rather than steaming to another state with higher landing limits.

Fluke Recreational Regulations: The recreational summer flounder limits were amended by emergency regulation to establish a May 21–September 29 open season, 5-fish bag limit, and 16.5" minimum size. This replaced the May 23–October 9 open season, 5-fish bag limit, and 17" minimum size. These changes were enacted to meet an allowed 16.5% liberalization in projected recreational harvest in 2022, accomplished principally through the minimum size decrease, while also aligning the start of the season with recreational black sea bass. These emergency regulations were later adopted as final regulations.

Scup Commercial Winter I Declaration: A Director's Declaration set the 2022 Winter I (January–April) trip limit at 50,000 pounds to complement the federal measures. DMF replaced the declaration process with a fixed state waters tip limit in time for the 2022 Winter II fishery (October–December). See below.

Scup Commercial Regulations: In lieu of continuing to seasonally declare the state waters scup winter-time limits to match those established for federal waters, DMF adopted a 2,000-pound state waters possession limit spanning October 1–April 30. A transiting provision was included authorizing federally-permitted vessels to possess non-conforming quantities taken from federal waters and consistent with those rules. The 2,000-pound limit recognizes the potential for limited state waters catch during this time period that largely consists of an offshore fishery, while reducing administrative burden on the agency. This rule change was in effect in time for the Winter II fishery in 2022.

Scup Recreational Regulations: The recreational scup minimum size was increased from 9" to 10" by an emergency regulation effective April 28. A 1" increase to all states' minimum size was required by the ASMFC to achieve a projected 33% reduction in harvest coastwide. The Massachusetts season remained open year-round with a 30-fish possession limit, except for a 50-fish limit aboard for-hire vessels during May–June. This emergency regulation was later adopted as a final regulation.

Black Sea Bass Commercial Regulations: In response to increases in the commercial quota and fishery performance in recent years, DMF adjusted the directed commercial black sea bass season, trip limits, and open fishing days for 2022. The directed commercial fishery opening date was moved a week earlier to the first open fishing day on or after July 1 (previously July 8); Mondays and Wednesdays were added as open fishing days, allowing commercial fishing to occur Sundays–Thursdays through September 14, then going to all seven days per week on September 15; the trip limits were increased 25%, from 400 pounds to 500 pounds for pot gear and from 200 pounds to 250 pounds for other non-trawl gear; and if at least 15% of the quota remains on September 15, the trip limits increase to 600 pounds for pots and 300 pounds for other non-trawl gear. In addition, consistent with changes in the open fishing days for the directed commercial summer flounder trawl fishery, trawlers were authorized to retain a 100-pound bycatch limit of black sea bass beginning on April 23 with no closed days (although the effective date of this rule was not until May 13 in 2022).

Black Sea Bass Commercial Pot Fishery Consecutive Daily Trip Limit Pilot Program: Analogous to the similarly named pilot program for summer flounder trawlers, DMF initiated a pilot program allowing black sea bass pot fishermen to land two daily limits of black sea bass caught and retained over consecutive fishing days. The program was meant to enhance quota utilization by enabling harvesters to fish more efficiently and safely. The pilot program was implemented by Letters of Authorization. Participants received DMF-issued tags—used to identify and lock fish taken on the first day of fishing activity—as well as a logbook to document and report daily catch taken as part of the pilot program.

Black Sea Bass Recreational Regulations: The recreational black sea bass limits were amended by emergency regulation. The emergency regulations established a May 21–September 4 open season, 4-fish bag limit, and 16" minimum size. This replaces the May 18–September 8 open season, 5-fish bag limit, and 15" minimum size. These changes were necessary to reduce projected recreational harvest by 20.7% as required by the ASMFC to stay within the established recreational harvest limit. These emergency regulations were later adopted as final regulations.

Commercial Quota Transfers: DMF accepted a transfer of commercial fluke quota (1,944 pounds) from New York in February to account for landings made by a vessel bound for that state but granted safe harbor in Massachusetts due to dangerous weather conditions. In April, DMF agreed to transfer 200,000 pounds of scup Summer Period commercial quota to Connecticut based on prior years' fishery performance indicating that this would not impact the Massachusetts scup fishery while assisting the Connecticut fishery with their low allocation. In November, DMF agreed to transfer 25,000 pounds of black sea bass commercial quota each to Rhode Island and Connecticut to help maintain their fisheries' open status without impacting the Massachusetts commercial black sea bass fishery. All such transfers require multi-state agreement and ASMFC and/or NOAA Fisheries approval per FMP requirements.

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.

Commercial Groundfish Closures: For 2022, DMF rescinded the conditional commercial groundfish closure during the month of April between Plymouth and Marblehead and replaced it with an April 15–April 30 commercial groundfish closure within all state waters from Plymouth (42°00'N latitude north) to the Massachusetts/New Hampshire maritime border. The old conditional groundfish closure was a mortality closure designed to prevent the state waters groundfish fishery from exceeding federally set harvest targets for certain stocks. The new commercial groundfish closure is designed to enhance spawning cod protections. The closure applies to all gear types capable of catching groundfish (e.g., hook and line, trawl, gillnet) with an exception for shellfish dredge gear.

Commercial Trip Limit Adjustments: Effective February 18, DMF increased the state waters trip limits for Gulf of Maine cod from 200 pounds to 400 pounds and Gulf of Maine yellowtail flounder from 250 pounds to 350 pounds. It was determined that the expansion of the seasonal gillnet closure to protect right whales and the late-April commercial groundfish closure to protect spawning cod were going to limit state waters groundfish landings. Accordingly, these trip limit adjustments were designed to provide the small number of vessels participating in the state waters groundfish fishery with additional opportunities to harvest and land available allocations of groundfish at times and places where spawning cod and right whales are less of a concern. Both stocks have been underutilized in state waters in recent years.

Recreational Georges Bank Cod: Effective July 15, DMF enacted by emergency regulation an August 1–April 30

open season with a five-fish bag limit and a slot limit of 22” to 28” (meaning the fishery was closed July 15–30, 2022, and would again close May 1–July 30, 2023 unless further modified). This replaced the prior limits that allowed recreational fishing year-round with a 10-fish bag limit and 22” minimum size. These changes matched the federal regulations implemented as part of Framework 63 to the Multi-Species Groundfish Fishery Management Plan. Framework 63 cut the Georges Bank recreational cod target by about 50% for the 2022 and 2023 fishing years and these amendments to the recreational fishing regulations were designed to keep recreational fishing mortality below the catch target. These emergency regulations were later adopted as final regulations.

Recreational Gulf of Maine Cod: Effective September 1, DMF enacted by emergency regulation open seasons of September 1–October 7 and April 1–April 14 with a 1-fish bag limit and 22” minimum size. This extended the fall recreational fishing season by three weeks and increased the minimum size by 1” compared to the prior limits that established open seasons of September 15–September 30 and April 1–April 14 with a 1-fish bag limit and a 21” minimum size. These state limits matched the federal rules adopted by NOAA Fisheries for this stock. These emergency regulations were later adopted as final regulations.

Recreational Gulf of Maine Haddock: Effective September 1, DMF enacted by emergency regulation an increase in the possession limit for GOM haddock from 15 fish to 20 fish while maintaining the April 1–February 28 open season and 17” minimum size. These state limits matched the federal rules adopted by NOAA Fisheries for this stock. These emergency regulations were later adopted as final regulations.

Horseshoe Crab

Commercial Limits: Consistent with changes in the open fishing days for the directed commercial summer flounder trawl fishery, DMF modified the authorization for trawlers to retain their lawful bycatch of horseshoe crabs with no closed fishing days beginning on April 23 (although this rule wasn’t effective until May 13 in 2022). However, the horseshoe crab lunar closures for spawning protection still applied to the trawl fishery. The bycatch limits themselves remained unchanged at 300 crabs for limited entry permit holders and 75 crabs for non-permit holders.

Lobster

Setting of Lobster Trawls in Gosnold Waters: In January, DMF advised lobster trap fishers that the Massachusetts state legislature had amended G.L. c. 130, §37, striking the long-standing prohibition on the fishing of lobster trap trawls in the waters of the Town of Gosnold. With this change, permitted lobstermen became able to set and fish multi-trap trawls within these town waters (or continue to fish single traps, where every trap has its own buoy line, if that is their preference). DMF sought this amendment to reduce buoy lines and any associated risk of entanglement with protected species such as whales and leatherback turtles. As a consequence of this statutory change, there is no longer any area in state waters where single trap fishing is mandated.

Lobster Trap Tag Installation Deadline: The deadline whereby any lobster traps being fished must have a current year trap tag installed in the trap was moved to May 1 for all Lobster Conservation Management Areas. Previously, this was a March 16 deadline for the Outer Cape Cod Lobster Conservation Management Area and a June 1 deadline for all other Lobster Conservation Management Areas.

Recreational Lobster and Crab Trap Clarification: DMF modified the regulations to clarify that recreational fishermen may only use traps to catch Cancer crabs and that all traps used must comply with recreational lobster trap restrictions.

Protected Species

Buoy Line Marking Rules: Effective February 18, DMF modified the buoy line marking rules enacted in 2021 for 2022 to: 1) have the requirements apply to all commercial trap fisheries—including not just the commercial lobster trap fishery but also the scup pot, black sea bass pot, and whelk pot fisheries; and 2) clarify that buoy lines fished by Massachusetts trap/pot fishermen in federal waters were to have a green mark next to all adjacent red marks and that buoy lines fished by Massachusetts trap/pot fishermen in state waters were to have only red marks in the buoy line. The was done to maintain the integrity of the jurisdiction-specific buoy line marking requirements for all trap/pot fisheries in the state.

Expansion of Seasonal Commercial Gillnet Closure: Effective February 18, DMF modified the spatial boundaries of the January 1–May 15 gillnet closure to protect right whales. Whereas the closure previously only applied in Cape Cod Bay, it was amended to apply throughout all Massachusetts state waters. This closure is designed to mitigate the risk of a right whale becoming entangled in this fixed gear when they seasonally aggregate in and migrate through our waters. Of particular concern was the potential co-occurrence of gillnet gear and right whales in Massachusetts Bay and off Cape Ann during April and early May. In recent years, right whale sightings data show right whales are increasingly using these waters during this time.

Small Vessel Speed Restriction Declaration: Resulting from the presence of large aggregations of right whales, DMF extended the small vessel speed restriction in Cape Cod Bay through May 15, 2022. Under the Director's Declaration, small vessels (those less than 65') were required to travel at speeds no greater than 10 knots in this area. A complementary federal speed restriction applied to vessels 65' and greater in the same area until May 15.

Sharks

Spiny Dogfish Commercial Trip Limit: Effective May 13, DMF increased the spiny dogfish trip limit from 6,000 pounds to 7,500 pounds consistent with changes to the federal trip limit to encourage better quota utilization.

Striped Bass

Commercial Permit Control Date: DMF established a June 14, 2022 control date for the commercial striped bass regulated fishery permit endorsement. This control date may be used in the future to limit future access and allowable harvest in the commercial striped bass fishery. This replaced the prior September 13, 2013 control date. A more current control date may prove useful if DMF were to limit participation in the commercial striped bass fishery, as it would be inclusive of recent entrants and the geographic shift of this fishery in recent years to the northern part of the state.

General Matters and Other Species

Small Mesh Trawl Season Extension: DMF declared a one-week extension to the small mesh trawl season for squid through June 15. By regulation, the season ends on June 10 but the Director may extend the season by permit condition to provide additional harvest opportunity. This decision considered fishery economics, catch rates and composition, and diminished fishing effort due to poor early season weather and reduced participation. At the beginning of the year, DMF had proposed a regulatory change to permanently set the season as April 23–June 15, but this was not supported by the MFAC and did not come to pass.

Free Saltwater Fishing Days Declaration: DMF declared June 18 and 19 as the Commonwealth's free saltwater fishing days for 2022. 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.

Purse Seine Permit Conditions: DMF issued routine permit conditions setting forth restrictions on the use of purse seines in order to properly conservation and manage inshore bait fisheries. Two sets of permit conditions were issued specific to Inshore Net permits (which allow the use of purse seines in the Inshore Restricted Waters) and Coastal Access Permit Purse Seine endorsements (that do not). These conditions include such items as reporting requirements, maximum net size, spotter plane limitations, prohibited areas, and closed days. After consultation with the MFAC, the Inshore Net permit conditions were issued with an allowance to purse seine for menhaden in Boston Harbor (including Fridays which had been subject to a petition to prohibit) but not with the assistance of a carrier vessel.

Seasonal Lobster Permit Residency Requirement: DMF adopted a new policy on the issuance and use of seasonal lobster permits. This policy clarifies that the season lobster permit does not authorize the taking of edible crabs, defines "full-time student" with regards to the eligibility requirement, and clarifies that the permit maybe issued to non-resident full-time students. This policy was issued in March 2022.

Owner-Operator Clarification: DMF modified the regulation to clarify that the owner-operator requirement in certain fisheries does not require the individual named on the permit be present when fish is sold to a primary buyer or when fish is transported overland for sale to a primary buyer.

For-hire Liability Clarification: Effective May 13, DMF rescinded language regarding officer discretion in the for-hire liability regulation for clarity and removal of redundancy.

Limited Entry Permit Endorsement Renewal Deadline Clarification: DMF clarified that applications for limited entry permits that are postmarked or received after the deadline may *not* be renewed.

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 2022, DMF initiated eight proceedings based on violations that occurred during 2021 and 2022. The first proceeding addressed an individual operating a charter boat without a valid for-hire vessel, which followed the 2021 revocation of the individual's charter boat permit. This matter went to hearing and the Director issued a Final Agency Action to revoke all remaining commercial fishing permits issued in the person's name, consistent with the magistrate's Recommended Final Decision. A second proceeding addressed overages of the lobster bycatch limit for gillnet fishers and misreporting. This matter was settled prior to hearing subject to a two-year suspension of the individual's Offshore Lobster Permit and a three-year probationary period. A third proceeding addressed the commercial harvest of shellfish from an area close due to contamination. The individual previously had their commercial shellfish permit suspended for violations of the state's shellfish sanitation regulations. This matter went to hearing and the Director issued a Final Agency Action to permanently revoke the commercial shellfish permit, consistent with the magistrate's Recommended Final Decision. Lastly, DMF initiated five proceedings regarding commercial lobster trap permit holders for lobster trap gear violations. The violations included setting and abandoning traps within the February 1–May 15 Commercial Trap Gear Closure to Protect Right Whales, buoy line marking and modification requirements, trap tag requirements, and surface marking requirements. Four of these matters were settled prior to hearing through permit suspensions and probationary periods. The permit suspensions ranged from a reoccurring, annual three-month (November–January) suspension for a period of five -years to a three-year suspension. The fifth matter was also settled prior to hearing with the permit holder agreeing to transfer their permit and not participate in the state's commercial lobster trap fishery.

One adjudicatory proceeding initiated in 2021 was concluded in 2022. The matter addressed non-compliant lobster trap gear, including buoy line marking and modification, trap tag, surface marking, and oversized trawl violations. This matter went to hearing and the Director issued a Final Agency Action to revoke the Coastal Lobster Permit issued in the person's name, consistent with the magistrate's Recommended Final Decision.

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 2022, 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. The MFI Advisory Council met November 18, hosting a research symposium on various MFI projects related to bycatch reduction, conservation engineering, population dynamics, stock assessment, survey methodology, and management research.

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 2021–2022 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; funds generated from its sale would be dedicated to striped bass studies, fish passage improvement projects, and angler education. By early 2020, the minimum number of orders to launch a new license plate was met; however, the Covid-19 pandemic dramatically interrupted what would have normally been a 6- to 8-month process to get a plate approved, produced, and distributed through the Registry of Motor Vehicles. Direct distribution of new plates to pre-applicants occurred in 2022, as well as general availability of the plates through the RMV. A grant review panel was also populated late in the year, with the expectation of a first meeting to come in 2023; this panel will assist the MET is determining project priorities and grant award recipients for the funds generated by the Striped Bass Conservation Plate.

Additional Committee Work

Staff served as the state's representative to the Stellwagen Bank Sanctuary Advisory Council (SAC), which included attendance three SAC meetings in 2022. 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 2022, the SAC discussed Sanctuary management plan revisions, MA Bay water quality, ropeless (on-demand) gear efforts, and offshore

energy development among other work. The SAC also stood up a subcommittee on wind energy to support the superintendent in responding to future offshore wind development in the Gulf of Maine. Staff reported on DMF activities relevant to Sanctuary resources (e.g., right whale conservation, cod research, derelict gear removal, and fishery management actions) and will serve on the wind energy subcommittee, expected to commence in 2023.

Permitting and Statistics Program

Personnel

Story Reed, Program Manager
Anna Webb, Fisheries Statistics Project Leader
Kerry Allard, Permitting Project 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 (started in November)
Whitney Sargent, Permitting Support
Matthew Duggan, Permitting Specialist
Sandra Downing, Permitting Receiving Teller
Kim Trotto, Permitting Receiving Teller
Lynne Besse, Permitting Receiving Teller
George Davis, Permitting & Support for Fisheries Reporting
Luke Putaansuu, Permitting & Support for Fisheries Reporting (started in March)
Vicky Oliviera, Permitting Receiving Teller (started in November)
Amanda Meli, Seasonal Receiving Teller (moved to Fiscal team in November)
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 Project** 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. Project personnel also participate in the planning and development of the Atlantic Coastal Cooperative Statistics Program (ACCSP) and provide support to administrative staff for policy and 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 Fisherman Permits

Anyone who lands and sells finfish, shellfish, lobsters, edible crabs, or other living marine resources in MA must have a DMF commercial fishing permit and must sell only to permitted Massachusetts dealers. DMF issued a total of 7,627 commercial fisherman permits in 2022 (Table 1). Over the past decade, DMF has seen a general

increase in commercial fisherman permit sales, particularly for small Boat 0–59' in length (Figure 4).

Table 1. 2022 commercial fisherman permit issuance.

Permit Type	Permits Issued (#)	
	Residents	Non-residents
Coastal Lobster	1,001	6
Offshore Lobster	282	83
Seasonal Lobster	103	2
Boat 99+'	11	17
Boat 60-99'	87	215
Boat 0-59'	3,565	420
Individual	204	8
Shellfish and Seaworm	796	1
Shellfish and Rod & Reel	379	0
Rod & Reel	418	29
Total	**6,846**	**781**

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.

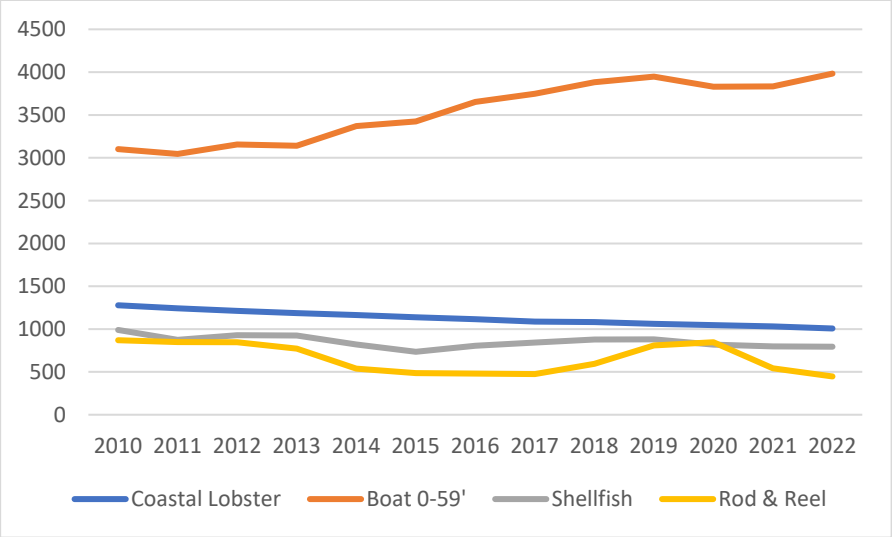


Figure 4. Trend in sales of four frequently issued commercial fisherman permits, 2010–2022.

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 fishermen are considered primary buyers, and must be so endorsed on their dealer permits. DMF issued a total of 1,882 seafood dealer permits in 2022 (Table 2), a number relatively unchanged over the past ten years.

Table 2. 2022 dealer permit issuance.

Permit Type	Permits Issued (#)	
	Resident	Non-resident
Wholesale Dealer	370	8
Wholesale Truck	78	117
Wholesale Broker	29	6
Retail Dealer	807	98
Retail Truck	33	2
Retail Boat	176	4
Bait Dealer	128	15
Retail Farmer's Market	10	1
Total	**1,631**	**251**

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 MassDPH 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, whether frozen or unfrozen, shellfish, and lobsters at one retail location. The holder must purchase shellfish only from a holder of a wholesale dealer or wholesale truck permit, or 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. After issuing a record 303 Retail Boat permits in 2020 due to COVID-related market conditions, 180 were issued in 2022 as market conditions continued to return to normal.

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. This permit was established by regulation in 2019 in order to make the permitting process for farmer's markets more intuitive.

Special Permits & Regulated Fishery Endorsements

Special Permits are required for certain activities in the marine environment, as described below. DMF issued a total of 22,717 special permits in 2022 (Table 3).

Table 3. 2022 special permit & regulated fishery endorsement issuance.

Permit Type	Permits Issued (#)	
	Resident	Non-resident
Non-commercial Lobster	5,686	114
Regulated Fishery Endorsements	15,172	1,196
Master Digger	4	0
Subordinate Digger	27	0
Scientific Collection	72	18
Shellfish Propagation & Aquaculture	428	0
Total	**21,389**	**1,328**

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 fisherman permit. Regulated Fishery Endorsements are required for dragging, gillnetting, netting in inshore net areas, and setting fish pots in waters under the jurisdiction of the Commonwealth. Regulated Fishery Endorsements are also required for the commercial harvest of northern shrimp, surf clam/ocean quahog, sea herring, sea urchins, fluke, black sea bass, scup, striped bass, dogfish, American eel, horseshoe crab, groundfish, tautog, and menhaden.

Master Digger Permit is required for an individual who wants to harvest contaminated clams from areas classified as "restricted." Shellfish are depurated at the Shellfish Purification Plant in Newburyport in accordance with regulations and established procedures. In addition to 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 190,815 recreational saltwater fishing permits in 2022 (Table 4).

Table 4. 2022 recreational saltwater fishing permit issuance.

Permit Type	Permits Issued (#)	
	Resident	Non-resident
Recreational Saltwater, Age 16–59	110,794	16,407
Recreational Saltwater, Age 60+	55,772	7,014
Charter Boat	720	59
Head Boat	43	6
Total	**167,329**	**23,486**

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, fluke, 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 5 for a summary of transfers administered by DMF during the year.

Table 5. 2022 Preliminary Limited Entry Permit Transfer Statistics.

Permit/Endorsement Type	Permits Transferred (#)	
	Resident	Non-resident
Coastal Lobster	25	0
Mobile Gear Coastal Access	3	2
Fish Pot	4	0
Fluke	8	6
Black Sea Bass	13	2
Groundfish	1	0
Surf Clam/ Ocean Quahog	5	0
Quahog Dredge	1	0
Horseshoe Crab	0	1
Menhaden	0	0
Tautog	7	0
Inshore Net	0	0

Fisheries Statistics Project

Dealer Landings Data Collection

Landings or purchases of all marine species by seafood buyers from commercial fishermen were collected as part of the dealer reporting program. Since 2005, all primary buyers not already required by federal law to report electronically have been required to report under state regulations. 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 2022, 1,880 businesses obtained a Massachusetts seafood dealer permit. Of those, 521 (or 28%) 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 521 dealers, 266 had a federal dealer permit and the remaining 255 dealers were categorized as "state-reporting." Compared to 2021, there were 7% less primary buyers in 2022. However, 2022 still had an 11% increase over 2019.

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, 139,740 dealer reports were entered into the SAFIS database, an approximate 2% increase over 2021. Total landings (in whole pounds), as reported through the SAFIS database or other federal reporting programs, amounted to 526 million pounds valued at $668 million (ex-vessel; calculated from price paid to fishermen). The top five species in order of value were sea scallop, American lobster, Eastern oyster, haddock, and Jonah crab totaling $535 million, or 80% 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; however in 2022, levels declined to those seen in 2019 (Figure 5). Total landings were also considerably lower in 2022 (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. Furthermore, 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.

Offshore shellfish (sea scallop, Atlantic surf clam, and ocean quahog) made up 62% 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 eight percent of total value landed. Landings of invertebrate species (lobster, crabs, and whelk) amounted to 29 million pounds, valued at $106 million, or 16% of the total value landed. Cumulative finfish landings, including both pelagic and benthic species, made up 15% of the total value with groundfish species amounting to 9% of the total value. Landed species with an individual gross value over $2 million are shown in Table 6; in aggregate, these species accounted for approximately 97% 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.

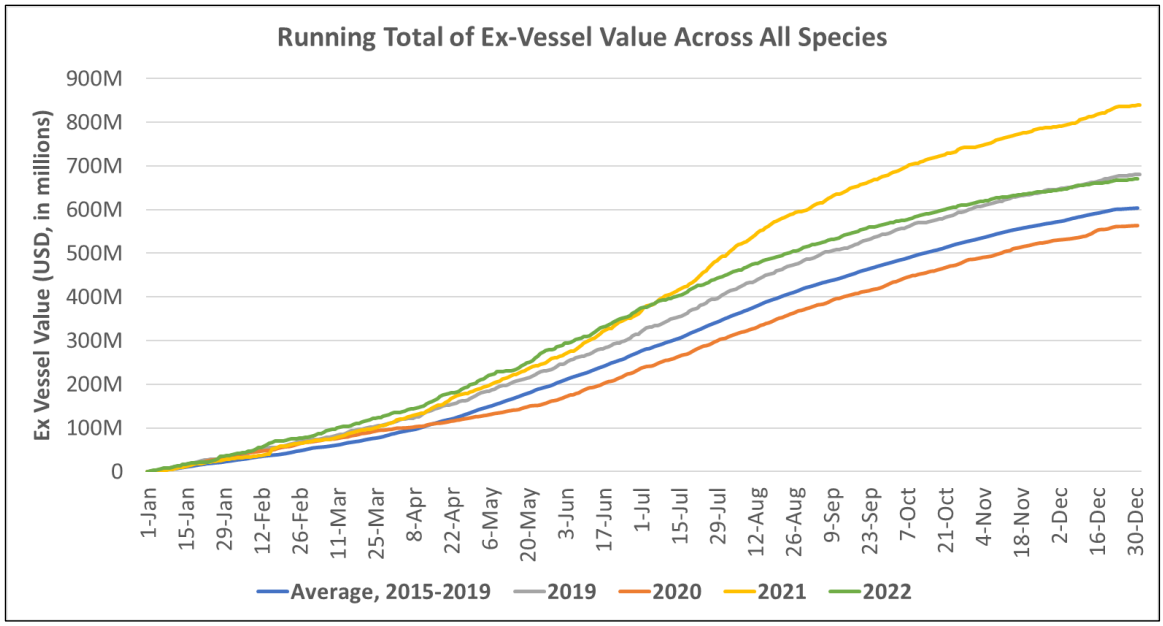


Figure 5. Daily running total ex-vessel value for 2019-2022 and the average of 2015-2019.
Source: ACCSP Data Warehouse; 4/8/2023.

