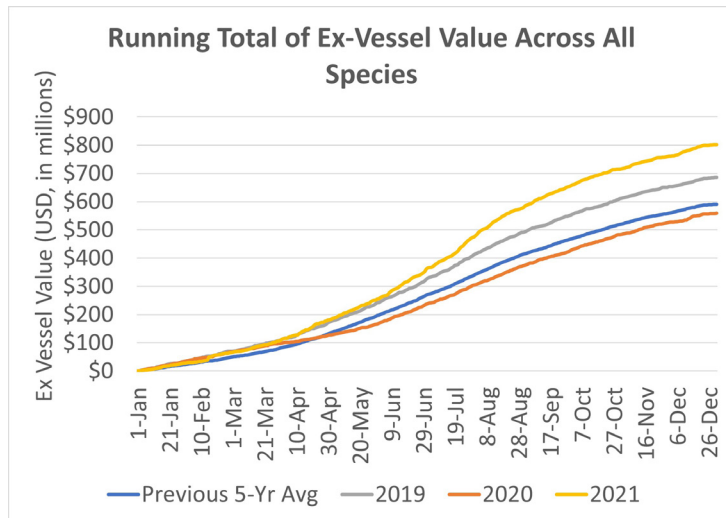


Published by the Massachusetts Division of Marine Fisheries (DMF) to inform and educate its constituents on matters relating to the conservation and sustainable use of the Commonwealth's marine resources.

DMF News

Massachusetts Seafood Value Reaches an All-Time High in 2021

Preliminary data shows that the ex-vessel value of seafood landed in Massachusetts reached an all-time high of over \$800 million in 2021. This is a remarkable turnaround from 2020 when many segments of the seafood industry suffered revenue losses due to the impact on traditional markets caused by the COVID-19 public health emergency. For comparison to the \$800 million, the 2020 ex-vessel value was \$558 million and the five-year average (2015-2019) ex-vessel value was approximately \$600 million.



Excluding surf clams and ocean quahogs. 2021 Data are preliminary. Some species with closed days may drive up the totals in the average. Data Source: SAFIS eDR as of 1/5/2022.

In recent years, sea scallops and lobsters accounted for approximately 70% of the ex-vessel value of seafood landed in Massachusetts. While quantities landed followed similar trends to previous years in 2021, these two species had consistently higher than average per unit prices through the year, resulting in them accounting for 79% of the total value of all species landed. The ex-vessel value of sea scallops and lobster reached all time highs of approximately \$500 million and \$120 million, respectively. These drove the dramatic increase in total ex-vessel value.

Inside

- MA Seafood Value All Time High... 1
- Round 2 CARES Relief... 2
- Dish on Fish: Skate Piccata... 3
- DMF Invests in Striped Bass Research... 4
- Management Changes to Striped Bass... 5
- Diadromous Fish Program Update... 6
- Monitoring Dissolved Oxygen in CCB... 7
- Creature Feature: *Karenia mikimotoi*... 8
- New MassFishHunt System... 9
- Legislature Formalizes Shellfish Panel... 9
- DMF Reclassifies the Three-Bays... 10
- 2022 Quota Outlook... 12
- Division Coming and Goings... 14
- Adjudicatory Proceedings... 15
- Regulation Updates... 15



Commonwealth of Massachusetts
Department of Fish & Game
Division of Marine Fisheries