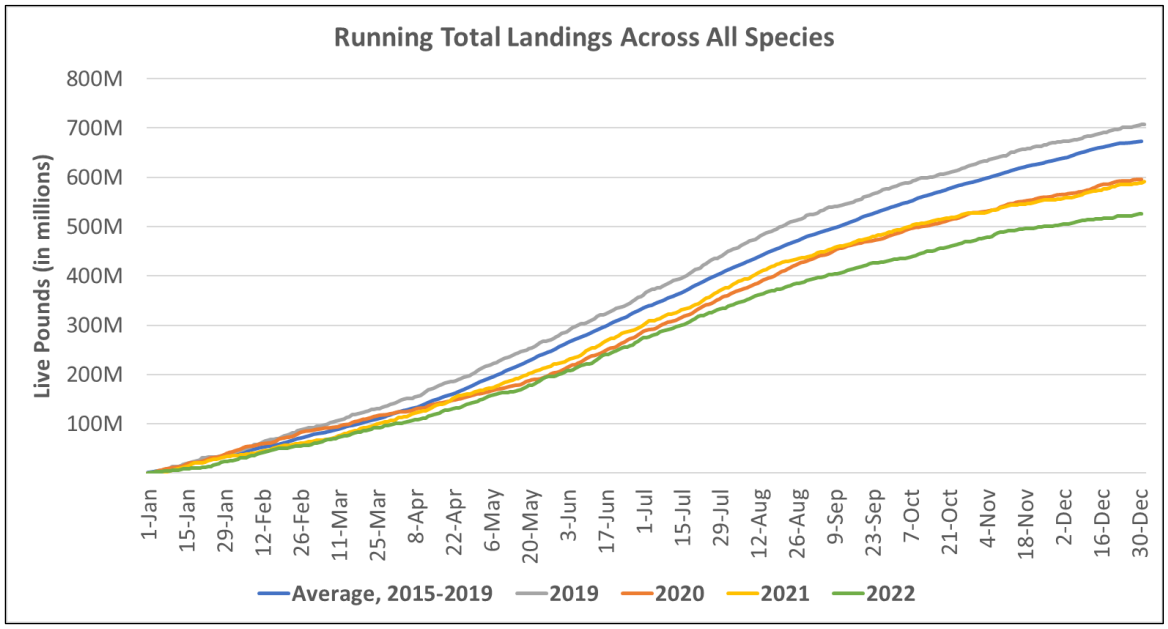
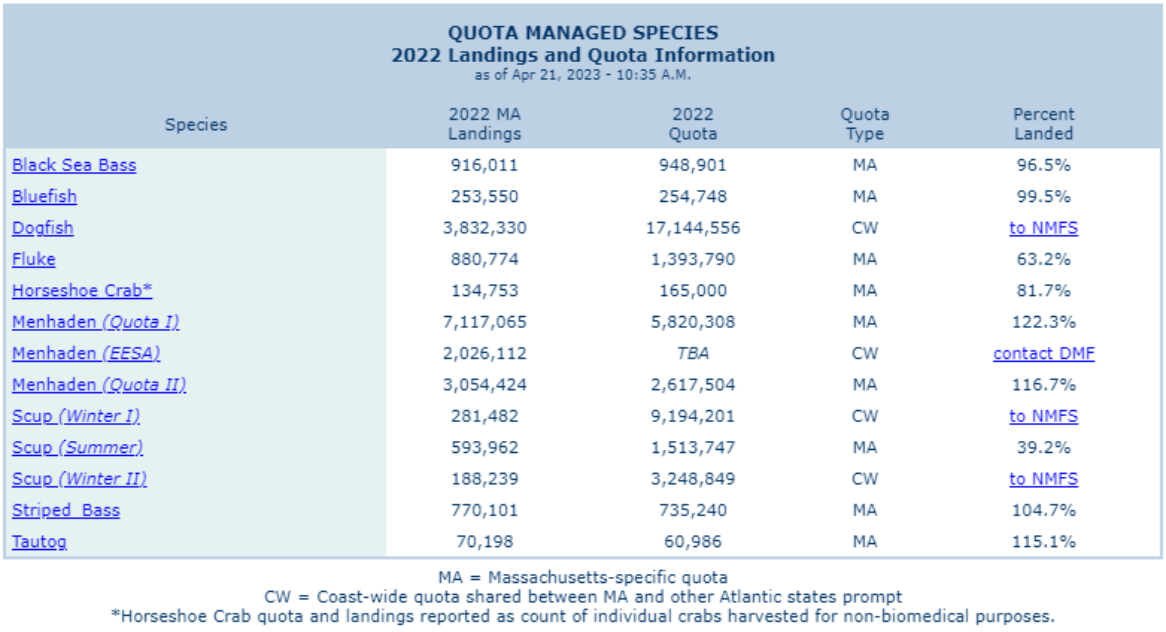


Figure 6. Daily running total landings in live pounds for 2019-2022 and the average of 2015-2019.
Source: ACCSP Data Warehouse; 4/8/2023.

Table 6. 2022 MA-landed species with ex-vessel value >$2 million.* Source: ACCSP Data Warehouse, 4/8/23.

Species*	Landings (whole pounds)	Ex-Vessel Value (USD)
Sea scallop	215,038,598	$390,117,734
American lobster	14,608,443	$81,793,467
Eastern oyster	9,701,489	$32,712,708
Haddock	10,545,887	$16,974,402
Jonah crab	7,432,651	$13,443,175
Atlantic surf clam	41,615,178	$12,127,626
Ocean quahog	124,918,448	$11,759,156
Goosefish	10,227,822	$8,898,841
Silver hake (whiting)	6,550,737	$8,085,269
Soft clam	3,435,743	$8,042,616
Pollock	6,898,653	$7,974,763
Longfin squid (*Loligo*)	4,239,265	$7,208,058
Bluefin tuna	1,218,605	$6,254,612
Acadian redfish	8,333,801	$5,796,378
Northern quahog	4,084,944	$5,570,979
White hake	3,086,998	$4,644,774
Channeled whelk	917,615	$3,802,944
Menhaden	10,425,267	$3,648,843
Striped bass	769,976	$3,111,099
Witch flounder (gray sole)	1,599,090	$2,713,434
Black sea bass	915,637	$2,475,734
American plaice (dab)	1,408,311	$2,374,929
Summer flounder (fluke)	872,386	$2,372,519
Atlantic cod	1,003,715	$2,082,628

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



QUOTA MANAGED SPECIES
2022 Landings and Quota Information
as of Apr 21, 2023 - 10:35 A.M.

Species	2022 MA Landings	2022 Quota	Quota Type	Percent Landed
Black Sea Bass	916,011	948,901	MA	96.5%
Bluefish	253,550	254,748	MA	99.5%
Dogfish	3,832,330	17,144,556	CW	to NMFS
Fluke	880,774	1,393,790	MA	63.2%
Horseshoe Crab*	134,753	165,000	MA	81.7%
Menhaden *(Quota I)*	7,117,065	5,820,308	MA	122.3%
Menhaden *(EESA)*	2,026,112	*TBA*	CW	contact DMF
Menhaden *(Quota II)*	3,054,424	2,617,504	MA	116.7%
Scup *(Winter I)*	281,482	9,194,201	CW	to NMFS
Scup *(Summer)*	593,962	1,513,747	MA	39.2%
Scup *(Winter II)*	188,239	3,248,849	CW	to NMFS
Striped Bass	770,101	735,240	MA	104.7%
Tautog	70,198	60,986	MA	115.1%

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

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 fisherman 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 (available since 2010), while SAFIS eTRIPS Mobile is a newer 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. 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 2022, DMF issued 7,627 commercial harvester permits, of which 19% were for federal reporting vessels, and the remaining 6,141 commercial permits were designated as “state-reporting.” Thirty-eight percent of all permit holders reported electronically using the SAFIS eTRIPS Online or Mobile applications, which was similar to 2021. This left 42% of all harvesters submitting paper reports to DMF. Of the greater than 91,900 commercial trips that were entered into the SAFIS database for state reporting harvesters for the 2022 calendar year, approximately 35.5% 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 a slight increase over previous years. Compared to 2021, the total number of trips reported for 2022 very similar and remained higher than that reported for 2020, when covid impacted effort levels, but less than pre-COVID years.

Data Analysis and Dissemination

Following the COVID-19 rebound and inflation witnessed in 2021, project staff were asked to provide updates on the declines in activity and value seen in 2022 and described above. While these in-year analyses excluded surf clams and ocean quahogs as they are reported to a separate system, the results clearly showed a significant decrease as compared to 2021 in overall value primarily driven by the sea scallop and lobster fleets. Additionally, significant time was dedicated to routine activities such as ensuring correct harvester reporting methods and maintaining compliance metrics for harvester and dealer reporting. More specifically, time was spent reviewing the 2021 collection of the new fixed gear fields; because 2021 was the first year collecting these data elements, significant post hoc review of submitted data was required. This began in the late summer of 2022 and will continue well into 2023. Additionally, 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 has become increasingly more important in discussions involving conservation of protected species. 2022 marked the 14th year data on vertical lines for the Massachusetts pot/trap fisheries were collected, and the first in which only data at the trip-level were collected from most permit holders rather than an annual recall. DMF worked to compile all available vertical line data for use in several data requests involving federal managers and academic modelers. The NOAA Fisheries ALWTRT decision

support tool was updated using the most current vertical line data. Additionally, Homarus Strategies, LLC, in collaboration with DMF, used vertical line data in an economic model predicting costs for implementing ropeless technology in the Massachusetts pot/trap fisheries (refer to Protected Species Project, page 87, for more details).

Jonah Crab: Project staff worked to complete multiple internal and external data requests involving Jonah crab in 2022. Most requests were to support the stock assessment, for which an 11-year time series of Massachusetts landings were summarized. Other requests included a summary of Jonah crab bycatch data in the lobster pot fishery. Topics involving Jonah crab are evolving as the emerging fishery gains traction in the public eye.

Wind Analyses: Vineyard Wind is building the first utility-scale offshore wind farm over 15 miles from the coast of Martha's Vineyard which includes deploying a submarine cable which will transverse Statistical Reporting Areas 10 and 12. Project staff completed an extensive analysis of the fishing activity in these areas to assess the impact of potential closures. Data summaries of annual landings, value, and effort were broken down by statistical reporting area, species, and permit type. Also, monthly summaries were included for the most vulnerable fisheries (e.g., conch-pot) that would be impacted by this work.

Inshore Shellfish Ranking Analysis: In many coastal communities, commercial shellfish play an important role in a town's economy, community, and tradition. Stemming from an annual request submitted by Wellfleet's shellfish warden, project staff conducted an analysis that ranked ports based on shellfish landings and ex-vessel value. In 2022, Plymouth ranked first in volume of shellfish landings followed by Wellfleet, Chatham, Duxbury, and Barnstable. Wellfleet ranked first in value of shellfish landings with Duxbury, Barnstable, Ipswich, and Essex rounding out the top five. As the state's third highest valued species, oyster landings drive these trends, followed by soft shell clam and northern quahog landings.

Striped Bass Tagging Program: 2022 was the ninth 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 7). Program staff estimated the 2022 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 ASMFC. Program staff were responsible for identifying any discrepancies and following up with dealers as needed.

Table 7. 2022 striped bass tagging statistics (as of June 2023)**.**

# of Dealers Receiving Tags	# of Tags Purchased by DMF	# of Tags Distributed	# of Tags Returned	# of Tags Used	# of Tags Missing
124	65,000	58,560	24,931	32,989	640

Tautog Tagging Program: 2022 was the third 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 8). 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 8. 2022 tautog tagging statistics (as of June 2023)**.**

# of Eligible Fishermen	# of Fishermen Receiving Tags	# of Tags Purchased by DMF	# of Tags Distributed	# of Tags Returned	# of Tags Used
210	145	35,000	33,850	10,788	23,062

ACCSP Participation and Planning

DMF staff continued to participate in all partner-based committees within ACCSP. Staff served on the Operations, 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 program 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, vessel monitoring (as described below) and the eTRIPS redesign project 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.

Vessel Tracking Projects: Work continued investigating cellular-based vessel monitoring systems (VMS), which carry lower costs and are just as effective for post hoc review of tracks from inshore waters, and even offshore waters, as compared to satellite-based systems. In early 2022, project staff completed and submitted the final report for ACCSP-funded pilot project, *Integration of Vessel Monitoring Systems and Electronic Reporting in SAFIS and SAFIS Applications Through API Development and Field Testing of Multiple Hardware Options*. The project focused on the integration of VMS data with eTRIPS Mobile and was done in collaboration with Rhode Island Division of Marine Fisheries (RIDMF), ACCSP, and Harbor Light Software.

In April 2022, work began on Phase 2 of this project, which primarily focused on building a VMS administrator interface, a tool necessary for the 2023 implementation of mandated VMS within the federally permitted lobster fleet as required by ASMFC (see below). This administrative tool was created within ACCSP's application suite to manage vessel tracking data, match vessel tracks with trip-level reports, and monitor vessel compliance with tracking regulations. The project staff gathered initial feedback from multiple ACCSP partners who reviewed the application and worked with approved vendors to test data submissions. The application was anticipated for release in April 2023.

Additionally, project staff created a survey to evaluate priorities for future geospatial capabilities of eTRIPS mobile including real time vessel locations, map features, and geofencing capabilities. This survey was planned for distribution to fishers in 2023 through the various ACCSP federal and state partners.

In early 2022, project staff worked with ASMFC to produce Draft Addendum XXIX to Amendment 3 to the Interstate Fishery Management Plan for American Lobster and Draft Addendum IV to the Jonah Crab Fishery Management Plan. The Addenda were approved in April 2022 and require approved vessel tracking devices be deployed on federally permitted lobster vessels by December 2023. The administration of vessel tracking devices will be conducted by vessels' principal port state fisheries agency. Additionally, project staff served on the committee for ASMFC tracking device approval. This work included reviewing the vendors' applications and, ultimately, three device types were approved, with two available to Massachusetts based permit holders.

In late 2022, Massachusetts began the process to implement regulations specifying requirements for Massachusetts based federal trap permit holders with public hearings and presentations to the MFAC. This established a start date for the Massachusetts-managed program as of May 1, 2023, and project staff began preparing by the end of 2022. Massachusetts will be the first state to implement the ASMFC mandated program with others following later in the year. 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.

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 2022, 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 staff working remotely. The project intends to modernize this platform in 2023 and 2024.

Oracle Database/Application Development & Maintenance: DMF continued to use three production Oracle databases and associated applications during 2022: Commercial Permits and Statistics; Lobster Sampling; and Shellfish Sampling & Area Management. The Aquaculture Permits application remained paused during 2022. EOEEA-IT initiated a project to redesign the current Oracle system and associated applications in late 2018; however, the project was paused throughout 2020 due to funding and time limitations from EOEEA-IT. The project resumed in early 2021 with a focus on the commercial and aquaculture permitting application and continued into 2022. The new permitting application is intended to include all details of commercial, seafood dealer, and special (e.g., aquaculture, propagation, scientific collection) permit categories, incorporate online credit card permit sales, in-office sales, reporting options, and administrative tools. However, the project scope was much broader than originally realized and important items were pushed to a second phase to begin in 2023, including certain permitting elements and the redesign of the sampling modules. As such, the permitting Oracle application was decommissioned at the conclusion of 2022, but the lobster and shellfish sampling and rainfall Oracle applications were still in use by DMF staff at the end of 2022.

Development of the new permitting application continued into 2022, with the first test environment release launched on May 5, 2022. A permitting lead, a statistics lead, and the CFO were heavily involved in the project and met with EOEEA-IT daily, often multiple times per day, throughout much of 2022. In the latter half of the year, the aquaculture permitting team joined these meetings as well. 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 was labor intensive and all permitting and statistics staff contributed. Additionally, a new data warehouse was developed in Oracle to accept a data stream from the new permitting SQL Server database. Development and testing of the data warehouse required weekly meetings with project staff familiar with Oracle and database design or management. The internal permitting application for commercial and seafood dealer permits and the data warehouse launched in production on January 6, 2023, and the older Oracle permitting application was made read only. This did not include the launch of the external facing module, but that was also expected in 2023.

Remote Work: In 2022, all staff were using mobile assets and Microsoft tools such as OneDrive, SharePoint, and Teams to work collaboratively and remotely. This ultimately supports the adoption of the hybrid work model implemented by the Commonwealth. Furthermore, inter-office collaboration has expanded given these tools.

SHELLFISH AND HABITAT SECTION

Shellfish Sanitation and Management Program

Personnel

Jeff Kennedy, Environmental Analyst V/Program Lead

Gloucester
Gregory Bettencourt, Environmental Analyst IV/Regional Supervisor
Florence Cenci, Bacteriologist III, Shellfish Lab Supervisor
Ryan Joyce, Biologist II
Devon Winkler, Biologist II (resigned March)
Melissa Campbell, Biologist II
Brooke Dejadon, Biologist II (beginning October)
Ashley Lawson, Bacteriologist I
Amber Woolfenden, Bacteriologist I (beginning June)

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

Newburyport
Diane Regan, Bacteriologist III/Shellfish Lab Supervisor
Jacob Madden, Bacteriologist I (beginning March)
Conor Byrne, Depuration Coordinator I/Process Area Supervisor
Richard Hardy, Wildlife Technician II (through April)
Peter Kimball, Wildlife Technician II
Rachel Tripp, Seasonal Laborer

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 Interstate Shellfish Sanitation Conference (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 2022, staff biologists completed 288 annual reports, 58 triennial evaluations, and 10 sanitary surveys (Table 9). Thirty-one conditional area management plans were re-evaluated. A total of 7,970 water samples were collected and analyzed for fecal coliform bacteria from 249 shellfish growing areas in 64 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 9. Summary of 2022 shellfish growing area report and sampling activity.

	North Shore	South Shore	Total
Annual Reports	34	268	288
Triennial Evaluations	6	50	58
Sanitary Surveys	0	10	10
Management Plans/MOUs Reviewed	20	11	31
Total Water Samples	2,293	6,838	9,131
Classification Station Water Samples	2,199	6,522	8,721
Pollution Source Water Samples	52	316	368
Ad-hoc Water Samples	42	0	42
Shellfish Growing Areas Sampled	20	229	249
Classification Sub-Areas sampled	104	558	662
Cities/Towns Sampled	19	45	64

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 towards 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 or seasonally poor water quality or other predictable events. When open, it is treated as an Approved area.
3. RESTRICTED: Contains a limited degree of contamination at all times. In Massachusetts, when open, with a contaminated relay permit, shellfish can be relayed by municipalities to a less contaminated area (Approved or Conditionally Approved) for natural contaminant reduction.
4. CONDITIONALLY RESTRICTED: Contains a limited degree of contamination at all times, subject to intermittent pollution events and may be closed some of the time due to rainfall or seasonally poor water quality. In Massachusetts, when open, only softshell clams may be harvested by Master/Subordinate Diggers for depuration at the DMF Shellfish Purification Plant.
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.

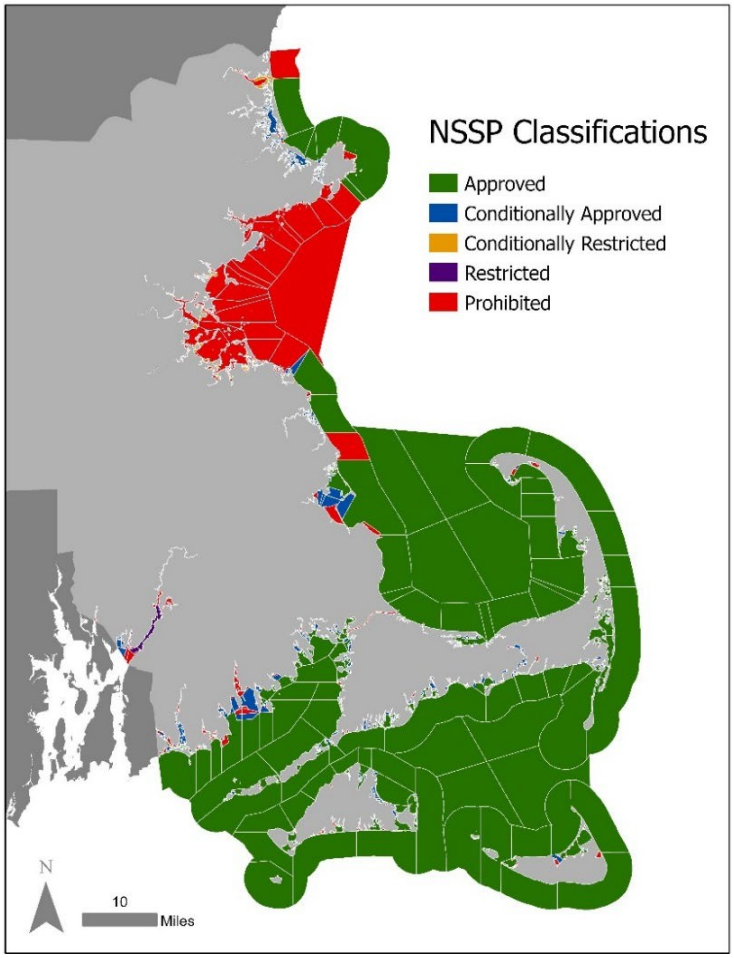


Figure 8. 2022 NSSP classification map of MA waters.

In 2022, a total of 1,743,996 acres were assigned a Classification (Figure 8, Table 10). The total acreage of Approved and Conditionally Approved areas decreased, and total acreage of Restricted and Prohibited areas increased in 2022. Many 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 2002 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.

Notification: A legal notice is required for each change in a shellfish growing area's classification or status. These notices reflect the type of opening or closure, the dates, the reason, and other pertinent descriptive information. Copies are sent to municipal managers, Massachusetts Environmental Police (MEP), Massachusetts Department of Public Health (*Mass*DPH), USFDA, and other interested parties. In 2022, staff generated 284 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 10. Change in Massachusetts shellfish growing area classification, 2021 to 2022.

Area Classification	Acreage		
	2021	2022	Change
Approved	1,445,489	1,445,235	-254
Conditionally Approved	34,566	34,559	-7
Restricted	2,525	2,541	17
Conditionally Restricted	4,430	4,430	0
Prohibited	256,985	257,229	244
Total	1,743,996	1,743,996	0

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 9.)

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

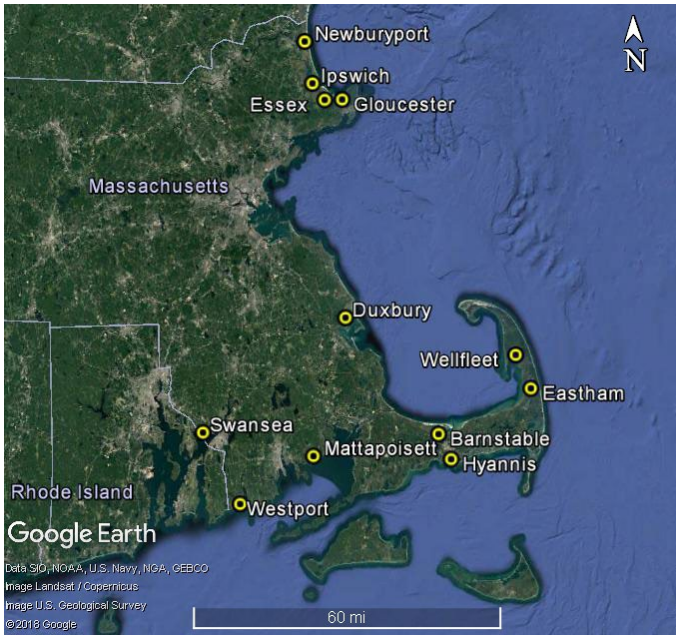


Figure 9. Map of primary phytoplankton monitoring stations.

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 2022, 240 phytoplankton samples were collected at primary stations for analysis at the New Bedford office. An additional 65 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 (720 cells/L) was detected in the Nauset System on Cape Cod late December of 2021 with steady presence observed through June 2022. Peak concentration of >89K cells/L was observed on April 12 which was a month earlier than the cell peak in 2021. This was the first documentation 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 (37-45°F) and low likelihood of substantial shellfish pumping activity. *Alexandrium* bloomed a second time in 2022 at DMF's Swansea primary station from March 27–May 9 with observed peak concentration reaching 2,070 cells/L in late April. Quahogs and softshell clam were tested with results below the limit of detection. No closure was required.

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 this year. On three occasions, abundances of *Pseudo-nitzschia* exceeded 30,000 cells/L: Wellfleet Harbor (>42K cells/L) in January, Nauset (>281 cells/L) in March (system was already closed due to PSP), and Swansea (>107K cells/L) in April. Oysters and quahogs from Wellfleet were tested by the Rhode Island State Health Laboratory and only trace amounts of toxin were detected. Replicate Scotia rapid screening kits for ASP were used to test water samples from Nauset and Swansea and results were negative for both. In all cases the *Pseudo-nitzschia* blooms subsided in the following week and 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. Unfortunately for aquaculturists and wild harvesters in the Nauset System, a month after reopening from a prolonged PSP closure the area was closed for another two months due to DSP. This summer bloom discolored the water and peaked at >725 cells/L of *Dinophysis acuminata* on July 13. Samples were sent to the USFDA lab in Maryland for analyses and DSP toxins were detected in oysters, quahogs and blue mussels, but only quahogs and blue mussels had toxin levels near or exceeding the closure action level.

Noteworthy blooms of *Karenia papilionacea* occurred in Swansea in April and Nauset and Mattapoisett in late August. This is the same genus responsible for the Florida red tide which can produce brevetoxins and cause Neurotoxic Shellfish Poisoning (NSP). This particular species of *Karenia* has only been associated with low levels of toxin production. Oysters, quahogs, and water samples were sent to the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute and while the organism was positively identified as *K. papilionace*, all shellfish and water samples were negative for brevetoxins.

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* sp. These observations are noteworthy given the recent communications from aquaculturists of high seed mortality.

North Shore biologists collected 188 samples from the four primary regional stations in Newburyport, Ipswich, Essex, and Gloucester. One additional sample was collected from Deer Island during the end of June to determine if the bloom was on its way into Boston Harbor. In 2022 we began seeing low numbers of *Alexandrium*-like cells in north shore stations for a week or two mid-April, but there was no associated toxicity leading us to believe these were a non-toxic look-alike. Cell counts began rising in mid-May and during this time we began seeing toxicity in shellfish meat samples (see Paralytic Shellfish Poisoning Monitoring Section). Cell

counts of *Alexandrium* peaked mid-June with a maximum of about 5 thousand cells per liter on June 17 at our Newburyport station. Through July, cell counts started declining but there was another smaller bloom at the beginning of August. We observed varying abundances of both small and large *Pseudo-nitzschia* cells throughout the year, however, nothing in large enough concentrations to warrant concern. *Dinophysis* cell concentrations were relatively low throughout the year except for a spike that coincided with the *Alexandrium* bloom. We saw *Karenia mikimotoi* again briefly in 2022, but lower concentrations than previous years and for a shorter period. There were no other noteworthy species seen on the North Shore in 2022.

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. Blue mussels are used as our sentinel species. Blue mussels act as a "canary in the coal mine" because they tend to take up and bioaccumulate toxins quicker than other shellfish species. Consumption of shellfish containing high levels of PSP toxin can cause severe illness and even death. 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 (Figure 10). A total of 404 shellfish samples from state waters were processed for PSP during 2022, plus eight mussel samples collected by Salem State University in federal waters. Unfortunately, the Salem State University mussel site was damaged beyond repair presumably by errant ship traffic and cannot be utilized by Salem State or DMF for biotoxin monitoring in the future.

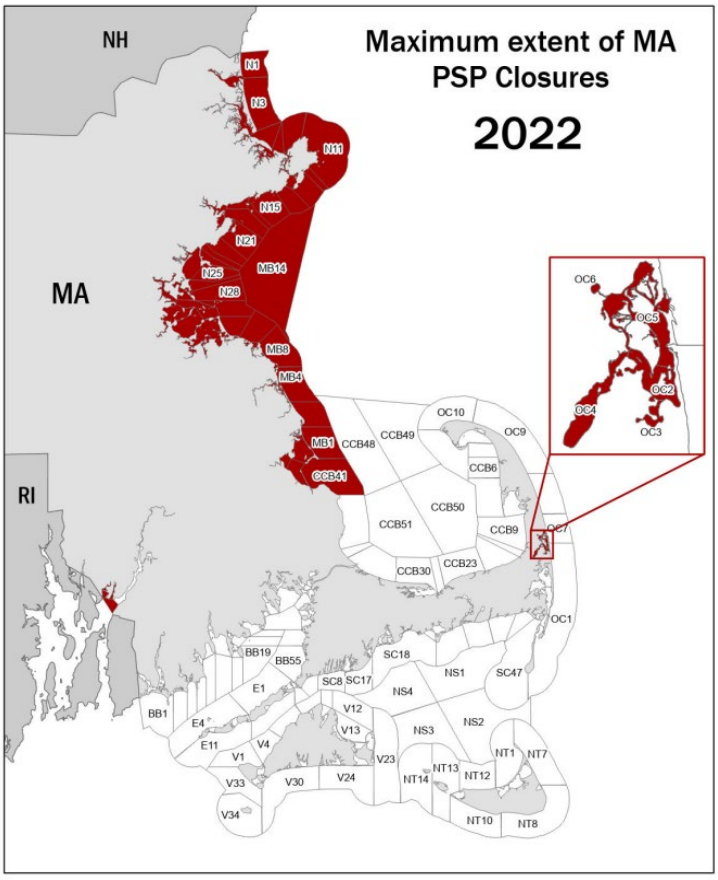


Figure 10. Map of 2022 PSP Closures

A PSP closure of the Nauset system is a nearly annual event, whereas PSP closures elsewhere occur more sporadically. In 2022, the Nauset system closure was issued on April 14 and remained in effect for all areas in Nauset until June 3 except for Salt Pond which reopened the following week on June 10. A precautionary PSP closure was put in place on April 13 in Swansea due to the high Alexandrium cells counts. Softshell clam and quahog samples were tested for PSP toxins and both results were below the limit of detection and the areas reopened the following day on April 14. This bloom did not result in a toxicity closure, but is noteworthy as it is unprecedented, or at least undocumented, for the South coast area to experience a bloom not related to a large regional event originating in the Gulf of Maine.

In recent years, the north shore and particularly south 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. In addition, the upper north shore is responsible for the majority of softshell clam landings in Massachusetts with PSP closures significantly impacting statewide totals during the summer season when most softshell clam landings occur. 2022 was another anomalous year for north and south shore PSP blooms. Historically the onset of Gulf of Maine closures would first impact North Shore areas on the third week of May, and if the bloom made it around Cape Ann would impact areas south of Boston Harbor in one-to-two weeks' time. Most closures would be lifted by the end of June. The 2022 Gulf of Maine PSP season in Massachusetts began later, in June and persisted through July, finally wrapping up in September.

On June 14, all areas from the New Hampshire border to the Gloucester/Manchester municipal boundary (areas N1–N14) were closed to the harvest of mussels, followed by a closure for all species on June 16. A week later on June 23, the closure for the harvest of blue mussels was extended south to Manomet Point in Plymouth. On July 7, Essex Bay N7 reopened for the harvest of softshell clams, followed on July 13 with a reopening of N4, N5 and N6, Plum Island Sound, Ipswich River and Cranes Beach for softshell clams. On July 14, the blue mussel closure was lifted in Duxbury, Kingston, Marshfield, and Plymouth. On July 21, North Shore areas (all N designations except N2) from New Hampshire through Gloucester reopened to all shellfish except surf clams, ocean quahogs, and carnivorous snails. On July 27, all shellfish except carnivorous snails and whole sea scallops reopened in Massachusetts Bay areas (MB designations) from Boston to Plymouth. The Merrimack River area N2 reopened for the harvest of softshell clams on July 29. All remaining Boston Harbor and North Shore PSP closures were lifted by mid-September. 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*) and American oysters (*Crassostrea virginica*) were the only species transplanted throughout 2022 (Tables 11 and 12). A single dredge boat was contracted by nine towns and permitted for contaminated relay activities, with all quahogs originating from the Taunton River. Prior to harvest, shellfish veterinary disease monitoring was conducted on quahogs from several locations within the donor site (pathology conducted by Kennebec River Biosciences in Richmond, Maine). While relay harvesting in the Taunton River typically commences in late April, it was delayed until May 2 in 2022. As a result, 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 and harvest. The dredge boat harvested a total of 8,680.5 bushels of quahogs for the nine communities during the season which ended on November 9 when all orders were filled.

Table 11. 2022 Municipal Relays of contaminated quahogs.

Harvest Site	Receiving Municipality	Transplant Site	Classification Area	Bushels	Last Day Planted
Taunton River	Truro	Pamet Harbor	CCB7.1	300	May 27
Taunton River	Dennis	Bass River Center	SC34.23	60	June 13
Taunton River	Wellfleet	Inner Harbor & Harbor	CCB11.20, 12.5, 13.21	1,299	June 30
Taunton River	Swansea	Outer Cole River	MHB4.12	300	July 8
Taunton River	Fairhaven	Round Cove	BB18.20	600	July 28
Taunton River	Sandwich	Sandwich Harbor	CCB37.0	300	Aug 18
Taunton River	Yarmouth	Lewis Pond	SC31.2	671	Sept 16
Taunton River	Mattapoisett	Shining Tides	BB25.12	150	Oct 5
Taunton River	Westport	West Branch	BB3.27	1,109	Oct 26
Taunton River	Westport	East Branch	BB4.17, 4.21, 4.22	3,889	Nov 9

Table 12. 2022 Municipal Relays of American oysters.

Harvest Site	Receiving Municipality	Transplant Site	Classification Area	Count	Last Day Planted
Falmouth DPW	Falmouth	West Falmouth Harbor	BB54.24, 54.25	381,000	March 31

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 and critical 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, as well as out-of-state in Maine, 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.

Throughout 2022, the Purification Plant received clams on 142 days out of the year. The plant allowed harvesters to dig five days per week. The total number of days harvested decreased by six. The Purification Plant saw a decrease in overall racks processed for depuration. Four Master Digger Permits were active throughout the year. The plant saw an increase in areas frequented by harvesters in 2022. In the last three years, the plant has processed 3–9% of all softshell clam landings in Massachusetts.

The Shellfish plant was shut down for all of June and part of July due to an issue with the last remaining, functioning saltwater well. This prolonged shutdown severely curtailed total annual plant production, impacting all depuration areas (Merrimack River, Pines River, and all of Boston Harbor. When the plant opened for business in late July the frequency of tropical systems moving through the area resulted in numerous

overlapping closures due to excessive rainfall. The number of racks brought into the plant for depuration fell by 68% compared to the previous year. In previous years the period of May through August has produced a majority of landings compared to the remaining 8 months. Had it not been for an extraordinarily wet season, following the closure due to the saltwater well failure, plant production would likely have remained even with 2021 levels or increased slightly and not seen such a dramatic decrease in shellfish processed.

Shellfish Purification Plant Laboratory

The Shellfish Purification Plant's laboratory analyzed 346 shellfish samples from the 142 lots of shellfish received at the Plant. The samples were analyzed for fecal coliform in compliance with federal and state depuration standards. In addition, 604 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 187 shellfish and water samples for the presence of Male Specific Coliphage (MSC). MSC is a virus of E. coli and is utilized to indicate when an increased risk of Norovirus or other human viral pathogens may be found in shellfish and shellfish waters. The plant's MSC testing included 43 wastewater treatment samples tested at the influent, pretreatment, and effluent stages processed in conjunction with the DMF New Bedford laboratory for fecal coliform assessment.

The Newburyport laboratory continued its collaboration with the New Hampshire Department of Environmental Services analyzing for MSC in New Hampshire shellfish and environmental waters. In April 2021, the plant laboratory in partnership with Gloucester Marine Genomics Institute of Gloucester, MA received an Innovation Grant from the Seaport Economic Council to assess the relationship of MSC in shellfish with the risk of Norovirus through the utilization of specific genetic tools. The laboratory work ended in March of 2022 and data analysis and writing commenced to ensure public health measures and the safe promotion of the shellfish economy of Massachusetts' coastal communities. For the seventh year, the Purification Plant laboratory participated in DMF Vibrio parahaemolyticus (Vibrio) assessments used to determine Vibrio management plan protocols. The Newburyport laboratory received frozen samples processed from the DMF New Bedford laboratory. These were analyzed by qPCR for total and pathogenic Vibrio. Plant laboratory staff successfully participated in the FDA regulatory proficiencies for water and shellfish. At the end of February, a full-time bacteriologist was hired for the Shellfish Purification Plant laboratory to assist in maintaining the laboratory 7 days a week. 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.

Shellfish Restoration and Mitigation in Buzzards Bay

Buzzards Bay Shellfish Restoration Project: In April of 2003, the grounding of the B-120 oil barge, owned and operated by the Bouchard Transportation Company, resulted in an estimated 98,000-gallon oil spill in Buzzards Bay. Federal and state Trustee representatives were tasked, through the Natural Resource Damage Assessment process, with managing and supporting restoration of natural resources and mitigating resource use injuries.

Restoration planning was completed in 2014, and injuries to shellfish resources and the recreational shellfishery were among those addressed. In partnership with nine Buzzards Bay communities, DMF was selected by the B-120 Buzzards Bay Trustee Council to implement specified restoration strategies.

As a result, DMF oversaw a six-year program to restore shellfish resources and benefit public recreational shellfishing through three activities: 1) quahog broodstock relocation from bacterially contaminated waters in the Taunton River to designated transplant sites within the municipal waters of Bourne, Dartmouth, Fairhaven, Gosnold, Marion, Mattapoisett, New Bedford, Wareham, and Westport; 2) quahog seed grow-out and planting within the municipal waters of Wareham, Dartmouth, and Fairhaven; and 3) oyster seed grow-out and planting within the municipal waters of Bourne, Marion, and Wareham. DMF worked collaboratively with the Trustees

and town shellfish departments on all aspects of these projects (see prior year Annul Reports for more information). In 2022, Shellfish Program staff completed a six-year Final Report submitted to the Buzzards Bay Trustees.

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.

Town	License Sites	Acres
Eastham	6	6
Mattapoisett	1	0.37
Plymouth	1	4
Provincetown	1	1
Tisbury	2	2.1
Wellfleet	6	15.6
Yarmouth	1	3
Total	**18**	**32.07**

Table 13. New License Certifications in 2022.

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, the agency may deny certification or require the town to condition the license to minimize such impacts.

In 2022, Project staff certified 18 sites for new shellfish aquaculture licenses or extensions to existing sites. This involved surveying 32.07 acres of tidelands (Table 13). Staff also conducted an eelgrass survey of Cohasset Harbor in the Town of Scituate.

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 2022, DMF issued shellfish propagation permits to 395 private shellfish aquaculture license site holders (Table 14), and 30 municipalities (for public propagation activities) operating shellfish aquaculture projects in 37 coastal municipalities throughout the Commonwealth. A total 1358.3 acres were licensed for private shellfish aquaculture. In 2022, DMF also issued six aquaculture permits for the culture of the non-bivalve including species 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. 2022 private aquaculture and shellfish propagation permits and acreage under cultivation by municipality.

Municipality	# Permit Holders*	Acres**	Species Grown
Aquinnah	1	2.6	Quahog
Barnstable	52	158	Oyster, Quahog, Softshell Clam, Surf Clam
Bourne	8	17	Oyster, Quahog, Softshell Clam, Bay Scallop, Sugar Kelp
Brewster	11	11.5	Oyster, Quahog, Softshell Clam, Surf Clam
Chatham	3	7	Oyster, Quahog, Sugar Kelp
Chilmark	8	20	Oyster, Blue Mussel
Dartmouth	2	1	Oyster
Dennis	23	32	Oyster, Quahog, Softshell Clam, Surf Clam
Duxbury	30	79.1	Oyster, Quahog, Softshell Clam, Surf Clam, Bay Scallop, Sugar Kelp
Eastham	27	49.6	Oyster, Quahog, Softshell Clam, Surf Clam
Edgartown	12	20	Oyster
Fairhaven	4	44	Oyster, Quahog
Falmouth	9	54	Oyster, Quahog, Surf Clam, Bay Scallop, Sugar Kelp, Horseshoe Crab
Gosnold	1	32	Oyster
Harwich	2	0.01	Bay Scallop, Sugar Kelp
Ipswich	1	1	Soft Shell Clam
Kingston	3	8.5	Oyster, Quahog
Marion	3	1.5	Oyster, Quahog
Mashpee	4	19	Oyster, Quahog, Bay Scallop
Mattapoisett	3	60.4	Oyster, Bay Scallop
Nantucket	7	73	Oyster, Quahog
Oak Bluffs	2	4	Oyster, Quahog, Sugar Kelp
Orleans	13	18.5	Oyster, Quahog, Blue Mussel, Surf Clam
Plymouth	37	81.5	Oyster, Quahog, Softshell Clam, Surf Clam, Bay Scallop
Provincetown	15	40	Oyster, Quahog, Softshell Clam, Surf Clam
Rowley	2	24	Oyster, Quahog, Softshell Clam
Tisbury	2	4.0	Oyster, Bay Scallop
Truro	4	20	Oyster
Wareham	7	83	Oyster, Quahog
Wellfleet	93	267.6	Oyster, Quahog, Softshell, Surf Clam, Blood Arc
Westport	6	80	Oyster, Quahog
Yarmouth	6	36	Oyster, Quahog
Grand Total	**401**	**1358.3**	

*Permit holders category includes private shellfish propagation permit holders and non-bivalve aquaculture permit holders
**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 continues to dominate the aquaculture industry in Massachusetts. Landings value of aquacultured oysters in 2022 increased by over 5% compared to 2021. Quahog aquaculture revenue continued to be dominated by landings from growers in Barnstable and Wellfleet and increased by 15% from 2021, to $1,509,600 in 2022. The value of other cultured shellfish species including bay scallops, softshell clams, surf clams, and kelp does not substantially add to aquaculture landings value and are not reported here due to confidentiality issues.

Table 15. 2022 Aquaculture Landings and Value for Oysters and Quahogs.

Eastern Oyster		
Town or Region	**Pieces**	**Reported Value**
Barnstable	10,569,020	$5,990,588
Brewster	875,024	$511,245
Dennis	2,357,253	$1,337,955
Duxbury	13,272,343	$7,527,949
Eastham	1,557,719	$879,224
Edgartown	1,861,885	$1,129,609
Falmouth	1,393,387	$744,238
Nantucket	735,350	$673,576
Orleans	713,900	$425,184
Other Buzzards Bay Towns	3,013,178	$1,580,421
Other Cape Cod Towns	853,201	$506,840
Other Island Towns	476,719	$393,828
Plymouth/Kingston	2,094,612	$1,132,031
Provincetown	134,532	$81,436
Rowley	*	*
Truro	173,150	$104,911
Wareham	1,296,250	$764,293
Wellfleet	12,038,053	$6,892,352
Yarmouth	853,100	$481,439
TOTAL	**54,268,676**	**$31,157,117**
Quahog		
Town or Region	**Pieces**	**Reported Value**
Barnstable	1,584,531	$477,521
Duxbury/Mashpee/Orleans	92,599	$33,572
Eastham	115,894	$39,950
Wellfleet	3,087,702	$958,556
TOTAL	**4,880,726**	**$1,509,600**
Total Aquaculture Landings Value		**$32,666,717**

*Confidential data; totals reflect only displayed values. Source: SAFIS Dealer Reports on April 13, 2023 and staff edits.

In September of 2022, after years of interagency coordination, Shellfish Program staff and the Massachusetts Environmental Policy Act (MEPA) office implemented a one-year pilot Shellfish Aquaculture Special Review Procedure (SRP). The SRP is intended to reduce the administrative and applicant burden and increase the efficiency of MEPA review for the majority of new shellfish aquaculture projects subject to DMF certification that have predictable and minimal individual impacts.

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), MIT Sea Grant Aquaculture Advisory Panel (MITSGAAP) and Atlantic States Marine Fisheries Commission (ASMFC) Aquaculture Committee; 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.

No major changes were made to the *Vibrio* regulations or Vibrio Control Plan in 2022. The only change to the Plan involved stating and clarifying that there is an allowance for wholesale dealers to take on the burden of initial icing at the landing provided the lot is adequately iced within the time to icing required for the harvest area.

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

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

The *Vibrio* Control Season in Massachusetts currently runs from May 19 to October 19, when the risk of *Vibrio* infection 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 workshops. DMF and *Mass*DPH continually evaluate the effectiveness of *Vibrio* controls and work with industry and other stakeholders to make improvements and incorporate state-specific data where possible. With the exception of the pandemic anomaly in 2020, oyster landings have steadily increased over the last decade but the number of illnesses per million oysters landed have remained relatively constant since 2016 (Figure 11).

*Mass*DPH and DMF investigated 47 confirmed *Vibrio* illnesses involving consumption of shellfish in 2022. There were 16 Massachusetts single-source (traced to a single shellfish growing area) *Vibrio* illnesses in 2022 (Table 16) that included both confirmed *Vibrio parahaemolyticus* and cases that utilized culture independent diagnostic

testing (CIDT) which confirms *Vibrio* but does not identify species. All but one of the single-source illnesses involved consumption of raw oysters. The single case that involved quahog consumption was recreationally self-harvested. Katama Bay (V20) in Edgartown and Duxbury Bay (CCB45) continue to lead with the most single source illnesses (each with three confirmed *Vp* and one *Vibrio* species). One single-source case traced back to a Buzzards Bay growing area (BB37) and six cases were harvested from various Cape Cod growing areas (CCB11, CCB14, CCB23, CCB31 and SC49 (x2)). Seven multi-source illness tracebacks involved oysters from only MA growing areas, nine cases implicated both in-state and out-of-state growing areas, and six illnesses involved only out-of-state oysters. Despite the substantial efforts made in Massachusetts to curb *Vibrio* illness, the Plymouth, Kingston, and Duxbury three bay system (CCB42, 43, 45) and Katama Bay (V20) on Martha's Vineyard continue to be annually implicated in single-source illness tracebacks. Those areas have a shorter window of one hour between harvest and icing from July 1 to September 15.

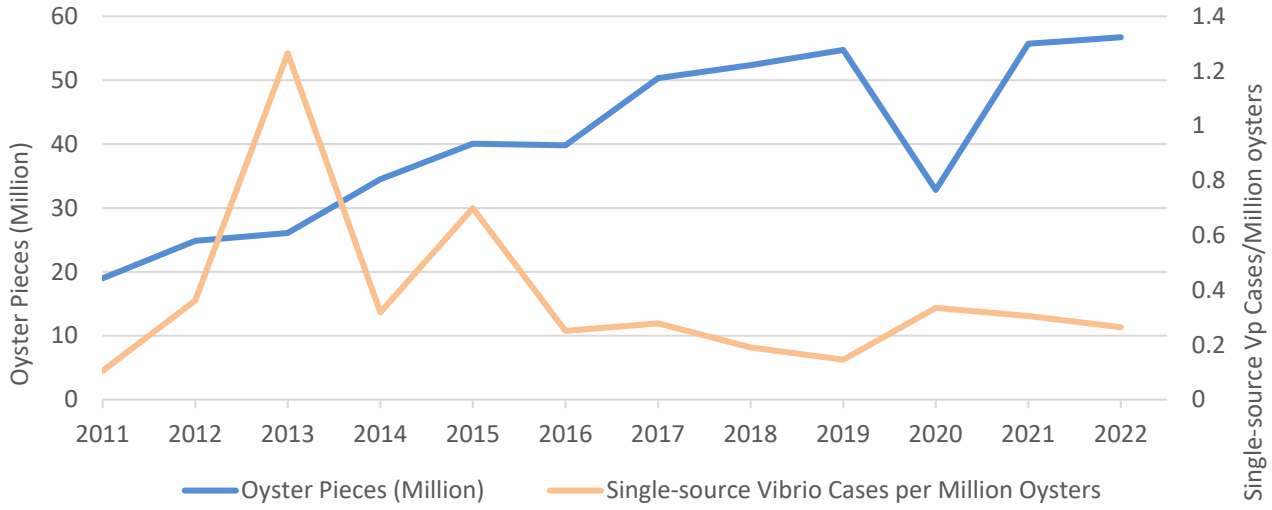


Figure 11. Trends in *Vibrio* Illnesses Relative to Quantity of Oysters Landed.

DMF conducted a *Vibrio* surveillance time series for the entire *Vibrio* season at four locations (Duxbury/ Plymouth, Wellfleet, Wareham and Edgartown) most consistently associated with *Vibrio* illness to compile background data and inform future *Vibrio* management decisions. Analyses included total *Vibrio* abundance and presence of genes associated with pathogenicity in the targeted shellfish growing areas. There was great variability in total *Vp* abundance, and total *Vp* was only loosely correlated with the presence of potentially pathogenic *Vp* genes *tdh* and *trh*. Collaborators at the University of New Hampshire will be conducting genetic analyses to determine which *Vibrio* strain types were present in those samples.

Other Activities

Staff participated in professional organizations and meetings including the Shellfish Advisory Panel, the Massachusetts Shellfish Officers Association, the 2022 Northeast Aquaculture Conference & Exposition, the 41st Milford Aquaculture Seminar, 2022 Ocean Sciences Meeting, and several in-state conferences (e.g., Plymouth Blue Future Conference).

In 2022, DMF applied for and was awarded a fourth FDA Milk and Shellfish Grant to purchase shellfish program equipment. DMF used the $30,000 received to purchase needed supplies and equipment for the laboratory, aquaculture, and classification projects. Lab equipment and supplies consisted of three different micrometers for the microscope, biotoxin testing kits for PSP, DSP, and ASP with the ELISA plate reader for reading results,

timers, a circulating water bath, three different kinds of pipettes and pipette tips, thermometers, filter funnels, an incubator, a four-burner stirring hot plate, a freezer, bone snips, and a float coat. The Aquaculture project obtained Hobo MicroRX temperature monitoring stations and smart temperature sensors from Onset while Classification obtained a GPS, plotter/fish finder, and a float coat. DMF is grateful for the support of the FDA, ISSC, NCIMS, and AFDO National Shellfish Sanitation Grant Program for providing over $65,000 to the Shellfish Sanitation and Management Program in capital and educational funding.

In February 2022, a team of individuals from DMF, the Massachusetts Shellfish Officers Association (MSOA), and MA Environmental Police (MEP) planned on offering a two-week, in-person Shellfish Constable training course at the Massachusetts Maritime Academy. The course was cancelled due to the COVID pandemic. Acknowledging that many registrants for the course had been waiting three years for certification, the Director requested that the MSOA planning team reconsider and proposed sponsoring an all-virtual certification option. The planning team reviewed online options, revised, and condensed training materials, and designed a virtual, webinar type certification course which was held March 7–March 28. The revised virtual training occurred Monday through Friday, for approximately four hours per day, culminating in a final exam. Forty-seven Shellfish Constables and Deputy Shellfish Constables from across the Commonwealth successfully completed the course and received certificates. Sixty presenters from a variety of state, county and federal agencies, educational institutions, and non-profit organizations gave presentations on a wide spectrum of topics. DMF and MSOA staff are working on the development of a similar on-line training module for use in early 2025.

Pursuant to Chapter 363 of the Acts of 2020, DCAMM, in consultation with the Department of Fish and Game through DMF established a 15-year lease with Martha's Vineyard Shellfish Group (MVSG) in October 2022 for continued use of the John T. Hughes Hatchery and Research Station located in Oak Bluffs on Martha's Vineyard. MVSG continues to adapt portions of Hughes Hatchery to increase capacity for culturing larval and post-set shellfish, microalgae, and eelgrass. Hughes Hatchery primarily functions as an overflow space to culture shellfish spawned at MVSG's other two shellfish hatcheries in Vineyard Haven and on Chappaquiddick Island. In 2022, Hughes Hatchery became the primary office space for three full-time staff, an additional space to culture algae, and remained the hub of the island's only shell recycling program for the seventh consecutive year. Culture activities in the main building and two greenhouses continue to include larval culture of bay scallops and oysters, nursery grow-out of quahogs and oysters in land-based upweller silos, tanks and tables, utilizing fresh seawater and aeration from Lagoon Pond. The greenhouses also support eelgrass propagation research and spawning of ribbed mussels for saltmarsh restoration on the island. In 2022, MVSG distributed around 25 million bay scallop, oyster, and quahog seed to the island's six towns.

The Shellfish Program also participated in the US Department of Agriculture funded bivalve surveillance program administered by the Animal and Plant Health Inspection Service. Softshell clam samples from the Annisquam River and Weir River on the north shore and the Cole River in Swansea on the south coast were all negative for shellfish diseases, though a small percentage of animals in all three locations showed minor metazoan parasitic infection.

*Mass*DMF in collaboration with *Mass*DEP, *Mass*DPH, and Bourne and Wellfleet Department of Natural Resources conducted shellfish sampling for PFAS in the winter and spring of 2022. Per-and polyfluoroalkyl substances (PFAS) are a group of chemicals that are anthropogenically sourced and have been used in a wide variety of consumer products. PFAS can be harmful to human health and is known for its perpetual existence in the environment, labeling it as a forever chemical. Shellfish samples were collected in Hen Cove (BB49) and Wellfleet Harbor (CCB11) and tested for PFAS in a *Mass*DEP sourced laboratory. Results from the study will be communicated in a final report from *Mass*DEP.

Habitat Program

Personnel

Mark Rousseau, Program Manager

Gloucester
Tay Evans, Marine Fisheries Biologist (through October)
Kate Frew, Marine Fisheries Biologist
Dr. Forest Schenck, Marine Fisheries Biologist
Iris Seto, Contract Technician (beginning in April)

New Bedford
Dr. John Logan, Marine Fisheries Biologist
Simonetta Harrison, Offshore Wind Specialist (through July)
Steve Voss, Marine Fisheries Biologist
Amanda Davis, Marine Fisheries Biologist (beginning in February)
Emma Gallagher, Contract Assistant
Kerri Goncalves, Contract Assistant (through June)
Luis DeLuna, High School Intern (July through August)

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. Projects from the Town of Hull north to the New Hampshire border are reviewed by program staff stationed at the Annisquam River facility, while South Coast office staff review projects from the Town of Cohasset south to the Rhode Island border, including the Islands.

In 2022, staff reviewed 841 permit filings associated with 593 projects in 93 municipalities (Figure 12). Of these, 369 were new projects, which is consistent with the average of 387 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; 230 (39%) projects were specific to replacements or repairs of previously permitted structures. For example, 88/122 hardened shoreline, 80/210 residential docks, and 42/68 commercial/public docks projects addressed the replacement of existing structures. Of all projects reviewed, 116 projects occurred in or near salt marsh (20%) and 31 in or near eelgrass (5%) habitats. In 2022, DMF recommended time of year restrictions

(TOYs) for 188 (22%) projects and received waiver requests for three of those projects.

Notable projects reviewed in 2022 include Eversource submarine cable in Vineyard Sound and Monatiquot River restoration including the removal of Armstrong Dam. Major dredging projects included Merrimack River and the Town of Harwich townwide maintenance dredging plan. Erosion control and nourishment projects included Plymouth Long Beach, Great Island Road in Yarmouth, and Cliff Road in Scituate at the entrance of the North River. Information about offshore wind and supporting onshore infrastructure projects are outlined below (page 54).

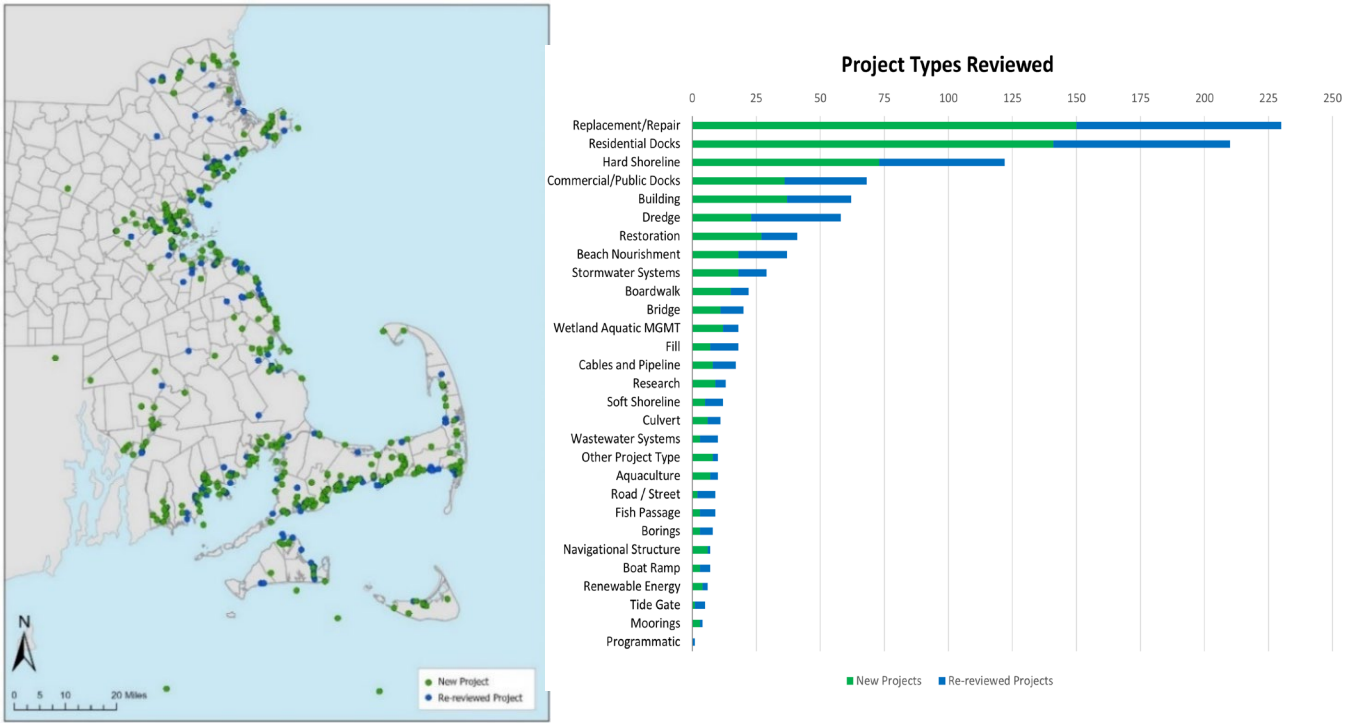


Figure 12. Coastal alteration projects reviewed in 2022 by location (left) and type (right). A single project can include multiple project types.