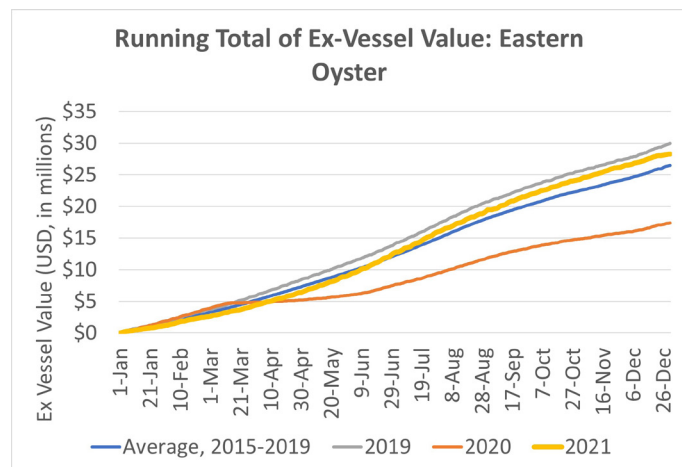
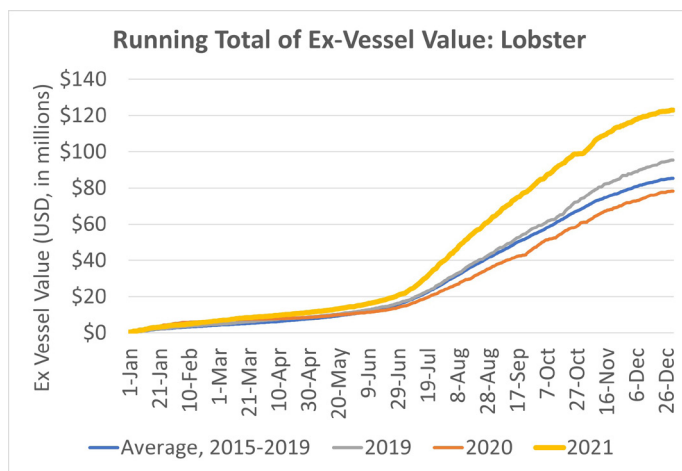
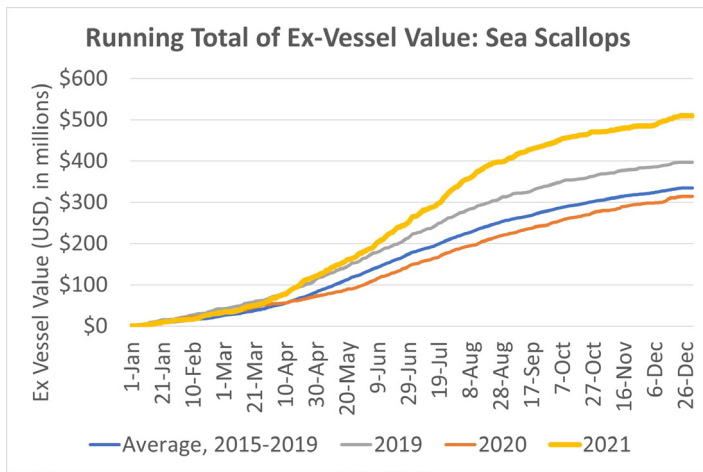
Recreational Saltwater Fishing Permit

Customer ID: 0000047 Expires: 12/31/2022
 JACK JACKSON Issued 01/01/2022
 92 JACKSON WAY DOB: 12/21/1966
 BOSTON, MA 02114

Signature: Jack Jackson

Have You Purchased Your Recreational Saltwater Permit Yet?

DMF has a new recreational permitting system! The project kicked off in March after an extensive market discovery and vendor search process in 2020 and 2021 led by the Department of Fish & Game in collaboration with DMF and MassWildlife. Check out DMF's new MassFishHunt recreational permitting system at <https://massfishhunt.mass.gov>. Read all about the new upgrade, as well as new features on Page 9!



Running total of ex-vessel value of sea scallops, lobster, and eastern oyster. Data Source: SAFIS eDR as of 1/5/22. *2021 Data are preliminary

Although scallops and lobster drove the increase in total ex-vessel value, other species did rebound to near pre-pandemic levels. These included finfish and shellfish species. The oyster fishery was hit particularly hard due to restaurant closures in 2020 with a nearly 35% drop in total ex-vessel value as compared to the previous five-year average. In 2020, ex-vessel value dropped to approximately \$17 million from nearly \$30 million in 2019. The preliminary total value for 2021 rebounded to over \$28 million with the reopening of restaurants and other traditional markets.

During the COVID-19 public health emergency, many wholesalers, retailers, and fishermen pivoted their operations to provide more local seafood options for Massachusetts consumers. The pivots included curbside pickup, home delivery, and increased retail boat sales. Many of these models were very successful and continued throughout 2021. DMF's Seafood Marketing Program will continue to work with the industry to promote sustainable Massachusetts seafood.