Data Management

Data management and archiving are important parts of Technical Review. Program staff continue to improve these systems as technologies improve. In 2022, Habitat Program staff working with the *Mass*DFG GIS Team developed a user-friendly tool for project reviewers to log and track project review, and to replace two Microsoft Access databases (one in each field office) that were being phased out of service. The new cloud-based user interface combines ArcGIS Online data, a dashboard, and Survey123 forms, and can be accessed and edited by multiple users simultaneously. The DMF Review Database (v. 2.1) tracks 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 17).

Table 17. Number of applications or documents reviewed by Habitat staff in 2022.

Review Document	Permit Associated	Number of Documents Reviewed	Agency that Comments are Due To
Notice of Intent	Order of Conditions	364 (43%)	City/Town Conservation Commission
Public Notice of Chapter 91 Waterways License or Permit Application	Waterways License or Permit	196 (23%)	MA Department of Environmental Protection (DEP)
Preconstruction Notification Form	General Permit	90 (11%)	U.S. Army Corps of Engineers (ACOE)
Environmental Notification Form	Secretary's Certificate*	74 (9%)	MA Environmental Policy Act (MEPA) Office
Notice of Project Change		25 (3%)	MEPA Office or ACOE
Environmental Impact Report or Reviews**		24 (3%)	MEPA Office
Public Notice	Individual Permit	10 (1.2%)	ACOE
401 Water Quality Certification Public Notice	401 Water Quality Certification	5 (0.6%)	DEP
Other (information or pre-app meeting requests)		53 (6%)	

*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 2022, 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 59; 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.

Offshore Wind

In 2012, the Bureau of Ocean Energy Management (BOEM) established two Wind Energy Areas (WEAs) south of Martha's Vineyard and Nantucket. By 2021, these WEAs had been divided into nine Lease Areas held by eight developers. Projects in these WEAs, including three in the Rhode Island–Massachusetts area and six in the Massachusetts area, were undergoing varying stages of site assessment and permit review in 2022 (Table 18).

In 2022, four Notices of Intent (NOI) to prepare Draft Environmental Impact Statements (DEIS) were submitted for Revolution Wind, New England Wind, Sunrise Wind, and SouthCoast Wind (formally Mayflower Wind). Vineyard Wind 1 and South Fork were the nation's first and second commercial-scale offshore wind projects to receive Records of Decision approving project construction and operations, respectively.

Table 18. Leasing & Permitting Status of Massachusetts and Rhode Island Wind Energy Areas (WEAs)[1,2]

Lease Number	Project Name	Developer(s)	Site Assessment Plan Status	Construction and Operations Plan Status	Environmental Impact Statement Status	Record of Decision Status
RI OCS-A 0486	Revolution Wind	Ørstead/ Eversource	Approved	Submitted	Draft EIS (DEIS)	N/A
RI OCS-A 0517 (Formerly 0486)	South Fork	Ørstead/ Eversource	Approved	Approved	Final Published	Approved
RI OCS-A 0487	Sunrise Wind	Ørstead/ Eversource	Extension Approved	Submitted	DEIS	N/A
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	DEIS	N/A
MA OCS-A 0501	Vineyard Wind 1	Avangrid/ Copenhagen Infrastructure Partners	Approved	Approved	Final Published	Approved
MA OCS-A 0520	Beacon Wind	Equinor/BP	Approved	N/A	N/A	N/A
MA OCS-A 0521	SouthCoast Wind	Energias de Portugal Renováeis/Shell	Approved	Submitted	DEIS	N/A
MA OCS-A 0522	Vineyard Wind – Liberty Wind	Copenhagen Infrastructure Partners	Approved	N/A	N/A	N/A

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

DMF continued its participation in multiple wind-energy activities, including conducting technical review of projects in the Massachusetts WEA, attending workshops and webinar series focused on offshore wind research and monitoring priorities, and fulfilling advisory roles for research and stakeholder engagement efforts. In 2022, the Habitat Team 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. Cable projects in Massachusetts state waters associated with the WEA that underwent environmental review in 2022 included Park City Wind's New England Wind 1 Connector project and Commonwealth Wind's New England Wind Connector 2 project, both with landfall in the Town of Barnstable. The cable component with a targeted Falmouth landfall for the Mayflower Wind SouthCoast project also underwent environmental review in 2022, with the accompanying cable with a Somerset landfall targeted for 2023 review. Topics of concern included impact-producing factors associated with project construction, species vulnerabilities in Nantucket Sound, benthic and finfish monitoring design, and compensatory mitigation for affected fisheries. DMF also reviewed permit applications by Prysmian Projects North America LLC for its proposed submarine cable manufacturing facility in Somerset and by Crowley Wind Services, Inc. for its proposed port development to

serve as a marshaling terminal in Salem to support offshore wind.

In May 2020, Vineyard Wind, LLC and the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) signed an agreement establishing the Fisheries Innovation Fund. The objective of the Fund is to support programs and to promote technology and other activities that support the coexistence of fisheries and offshore wind development. The Fund was developed through a review of landings in the Vineyard Wind Lease Area and will be managed by a third-party administrator who will review claims by fishermen. The Fund is managed by the DMF Director with oversight from an Advisory Panel appointed by the *Mass*DFG Commissioner and input from the MA Office of Coastal Zone Management (*Mass*CZM). The Panel, consisting of representative of Massachusetts fishing gear types and shoreside businesses convened its first meeting in June 2022. Panel members agreed that applicant eligibility, solicitation timeline, and the specifics of fund administration should be topics of discussion for future Advisory Panel meetings. Specific items of discussion included how to identify the fisheries most susceptible to impacts from offshore wind development; how to effectively utilize state-negotiated funds to facilitate coexistence of fisheries and offshore wind in federal waters; how to ensure expenditures from the Fisheries Innovation Fund and Compensatory Mitigation Fund are not distributed to redundant efforts; and how to effectively communicate with other states that may have developed similar mitigation packages. Unspent funds will roll into the Fisheries Innovation Fund every five years.

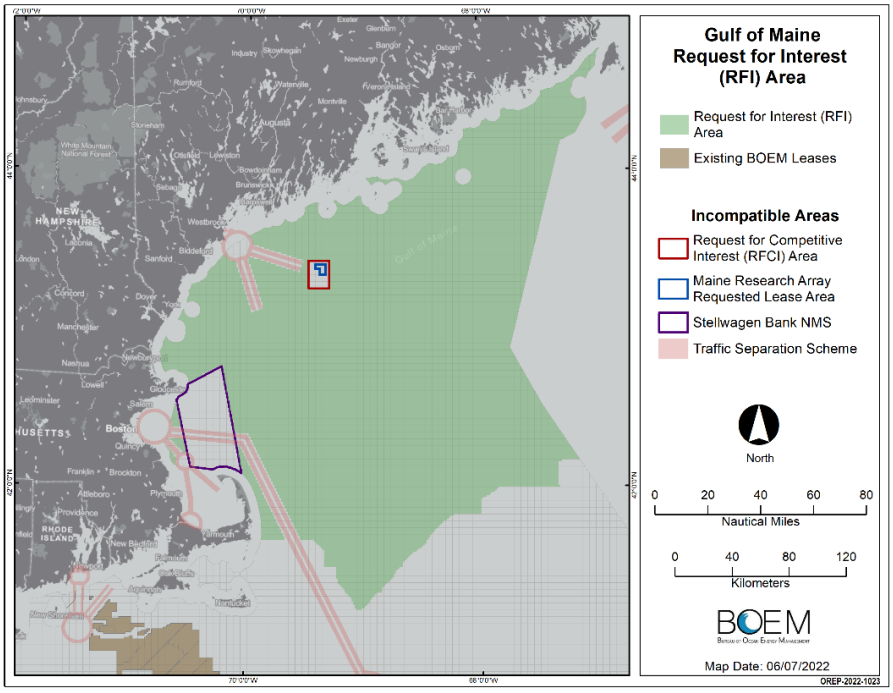


Figure 13. Gulf of Maine Request for Interest (RFI) Area. Source: BOEM 2022.

EEA, *Mass*CZM, and DMF convene and manage the Fisheries Working Group in coordination with the Massachusetts Clean Energy Center (Mass CEC) to engage with the Commonwealth's fishing industry on the development and operation of offshore wind projects on the Atlantic outer continental shelf. 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 WEAs. Held quarterly, Fisheries Working Group meetings in 2022 covered topics including permitting, navigation and transit, habitat and fisheries monitoring, fishing activity, construction and operation considerations, and research needs and opportunities.

DMF continued to participate in ongoing coordination with BOEM and the states of Maine and New Hampshire to establish siting principles for potential WEAs in the Gulf of Maine. In 2022, The Department of the Interior (BOEM) announced a Request for Interest (RFI) the first step in the commercial leasing process. The RFI area consists of 13.7 million acres off the coasts of Massachusetts, New Hampshire, and Maine and covers most of the Outer Continental Shelf (OCS) within the Gulf of Maine (Figure 13). BOEM also announced a Request for Competitive Interest (RFCI) in response to Maine's unsolicited research lease application. Maine's research lease

is intended to inform future GOM commercial offshore wind development, including the deployment of floating offshore wind technology. Maine's proposed research array includes up to 12 floating wind turbine generators (WTGs) capable of generating up to 140MW, is located approximately 25 nautical miles offshore. Both the RFI and RCFI notices were published in the Federal Register on August 19, initiating separate 45-day comment periods. BOEM released an Issue decision on the RCFI requiring indications of interest in a commercial wind energy lease to include a conceptual Research Framework.

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 2022, 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.

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 2022, 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. Most fish documented through the acoustic receiver data were striped bass. 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.

Figure 14. Monitoring at the Artificial Reef in Yarmouth.

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 continued to 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 deployment on the Harwich and Yarmouth reefs. 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.

Material Storage and Procurement: DMF lease agreement utilizing the Massachusetts Clean Energy Center New Bedford Commerce Terminal to stage artificial reef material expired in 2022 (prompting urgent planning for material deployments, see below). Efforts to obtain and store surplus materials from *Mass*DOT, DER, and MBTA, were ongoing in 2022. =

Deployments: There were two barge deployments to the Yarmouth artificial reef and one barge deployment to the Harwich artificial reef sites in June using over 2,000 cubic yards of granite block and secondary use concrete stored at the MA CEC New Bedford terminal (Figure 15). The deployments were carried out with funding provided by EEA / DFG.

Figure 15. Materials deployed to the Harwich Reef site.

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. 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, the Cape Cod Salties, and the ASMFC Artificial Reef Committee. Project staff collaborated with NMFS staff and other state reef program managers on an assessment of artificial reefs in the US, scheduled for release in 2023.

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 2022.

MA Climate Assessment: Program staff contributed to the 2022 Massachusetts Climate Assessment, a statewide analysis developed by EEA as part of Executive Order 569 establishing an Integrated Climate Change Strategy for the Commonwealth. The MA Climate Assessment evaluates 37 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 a high priority for the Commonwealth due to substantial loss of fishery revenue associated with species migration in response to changing ocean temperatures. This assessment will directly inform the first five-year update to the State Hazard Mitigation and Climate Adaptation Plan (SHMCAP),

planned for release in Fall 2023.

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 two manuscripts associated with this work with targeted 2023 submissions for peer review related to foraging ecology and energetics of bluefin, yellowfin, and bigeye tunas in the Northwest Atlantic.

A study initiated in 2012 to examine the interplay between eutrophication and transfer of contaminants into Cape Cod estuarine food webs continued in 2022. Archived samples were analyzed for carbon and nitrogen stable isotopes to relate observed patterns in mercury accumulation in estuarine fish and invertebrates to primary production sources and trophic position through funding from Woods Hole Sea Grant (WHSG). Preliminary results were presented to WHSG in a 2022 Outcomes Report.

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 15th 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 2022, DMF staff co-authored a regional synthesis published in *Frontiers in Marine Science* describing the effects of rising water temperatures on eelgrass in the northeastern US that utilized data from this monitoring effort. Tunicate monitoring also continued at this site as part of a collaborative effort with scientists at WHOI, EPA, DFO, USGS, NPS, and state representatives along the East Coast to assess regionwide trends in tunicate colonization of eelgrass. Tunicate monitoring was expected to continue in 2023.

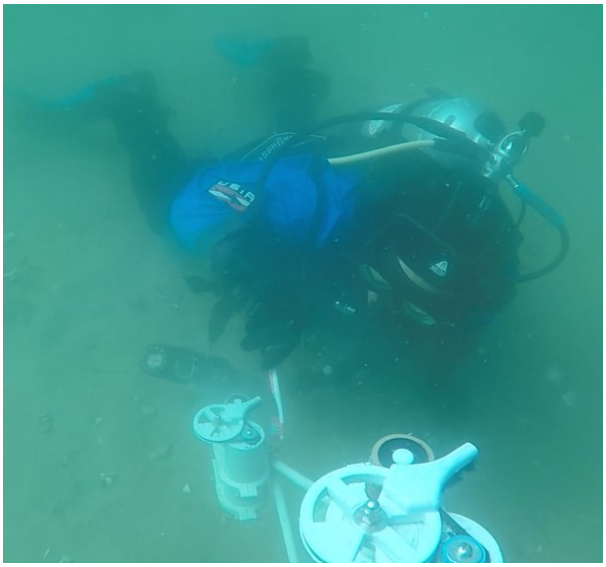


Figure 16. Biologist Tay Evans maintaining temperature and light sensors at a potential eelgrass restoration site in Cape Cod Bay.

Project staff completed coordination of a 5th 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 2022 remained in the Duxbury-Kingston-Plymouth embayment (DKP), where there is an ongoing collaboration with the Massachusetts Bay National Estuarine Program, EPA, and North and South Rivers Watershed Association supported by mitigation funding from *Mass*DEP and Veolia. A total of 8 volunteers contributed to the eelgrass assessment in DKP, sampling at 34 locations in August. Overall, these data continue to suggest the distribution of eelgrass remains well below the historic baseline in DKP. Other local watershed groups expressed interest in participating in the Citizen Science Eelgrass Rapid Assessment Program in 2022

including Salem Sound Coast Watch, Seaside Sustainability, and Cohasset Center for Student Coastal Research. Outreach efforts to expand the program are expected to continue in 2023.

Assessment of Eelgrass Monitoring Methods: Project staff provide field and technical support as a partner on a project led by the Massachusetts Bay National Estuarine Program to identify the limits of side scan sonar, aerial photography from drone and fixed-wing aircraft, and satellite imagery in detecting eelgrass. The project will inform new guidelines and procedures for surveying, mapping, and protecting eelgrass habitat in Massachusetts.

Salem Sound Eelgrass Restoration: In 2022, staff completed the fourth of five years of required annual monitoring at our eelgrass restoration site at Middle Ground in Salem Sound—the first ILF funded eelgrass restoration project in Massachusetts. A half-acre site was planted with eelgrass in 2017 and 2018. The planted plots are on target to meet success criteria. The final year of monitoring will occur in 2023.

Eelgrass Restoration Site Selection Project: Project staff continued efforts to identify suitable locations for future eelgrass restoration with funding from the MassDFG ILF Program. In 2022, this work included assessment of available data layers in GIS to determine potential suitable planting locations in collaboration with *Mass*DFG GIS staff; monitoring light, temperature, and sediment characteristics at locations identified as potentially suitable from the GIS assessment (Figure 16); and permitting, planting, and monitoring test plots where field monitoring suggested suitability. Project staff plan to continue these efforts in 2023.

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 2022, project staff conducted data analyses and assisted in the drafting of a manuscript associated with the project with a 2023 target for submission for publication in a scientific journal. Project staff also conducted additional side scan sonar surveys along the Marblehead coastline with the objective of assessing eelgrass habitat before and after the installation of floats.

Lake Tashmoo Survey: In 2021, The Town of Tisbury contacted the DMF requesting assistance in surveying existing eelgrass in areas of Lake Tashmoo (Figure 17). Biologists from the MA DMF Habitat Program and Shellfish Program conducted a survey in June with the assistance of the Tisbury Shellfish Department. Analysis of side scan survey data coupled with the collection of photo data to verify survey results estimated 47 acres of eelgrass habitat within the 99 acres surveyed.

Figure 17. Delineated eelgrass boundaries with coded drop camera

Salt Marsh

Private docks are frequently constructed over salt marsh, potentially impacting this important habitat through shading impacts. In quantitative research studies from 2013–2015, DMF showed that current dock design guidelines recommending dock height be set equivalent to dock width (i.e., 1:1 ratio) was inadequate for minimizing shading impacts. DMF's review paper, titled *A Review of Habitat Impacts from Residential Docks and Recommended Best Management Practices with an Emphasis on the Northeastern United States,* was published in 2022 and incorporated into environmental review comment letters pertaining to dock and pier construction.

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 2022, analysis of sidescan sonar and bottom images continued with a 2023 target for completion.

Winter Flounder eDNA

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 currently 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 time and space. In 2019, the Habitat team began a sampling program to assess the feasibility of using environmental DNA (eDNA) to establish when and where winter flounder are located. South of the Cape, the Habitat team collected water samples in partnership with the Rhode Island Department of Environmental Management's (RI DEM) winter flounder fyke net survey in the winters of 2019 and 2020. These samples will allow eDNA data to be compared with traditional survey assessments of winter flounder presence and abundance during winter months. Additional field validation samples were collected in

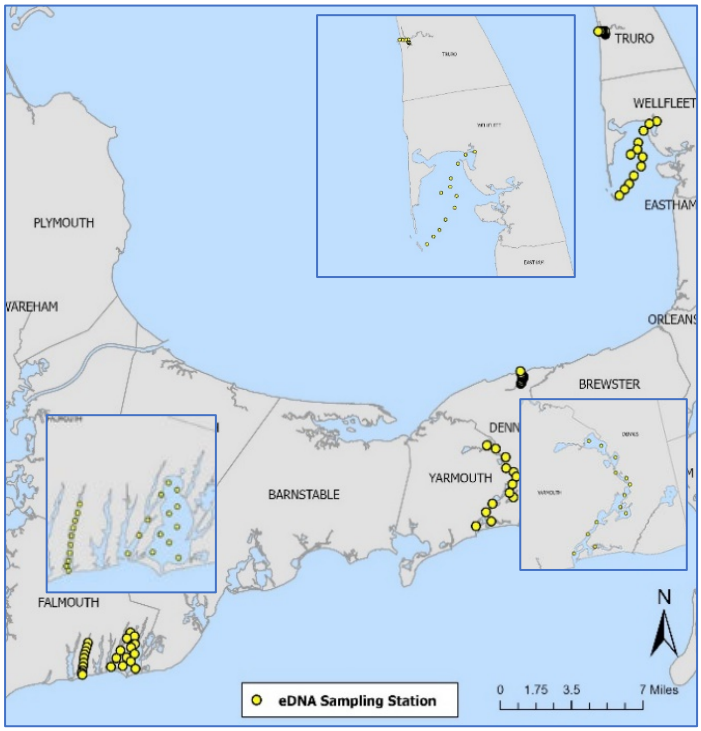


Figure 18. Sampling locations for the 2021-22 pilot winter flounder eDNA study.

summer 2020 and 2021 in association with our young-of-year winter flounder seine survey on Cape Cod to provide similar summer month comparisons to traditional survey results.

In 2021, the Habitat team initiated a pilot winter flounder eDNA study. The study consists 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 is 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. During 2022, monthly water sampling continued through July at our six Cape sites (Figure 18). At the conclusion of the 12-month sampling effort, DMF had collected approximately 1,000 water samples for eDNA analysis. GMGI was able to process the majority of these samples in 2022 (Figure 19) and preliminary results were presented in 2022 at the State of Wellfleet Harbor Conference and the Fall New England Estuarine Research Society (NEERS) meeting.

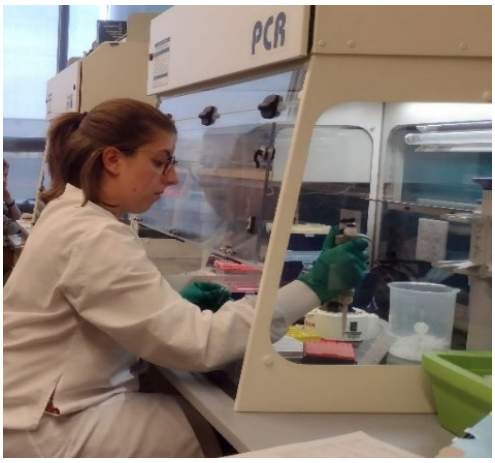


Figure 19. GMGI geneticist Carly McCall prepares a sample for qPCR to test for winter flounder eDNA detection.

In partnership with the Rhode Island Department of Environmental Management (RI DEM), monthly water samples were also collected in 2022 from Ninigret Pond in Charlestown, Rhode Island where pre-existing fyke and beach seine surveys for winter flounder provide complementary survey data for comparison with winter flounder eDNA results. A sub-set of these samples were also analyzed using multiple filter types to test the efficiency of different methods towards a streamlined survey approach.

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, the New England Estuarine Research Society's Executive Committee, the PEW National Coastal Habitat Report review team, and the MIT Sea Grant Advisory Committee.

Publications: In 2022, the Habitat Program developed a Fisheries Habitat Publications web page 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 two peer-reviewed articles on topics that ranged from reviewing habitat impacts of residential docks and associated best management practices to describing the effects of rising water temperatures on eelgrass.

Support Activities: Staff reviewed proposals for NOAA, MIT Sea Grant, ACFHP, and performed peer review for eight academic journals and served as an editor for 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 and UNH. Project staff advised one New Bedford, MA high school student intern during summer 2022 through the SMAST Summer Internship Program (Figure 20).

Figure 20. New Bedford High School student and DMF intern, Luis DeLuna, prepares a sampling bottle for eDNA water collection in Wellfleet Bay.

FISHERIES BIOLOGY SECTION

Dr. Michael Armstrong, Deputy Director, Section Leader

Fish Biology Program

Personnel

Dr. Gary Nelson, Program Manager

Age and Growth
Scott Elzey, Biologist
Kimberly Trull, Assistant Biologist
Christy Draghetti, Ageing Technician
Kara Duprey, Ageing Technician (July–December)

Fisheries Research and Monitoring
William Hoffman, Senior Biologist
Brad Schondelmeier, Biologist
Elise Koob, Assistant Biologist
Joe Holbeche, Assistant Biologist
Michelle Heller, Assistant Biologist (December)

Resource Assessment
Steven Wilcox, Senior Biologist
Vin Manfredi, Biologist
Mark Szymanski, Biologist

Fish Stock Assessment
Dr. Micah Dean, Senior Biologist
Dr. Samuel Truesdell, Senior Biologist
Dr. Tara Dolan, Senior Biologist (April–December)

Overview

The objectives of the Fish Biology Program are to collect, process, and analyze biological data on recreationally and commercially important fishes needed for effective, science-based management of Massachusetts' fishery resources. Biological data collected from harvested and released fish include age structures (i.e., scales, otoliths, vertebrae), length frequencies, maturity stages, and bycatch levels. All data are used in stock assessments to determine the status of those resources. In addition, information on catch and effort of recreational anglers are collected via volunteer surveys. Special research projects are also conducted to address specific management needs. 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 2022, 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. Several focus areas for 2022 are highlighted below.

River Herring: In early 2022, the Age and Growth project worked with the Passamaquoddy tribe conducting research on river herring in the St. Croix River along the U.S./Canada border. Otoliths were collected from 250 fish (subject to staff's written protocols for river herring) that were aged by the Age and Growth Project.

Striped Bass: In 2022, work continued on a project to explore the influences of environmental and population variables (e.g., temperature, abundance, oxygen) on growth of Chesapeake Bay Striped Bass. Annuli measurements were taken from 2,440 sectioned otolith samples (years 2002–2020), provided by the Virginia Marine Resource Commission. Organization and analysis of the annuli data began and will continue into 2023 (Figure 21).

Winter Flounder: In 2022 Age and Growth staff extracted otoliths from 2,800 young of year Winter Flounder. The otoliths were subsampled and 242 of them were selected for daily age analysis. The age of these young-of-year fish can be used to calculate their hatch date and thereby gain more information about the spawning season of the adults.

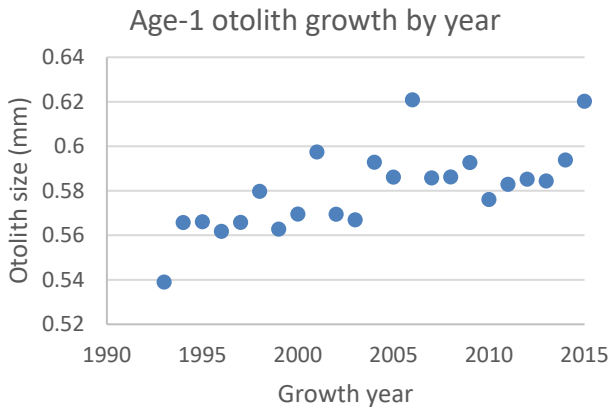


Figure 21. Environmental and population changes affect the growth of striped bass. This plot of average otolith size in the first year of growth illustrates potential growth differences between years.

Table 19. Samples processed for ageing in 2022.

Species	Structure	Process	Number
American Shad	Otoliths and scales	Otoliths aged, scales checked for spawning marks	310
Black Sea Bass	Otoliths and scales	Otoliths sectioned & aged, Scales pressed and aged	600
Bluefish	Otoliths	Baked, sectioned, aged	107
Atlantic Cod	Otoliths	Sectioned, aged, measured	199
Fluke	Scales	Cleaned, pressed	60
Menhaden	Scales	Cleaned, mounted, sent to NMFS	172
Rainbow Smelt	Scales	Cleaned, mounted, aged	649
River Herring	Otoliths	Cleaned, aged	3881
Scup	Scales	Cleaned, pressed	133
Striped Bass	Otoliths	Sectioned, aged	254
Striped Bass	Scales	Cleaned, pressed, aged	1461
Tautog	Otoliths and fin spines	Cleaned, sectioned, aged	319
Winter Flounder	Otoliths	Sectioned, aged	839

Other Activities: Atlantic cod otoliths captured by the industry-based survey in 2018 were sectioned, aged, and the first annulus was measured. These data were added to the work done previously by the Age and Growth

project to help discriminate between stocks of fish with different spawning seasons.

In 2022, two manuscripts on Atlantic wolffish and Atlantic halibut work from collaborations between Age and Growth staff and external agencies were published.

Fisheries Research and Monitoring Project

The Fisheries Research and Monitoring (FRM) Project is a result of the merging of the former Fisheries Dependent Sampling and the Fisheries Research projects. This 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 FRM 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 ASMFC. After a period of COVID-19 restrictions, nearly all access to fish samples was restored in 2022. Where prior access and efforts had not been restored, Project staff remained in close contact with industry members, stakeholders, and managers in order to minimize the impact of reduced data collection.

In late 2021, DMF allocated resources to bolster the port and sea sampling of the Commonwealth's commercially harvested marine resources. In 2022, with the understanding that federal commercial port sampling levels were not sufficient to support regional stock assessments for some important species, FRM laid the groundwork for a state-federal partnership to collect these necessary samples. FRM biologists worked with NOAA Fisheries staff, gained crucial data access, developed a sampling strategy, and hired two full-time biologists to join the Project. Work continues, with the goal of FRM sampling to augment federal sample collection, resulting in more robust and reliable stock assessments.