By Story Reed, Permitting & Statistics Program Manager

Massachusetts Distributes \$23 Million through the Federal Round 2 CARES Act Fisheries Relief Program and Applies for Further Seafood Processor Pandemic Assistance

On October 7, 2021, payments were mailed to all qualified applicants for Massachusetts' Round 2 CARES Act Fisheries Relief program, concluding this critical pandemic recovery program. This funding was allocated through the Consolidated Appropriations Act of 2021 to support activities previously authorized under Sec. 12005 of the Coronavirus Aid, Relief, and Economic Security Act, also called the CARES Act, to states, Tribes, and territories with coastal and marine fishery participants who have been negatively affected by COVID-19.

For the Round 2 CARES Act Fisheries Relief program, DMF kept much of the same structure of the Round 1 CARES program, with modifications where allowable to streamline the application process and qualify new applicants.

DMF mailed Round 2 applications to all relevant permit holders on July 20, 2021 and set an application deadline of August 28. During the application process, DMF worked intensively with applicants to ensure that submitted applications were complete and correct, including holding four workshops along the Massachusetts coast, in coordination with the Massachusetts Lobstermen's Association and the Cape Cod Commercial Fisherman's Alliance, to assist with the application process. Following the completion of appeal review, the Atlantic States Marine Fisheries Commission (ASMFC) mailed checks to qualified Massachusetts Round 2 CARES Act Fisheries Relief applicants.

Across the four program sectors (seafood processors/wholesale dealers, commercial fishing, aquaculture, and for-hire fishing), the number of Round 2 applicants decreased slightly compared to Round 1, but interest in the program remained high. Due to the requirement that applicants could not be made more than "whole" (i.e., exceed traditional revenue), some applicants were found to be ineligible based on their 2020 revenue and Round 1 CARES payment, while others received a partial share so they did not exceed their made "whole" amount.

| Sector | Budget | | Payments Issued | | Median Payment | |
|-------------------------------|----------------------|----------------------|-----------------|------------|----------------|----------|
| | Round 1 | Round 2 | Round 1 | Round 2 | Round 1 | Round 2 |
| Seafood Processor | \$13,779,789 | \$11,548,170 | 113 | 103 | \$89,480 | \$88,934 |
| Commercial Fishing | \$11,828,404 | \$9,912,809 | 566 | 474 | \$19,079 | \$20,645 |
| Aquaculture | \$1,152,652 | \$965,982 | 169 | 103 | \$3,958 | \$5,642 |
| For-Hire Head Boat Fishing | \$416,000 | \$502,831 | 34 | 24 | \$14,320 | \$20,651 |
| For-hire Charter Boat Fishing | \$584,000 | \$335,220 | 72 | 29 | \$9,344 | \$11,431 |
| Total | \$27,780,506* | \$23,314,378* | 954 | 733 | | |

**Includes supplies, administrative and indirect/fringe costs, and payments to tribal participants.*

On October 14, 2021, DMF was alerted by some Round 2 CARES Act relief recipients that their checks had bounced after deposit. This problem arose from an unexpected technical issue with ASFMC's financial institution and was corrected on that same day. DMF quickly emailed CARES recipients when the issue arose to alert them of this complication and to ask that checks not be deposited at that time. On October 15, 2021, a follow-up email was sent to inform recipients that checks could be deposited without any issues and to ask anyone who needed checks to be re-issued to contact DMF. ASFMC has mailed new checks to all Round 2 CARES recipients who have contacted us about this issue.

DMF is also pursuing other seafood industry relief allocated through the Consolidated Appropriations Act of 2021. The U.S. Department of Agriculture Seafood Processors Pandemic Response and Safety (SPRS) Block Grant Program will reimburse

eligible seafood processors for partial expenses incurred from January 27, 2020, to December 31, 2021, in the following categories: workplace safety measures, market pivots, retrofitting facilities, transportation, worker housing, and medical services.

Massachusetts was allocated \$1,104,725 in funding for this program. DMF applied for the SPRS block grant program in November 2021 and expects to be notified of funding by January 2022. DMF will continue to perform outreach and inform potential beneficiaries of the program as more information becomes available.

By Maggie Nazareus, Program Coordinator

Dish on Fish: Skate Piccata

Skate is known for its unique tender ribbed texture and sweet scallop-like flavor that makes it a favorite for many. Skate is rich in protein and low in cholesterol, sodium, and fats, making it not only a delicious choice but a healthy choice.

Ingredients

- 4 skate wings, skinned and filleted
- 2 tablespoons canola oil
- Salt and pepper
- ¼ cup flour
- 4 tablespoons butter, cut into chunks
- 2 lemons, juiced
- 2 tablespoons capers, rinsed
- 2 tablespoons parsley, finely chopped

Directions

1. Set a large frying pan over medium heat and add oil.
2. Season skate wings with salt and pepper on both sides. Dust with flour.
3. Add skate to the pan and cook for 3-4 minutes on both sides
4. Remove fish to plate and turn heat to high. Add cubed butter and cook until it foams and brown bits appear. Add lemon juice, capers, and parsley. Pour over fish and serve.



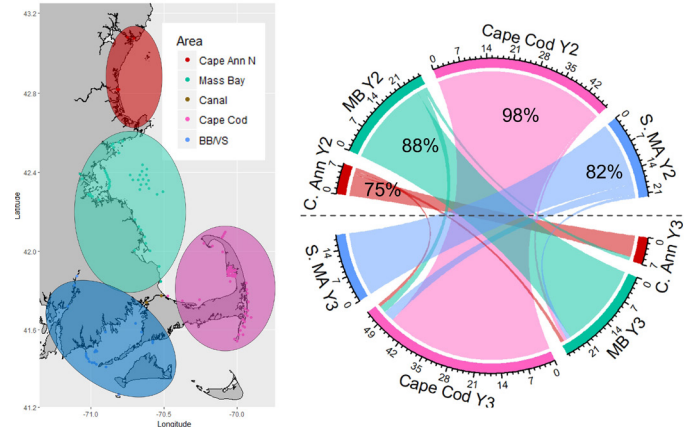
Recipe courtesy of Eating with the Ecosystem with funding from DMF's Seafood Marketing Program.

DMF Invests in Striped Bass Research to Improve Fishery

Striped bass have long been a central part of the Commonwealth's fisheries and remain an immensely popular target of anglers whether they prefer a boulder beach lit by the moon, trolling umbrella rigs along a reef, or casting flies and tossing artificials into a frenzied blitz. This long-sustained passion for striped bass is also an important part of the coastal economy, with rough estimates of \$600 million dollars being spent annually by anglers pursuing stripers in Massachusetts alone. Striped bass have also been the focus of several recent management actions following a sustained period of poor spawning success in the Chesapeake Bay, which has historically contributed the majority of stripers to the coastal stock. These are the migratory bass that Massachusetts residents eagerly await to arrive as the spring days grow longer and the water warms... and then mourn in the late fall as the days once again grow short and the water cools. This annual pattern of presence and absence, celebration and dreaming, is a product of the striper's migratory behaviors.

As most anglers know, striped bass are an anadromous fish, meaning they spawn during spring in coastal rivers, but spend the remainder of the year in estuaries and coastal waters. Individual bass will remain largely faithful to the same spawning river over the course of their lives. Currently, most striped bass are thought to originate in the rivers that feed the Chesapeake Bay, with significant contributions also coming from spawning in the Delaware River, Hudson River, and the rivers feeding Albemarle Sound in North Carolina. However, fisheries managers currently lack an effective way to accurately and quickly identify how much of the striper catch in coastal waters comes from each spawning population. Furthering the difficulty of this task, in each of these spawning populations, it appears that some fish can remain in local waters for most or all of their lives while others favor roaming the East Coast from North Carolina to Maine. These different groups of fish within each population are what fish biologists call "contingents", and they add another layer of complexity to understanding population fluctuations and how that affects fishing on our shores. This issue has always been pertinent to management of striped bass, but as the amount of spawning fish has declined coast-wide these questions have become a central focus for the future of the fishery, with an eye toward maintaining opportunity for Massachusetts anglers.