Port sampling of commercial catches, primarily striped bass, winter flounder and menhaden, was conducted in partnership with the South Shore Recreational Fisheries Project staff (Table 20). The commercial striped bass season ran from mid-June to early-August, during which Project staff collected striped bass scales, otoliths, fin-clips, and biological data from landed fish at seafood dealers along the coast. Port sampling of winter flounder landings during the spring spawning period were prioritized in support of the larger Boston Harbor Winter Flounder Study (see Fisheries Research on page 66). From early March to mid-April, eight trips and 258 fish were sampled for sex, maturity, and spawning status in addition to fin-clips which were taken for future genetic analysis. The directed menhaden fishery, which has capitalized on a large biomass of fish in coastal waters for the past few years, began on June 1 and ran through late July winverith the transfer of additional quota and access to the Episodic Event Set-Aside. FRM collected and analyzed seventeen commercial samples from the fishery.

Species	Intercepts (#)	Individuals (#)	Age samples
Striped Bass	16	285	343 (scales & otoliths)
Menhaden	17	170	170 (scales)
Winter flounder	8	258	80

Table 20. Number of port sampling events, or trips, made to intercept commercial vessels or seafood dealers where information was collected in 2022.

At-sea sampling activities by Project staff were increased from past years. Monitoring of the state's coastal lobster fishery was a major priority. Sampling occurred between May and November and was conducted out of five ports: Rockport, Gloucester, Beverly, Quincy, and Boston (Table 21). A summary of 2022 commercial sampling efforts is covered in the Invertebrate Fisheries Project section (page 80).

In support of characterizing the spawning timing of winter flounder during spring in Massachusetts coastal waters, FRM staff conducted six sea sampling trips aboard a contracted bottom trawl vessel out of Gloucester. Standard commercial and survey-style tows were conducted, with winter flounder and Atlantic cod length, weight, sex, maturity, otolith and finclip collection a priority (Figure 22).

Multiple sea days were spent aboard R/V *Michael Craven* and R/V *Alosa* to support other Division projects and external collaborations. These efforts included collecting water quality samples for DMF's shellfish project, supporting dive operations for the Habitat project, and supporting Massachusetts Environmental Police removal of non-compliant commercial fishing gear as well as supporting on-the-water lobster fishery enforcement training.

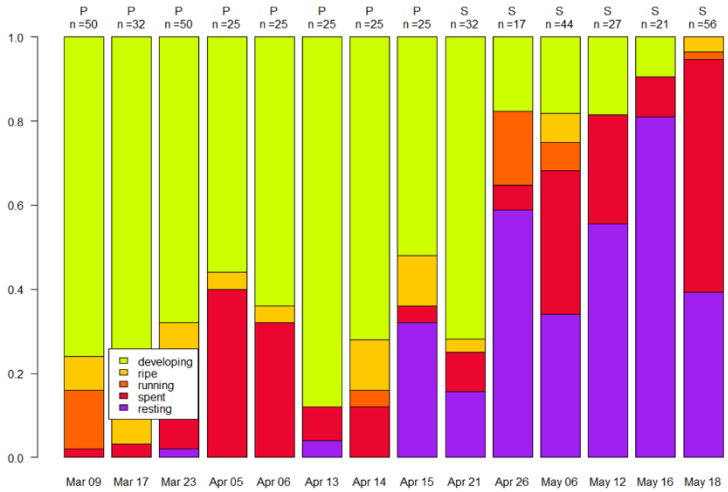


Figure 22. Results from winter flounder port and sea sampling plotting maturity ratios over time. Fish were caught in Mass Bay and spawning peaked mid-April. Another year of sampling was anticipated for 2023.

Table 21. Summary of at-sea sampling efforts by Project staff in 2022.

Sea Days (#)	Project
72	Winter Flounder Acoustic Telemetry and Beam Trawl Survey
26	Acoustic Telemetry- Striped Bass
8	Sea Sampling
30	Coastal Lobster
6	Resource Assessment
2	Lobster Gear Compliance
14	Vessel Support for External Projects (e.g., White Shark, Habitat, Shellfish)

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 the initial stages of planning for distribution of 2019 Atlantic herring fishery Disaster Relief Funds.

Fisheries Research Projects

DMF continued its commitment to applied fisheries research to improve the management and assessment of the Commonwealth's marine resources through various collaborations with university, non-profit, state, and federal organizations.

Industry-Based Survey of Gulf of Maine Cod

The industry-based survey (IBS) was a scientific bottom trawl survey conducted aboard contracted commercial fishing vessels. This project intensively sampled the Gulf of Maine during two periods (IBS1: 2003-2007; IBS2: 2016-2019), providing a comprehensive description of the distribution and demographics of the cod stock, as well as many other species. More than 3,500 standardized tows were completed, yielding biological observations from over 100,000 individual cod. DMF staff have published a series of peer-reviewed scientific journal articles from this unique dataset that are being used to inform stock assessments and fisheries management.

The most recent article, titled "*Lost in Translation: explaining divergent perspectives on a depleted fish stock*" was published in 2022 and offers an explanation for why fishermen consistently disagree with stock assessment results. We found that this difference in perspectives is primarily due to the regulations imposed upon the fishery, which caused catch rates to increase while the stock declined (Figure 23). Furthermore, inconsistent assessment results (i.e., retrospective patterns) have eroded trust in the scientific process, making it difficult for managers to settle on a commonly accepted view of stock status. The IBS has attempted to bridge this gap between fishermen and stock assessments by providing new information that is hopefully credible to all stakeholders. In general, IBS results corroborate the assessment perspective on the extent of stock decline, yet suggest that improvements could be made to better describe the age distribution of the population.

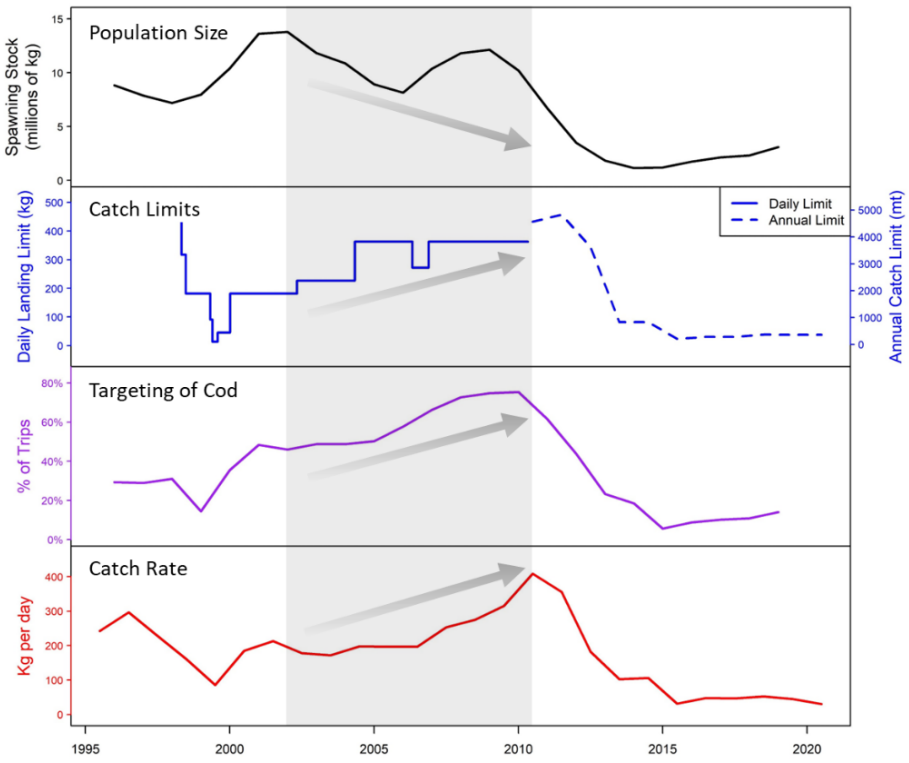


Figure 23. As the cod stock declined and access to fishing grounds ("days-at-sea") were cut between 2000-2010, the daily trip limit of cod was *increased* several times to reduce the wasteful discarding of fish. This led fishermen to target cod more, which caused catch rates to increase while the stock declined.

Cod Research StoryMap

DMF has conducted extensive research on Atlantic cod over the past two decades to help improve stock assessments and fishery management. Although we regularly publish our findings in peer-reviewed scientific journals (27 cod research articles since 2012), these results aren't always presented in a format that is easily understood by the general public. To make our research results more readily accessible, we created an ESRI StoryMap in 2022, which offers an interactive multimedia-rich tour of the cod research conducted by the State of Massachusetts (Figure 24). Since its implementation, the Cod Research StoryMap has gained public interest and has been featured in several news articles.

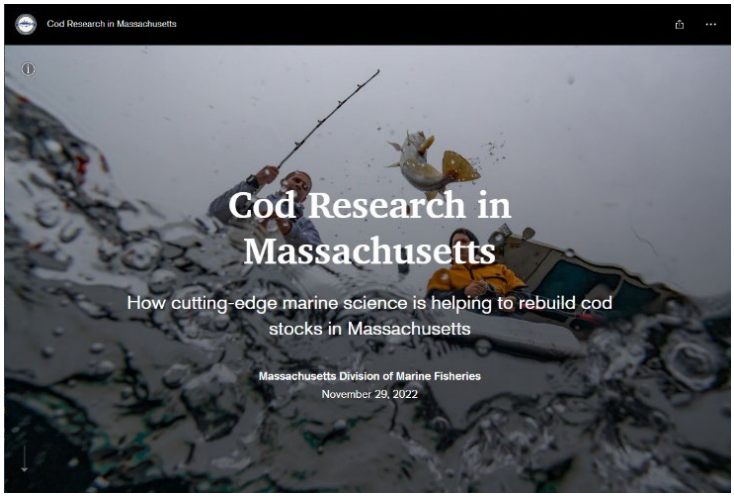


Figure 24. The new Cod Research StoryMap uses photos, videos, and interactive maps to communicate scientific results to the public. https://www.mass.gov/info-details/cod-research

Haddock Citizen Science

In 2020, DMF published a new Recreational Haddock Fishing Guide, which contains detailed monthly maps of areas to target (good haddock fishing with little cod bycatch), and areas to avoid (not as good haddock fishing, with high cod bycatch). With its creation came the need to monitor the validity of the guidance maps. Fish populations are always changing and as we get further away from the IBS dataset (2016–2019) used to create the maps and the large-scale recreational testing effort (2019), there is a chance that the Haddock Guide will lose its relevance over time. Therefore, we established a "Citizen Science" program in 2020 with additional funding from NOAA Fisheries, in which volunteer anglers submit standardized catch, effort, and location data. Participating anglers receive fishing pliers after submitting their first report and a raffle entry to win a Yeti® cooler for each subsequent report (Figure 25). Over 200 anglers signed up to participate in the program between 2020 and 2022, submitting almost 250 fishing reports. These data suggest that Recreational Haddock Fishing Guide maps continue to be relevant and useful, with fishing in target areas achieving a 92% higher haddock catch rate and a 35% lower cod bycatch rate.

Figure 25. Dan Schaefer (right), winner of the 2022 Citizen Science raffle prize, alongside DMF biologist Micah Dean.

Protecting Spawning Cod

Many electronic tagging studies (including several conducted by DMF) have demonstrated that individual Atlantic cod return to the same precise seafloor feature 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, in order 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. To date, 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, as well as from mobile autonomous underwater vehicles (AUVs). Passive acoustic recorders are also listening for cod spawning grunts via both fixed stations and mobile AUV surveys. Preliminary 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. Outcomes from this five-year project (2019–2024) will be a description of the spawning dynamics of cod in Southern New England, and an assessment of their connectivity with other cod populations. The anticipated benefits include an understanding of seasonal habitat usage to help evaluate the potential impacts of offshore wind development.

Atlantic Cod Stock Assessment

In 2018, a group of scientists from the US and Canada formed the Atlantic Cod Stock Structure Working Group, with the objective of determining the most appropriate population structure of Atlantic cod stock structure for use in regional stock assessments. Over the past several years, this group broadly reviewed all available scientific information (tagging, genetics, natural markers, fishermen knowledge, and life history) and determined that cod in US waters function as five separate stocks. Two of these stocks overlap in the western Gulf of Maine yet spawn at opposite times of year and are genetically distinct. DMF scientists lead sub-groups on early life history and fishermen ecological knowledge. The final report of this group was published in 2022 (NOAA Technical Memo NMFS-NE-273), and a "research track" assessment is now underway that will determine the status of these new stock units. DMF scientists and survey datasets will be instrumental in this major stock assessment overhaul, the first in more than a decade.

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 complete three tasks to determine the following: 1) Using acoustic telemetry, determine the time and location of spawning; 2) conduct a beam-trawl survey to understand the distribution of YOY and juvenile winter flounder throughout the harbor; and 3) determine the hatch and spawning date through daily aging (see Age and Growth on 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.

Building off the first year of the study, in 2022 DMF staff increased the overall size of the Boston Harbor acoustic telemetry array to 49 receivers. The larger array enhanced researchers' ability 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 Program's array of receivers, will provide comprehensive coverage of Massachusetts state waters and be instrumental in tracking year-round movements of adult winter flounder.

In late April and early May, 56 additional adult winter flounder were tagged with acoustic transmitters resulting in a total of 151 adults for the study. The acoustic tags are programmed to transmit for three years, which will allow researchers to track over multiple seasons. In 2022, 35 of the 95 fish that were tagged in 2021 returned to the Boston Harbor estuary. This evidence of site fidelity underlines the importance of the estuary and that the study's design is working.

DMF staff conducted the second year of a beam-trawl survey that started in late-June and ran through October. Using a stratified-random survey design, 24 tows a week were conducted on DMF's *R/V Alosa* (Figure 26) and UMass-Amherst's *R/V Sweet Caroline*. Both teams recorded data and lengths with custom designed BigFin Scientific software and hardware and retained all winter flounder YOY for further age and genetic analysis to accomplish task 3. Overall in 2022, 37 surveys were conducted, nearly 450 tows were completed, and over 4,300 winter flounder were collected. The beam trawl survey and acoustic tagging activities will incorporate findings and continue in 2023.

Figure 26. Winter Flounder beam-trawl crew on the R/V Alosa: (left to right) Brad Schondelmeier, Katrina Zarrella-Smith (UMass-Amherst), Tara Dolan, and William Hoffman.

Resource Assessment Project

2022 Trawl Survey

The 44th annual spring and fall surveys were successfully completed aboard NOAA's R/V Gloria Michelle in 2022. The spring survey completed 101 stations from May 11–26 and the fall survey completed 100 stations from September 6–22 (Figure 27). 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 28).

Many different volunteer scientists assisted in making both trawl surveys successful this year. To minimize the risk of Covid-19 infection, the survey continued to follow protocols including testing prior to trips and a slightly modified schedule to reduce scientific crew changes. Twenty-four DMF employees participated in the spring survey as part of the scientific party along with one biologist from UMass-Amherst and one biologist from Gloucester Marine Genomics Institute. The scientific party for the fall cruise was staffed with 34 DMF employees, three NOAA employees, a Gloucester Marine Genomics Institute scientist, a UMass-Amherst PhD student, and a scientist from Responsible Offshore Science Alliance. A return to more traditional survey staffing allowed for an increase in otolith extraction and collection as well as the documentation of additional sex and maturity observations.

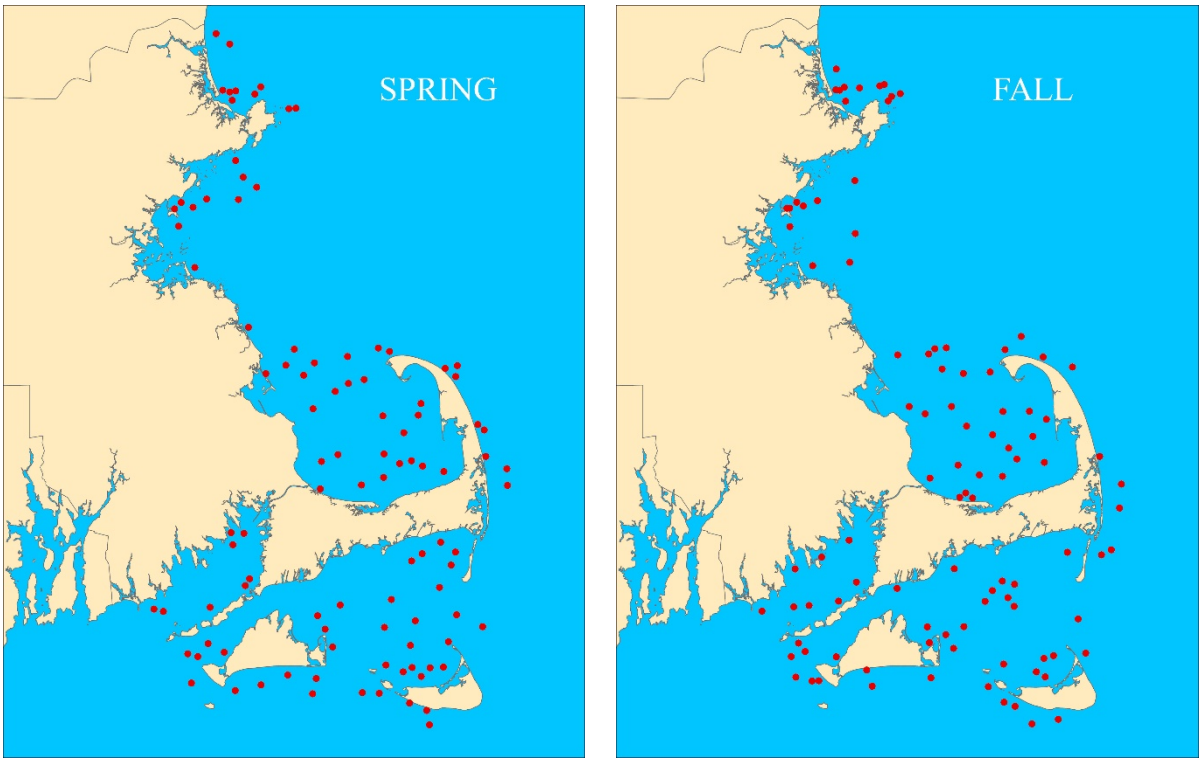


Figure 27. Completed 2022 spring (left) and fall (right) trawl survey station locations.

The spring survey had some noteworthy records. The first spring catch of spot was recorded at a station in Buzzards Bay. A station in Mass Bay set a record for both biomass and abundance of yellowtail flounder and a station west of Martha's Vineyard had the highest abundance of smallmouth flounder in our timeseries. Scup were observed at the highest percentage of stations in timeseries history with several strata in Mass Bay having

their first ever catch. Little skate and winter skate were observed at the lowest percentage of stations in survey history. This was the first spring survey with no American lobster observed in Buzzard's Bay, Vineyard Sound, and Nantucket Sound.

The fall survey also had several timeseries records. Scup set records for biomass and abundance at a station north of Nantucket and a station south of Martha's Vineyard respectively. This survey also had the highest stratified mean abundance of scup across all stations. Red hake set a timeseries high for stratified mean abundance and biomass driven by increased catches in the deeper strata of Mass Bay. Little skate had the lowest stratified mean abundance and biomass in timeseries history. Winter skate catches remained low, and they were observed at the lowest percentage of stations to date. There were strata specific record catches of butterfish within the two deepest strata of Cape Cod Bay.

Figure 28. Photo collage from the 2022 spring (left) and fall (right) trawl surveys.

2022 Seine Survey

The 47th Nantucket Sound Estuarine Winter Flounder Young-of-Year (YOY) Seine Survey was completed from June 20–July 8. 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/absence for all other species was recorded. Thirty-nine species occurred in the year's seine survey hauls. The 2022 stratified mean index for YOY winter flounder abundance increased slightly and remained above the time series median for the third consecutive year (Figure 29). While five of the last ten years were above the time series median, the overall trend has decreased since the survey's inception.

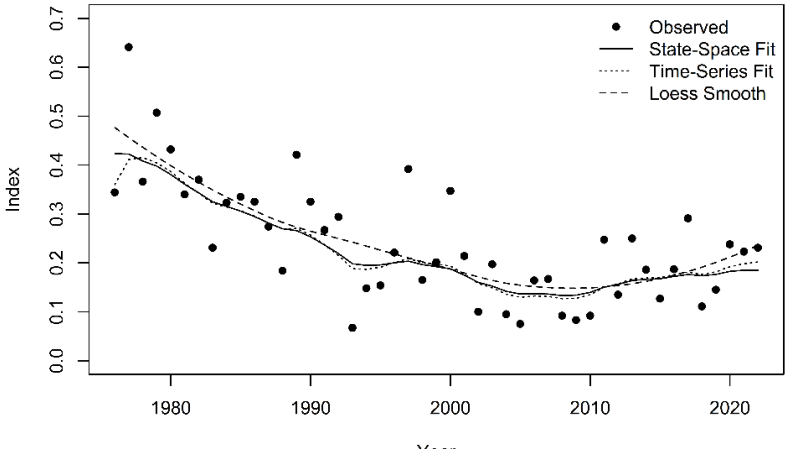


Figure 29. Young-of-the-year winter flounder index from the Resource Assessment seine survey.

Fish Stock Assessment

Staff represented DMF on ASMFC and MAFMC Technical Committees and Monitoring Committees for Bluefish (chair of Technical Committee), Black Sea Bass, Scup, Summer 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, Monkfish Committee, Transboundary Resource Assessment committee (TRAC), groundfish assessment peer reviews, the Atlantic Herring Plan Development Team and Technical Committee Team, and the ASMFC's Striped Bass Technical and Stock Assessment Committees, Menhaden Technical Committee, Multispecies Committee, and Age and Growth Committee

DMF's black sea bass spawning survey continued during May–July 2022, marking the fifth year of this program. The purpose of this rod-and-reel sampling is to collect data on Buzzards Bay Black Sea Bass as the spawning season progresses. Eight sampling trips were made during 2022. 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 are expected to be used in upcoming black sea bass coastwide stock assessments.

Staff participated in research track stock assessments led by NMFS scientists for bluefish, black sea bass (ongoing at year's end), yellowtail flounder, and Atlantic cod. Specific contributions included quantitative life history analyses, evaluating backup assessment models, survey index standardization, compiling coastwide 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. 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 conducted in 2022. In addition, a tag retention study was conducted at the DMF Cat Cove Marine Laboratory in Smith Pool (Figure 30). Over three days, fifty striped bass of varying sizes were captured, transported to Smith Pool, tagged with the identical transmitters that were used in the post-release mortality study and monitored for the summer and fall season. It was important to assure that a tag shedding rate (if any) could be calculated to assist in the determination of the acoustic transmitter signal of a dead striped bass. Of the 50 striped bass, all retained the tags over a two-week period, allowing biologists to refine mortality rates.

Figure 30. Smith Pool at DMF's Cat Cove Marine Laboratory in Salem provided a closed system for assessing striped bass tag shedding rates as part of the larger post-release mortality study.

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, handling time, and water temperature. A draft manuscript of the study has been written and submitted to a peer-reviewed journal for potential publication.

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 2022, 437 striped bass were tagged. These fish ranged in size from 21 inches to 43 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) are collected during market sampling trips, in accordance with ASMFC target sampling levels. During 2022, staff conducted 17 market sampling trips and collected length, weight, and age structures (scales) from 285 Striped Bass.

Acoustic Tagging Study

During 2015–2019 staff conducted a study that examined how mortality of striped bass is influenced by habitat

selection and migratory route 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 that funds the analysis of 5,000 DNA samples collected from Massachusetts recreational and commercial fisheries during 2015–2019. These data will connect to the data from acoustically tagged fish and reveal potential patterns in stock composition based on size class and summering area. As part of the grant, DMF will also use the data to simulate sampling program accuracies to create recommendations for a coastwide sampling program that can be used to vastly improve the ASMFC striped bass stock assessment. A new genomic panel that minimizes the cost per sample was created in 2022 and is now being applied to the 5,000 funded samples.

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. In 2013,black sea bass, summer flounder, and scup were added to the program. During 2022, 39 participating anglers returned 869 paired length/age samples from striped bass. The size composition of striped bass reported by participating anglers is shown in (Figure 31). Participating anglers also collected 258 black sea bass samples, 60 summer flounder samples, and 125 scup samples. The striped bass carcass collection program also continued in 2022; volunteer anglers donated 198 carcasses.

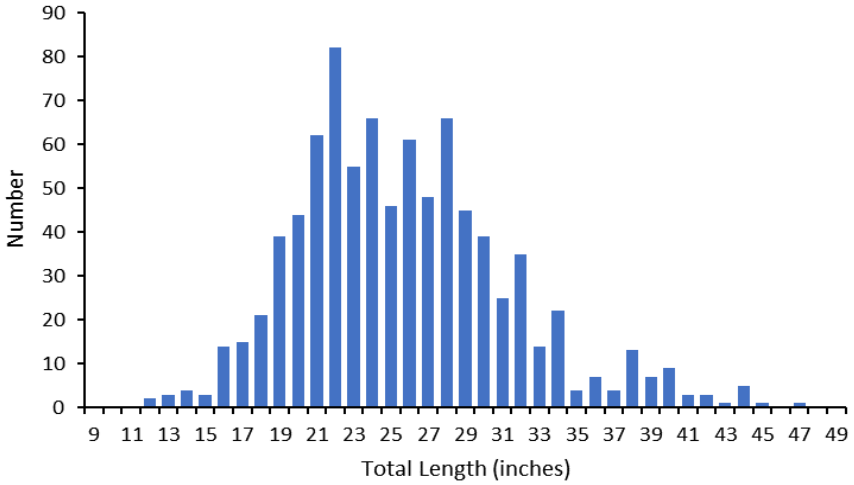


Figure 31. Size composition of Striped Bass collected by SADCT anglers in 2022.

Striped Bass Stock Assessment

Staff conducted the ASMFC striped bass coast-wide stock assessment. Results of the assessment indicated that the stock remained overfished (female spawning stock biomass below the threshold), but overfishing was no longer occurring (fishing mortality rate below the threshold) in 2021 (Figure 32). Short-term projections, despite assuming continued low recruitment, indicated a very high probability of the stock achieving a rebuilt status by 2029 (the rebuilding deadline) under the 2021 fishing mortality rate. These findings resulted in the ASMFC not taking any management action to amend the regulations that had recently been carried forward under Amendment 7 to the interstate plan.

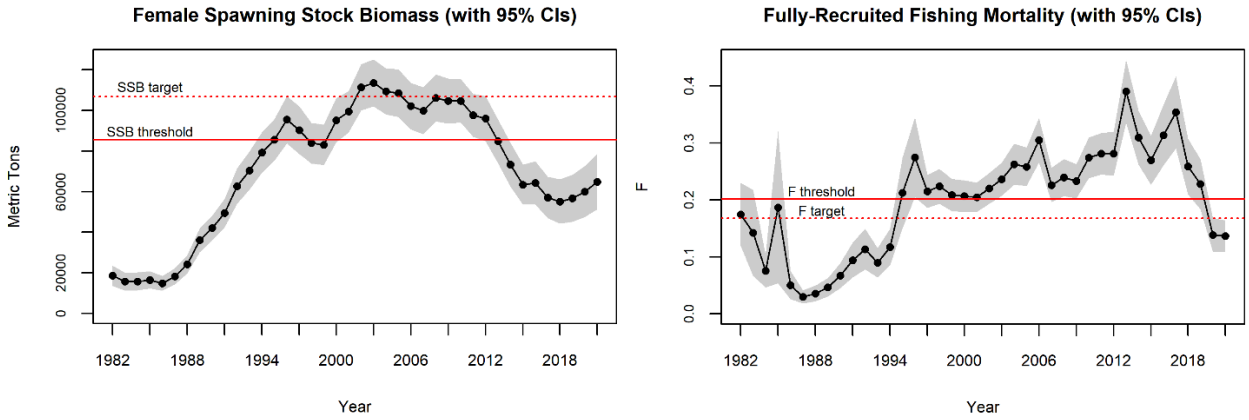


Figure 32. Comparison of striped bass female spawning stock biomass (SSB) and fully-recruited fishing mortality (F) to corresponding threshold and target values from the 2022 stock assessment.

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 2021.