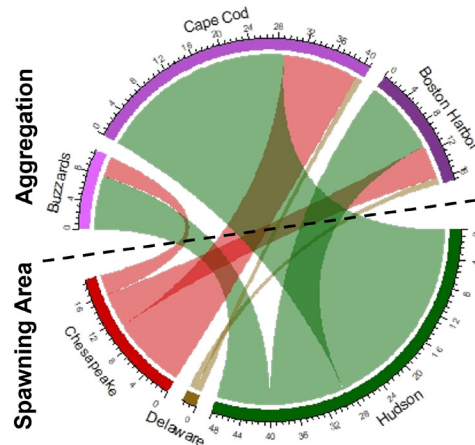
During the summers of 2015 and 2016, DMF biologists tagged 260 striped bass in coastal waters of Massachusetts. Tagging was focused in three areas: Boston Harbor, the back side of Cape Cod, and Buzzards Bay/Vineyard Sound. Staff also spread tags out among size classes, focusing on fish below 28" that could not be kept, fish between 28" and 35" that could be kept recreationally, and fish 35" and up that were available to both recreational and commercial fishers (under the regulations at that time). These tags emit uniquely coded acoustic pulses that can be heard by hydrophone receivers up to a kilometer away. DMF maintains an array of more than 100 hydrophones to detect their movements within Massachusetts waters, and because the technology is widely used by researchers along the coast in other states, we are able to follow their movements along their entire migratory route. The tag's 7-year lifespan meant the same fish could be followed over several consecutive years as well. With this strategy we hoped to describe the fidelity to summer feeding areas, residence times, migratory routes, and spawning groups.



Map showing summer aggregation areas in coastal Massachusetts with ribbon plot showing interannual fidelity of striped bass to those areas for fish tagged in 2015. Areas on the top side of the circle are where bass were detected in the summer of 2016 (Y2) and areas on the bottom are where the same fish were detected in 2017 (Y3). Fidelity to Cape Cod waters was extremely high and Massachusetts Bay fish also remained in those waters. Striped bass summering in Cape Ann or Southern Mass waters exhibited strong fidelity but more variability than bass from the other two aggregations.

One caveat to the broad hydrophone coverage along the coast is that it can often take a year or more to receive all the data related to tags from other researchers. We have only recently received all the data for bass tagged in this project and a full analysis of the data is currently underway. However, we have been able to make a few important conclusions based purely on data from Massachusetts receivers.

First, stripers in Massachusetts showed remarkable fidelity to broader areas of coastal Massachusetts as 90% of tagged bass detected for four or more years returned to the same coastal area each year. Second, there appears to be little difference in spawning population composition among tagging areas. Most fish returned to the Hudson to spawn, followed by the Chesapeake, and then a very small contribution from the Delaware River (importantly, there was size difference as fish larger than 35" were most often from the Chesapeake). Finally, the migratory route striped bass follow likely affects their mortality in Massachusetts waters because fish that summered north of Cape Cod used the Cape Cod Canal almost exclusively in both spring and fall, which appeared to lead to higher catch rates.



Ribbon Plot showing the connection between summer aggregation area (location of tagging) and where a striped bass was later detected during spawning for fish tagged in 2015. Aggregation areas are shown on the top of the circle and spawning areas on the bottom. Each thin slice of a ribbon represents 1 striped bass and the thicker a ribbon connecting an aggregation area to a spawning location the more fish made that migration. Red ribbons represent Chesapeake Bay Spawners while green represents Hudson and Boston Harbor and purple represents the Delaware.

From 2015 until 2020, DMF supplemented the acoustic telemetry work by collecting thousands of genetic samples from fish caught in both recreational and commercial fisheries throughout coastal Massachusetts. By partnering with researchers at University of Massachusetts, University of New Brunswick, and University of Montana, a new baseline was developed for striped bass from North Carolina through the Canadian Maritimes using powerful modern genomic techniques; this can be thought of as a catalog of genetic signatures for different spawning populations. This work was published last year and will provide the blueprint for future genetic work in Massachusetts and elsewhere.

By combining the samples collected from thousands of Massachusetts bass with the new baseline, DMF biologists can compare the spawning area origin of tagged fish (which we also took samples from) to the actual fish caught by anglers and determine if the behaviors of tagged fish reflect the larger population they were sampled from and if the composition of spawning groups has changed over time. By comparing the genetic signature of tagged fish with their observed movements, we can also shed light on behaviors like straying and range expansion that have been difficult to impossible to get to date. Finally, DMF has recently received funding to develop and test a genetic monitoring program of coastally caught striped bass that would allow manag



DMF's Ben Gahagan tagging a striped bass with an acoustic receiver.

ers to differentiate between the spawning populations, rather than treat them as one coastal stock. This would be a pivotal step forward in the interstate management of striped bass.