Assessment and Survey Program

Personnel

Robert Glenn, Deputy Director and Program Manager

Conservation Engineering Project
David Chosid, Marine Fisheries Biologist

Invertebrate Fisheries Project
Dr. Tracy Pugh, Senior Marine Fisheries Biologist, Project Leader
Derek Perry, Marine Fisheries Biologist
Steve Wilcox, Marine Fisheries Biologist (January–March)
Alex Boeri, Marine Fisheries Biologist
Brendan Reilly, Assistant Marine Fisheries Biologist
Rachel Vollemans, Assistant Marine Fisheries Biologist
Jacob Dorothy, Seasonal Fisheries Technician (May–December)

Protected Species Project
Erin Burke, Protected Species Specialist
Taylor Stoni, Protected Species Permit Specialist (January–October)
Justin Wilson, Protected Species Gear Specialist (January–October)

Overview

In 2022, the Assessment and Survey Program was restructured to include only three projects. The Resource Assessment Project and Stock Assessment and Management Support Project were moved under the Fish Biology Program. This was done to account for agency restructuring. Moving forward in 2023 the Invertebrate Fisheries Project and Protected Species Project will be promoted to Programs to account for substantial increases in agency work in these two areas. The Conservation Engineering Project will be moved under the Invertebrate Fisheries Program and will switch focus from primarily mobile gear fisheries to fixed gear fisheries.

The **Conservation Engineering Project** collaborates with commercial fishing industry members and others to improve the design and performance of fishing gear and fishing practices. Focus is on reducing impacts of fishing gear on non-target species by understanding the behavior of fish around fishing gear. The project is becoming increasingly involved with work related to minimizing interactions between fixed fishing gear and protected species, as well as marine debris issues, specifically abandoned, lost, or otherwise discarded fishing gear.

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

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

Conservation Engineering Project

The Conservation Engineering Project focused on required and remaining conservation engineering tasks and grants and newer marine debris related topics.

Bycatch Reduction of Red Hake in the Southern New England Silver Hake Trawl Fishery

The NMFS Bycatch Reduction Engineering Program (BREP) awarded DMF this project in 2019 (along with co-P.I.s 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 southern New England continue to decline despite effort reduction measures.

Due to delays from the Covid-19 pandemic, the project applied for and received grant extensions until December 2022. Fieldwork was conducted over two, six-day trips on-board the whiting vessel *F/V Gabby G*, in April–May 2022 (Figure 33). Sixty-four valid, paired tows were conducted, day and night, comparing nets using the large-mesh belly panel against standard whiting nets. Video was also collected to confirm the nets operated as expected and to observe behavior of fish around the belly panels. Results indicate that the gear modifications did not significantly reduce red hake catch rates.

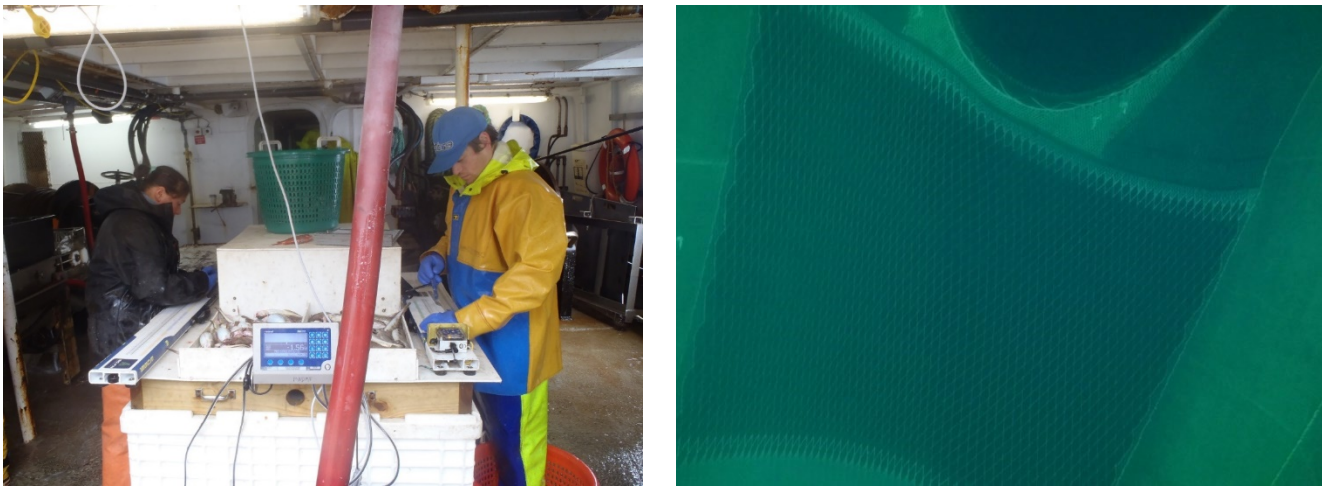


Figure 33. DMF staff sampling catch on the F/V Gabby G (right); underwater, top-down view of the large mesh belly panel, footrope, and sweep during setting a tow.

Additional tasks completed this year for this project included permit applications for conducting research trips, safety (covid-related) planning, sea sampler training, data entry, QA/QC, data analyses, participant meetings, report writing, equipment acquisitions and maintenance, budgeting, contracting, and outreach meetings. A final report was underway at year's end to meet the requirements of the grant and to provide to relevant organizations, such as the NEFMC. Staff presented this research to the Southern New England Chapter of the American Fisheries Society in June and contributed information on the project to the MFI Annual Report.

Complementary Testing of Off-Bottom Trawls to Target Georges Bank Haddock

This project, funded by the NMFS Saltonstall-Kennedy (SK) 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. Staff led development and submission of a manuscript resulting from this project and contributed information on the project to the MFI Annual Report.

Small Channeled Whelk Bycatch Reduction Device for Pots in Massachusetts

Staff continued to collaborate with the Invertebrate Fisheries Project to modify channeled whelk traps (pots) to reduce bycatch of undersized individuals. A final report of the protocols that were followed for all work to-date and recommendations for future work, including field trials using industry vessels, was drafted but the report and additional analyses were delayed due to staffing shortages.

Abandoned, Lost, or Otherwise Discarded Fishing Gear and Protected Species Safety Solutions

Conservation Engineering staff worked with DMF's Protected Species Project, the MA General Counsel, and DFG IT to develop a proposal for the 2022 NOAA Marine Debris Removal Grant titled, "Protecting Right Whales through an Industry-Cooperative Gear Recovery Program in Massachusetts." This work proposed to establish an abandoned, lost, and discarded fishing gear (ALDFG) recovery program during Massachusetts seasonal gear closures, ensuring that the closures are as effective as intended, by permitting stakeholders to collect and keep or sell recovered gear. The grant proposal was submitted along with gathered letters of support from state legislators, industry, and research institutions. Unfortunately, funding for this grant was cancelled by NOAA.

Despite the outcome of the Marine Debris Removal Grant, DMF continued to pursue an ALDFG recovery program, partially operated through Conservation Engineering. A Marine Debris Task Force was assembled which included DMF, *Mass*DEP, industry representatives, outside research institutions, and state legislature representatives. The purpose of this group is to establish the definitions, and legislative and regulatory language for a marine debris program in Massachusetts and then to implement the program. DMF convened three meetings during this year with participants and multiple internal meetings. A white paper by DMF was in production at year's end detailing the project's progress and plans.

Staff assisted with the transport of traps collected from the Massachusetts fixed gear closures to a storage location at Otis Air National Guard Base on Cape Cod (Figure 34).

Figure 34. DMF employees stacking derelict lobster gear collected during the MA fixed gear closure at Otis Joint Base.

Conservation Engineering staff participated and represented DMF on two committees of the NOAA Marine Debris Action Plan for the Gulf of Maine including the groups on Derelict Fishing Gear and Wildlife and Habitat Impacts. Four meetings were held. Data collected on gear recovered during Massachusetts closures were shared with the group. From this work, the NOAA "Gulf of Maine Marine Debris Action Plan, 2022 Mid-Plan Update" was produced with updated actions. Recommendations were also provided for the establishment of a Southern New England Marine Debris Action Plan.

Staff cooperated with the NOAA NEFSC, the Conservation Law Foundation, and industry members to obtain a Massachusetts Letter of Authorization (LOA) to trial buoyless, on-demand fishing systems in state waters. Staff also assisted with developing the trial plan and offered assistance for field operations. The LOA was issued by DMF to five fishing vessels on February 9, 2023 to conduct operations.

Staff attended multiple meetings related to marine debris and whale safety issues. Live meetings attended of particular significance included the Ropeless Consortium meeting (10/24) and the North Atlantic Right Whale Consortium meeting (10/25-10/26) in New Bedford, MA.

Conservation Engineering staff pursued the potential for future diving operations to remove derelict lobster traps from the Cape Cod Canal in cooperation with *Mass*DEP and the Army Corp of Engineers. Future activities will be based around need as identified by the Army Corp.

Staff also responded to information and data requests on marine debris related issues and topics on marine mammal entanglements in fishing gear.

Other Activities

Staff acted as a proposal reviewer on the Food Security Infrastructure Grant Program and the Massachusetts Environmental Economic Innovation and Resiliency in Marine Fisheries Grant Program.

Staff was a co-P.I. on a proposal to the 2022 Saltonstall-Kennedy Competition titled, “Light-assisted automatic jigging as an alternative and sustainable fishing gear for longfin squid in New England.” This project, submitted by the Center for Coastal Studies and involving partners from industry and other research institutions, proposed to investigate the potential for a night-time, longfin squid jigging fishery using lights as attractants by first studying squid behaviors to lights and then applying the findings to a pilot study on commercial fishing vessels. However, it was not awarded funding.

Staff was a participant on an SK proposal, submitted by SMAST and involving other research and industry organizations, titled, “Promoting fishing gear conservation engineering research results in the Northeast: Factsheets and information portal.” The goal was to facilitate uptake and usage of the innovative gears by the fishing industry and gear researchers and additionally inspire further innovation. However, this proposal was not awarded funding.

Staff received continuing education from Bristol Community College’s course titled, “Orientation to Offshore Wind” which was approved and reimbursed through the DMF Academic Board.

Staff worked with EOEEA and DFG to transition video archives to SharePoint from local drives and to establish protocols for uploading new video files and downloading existing files for editing and viewing. Video databases were modified for the SharePoint structure and new videos were added to the database.

Invertebrate Fisheries Project

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 2022, the 42nd year of operation, a total of 58 trips were conducted by staff members of the Invertebrate Fisheries Project (28 trips) and the Fisheries Dependent Investigations Project (30 trips), during which 23,485 lobsters were sampled from 10,900 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 2022, a total of 5,172 lobsters were sampled for shell disease.

Staff have begun developing a report format to share each captain's sampled catch data with that individual captain. 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.

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 35). 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 2022 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 44 sea days in 2022. A total of 9,029 lobsters were sampled from 2,842 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 588 lobsters were sampled from 282 trap hauls.

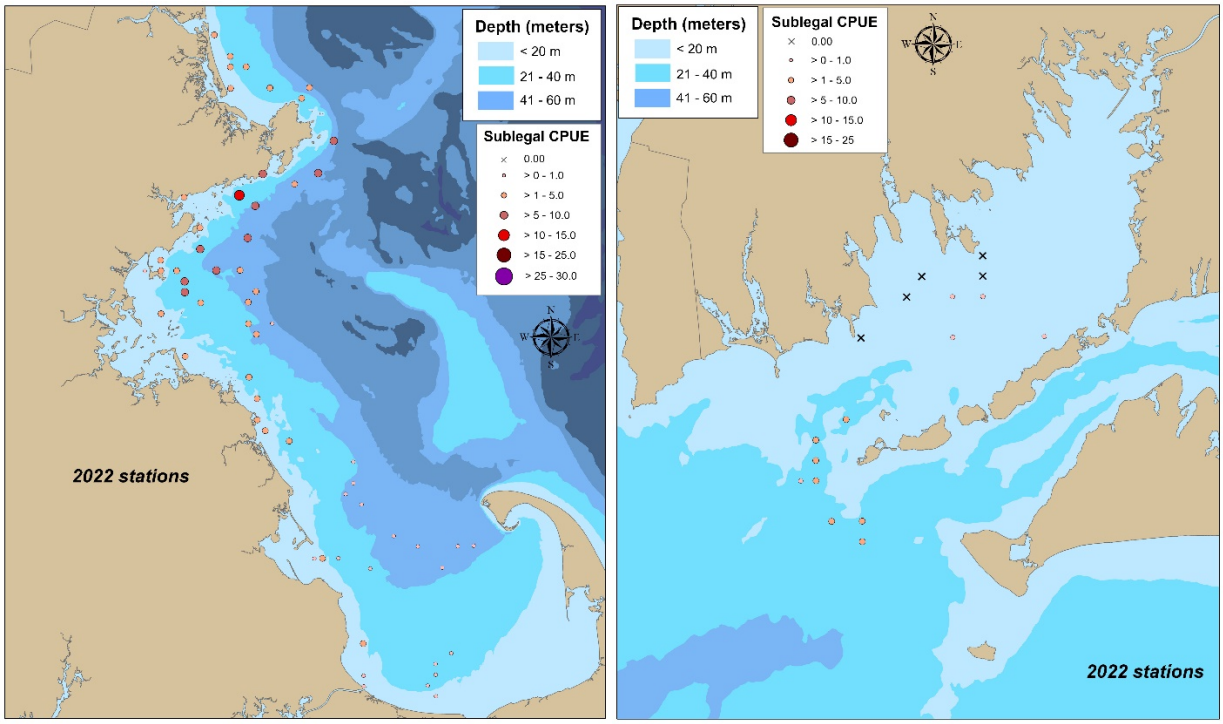


Figure 35. Average catch per trap haul (CPUE) of sublegal-sized lobsters at the 2022 ventless trap survey stations in the northern (left) and southern (right) survey areas.

Additional biological sampling of bycatch species was continued in 2022, 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.

Changes were made to the SNE survey in 2021 due to lack of interested participants: the spatial footprint was reduced, the number of hauls was reduced (from two to one per month), and the survey season was reduced by one month to just June–August. These changes to the SNE survey necessitated re-analysis of the abundance time series to adjust to the reduced survey design. Staff completed this work early in 2022 and reported on the resulting changes (which were minimal) to the abundance index to the ASMFC Lobster Technical Committee.

Annually, significant time is dedicated to maintenance of the DMF-owned gear needed to conduct the survey. Over 600 traps and 6+ miles of groundline must be checked, repaired, and standardized each year. Trap maintenance includes twine repair, wire mesh repair, runner replacement, 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.

Annual Early-Benthic-Phase Lobster Suction Sampling: Project staff completed the 28th year of this sampling program in 2022. The survey tracks year-class strength of newly settled post-larval American lobsters and delineates coastal habitat important to the settlement of these juveniles. Project staff conducted the SCUBA-based survey over ten field days in August and September, sampling 16 coastal sites spanning Cape Ann to Buzzards Bay (Figure 36). 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. Average density of YOY lobster was at or below time series averages for each region (Table 22). No YOY lobster were observed in Boston Harbor or Buzzards Bay. Data from this program 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

Figure 36. DMF biologists conducting the annual early benthic-phase lobster suction sampling survey.

Table 22. Comparison of 2022 YOY lobster densities to time series averages, by region.

Region	# years sampled	2022 YOY Average (#/m^2)	Time Series Average (#/m^2)
Cape Ann	13	0.25	0.41
Beverly/Salem	27	0.17	0.55
Boston Harbor	26	0.00	0.21
South Shore	11	0.08	0.08
Buzzards Bay	28	0.00	0.07

Assessment and Management Support: Staff served as the vice-chair for the ASMFC American Lobster Technical Committee and served on the ASMFC American Lobster Stock Assessment Subcommittee. Work focused primarily on data updates and meetings to support the continued development of Draft Addendum XXVII to increase protection of the GOM/GBK 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 2022. Staff monitored the Fleet's incoming data, and continued work with the DFG GIS team to develop GIS tools for monitoring, summarizing, and sharing data. The project launched a publicly accessible website (mass.gov/capecodbaydo) that displays a map of existing and recent DO and temperature conditions. Based on conditions detected by the Study Fleet's data, DMF issued an advisory to the public in September 2022 to call attention to declining DO levels in the southern portion of the Bay (Figure 37). Conditions improved dramatically soon afterwards due to high winds and waves that provided some mixing of the water column.

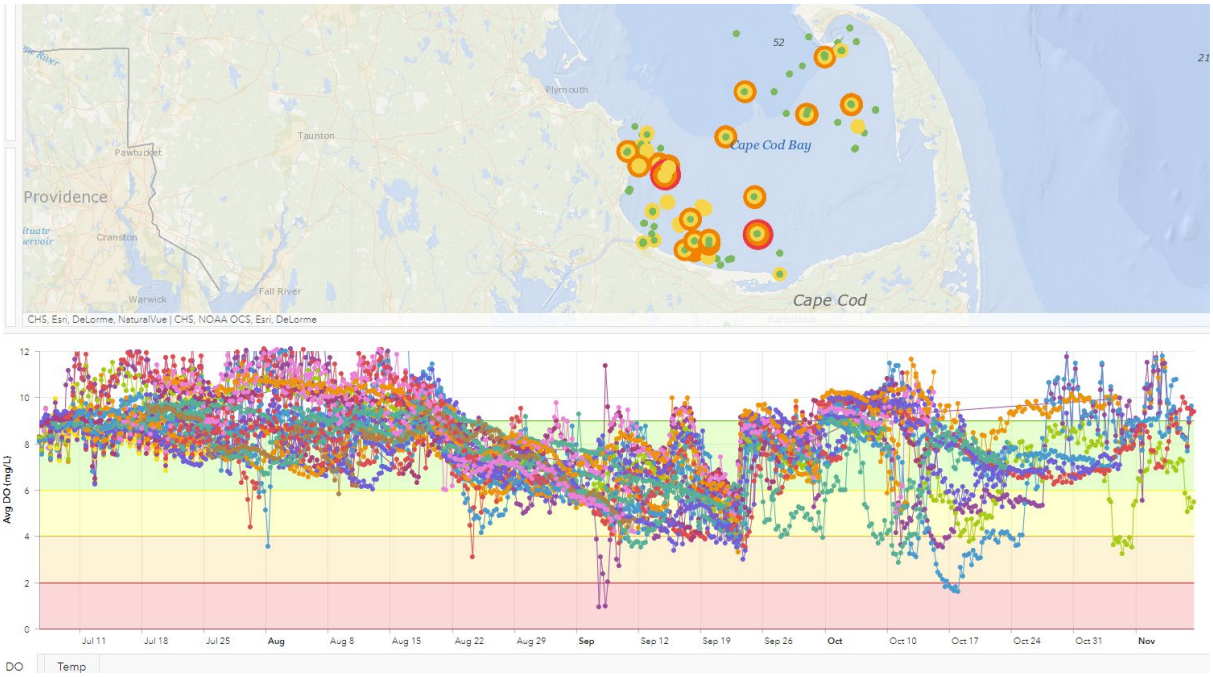


Figure 37. Dissolved oxygen tracking GIS dashboard showing 2022 data from the Cape Cod Bay Study Fleet.

Project staff also continued to work with collaborators at Center for Coastal Studies and the Woods Hole Oceanographic Institution to understand the drivers of low DO in Cape Cod Bay. A manuscript resulting from this collaboration has been published in the scientific literature. The paper developed a hypothesis linking changing physical conditions (winds, temperature stratification, and nutrients) and a recently observed dinoflagellate species to the hypoxic conditions observed in 2019 and 2020. This research is funded through a grant to DMF from the National Sea Grant American Lobster Research Initiative.

Another goal of this study is to understand how changing DO conditions affect lobster catch in the region. To address this, DMF staff conducted weekly sampling trips aboard a contracted Cape Cod Bay lobster boat to collect catch data associated with the Study Fleet's high resolution DO and temperature data; this sampling occurred during August–October 2022. Data 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. Work on this study will continue through 2023.

Project staff finalized work on a laboratory-based growth study of large lobsters (>100 mm CL), which addressed a data need for an improved growth matrix for the ASMFC lobster stock assessment. Molt increment data were collected for 112 large lobsters that successfully molted in the laboratory, most of which were females. Data were provided to the stock assessment committee working to update the growth matrices. This study was funded by the National Sea Grant American Lobster Research Initiative. The final report was submitted to NOAA Sea Grant in April 2022.

Staff participated in the development of two manuscripts accepted to peer-reviewed journals that resulted from the NOAA Fisheries Saltonstall-Kennedy grant-funded project titled "*Can climate change induce reproductive failure in American lobster? Case study of a collapsed stock.*" This project, led by DMF staff, was completed in 2021 and was a collaborative effort with a team of researchers from University of New Hampshire, Wells National Estuarine Research Reserve, and Department of Fisheries and Oceans Canada.

Outreach: Project staff addressed media requests for the Cape Cod Bay dissolved oxygen monitoring work. Additionally, staff gave multiple presentations on lobster biology and monitoring work throughout the year, including invited seminars at the MA Shellfish Officers Association Constable Training, UMASS Dartmouth's SMAST seminar series, and the Sea Grant American Lobster Initiative's Collaborative Chats series.

Horseshoe Crab Monitoring

Commercial Fishery Sampling: Monitoring of the commercial bait and biomedical harvests of horseshoe crab continued in accordance with the ASMFC Fisheries Management Plan (FMP). This includes incorporation of monitoring at a new biomedical facility, Charles River Laboratories, that opened in Harwich, Massachusetts in July 2022. Prior to Charles River Laboratories, Associates of Cape Cod, which opened in the 1970s, was the only biomedical company to bleed horseshoe crabs in the state. These biomedical facilities bleed horseshoe crabs to produce Limulus Amebocyte Lysate, a critical component of safety testing in human and veterinary medicine.

DMF has collected prosomal width measurements from horseshoe crabs in bait and biomedical facilities since 2008. Widths were obtained from 1,572 crabs from the bait fishery and 2,054 crabs from the biomedical fishery in 2022. One at-sea biomedical collection trip and one release trip were also observed by DMF staff. More observed collection and release trips were planned for 2023.

The size distributions of male crabs from both fisheries and female crabs from the biomedical fishery have been relatively consistent over the entire time series. However, the average size of female crabs observed in the bait fishery has decreased since 2014. This may be related to expanding our sampling season to include crabs caught after the spawning season by the mobile gear fleet, which now accounts for more than half of horseshoe crabs landed in Massachusetts and is more likely to catch smaller crabs. Crabs caught by hand harvesters during the spawning season are usually mature adults that are coming up on the beach to spawn, whereas the mobile gear fleet is catching crabs of a wider size range that can include adults and sub-adults.

Fisheries-Independent Surveys: DMF and numerous volunteer organizations conducted spawning beach surveys at 17 beaches along the South Coast, Cape Cod, and the islands in 2022. Surveys were conducted at high tide two days prior, the day of, and two days after the new and full moons from May to the end of June. DMF staff conducted 24 surveys at Swift's Beach in Wareham. The number of female crabs observed in the survey was above time series medians for 73% of beaches in 2022 (Table 23). Eighty-four percent of beaches have an increasing trend over the last 5 years, and 73% are increasing over the last ten years.

Table 23. Summary of 2022 Massachusetts Horseshoe Crab Spawning Beach Surveys and survey trends. Survey beaches are grouped by region with day and night surveys treated independently for beaches that conduct surveys at both time periods. Survey results for 2022 are compared to respective survey time series medians. If the 2022 data point was above the time series median, it is shaded green; if it was below, it is shaded red. Linear trend lines were applied to the last 10 and 5 years of survey data for each beach. Those with a positive trend are shaded green; those with a negative trend are shaded red. N/A denotes surveys with time series less than 5 or 10 years.

Beach	Region	Time of Day	2022 vs Median	10-year trend	5-year trend
Duxbury	Cape Cod Bay	Day	above	decreasing	increasing
Duxbury	Cape Cod Bay	Night	above	decreasing	increasing
Long Beach	Cape Cod Bay	Day	above	N/A	N/A
Long Beach	Cape Cod Bay	Night	above	N/A	N/A
Millway Beach	Cape Cod Bay	Day	above	increasing	increasing
Millway Beach	Cape Cod Bay	Night	above	increasing	increasing
Long Pasture	Cape Cod Bay	Day	above	increasing	increasing
Long Pasture	Cape Cod Bay	Night	above	increasing	increasing
Sanctuary Beach	Cape Cod Bay	Day	above	increasing	increasing
Indian Neck	Cape Cod Bay	Day	equal	increasing	increasing
Indian Neck	Cape Cod Bay	Night	below	decreasing	decreasing
Great Island	Cape Cod Bay	Day	above	increasing	increasing
Priscillas Landing	Outer Cape Cod	Day	above	increasing	increasing
Marsh 2-3	Outer Cape Cod	Day	above	increasing	increasing
Erica's Beach	Outer Cape Cod	Day	below	increasing	increasing
Stage Harbor	Nantucket Sound	Day	N/A	N/A	N/A
Stage Harbor	Nantucket Sound	Night	N/A	N/A	N/A
Bass River	Nantucket Sound	Day	above	N/A	increasing
Bass River	Nantucket Sound	Night	above	N/A	increasing
Monomoy	Nantucket Sound	Day	above	increasing	increasing
Monomoy	Nantucket Sound	Night	above	increasing	decreasing
Warrens Landing	Nantucket Sound	Day	above	increasing	increasing
Warrens Landing	Nantucket Sound	Night	above	increasing	increasing
Tashmoo	Nantucket Sound	Day	below	increasing	increasing
Tashmoo	Nantucket Sound	Night	below	increasing	decreasing
Tahanto	Buzzards Bay	Day	above	decreasing	increasing
Tahanto	Buzzards Bay	Night	N/A	increasing	increasing
Swifts Beach	Buzzards Bay	Day	below	decreasing	increasing
Swifts Beach	Buzzards Bay	Night	below	decreasing	decreasing

Assessment and Management Support: Staff continued to serve on the ASMFC Horseshoe Crab Technical Committee in 2022 and participated in an ASMFC working group to update the Best Management Practices for handling horseshoe crabs for biomedical purposes. Staff also prepared data summaries in support of several meetings and listening sessions DMF held with various stakeholders regarding potential regulatory changes.

Outreach: Staff gave virtual presentations on the status of horseshoe crabs to the Southeastern Massachusetts Pine Barrens Alliance and the Brewster Women's Library. The Massachusetts Horseshoe Crab Science Meeting, hosted annually by Invertebrate Fisheries Project staff, was held virtually in 2022. Staff gave a presentation at the MA Shellfish Officers Association Constable Training on horseshoe crab biology and management.

Jonah Crab Research and Monitoring

Commercial Fishery Sampling: Monitoring of the commercial Jonah crab catch has been required by the interstate FMP since 2015. Project biologists conducted 15 port sampling trips from eight individual boats to collect length frequency and sex ratio data from the commercial fishery in 2022. These trips sampled a total of 7,103 crabs from NMFS statistical areas 514, 537, 526, 525, and 562 (Figure 38). Most crabs are harvested in waters south of Martha's Vineyard and east to Georges Bank (NMFS statistical areas 537, 525, and 526). The median size of crabs sampled from these areas was similar to prior years.

Figure 38. Tote of Jonah Crabs.

Assessment and Management Support: Staff represented Massachusetts on the ASMFC Jonah Crab Plan Review Team and chaired the ASMFC Jonah Crab Technical Committee. Staff also served on the ASMFC Jonah Crab Stock Assessment Sub-Committee, which is working toward the first Jonah crab benchmark stock assessment, scheduled for completion in 2023. Staff provided landings data, spatial information, commercial size distribution data, survey indices, and biological information (e.g., maturity and movement data) for the assessment.

Outreach: Staff gave a presentation at the MA Shellfish Officers Association Constable Training on Jonah crab biology and management.

Whelk Research and Monitoring

Commercial Fishery Sampling: There were some challenges associated with transitioning of staff and lack of participants in 2022 that resulted in fewer whelk sampling trips than normal. Staff conducted two sampling trips aboard commercial vessels fishing whelk pots in the Buzzards Bay region, one in the spring and one in fall. Efforts will be made in 2023 to find new, willing industry participants for this sampling program.

Assessment and Management Support: Staff provided data in support of policy discussions related to the scheduled gauge size increases and participated in several meetings and a public hearing relative to this topic. Staff also participated in a meeting with SMAST regarding whelk-related research priorities.

Outreach: Staff gave a presentation at the MA Shellfish Officers Association Constable Training on whelk biology and management.

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 2022, instead of the full stock assessment historically conducted annually, the Technical Committee provided an update on stock conditions using a simpler "traffic light" approach based solely on survey data. Additional work focused on developing a "wake-up" index using recruitment indicators, intended to reinitiate more in-depth analyses (including a full stock assessment) should recruitment conditions suggest some improvement in the stock.

Other Activities

Other: Invertebrate Fisheries Project Staff acted as reviewers for peer-reviewed journals, and were co-authors on a total of four published articles. Staff served on the thesis committee for a Virginia Institute of Technology graduate student.

Staff initiated work to develop a comprehensive new database to house data collected from multiple Invertebrate Fisheries sampling programs. Substantial time was spent identifying needs for each program and conceptualizing a database structure that would be sufficiently robust to meet current and potential future needs. Staff then worked with DMF Statistics Program staff to vet and improve the design plan for EEOA IT to begin development in 2023.

Protected Species Project

Cape Cod Bay Right Whale Surveillance Program

In 2022, DMF partnered with the Center for Coastal Studies (CCS) and NOAA Fisheries to carry out the 24th year of the Cape Cod Bay Right Whale Surveillance Program. The program conducts aerial surveillance and habitat monitoring of right whales in the Cape Cod Bay portion of Right Whale Critical Habitat. The team documented 75% (n=254) of the known right whale population in Cape Cod Bay and adjacent waters, including Massachusetts Bay and the North Shore (Figure 39). Cape Cod Bay and adjacent Massachusetts coastal waters continue to be an important seasonal habitat for right whales, which is especially significant given that the population currently numbers around 340 individuals.

There were no known right whale mortalities in 2022. 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 high. During the 2022 right whale calving season, 15 live calves were identified, of which 10 mother/calf pairs were documented in Cape Cod Bay. The high abundance of right whales visiting Cape Cod Bay demonstrates how critical Massachusetts waters are to the North Atlantic population and the importance of protecting them.

In 2022, Project Staff administered the grant from NMFS that supports aerial surveillance and habitat monitoring and assisted in coordination of all large whale conservation activities.

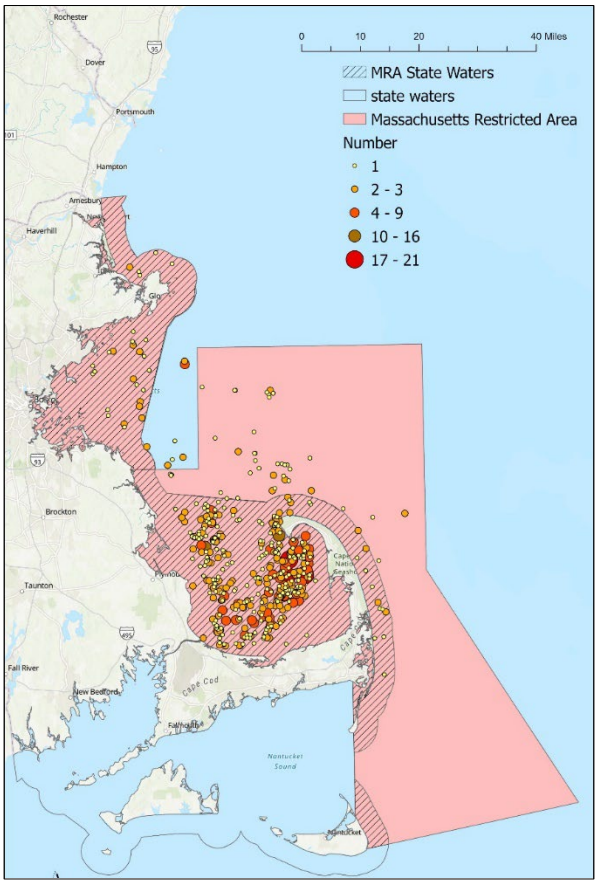


Figure 39. Map of right whale spottings from aerial surveillance monitoring in 2022.

Large Whale and Sea Turtle Disentanglement

DMF and PCCS cooperatively administer the large whale and sea turtle disentanglement efforts around Massachusetts through grants from NMFS and the Massachusetts Environmental Trust. Project Staff assisted in disentanglement efforts, gear analysis, and performed all grant management activities. A confirmed 19 whales

were reported as entangled within the PCCS response area. The team either partially or fully disentangled three humpback whales and one minke whale. Additionally, PCCS confirmed five sea turtle entanglements. All entanglements were confirmed as leatherbacks and four were disentangled.

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 and leatherback sea turtles. Project staff are part of DMF's ITP Task Force. In 2022, 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. In July 2022, DMF submitted a draft HCP to NOAA Fisheries for review and comments. Feedback from NOAA on that initial HCP has been instrumental in DMF's development of a final HCP draft, which will be submitted to NOAA Fisheries in early 2023. It will likely take one year for NOAA to review and analyze the final HCP.

Protected Species Regulations

In 2022, DMF implemented expanded buoy line marking requirements for commercial trap fishermen. The new requirements establish a distinct marking scheme for Massachusetts state waters and adjacent federal waters which distinguishes it from other jurisdictions (refer to Fisheries Management Actions, page 14, for more details). This is a critical component of Massachusetts' protected species management program to ensure any entanglement is properly attributed to the jurisdiction where the gear was set.

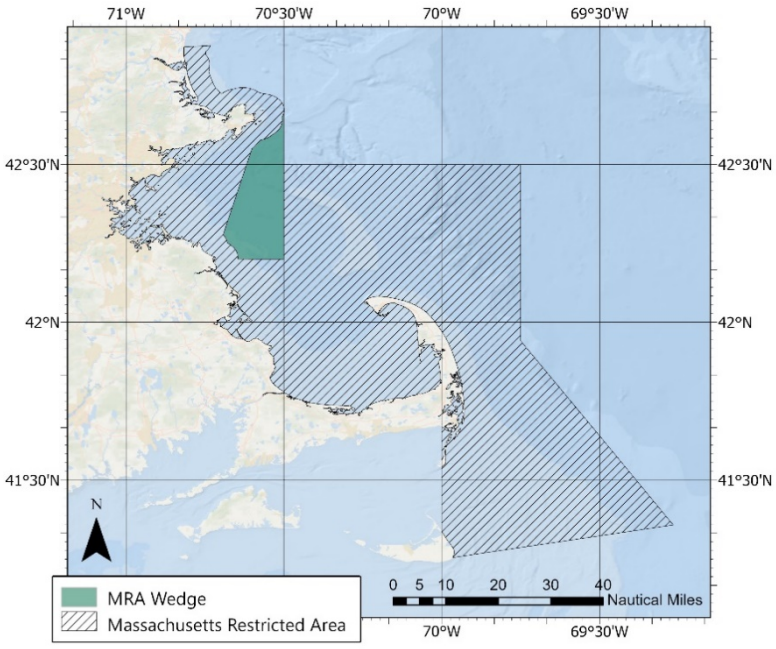


Figure 40. Map of the MRA Wedge and MA Restricted Area.

The National Marine Fisheries Service also implemented an emergency trap closure under the Atlantic Large Whale Take Reduction Plan, designed to protect right whales from entanglement. The "MRA Wedge" closure was adjacent to the current Massachusetts Restricted Area closure 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 from April 1–30, 2022 (Figure 40).

Derelict Gear Removal

In 2022, DMF initiated a cooperative program to locate and remove all lost, abandoned and illegally fished gear in the Massachusetts Restricted Area prior to the arrival of right whales. DMF partnered with the Massachusetts Environmental Police (MEP), commercial fishermen, and the Center for Coastal Studies (CCS) to locate and

remove all derelict trap gear within the portion of Massachusetts state waters that are seasonally closed for right whale protection. Beginning in February, DMF utilized a combination of aerial surveillance provided by CCS and MEP vessel patrols to identify and mark the location of lost/abandoned fixed fishing gear in the closure. DMF then worked with seven contracted commercial lobstermen to haul and remove all identified gear. This effort not only ensured that the seasonal state waters closure was effective in eliminating entanglement risk, but it also provided an opportunity to monitor compliance with the closure and requirements for weak rope/contrivances, maximum rope diameter, and gear marking schemes. Gear was hauled and information collected on location, amount of gear, gear type and convention, and compliance with whale regulations. In 2022, DMF conducted over 49 sea days during derelict gear removal efforts and hauled approximately 2,000 traps and 700 buoy lines.

Ropeless Fishing Scoping Project

Staff continued to work on a framework for the implementation of ropeless fishing in New England. The initial phase of the project was completed in summer 2022 and included interviews with a variety of stakeholders and a synthesis of the regulatory, logistical, technological, and financial challenges to implementing ropeless fishing. For the second phase, in 2022 DMF collaborated with our ropeless project contractor, Noah Oppenheim of Homarus Strategies, and Dr. Rob Griffin of SMAST to develop a socioeconomic model for on-demand gear use based on available fishery-dependent reporting and economic data and a series of stakeholder surveys/ interviews. The project produced a modeling framework that includes input parameters describing fishing activity under baseline conditions (i.e., traditional buoy lines/current time-area management) and various customizable scenarios that approximate a range of future operating conditions in the fishery. 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-call fishing gear management and implementation scenarios for the first time.

Weak Rope and Buoy Line Marking Outreach

To assist fishers in complying with the weak rope and buoy line marking regulations, Protected Species staff conducted outreach events at several locations across the state to distribute gear to fishermen. DMF staff hosted six gear distribution events in New Bedford, Gloucester, Scituate, Plymouth, Cape Cod, and Martha’s Vineyard to supply fishermen with weak rope, weak insert materials, and buoy line marking materials such as heat shrink, twine, and tape. In 2022, DMF distributed weak rope, contrivances, and gear marking supplies to approximately 480 commercial trap fishers.

Other Activities

Staff participated as a member of the Massachusetts Habitat Working Group. This body assists EEOEA, the federal Bureau of Ocean Energy Management, and the Massachusetts Clean Energy Center with analysis of natural resource data as it relates to potential impacts in the Massachusetts Wind Energy Area (WEA). State and federal governments are assessing the potential impact of wind energy development on marine mammals that inhabit the area south of Martha’s Vineyard and Nantucket.

Recreational and Diadromous Fisheries Program

Personnel

Dr. Gregory Skomal, Program Manager

Recreational Fisheries Project
John Boardman, Marine Fisheries Biologist
Matt Ayer, Marine Fisheries Biologist
Ross Kessler, Public Access Coordinator
David Martins, MRIP Coordinator
Kristen Thiebault, MRIP/FHTS Sampler

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

Diadromous Fisheries Project
Brad Chase, Senior Marine Fisheries Biologist, Project Leader
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Stephanie Berkman, Marine Fisheries Biologist
Ben Gahagan, Marine Fisheries Biologist
Edward Clark, Fishway Crew
James Rossignol, Fishway Crew

Overview

The Recreational and Diadromous Fisheries Program includes three Projects.

The **Recreational Fisheries Project** works to preserve, enhance, and promote the Commonwealth's marine recreational fisheries. The goals of the Project are to conserve key recreational species through science-based management; support the recreational fishing community, including local recreational fishing businesses; and educate the Commonwealth's citizens on the features and benefits of local recreational fisheries resources. Project personnel measure abundance, length frequency, and age classes of key finfish populations; assess habitat and prey needs of key species; 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.

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.

Recreational Fisheries Project

MRIP Sampling Project

Since 1983, recreational fisheries catch and effort data have been collected along the Atlantic Coast through NOAA Fisheries' Marine Recreational Information Program (MRIP). 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 head boat survey segment for Massachusetts waters since 2003 and assumed the shore-side Access Point Angler Intercept Survey (APAIS) sampling of charter vessels, shore anglers, and private/rental vessel anglers in 2013. The benefits of doing so include the ability to increase sample sizes and improve the precision of catch estimates. In 2020, DMF began the implementation and administration of the For-Hire Telephone Survey (FHTS) in Massachusetts.

DMF continued its coordination of APAIS surveys in 2022—training 20 seasonal field interviewers, scheduling trips, logging data, maintaining equipment, attending virtual 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 2022, MRIP field interviewers completed 1,283 assignments out of 1,329 scheduled for a total of 4,850 angler intercepts (slightly less than the year prior): 3,269 from private vessels, 641 from charter vessels, and 940 from shore anglers.

The FHTS, through which effort information from charter and head boats is collected throughout the fishing season continued in 2022. A total of 1,694 calls were completed to vessel representatives from March through December. FHTS staff also worked to update and improve the federal charter and headboat vessel directory to ensure survey precision and accuracy as well as sampling efficiency each year.

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 2022, there were 60 entries in the derby, including 32 winners and two Anglers of the Year. We also recognized one Skillful Skipper. No new state records were set. Other activities in 2022 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 February 18, 2023 (Figure 41).

Figure 41. John Clark, 2022 Junior Angler of the Year.

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), NGOs, 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 2021, DMF entered a partnership with the City of Salem and initiated work to replace the historic Salem Willows Park Pier. The pier has been a mainstay in Salem and has served the fishing public for over one hundred years. 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 (ADA) accessibility. Demolition of the old pier, which was condemned as unsafe, began in late 2021. In 2022, the project was expanded to include a new seawall and approach to the pier. Construction was scheduled to begin in the latter half of 2023, with an estimated duration of six and 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. Three projects were approved for funding in 2022: (1) Cohasset - the installation of two cartop access floats, which are specially designed to enhance the ability of canoe, kayak, and stand-up paddleboard users to access the water; (2) Barnstable - the repair of the concrete boat ramp at Blish Point; and (3) Newburyport - the installation of solar lights and running water at the Cashman Park fishing pier on the Merrimack River.

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.

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 2022, 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.

Outreach

Staff routinely answered public inquiries regarding recreational fisheries and attended meetings of the recreational fishing community, this included fishing and boating trade shows.

The 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. In addition, important recreational fishing news was distributed to

Figure 42. 2022 Saltwater Fishing Guide.

recreational permit holders through the Division's email list.

Large Pelagics Research Project

Shark Research

DMF began shark research in 1987 to more fully elucidate 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 methods. Our acoustic receiver array has been expanded to fill gaps around Cape Cod and to include most towns along the Massachusetts coastline. Tagging and survey efforts have been expanded into Cape Cod Bay. Five gridded acoustic arrays were deployed off beaches of the Outer Cape with the Center for Coastal Studies to examine fine-scale movements of sharks as they relate to the habitat. Five real-time acoustic receivers were deployed off popular Outer Cape swimming beaches including: Newcomb Hollow and Lecounts (Wellfleet), Head of the Meadow (Truro), Nauset Trail (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 will be used to examine swimming 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 cameras systems were utilized off the Outer Cape to observe nearshore white shark behavior.

As a result, 31 white sharks were tagged with acoustic transmitters off the Outer Cape in 2022; three of these also carried acceleration data logging camera tags for up to two days. This brings the total to 319 individuals tagged since 2009. These efforts were conducted with funding and logistical support from local nonprofits, including the Atlantic White Shark Conservancy. Data collected in 2022 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.

Shark Management: Staff participate in the state, interstate, federal, and international shark management processes. During 2022, 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 ten graduate students who are working with DMF to study the relative abundance, life history, movements, and physiology of sharks.

Publications: Staff co-authored seven articles published in scholarly journals in 2022. Topics included:

multispecies acoustic tracking of fishes in the Florida Keys; sharks as exfoliators; population genetics in whale sharks; angler responses to shark depredation; global collision hotspots for whale sharks; vertical movement ecology in sharks; and stress responses, health, and diseases in sharks.

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.

Table 24. River systems with diadromous fish populations monitored 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	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
Herring Creek, Aquinnah	No	Video
Mill River, Taunton	No	Video

Current monitoring coverage includes at least one station targeting spawning run counts and biological data for each of the major coastal drainage areas. Additionally, DMF and local partners now use electronic or video technologies to record spawning run counts at 22 river systems (Table 24). Project staff provide specific

assistance to Towns and watershed groups on electronic and video counting systems for river herring. DMF staff have designed, fabricated, and installed over 20 electronic and video counting systems in river herring runs. DMF presently maintains three video stations and six electronic stations while providing technical assistance to the remaining stations.

In 2022, river herring counts ranged from 23 fish (Concord River, North Billerica) to 436,387 fish (Mystic River, Medford), at 41 rivers in 31 towns where counts occurred. River herring counts decreased at most herring runs in 2022, although some locations posted counts above their time series average, including the Parker River, Newbury and the Essex River, Essex. Project staff provided technical assistance to local groups conducting volunteer visual counts at herring runs. Many of these local groups participate in the MA River Herring Network. DMF staff presented information to the Network's annual meeting in 2022 on management updates, population status, and diadromous fish restoration activities.

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 Policy. In 2022, the following seven stocking trips were made with the approximate number of stock adult river herring listed: 1,000 herring from the Nemasket River to the Three Mile River, Dighton; 420 herring from the Parker River in Byfield to Hood Pond, Topsfield; 600 herring from Town Brook, Plymouth, to Island Creek, Duxbury; 200 herring from the Monument River to Mill Pond, Barnstable; 250 herring from the Santuit River to Town Brook, Yarmouth; 250 herring from Santuit River to Bourne Pond, Falmouth; and 280 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 that required a sustained effort in 2022 are described below.

River Herring Habitat Assessment: 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. No habitat assessments were conducted in 2022 as efforts focused on data processing for assessment reporting. Datafiles were processed for six prior assessments in 2022 and a DMF Technical Report was submitted on the Mattapoisett River assessment.

Diadromous Fish Restoration Priority List/*Mass*DOT Diadromous Fish GIS Data Layer: Ongoing efforts continued to update a 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 480 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. Substantial progress was made towards finalizing a MassGIS data layer on diadromous fish expected for publication in early 2023.

Environmental Review: DMF staff biologist routinely provide technical assistance to the DMF Habitat Program's review of environmental permit applications in diadromous fish runs. This activity can involve extensive reviews of project designs and permit applications for larger projects and depends on decades of institutional knowledge within the Diadromous Fish Project of 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. The eel population in the lake was surveyed during the summer using eel pots to estimate the number of eels.

American Shad Monitoring

Charles River Monitoring: In 2022, project staff worked with colleagues at *MassWildlife* to collect adult American shad from the Charles River to characterize the population and identify fish marked with oxytetracycline in year-specific patterns. This effort was sidelined by the pandemic in 2020. 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 *MassWildlife* 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 2022 decreased in comparison to 2021. This monitoring also includes other diadromous fish species.

Taunton River Monitoring: A cooperative American shad stocking project for the Taunton River was initiated with USFWS and *MassWildlife* in 2022. The pilot season for this effort resulted in over 5 million juvenile shad stocked in the Taunton River in 2022. This work included a continuation of pre-stocking beach seine and boat electrofishing monitoring for shad in the Taunton River. Five years of pre-stocking seining at fixed stations had not captured any American shad. The first season of post-stocking seining in 2022 captured juvenile shad in June, July and August (Figure 43). Genetic samples will be processed to confirm that these fish were products of the stocking. Pre-stocking electrofishing had caught a few individual adult and juvenile shad during 2017-2021. No boat electrofishing was conducted in 2022 due to equipment issues and scheduling conflicts.

Figure 43. DMF beach seining for American shad in the Taunton River (right); juvenile American shad collected during seining.

American Shad Electrofishing Survey: In the spring of 2022, project staff completed the seventh season of monitoring the presence and abundance of American shad in the South River and Indian Head River in Marshfield and 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 2022, 17 sampling trips in the South River and 19 sampling trips in the Indian Head River were conducted between April and June; 17 and 57 shad were collected, respectively, for size, age, and genetic sampling. Scale-based aging indicated that these shad ranged from 4–8 years with some fish having spawned up to three times previously. Catch-per-unit-effort indices of abundance were calculated for each river. Monitoring is expected to continue in 2023 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 2022 improved to 89 eels per haul, with a total catch of 3,825; however, these values are still well below the time-series average and contribute to a significant declining trend. The Essex River fyke net catch continued with the high rates seen since 2019 with 492 eels per haul and a total of 18,703 eels in 2022.

Project staff has 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 outfitted with a collection tank to evaluate the performance of the eel ramp and the potential to use the location as a monitoring station for census counts of YOY or older eels. Collectively, between the deployment of eel ramps and an increase in coastal river dam removals, improvements to juvenile eel passage can be expected in some watersheds in the last 15 years. The Jones River YOY data were accepted as an index of abundance for the ASMFC eel stock assessment in 2012; and had been the only such eel 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 (Newbury), Fore River (Braintree), Jones River (Kingston), and Weweantic River (Wareham). The smelt catches in the Fore River continued to be the highest among stations in 2022 and were near the series average after very high catches in 2018–2020. The Jones River had catches increase from 2021 to 2022 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 species of diadromous fish, with potential indices of abundance for eel, white perch, Atlantic tomcod, and lamprey. The American eel bycatch in the Fore River fyke net was 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 2022, project staff devoted time to approximately 20 individual projects in various stages of

development and implementation. It was a busy year for project development for several larger projects. Additionally, six small DMF Fishway Crew jobs were completed in 2022—an increase in activity after high flows limited construction in 2021. The total cost for materials for six DMF jobs in 2022 was $5,400.

Monument River Fishway, Bourne: The Army Corps of Engineers requested DMF assistance to replace a critical concrete weir in the fishway that runs along their Cape Cod Canal property. The Corps provided funds for materials ($1,700) and much-needed crane and labor assistance. With tidal and river flows, water control at this site was difficult, with two pumps required along with upstream flow management for the four-day job. The concrete weir was replaced with concrete patches made to nearby walls during this challenging but rewarding example of cooperative work between the DMF Fishway Crew and property owners/agencies (Figure 44).

Figure 44. DMF Fishway Crew setting form for a new concrete fishway weir at the Monument River, Bourne.

Red Brook Fishway, Bourne: The fishway that connects fish passage from Red Brook Pond to the tidal Red Brook Harbor was rehabilitated in 1968, and had recently begun to show its age with concrete cracks and wall leakage. A cooperative project was organized with the Town of Bourne to provide a day of service with Town and DMF Fishway Crew staff to repair concrete cracks and remove invasive plants encroaching the fishway entrance and exit. The fishway was dewatered in the process, revealing the leakage originated upstream at the pond outlet, indicating a larger job is needed to correct the leakage.

Little River, Gloucester: Under a cooperative project with the City of Gloucester, the DMF Fishway Crew designed, permitted, constructed, and installed a small wooden fishway at the Lily Pond outlet to the Little River. The prior Alaskan steeppass fishway required more water than was typically available in this watershed. The new custom low-flow fishway is expected to provide improved and sustainable spring passage for alewife. The fishway materials were funded by the City of Gloucester and the fishway was built at DMF's New Bedford shop and transported to the Little River for installation.

Whelden Cotton Mill Dam, Acushnet River, Acushnet: Drought conditions during 2022 caused DMF staff to visit the remnant stone weirs at the Whelden Cotton Mill dam to evaluate current conditions. On August 30, 2022, river flow had declined to the degree that all downstream flow was seeping through the weir stones. Under this condition, young-of-year river herring moving downstream would be entrained into the weir stones and suffer high or full mortality. Six DMF Diadromous Project staff manually moved stones from two rubble dams to create passage channels free of interstitial spaces that could trap fish. A half-day of manual labor by the DMF crew corrected a significant threat to downstream juvenile herring passage.

Elm Street Dam Fishway, Indian Head River, Pembroke/Hanover: An effort to rehabilitate the fishway at the Elm Street Dam (also known as Luddam's Ford Park dam) by the DMF Fishway Crew continued in 2022. 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. Work in 2022 included replacement of 13 of 37 wood baffles and continued concrete and aluminum repairs to stop log board slots.

Black Pond Fishway, Harwich/Brewster: A cooperative project was conducted during the summer of 2022 with the DMF Fishway Crew and the Towns of Brewster and Harwich to repair the failed wood fishway that connects Black Pond to Long Pond in the Herring River watershed. Approximately one third of the 65-ft wood fishway was replaced. The remainder of the fishway was repaired by digging out sand around the walls and using jacks to correct the collapsing walls and adding wall stabilizers (Figure 45). Hand digging was done to avoid property disturbance. The digging extended the job duration to five-days. Both towns contributed field labor and permitting assistance. The Town of Harwich paid for the project materials ($1,600).

Figure 45. DMF Fishway Crew adding wall stabilizers to Black Pond Fishway in Harwich/Brewster.

Stump Brook Reservoir Bog Dam, East Bridgewater: The concept of providing river herring access to Stump Brook and the Monponsett ponds has been discussed for decades. The removal of the Cotton Gin Mill Dam on the Satucket River in 2017 left the Stump Brook Bog Reservoir Dam as the primary obstacle to this migration route. DMF began site investigations in 2019 at the dam and received a grant from the Taunton River Stewardship Council in 2021 to fund a design/permit contract. DMF contracted GZA for this task in 2022. The fishway permits were received in 2022, and the DMF Fishway Crew began fabrication of the custom aluminum fishway at the New Bedford shop in preparation for a 2023 installation.

Forge Pond Dam, Kingston: Work continued on the 20-year objective of restoring sea-run fish access to Silver Lake in the Jones River watershed. A project scope was prepared in 2021 for a design/permitting contract for designing a fishway at Forge Pond Dam along with associated dredging in Forge Pond. Funding from MassDEP and the USFWS were used to contract the design/permitting of this project in coordination with the City of Brockton and the Jones River Watershed Association. At the close of 2022, the project's 60% design plans were under review.

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 next contracted the USFWS Fish Passage Engineering Team in 2021 to prepare a scoping design for a fishway at Forge Pond Dam. DMF funded a fish passage improvement study in 2022 that was contracted to GZA. This study was completed and included recommendations for the next design stages and cost estimates. DMF staff began investigating funding opportunities for the project's next steps and communications with the upstream dam owner at Lake Nochoquoke.

Ipswich River, Ipswich: Efforts to improve fish passage at the Willowdale Dam and Howlett Brook in Topsfield on the Ipswich River continued. Increases in construction costs prevented the Willowdale Dam project from moving forward in 2022 but grant funding to provide passage for a new nature-like fishway at this site was obtained in cooperation with the Ipswich River Watershed Association and Foote Brothers Canoe. The Howlett Brook fishway project was designed and permits were acquired but high-water levels prevented the work from being completed. Pre-construction stocking of river herring in Howlett Brook continued in 2022 and grant funding to complete this project in 2023 was obtained in cooperation with the Ipswich River Watershed Association.

Horn Pond, Woburn: Recent efforts by DMF and local partners resulted in river herring entering Horn Pond in the Mystic River Watershed for the first time in over a century in 2017. Efforts continued in 2022 as project staff

worked with the Mystic River Watershed Association and Town of Woburn to manage flows and fish passage at the Scalley Dam. A visual count was made in 2022 and project staff moved 9,000 herring over the dam. Funding through an environmental mitigation process has led to the opportunity for a new dedicated passage structure at this site and DMF is working with the City of Woburn and other partners to design a new ladder that can also provide exemplary public access and viewing.

Large Fish Passage Collaborations: There was much activity in 2022 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 numerous projects under design in 2022. Large dam removal projects were ongoing at the High Street Dam, Town River, Bridgewater; Armstrong Dam, Fore River, Braintree; Talbot Mills Dam, Concord River, North Billerica; and Larkin Mill Dam, Parker River, Byfield.

Diadromous Fish Coast-Wide Survey

DMF began a survey of diadromous fish passage in Massachusetts coastal rivers in 2021 and continued those efforts in 2022. 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 in river herring runs and dams that obstructed passage. 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 will soon be published as a MassGIS Data Layer. The integrated survey, priority list, and GIS Data Layer should become valuable tools for restoration, resiliency, and transportation planning at local, state, and federal levels.

River Herring Stream Channel Maintenance

Project staff routinely field requests to assist Towns in 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 MassDEP to develop a policy to connect the Wetland Protection Act to stream maintenance for diadromous fish runs. This policy was issued in April 2022. Stream maintenance plan updates were finalized for Herring Brook, Pembroke; Island Creek, Duxbury; and the Weir River, Hingham. A new plan was prepared for Ryders Cove, Chatham. Project staff worked in 11 rivers with local partners in 2022 and with substantial efforts and improvements made in the Fore River, Braintree; Acushnet River, Acushnet; Jones River, Kingston; Island Creek, Duxbury; Mill Creek, Yarmouth, and Nemasket River, Middleborough.

Fishway Permitting and Operation and Maintenance Plans

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. Two working draft O&M plans were issued in 2022 for Herring Brook, Pembroke and White Island Pond, Wareham. A final fishway O&M was issued for the Draka Dam fishway in Taunton on the Three Mile River. DMF issues Fishway Construction Permits following the review of engineering plans to construct, rebuild, or alter fishways. During

2022, a Fishway Construction Permit was issued for the Blacks Pond fishway reconstruction in Harwich and a draft permit was prepared for Sylvia Place Pond in Furnace Brook, Kingston.

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. The number of requests in 2022 was larger than usual, possibly due to a resumption of in-person activities following COVID restrictions in 2020–2021. Over 20 formal presentations were given by project staff in 2022. The project leader gave 14 presentations on diadromous fish population management and restoration, including keynote presentations at three watershed organization's annual meetings and two training courses at the Massachusetts Maritime Academy.

Staff contributed to journal articles examining the effects of large-scale oceanic processes on river herring spawning migrations, the impact of bycatch on regional populations of river herring, and the effects of freshwater residence time on the reproductive success of alewife. Staff also drafted the first Habitat Plans for American Shad in the Taunton River and the Merrimack River basin and submitted a manuscript on a river herring spawning and nursery habitat for the Mattapoisett River to the DMF Technical Report series.

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 – Revenue

Administrative Support
Lynne Besse, Administrative Support
Amanda Meli, Administrative Support (through September)
Vicki Oliveira, Administrative Support (beginning December)

Grants Management
Stephanie Cunningham, Federal Aid and Grants Coordinator
Cecil French, Project Leader – Clean Vessel Act and Boating Infrastructure Grant
Whitney Sargent, Procurement and Project Coordinator – Clean Vessel Act
Maren Budrow, Assistant Federal Aid and Grants Coordinator
Melanie Griffin, Project Leader – Revolving Loan Fund and State Fishery Management & Technical Assistance
Maggie Nazarenus, Program Coordinator – CARES Act and Revolving Loan Fund (through February)
Amanda Meli, Program Coordinator – Grants Specialist (beginning October)

Outreach
Christine Cassidy, Information & Education Coordinator (through August)
Kimberly Fine, Angler Education Coordinator

Seafood Marketing
Wendy Mainardi, Marketing Coordinator

Scientific Diving
Vincent Malkoski, Diving Safety Officer

Capital Assets and Facilities Management
Brian Castonguay, Gloucester Office, Head of Facilities and Capital Assets
Vincent Malkoski, New Bedford Office, Facilities and Capital Assets
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, outreach efforts, 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. Outreach is conducted through the creation of educational media, event planning, and other

activities. Seafood Marketing efforts support and promote Massachusetts seafood and the commercial industry.

Budget

Overall, state-appropriated funds saw an increase of 13.58% from Fiscal Year (FY) 2021 to FY2022 (Table 25). The increase to these appropriations can be attributed to a small increase to cover non-discretionary costs, a Prior Appropriation Continued (PAC) of almost $200,000 that was approved to "balance forward" from FY2021 to FY2022 for expenditure on needs of the protected species program, and funds from a "reserve draw" account to compensate employees that were required to interact with the public during the COVID pandemic.

The Legislature has created three retained revenue accounts for DMF, whereby funds from a particular 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. Funding from retained revenue accounts decreased by 0.5% in FY22, resulting from the continued decline of shellfish depuration at the Shellfish Purification Plant.

Appropriations from special fund accounts increased by just under 5%. The Legislature slightly increased the appropriation on the Saltwater Sport Fish Licensing account to adjust for increased personnel and research costs; and received funds from a "reserve draw" account to compensate employees that were required to interact with the public during the COVID pandemic. 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 26 provides the breakdown of costs by primary spending category for the DMF operating accounts.

Table 25. Fiscal Year 2021 and 2022 appropriations (available funds for operations).

Title	Acct. Number	FY2021	FY2022	Change
General Fund Accounts				
General Operating	2330-0100	[1]$6,252,794	[2]$7,370,488	17.88%
Sportfish Program	2330-0120	[1]$799,954	[3]$884,326	10.55%
General Fund Total		$7,052,748	$8,254,814	17.04%
Retained Revenue Accounts				
Sportfish Retained Revenue	2330-0121	$217,989	$217,989	0.00%
Purification Retained Revenue	2330-0150	$25,210	$22,654	-10.14%
Ventless Trap Retained Revenue	2330-0199	$250,000	$250,000	0.00%
Retained Revenue Total		$493,108	$490,552	-0.52%
Special Fund Accounts				
Saltwater Sport Fish Licensing	2330-0300	$1,746,763	[4]$1,843,006	+5.51%
Seafood Marketing	2330-0104	$250,000	$250,000	0.00%
Special Fund Total		$1,996,763	$2,093,006	+4.82%
Appropriations Grand Total		**$9,542,619**	**$10,838,372**	**13.58%**

[1] The final budget FY2021 in Chapter 227 of the Acts of 2020 for appropriation 2330-0100 was $6,845,501 and $808,034 for 2330-0120. DMF's general operating budget was affected by: 1) earmarks totaling $525,000 ($450,000 to SMAST; $75,000 for the Gloucester Marine Genomics Institute); 2) $67,707 in 2330-0100 and $8,080 in 2330-0120 that was moved by ANF for the purpose of debt reduction.

[2] 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 ecosystem based 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.

[3] 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.

[4] 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.

Table 26. FY2022 expenditures (including earmarks) by account type and primary spending category.

	General Fund	Retained Revenue	Special Fund	Total
Salaries	$6,844,830	$130,002	$694,373	$7,669,205
Employee Expenses	$22,161	$2,632	$2,730	$27,523
Contracted Employees	$40,518	$20,479	$226,890	$287,887
Contracts	$64,039	$229,120	$97,487	$390,646
Facility Maintenance	$93,807	$26,139	$37,572	$157,518
Field & Lab Supplies	$197,774	$26,513	$64,927	$289,214
Fringe Costs	$157,338	$2,937	$17,337	$177,612
Fuel	$79,254	$6,667	$700	$86,621
Utilities	$63,856	$0	$0	$63,856
Lease/Rent	$207,436	$0	$0	$207,436
Maintenance/Repair	$81,608	$4,978	$0	$86,586
Office & Administrative	$231,617	$31,399	$59,820	$322,837
Outside Agencies	$106,933	$3,598	$72	$110,603
Grants	$1,206,850	$0	$81,814	$1,288,664
Total	**$9,398,021**	**$484,464**	**$1,283,721**	**$11,166,206**

Staffing

Staffing levels increased by eight positions from calendar year (CY) 2021 to the end of CY2022 (Table 27). This was primarily due to the timing of personnel turnover at the end of CY2021 in DMF's main account, with the CY2022 numbers being more reflective of typical staffing levels for the agency.

Table 27. Calendar Year 2020 and 2021 Authorized Personnel Levels.

Title	Acct. Number	CY2021	CY2022
DMF General Operating	2330-0100	60	72
Sport Fish Program	2330-0120	10	9
Saltwater Sport Fish Licensing	2330-0300	7	6
Federal Grants and Trust Account	2330-xxxx*	18	18
Total Employees in All Appropriations		**97**	**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 39,817 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 $2,123,090 in 2022 (Table 28). Overall, there was a drop in permit revenue collected of less than 1% as compared to 2021.

The Shellfish Purification Plant processed 2,835 racks of soft-shell clams in 2022, resulting in General Fund revenues of $17,011. This represents a 7.3% decrease in revenue from 2021 and is the lowest amount ever recorded. There has been a declining trend in racks processed and resulting revenues since 2009; as of 2022, Plant revenue is down by more than 80% as compared to 2009.

Table 28. Calendar Year 2021 and 2022 General Fund Permitting Revenue.

Permit Categories	CY2021	CY2022	Change
Commercial Fishing	$1,217,435	$1,228,205	+0.9%
Seafood Dealer	$193,830	$186,420	-3.8%
Special	$732,435	$708,465	-3.3%
Total General Fund Permit Revenue	**$2,143,700**	**$2,123,090**	**-0.9%**

Dedicated Fund Revenue

In addition to General Fund revenue, DMF generated $1,350,913 in revenue for the Marine Recreational Fisheries Development Fund in 2022 (Table 29). Revenue is primarily from the issuance of recreational saltwater fishing permits, but also includes direct donations to the fund. 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 2022, the count of recreational permits issued was almost the same as in 2021; 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 2.6%. The Fund also saw a dramatic decrease in donations, likely the result of a change in the online portal used to issue permits and collect donations. This contributed to the overall 6.7% decline in revenue to this fund.

Table 29. CY2021 and CY2022 Marine Recreational Fisheries Development Fund Revenue.

Permit Categories	CY2021	CY2022	Change
Recreational Saltwater	$1,306,000	$1,271,980	-2.6%
For-Hire (charter & head boat)	$60,905	$61,620	+1.2%
Recreational Fund Donations	$80,949	$17,313	-78.6%
Total Rec. Fisheries Fund Revenue	**$1,447,854**	**$1,350,913**	**-6.7%**

Grants

In FY2022, DMF spent approximately $3.2 million on federal grants and mitigation projects operating out of the DMF Trust Account. This was a decrease of just over 12% as compared to FY2021 (Table 30). The decrease is primarily the result of reduced costs on an Interstate Fisheries grant in FY2022, and because a large infrastructure project was completed with Trust funds in FY2021 with no new projects started in FY2022.

Table 30. Fiscal Year 2021 and 2022 Expenditures.

Title of Federal Grant or Trust	Account No.	FY2021	FY2022
Clean Vessel Act	2330-9222	$926,000	$909,000
Fisheries Statistics	2330-9712	$180,000	$129,000
Boating Infrastructure	2330-9725	$27,000	$0
Interstate Fisheries	2330-9730	$288,000	$143,000
ACCSP	2330-9732	$21,000	$87,000
Saltonstall-Kennedy	2330-9733	$13,000	$0
Turtle Disentanglement/Protected Species	2330-9739	$668,000	$959,000
Fish Age & Growth	2330-9742	$302,000	$240,000
Sport Fish Coordination	2330-9743	$106,000	$51,000
Sea Grant Lobster	2330-9745	$158,000	$145,000
Marine Fisheries Research Trust	2330-0101	$1,018,000	$599,000
Total		**$3,708,000**	**$3,260,000**

Massachusetts Seafood Processors Pandemic Response and Safety Block Grant

Throughout the Coronavirus Disease 2019 (COVID-19) pandemic, seafood processors and wholesale dealers experienced considerable changes to their standard business operations. Although seafood prices have largely recovered from the revenue declines seen early in the pandemic, many businesses' operating costs increased by implementing enhanced safety practices or market pivots.

The United States Department of Agriculture (USDA) Seafood Processors Pandemic Response and Safety (SPRS) Block Grant Program provided funds to states under section 751 of the Consolidated Appropriations Act of 2021 (Pub. L. No. 116-260) to assist seafood processors and wholesale dealers with expenses incurred in response to COVID-19. Massachusetts received $1,104,725 of these funds to create the Massachusetts SPRS Block Grant Program.

In March 2022, DMF mailed applications to potentially eligible wholesale seafood dealers that had a 2020 or 2021 permit that included seafood processor or primary buyer activities. Applicants could request reimbursement of eligible COVID-19 costs they incurred between January 27, 2020–December 31, 2021, from the following categories: workplace safety measures, market pivots, retrofitting facilities, transportation, worker housing, or medical services. By August 2022, DMF qualified 62 facilities meeting the eligibility requirements. The sum reimbursement requests from those qualified applications totaled $1,860,659.27, an amount surpassing the MA-SPRS allotment. Payments were capped at $21,588.85 per eligible facility (beneficiary) for all eligible cost categories requested. Beneficiaries who requested funds less than this amount were issued payments for the full costs associated with eligible expenses listed on their applications. A total of $1,092,293.69 was disbursed amongst the qualified beneficiaries by October 2022. The USDA SPRS Block Grant Program and other grant programs like it gave valuable support to our seafood processors and wholesale dealers and their role in our food security and seafood distribution chain.

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. The $45,000 allocated to state fiscal year 2022 (July 2021 – June 2022) 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 policy section and DMF submitted to the Council a summary report of the State's technical assistance activities during FY2022.

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.

CY22 saw DMF pivot from closing out the program and garnering funds to collaboratively working 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 on July 20 to first review previous program objectives and performance and then advise DMF on a final repurposing proposal to be submitted to NOAA. The group agreed to meet again following further development of a draft industry proposal for increasing utilization of the remaining funds and DMF analysis of funds to be allocated 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 2022, the 28th 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.

In 2022, 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 31, Figure 46). Total reimbursement for all new and replacement equipment was $84,961. An additional $614,086 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 (Figure 47). PPE remained in high demand for operators navigating pumpout operations during a pandemic. A multiyear effort to rewrite the Massachusetts original 1994 State CVA plan was initiated in 2022. 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.

Table 31. New and Replacement *Mass*CVA Infrastructure for 2022.

Recipient	Equipment
Cape Ann Marina, Gloucester	Replacement pumpout boat engine
Chatham	Replacement pumpout station
Hull	Replacement pumpout station
Kingston	Replacement pumpout boat engine
MacDougall's Marina, Falmouth	Replacement pumpout boat engine
Salem	Replacement pumpout boat engine
Winthrop	Replacement pumpout boat engine

Figure 46. *Mass*CVA infrastructure funded in 2022 included a replacement pumpout boat engine for Salem's busy harbor.

Figure 47. Tisbury's pumpout boat and station funded for operation and maintenance in 2022.

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 2022, one Tier II BIG grant was applied for by the town of Manchester by the Sea to extend the existing *Mass*BIG-funded dock to accommodate additional transient boaters (Figure 48). If the $600,000, three-year grant proposal is awarded, the project would include the construction of an additional 500 feet of dock, including electrical service and water service (to both old and new tie ups), and add a fixed pump-out station at the facility. This project would help address the ongoing significant lack of transient docking opportunities available in Manchester Harbor, and the greater Cape Ann region. A decision on funding was expected in 2023.

Figure 48. Manchester by the Sea applied for BIG tier II funds in 2022 to extend the existing BIG dock above.

Outreach

DMF's outreach efforts are focused on engaging and informing the Massachusetts saltwater fishing community and the general public. Activities are supported in large part by the sale of recreational saltwater fishing permits.

Information & Education

The Information & Education Project (I&E) focuses specifically on establishing and maintaining meaningful connections with Massachusetts recreational saltwater anglers. Staff achieve this in the following ways:

Events: Unfortunately, Covid-19 restrictions continued into the beginning of 2022, necessitating the cancellation of several events including the Saltwater Derby Awards Ceremony and attendance at a number of fishing and boating shows where staff would normally distribute thousands of informational brochures and flyers. The departure of the I&E Coordinator in August also contributed to a temporary decline in I&E activities. Staff attended and provided outreach materials for several events later in 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 coloring books, posters, gunnel stickers with a striped bass slot marker, size 8/0 circle hooks (targeting striped bass anglers), and #fishma stickers. Roughly 1,500 circle hooks and 2,000 coloring books were distributed.

The pilot year of the Take Me Saltwater Fishing initiative, a program to support adults in teaching kids how to fish, began in the spring. Seminars were held for several interested groups and these seminars were complimented with a Lend a Rod Program, which supplies a loan of fishing gear so groups can have their own youth fishing clinics. The project's Saltwater Fishing Field Guides were distributed during seminars providing information to introduce young anglers of Massachusetts to saltwater fishing.

In conjunction with the Angler Education project, staff also designed and implemented an All Woman's Take Me Saltwater Fishing Clinic.

Social Media: Communications with constituents through our social media platforms continued on Facebook, Twitter, YouTube, and Instagram and engagement increased for all these platforms. Content across platforms included regulatory updates, progress from field research, seafood marketing, recreational fishing topics, saltwater derby activity, and other areas. The companion videos for the Take Me Saltwater Fishing Guide, which contain information on knot tying, casting a spinning rod, fishing from shore and a pier, and responsible angler practices were heavily promoted throughout 2022. The most popular videos centered around rigging gear for different types of fishing.

Publications and Design: Routine reorders of I&E program materials were completed to fulfill distribution needs at events. Additional program materials and promotional items for the Take Me Saltwater Fishing initiatives were produced.

Saltwater Angler Education

DMF's Saltwater Angler Education initiative works to promote responsible recreational saltwater fishing in coastal Massachusetts waters, specifically reaching out to those who are new to the sport. Major components include fishing clinics (Figure 49 and 50) and a small grant program, which awards up to $500 per proposal for outside entities to create an event promoting saltwater angler education within Massachusetts.

In 2022, DMF hosted or participated in three youth fishing clinics for ages 7–15, six events opened to all ages, two adult training seminars, one all woman's fishing clinic, and one multi day summer camp fishing clinic. The 2022 events (Table 32) occurred from May through October and were free to the public. At these events, DMF biologists taught basic angling skills, how to responsibly handle fish, and other fun activities such as knot tying and fish identification. Educational handouts were distributed to registered youth, as were mini tackle kits which include materials such as circle hooks and measuring tapes. Our goal is to have participants feel confident enough to saltwater fish on their own. Providing them with tackle to do so greatly increases those odds. Staff also attended the Massachusetts Recreation and Park Associations Annual Exhibition to network and advertise the Take Me Saltwater Fishing Training Seminars and Youth Saltwater Angler Education Fishing Clinics. DMF plans to attend the 2023 conference to form new and strengthen existing partnerships.

Figure 49. DMF's Ross Kessler assisting anglers at a fishing event on Nut Island.

Figure 50. DMF Staff assisting attendees at a saltwater angler fishing event on Deer Island.

Table 32. 2022 DMF Saltwater Angler Education Fishing Events

Event	Partnering Organization(s)	Participants
Family Fishing at Onest Town Pier	Onset Pier, Buzzards Bay Coalition	30
Cohasset Recreation Department Casting Clinic	Cohasset	20
YMCA Casting Clinic New Bedford	New Bedford	20
Boston Harbor Island Anniversary	National Park Service, Boston Harbor Now, MWRA-Deer Island	200
Women Learn to Fish Night	Cape Cod Canal Visitor Center, Sandwich	20
Take me Saltwater Fishing Training Clinic Fort Taber, New Bedford	City of New Bedford, Straight Ahead Organization	10
Fort Taber Pop-up Clinic, New Bedford	City of New Bedford	30
Fort Taber Youth Angler Fishing Clinic	City of New Bedford & Youth, Opportunity, Unlimited	30
Hill to Harbor Discovery Camp Peddocks Island	National Parks of Boston, YMCA groups from the greater Boston Area	150
Fun Family Fishing Day	Cape Cod Canal Visitors Center, Sandwich	50
Bass River Youth Angler Fishing Clinic, South Yarmouth	Town of Yarmouth	Cancelled (due to Covid)
Boston Harbor Island Anniversary	National Park Service, Boston Harbor Now, MWRA, Fish and Wildlife-Nut Island	200

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. It's 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: The Seafood Expo returned to Boston in 2022 after a COVID hiatus. The energy was great despite being smaller. Over 30 businesses from the Commonwealth exhibited ,which is about half of the usual. For the third year, DMF and the Massachusetts Department of Agricultural Resources (MDAR) coordinated a Massachusetts Avenue at the Expo (Figures 51 and 52). This is a cluster of nine businesses from the Commonwealth that received a 50% cost-share for the show via MDAR and USDA and promotion by the Seafood Marketing Program. A banner was purchased to drive traffic to the Mass Ave area and DMF posted on social media leading up to the event.

Figure 51. Staff from DMF, *Mass*DFG, MDAR, and others at the Seafood Expo.

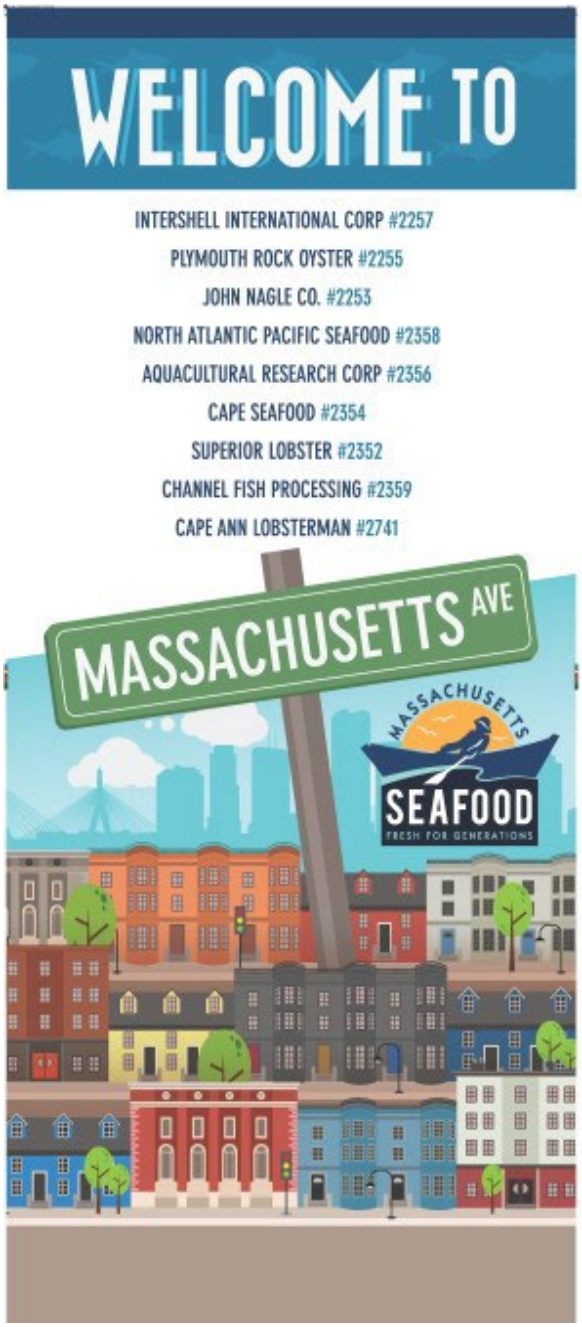

Figure 52. Promotional material for Mass. Ave. seafood businesses at the Seafood Expo.

New England Food Show: The Seafood Marketing Program spearheaded a Massachusetts Seafood Pavilion at the New England Food Show for the first time in early April 2022. A call went out to all permitted wholesale seafood businesses to table at the region's largest restaurant, retail, and foodservice event taking place at the Boston Convention & Exhibition Center. Nine businesses attended our Massachusetts Seafood Pavilion and sampled their products to show-goers. DMF had a booth that successfully directed people to the businesses and

answered general questions about Massachusetts seafood (Figure 53).

Boston Seafood Festival: The Seafood Marketing Program attended the Boston Seafood Festival, an event held annually since 2012 at the historic Fish Pier in the city's Seaport neighborhood. DMF provided fun and educational activities and outreach materials at its table amidst the event's attractions including seafood cooking demonstrations and competitions.

Figure 53. DMF's Julia Kaplan and Wendy Mainardi tabling at the New England Food Show.

Mixed Media Advertising: The Seafood Marketing Program worked with the Massachusetts Department of Transportation to broadcast a digital billboard via their public service announcement program (Figure X). Radio promotions for Massachusetts seafood occurred through iHeart radio for six weeks and Boston's local NPR station, WBUR, during the holiday season. Social media was used to share real-time catch data to educate on local species seasonal availability at markets. One of our Seafood Marketing Grant Program recipients (see below), Eating with the Ecosystem, paid social media influencers for seafood posts. They chose a theme every month; DMF re-posted this content. One focus area of content was informing the public about the misinformation surrounding the misguided Seafood Watch "red listing" of lobster and other fixed gear fisheries by Monterey Bay Aquarium.

Seafood Briefing Webinar: On November 9, DMF co-hosted with the Urban Harbors Institute a seafood briefing webinar for 30 local decision-maker participants (harbormasters, municipalities, etc.). This idea was born at the Working Waterfront Conference at UMass, July 2022.

Grant Program

In 2021, the Seafood Marketing Program partnered with Woods Hole Sea Grant to give away the largest sum of funds in the history of the Seafood Marketing Grant Program. $100,000 came from the National Sea Grant office through Woods Hole Sea Grant and $75,000 came from the seafood marketing budget. The goal of the grant program is to enhance the viability and stabilize the economic environment for the state's local commercial fishing and seafood industries and communities. Awards were announced for eight different businesses in early 2022. The grantees, projects and amounts were:

- Eating with the Ecosystem - Influencing the Influencers: Utilizing Food Influencers to Promote Massachusetts Seafood - $47,841
- Martha's Vineyard Shellfish Group - Martha's Vineyard Seafood Outreach Program - $14,278
- New Bedford Fishing Heritage Center - A School of Fish: Infusing Sustainable Seafood into Culinary Arts Programs & the Public Palate - $25,000
- University of Massachusetts/Gloucester Marine Station - Enabling Tools to Build a Sustainable, Equitable, and Inclusive Seafood Marketing Program - $25,000
- Ryan Curley - Community Seafood HACCP Facility Serving the Outer Cape Feasibility Study - $17,500
- Lobster Foundation of MA - Crustacean Nation Education Dissemination - $10,000
- Red's Best - Highlighting Local Species Through Video - $17,000
- Williams Agency - Marketing Campaign to Promote Underutilized Seafood within Ethnic Markets - $18,550

Scientific Diving

Scientific Diving is responsible for the management of 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.

Figure 54. DMF's Vin Malkoski prepares research gear for diver deployment.

DMF's scientific divers conducted over 390 research dives to support on-going research and monitoring programs, including artificial reef site surveys, coast-wide benthic temperature monitoring, early-benthic-phase lobster suction surveys, eelgrass monitoring and restoration, shellfish abundance and habitat surveys, maintenance of acoustic telemetry receivers for numerous finfish species, polychlorinated biphenyl monitoring sample collection, and dive program training (Figure 54). In addition to DMF divers, the Scientific Diving Program 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.

Routine program management duties included diver training, equipment maintenance and repair, and maintenance of the air system. Equipment maintenance and replacement costs totaled $16,864 in 2022. Sixty air cylinders were inspected in-house, a savings of $1,500. Additionally, in-house first responder training was provided for 34 DMF divers, dive tenders, boat operators, and eight SMAST divers. This represents a cost savings of $8,500.

In-person educational and outreach efforts to dive clubs, schools, and local dive shows resumed in a limited manner in 2022 (Figure 55). Several educational sessions were also conducted for local dive clubs using videoconference platforms. The Diving Safety Officer 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.

Figure 55. DMF's Vin Malkoski and Julia Kaplan tabling at an educational event.

Efforts continued on the 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. Headquarters are located in Boston, with the two primary field stations in Gloucester and New Bedford. Other facilities 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 FY2022, DMF prepared for the closing of the Boston office at 251 Causeway Street scheduled for early 2023 by packing all files, moving furniture to field stations, and reassigning Boston based personnel to a field office in either Gloucester, Salem or New Bedford. To accommodate additional staff at DMF field stations, much effort was put into preparing existing space in the field stations as efficiently as possible. DMF also began a major rehab of the Cat Cove Marine Lab. DMF built the marine lab in 1970 but has not occupied the space during the past 20 years as it was under agreement for use by Salem State University (SSU). SSU began transitioning out of the lab in 2019, and DMF began the process of establishing the Salem Field Station as a working marine lab with office space to accommodate up to ten employees.

The Salem facility was estimated to have approximately $1.5M in differed maintenance. DMF developed a plan to make repairs, renovate, and upgrade the facility over a 5-year period, which began with a new roof, new lighting, new doors and windows, an overhaul of the aquaculture systems, and new security and IT equipment. At the Gloucester Field Station, a new phone system was installed, office upgrades were made, and a new electronic security gate was installed in the parking lot. In Newburyport, upgrades were made to the plumbing necessary for the tanks at the shellfish purification plant. In total, DMF spent over $530,000 in facility planning, infrastructure maintenance, and emergency repairs in 2022.

Vehicles and Boats

DMF maintains a fleet of 40 vehicles and 16 boats. In 2022, $41,000 was paid to the Office of Vehicle Management (OVM) for lease vehicles, and an additional $30,000 was spent on maintenance and repair for all stock. OVM has not been able to fulfill vehicle replacement orders since pre-pandemic, and DMF had to sideline seven vehicles as they were inoperable and unsafe to drive. By December of 2022, OVM identified four available electric vehicles, and DMF expected to partially upgrade some of its vehicle fleet in early 2023.

DMF continued the vessel maintenance program that began in 2019. The total cost of upgrades, replacements, and general maintenance was in excess of $90,000 for FY2022.

Other Capital Expenditures

DMF has an active artificial reef program that is adminsitered by the Habitat Program. In 2019, DMF entered into an agreement with the Massachusetts Clean Energy Center to store over 2,000 cubic yards of reef material in New Bedford at no cost. In FY2022, DMF secured over $455,000 in Capital Funds to deploy the reef material using a vendor that was selected through a competitive bid process.

Appendix A. 2022 Publications

DMF Technical Reports

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