Over the next three to four years, analyses of acoustic telemetry, genetics, and the two in combination will be ongoing. This work has been supported by recreational permit funds and should pay back that investment with information that will allow DMF to maximize opportunity for striped bass anglers while ensuring that those opportunities are there in future years.

By Ben Gahagan, Biologist

Further Changes to Striped Bass Management are Coming

DMF manages striped bass cooperatively with the other East Coast states through the Atlantic States Marine Fisheries Commission (ASMFC). The latest assessment released in 2019 showed that striped bass are overfished primarily owing to the relatively poor year classes (the number of young born and surviving in a certain year) in the years 2005–2010.

These poor year classes combined with relatively high fishing mortality caused the population to decline (as measured by the spawning stock biomass or SSB, a measure of population health and reproductive potential). While these poor year classes are mostly caused by environmental conditions on the spawning and nursery grounds, as managers we must act on fishing mortality to maintain a healthy population as we have no control over environmental conditions.

In response to the decreased health of the striped bass population, the ASMFC's Striped Bass Management Board voted first to implement Addendum VI to Amendment 6 of the Interstate Fishery Management Plan (go to <http://www.asmfc.org/species/atlantic-stripped-bass> to find more information about striped bass management). Addendum VI reduced removals from the population by 18% through commercial quota cuts and a slot size (28" to <35") for the recreational fishery along the coast. The Addendum also put in place a requirement to use circle hooks when fishing with bait for striped bass. At the time that these measures were implemented, it was estimated that fishing mortality would be reduced to a level that would bring the striped bass population back to a healthy state over several years.

Unfortunately, Mother Nature continues to not cooperate and another series of relatively poor-to-average year classes has occurred from 2016–2021. This lack of good recruitment will present challenges to rebuilding the SSB under the current fishing mortality rate. To address this problem, the Management Board initiated Amendment 7 to the Interstate Fishery Management Plan at its May 2021 meeting. The Amendment is still in development with a schedule subject to change, but the hope is to conduct public hearings on proposed management measures in spring of 2022 for implementation in 2023. Per the Board's direction, the Plan Development Team is working on a suite of options to protect the strong 2015 year class to help in rebuilding SSB; reduce catch and release fishing mortality; change how Conservation Equivalency is used; revise the triggers used to initiate management responses to low SSB, high fishing mortality, and low recruitment; and establish a rebuilding plan under a "low productivity" scenario.

Under the latter, the Technical Committee would develop population projections as part of the 2022 stock assessment using low values for recruitment—similar to what the population is currently experiencing—to provide a more conservative view of where the stock is headed, rather than the usual projections which use more average recruitment values. If these analyses show that the stock will not grow to the target biomass under the low productivity scenario within the 10-year rebuilding timeline, the Management Board would address the need to implement further mortality reductions in an addendum to Amendment 7.

There are a lot of balls in the air right now and the final decisions on how to get the striped bass stock healthy again will not be made until May. When draft Amendment 7 is released to the public, we urge you to attend public hearings and provide input on which options you would like to see implemented for the striped bass fishery. Although opinions vary on how to best achieve the goal, we are all in agreement that further changes are necessary to rebuild the critical striped bass resource.

By Dr. Michael Armstrong, Assistant Director

Diadromous Fish Program Update

The Division of Marine Fisheries has been responsible for managing diadromous fish passage and populations in Massachusetts coastal rivers for nearly 90 years. These are the migratory fish that switch between marine and freshwater habitats to complete their life history. Most diadromous fish populations have declined sharply from historical periods when valuable fisheries were supported. Presently, modest fisheries occur for a few diadromous fish species and collectively these fish remain important forage for a wide range of fish and wildlife. The Diadromous Fish Project actively monitors river herring, American shad, American eel, and rainbow smelt spawning runs in coastal rivers; and provides technical support for the management of these populations. The Project also includes the DMF Fishway Crew which was established in 1934 to support Towns and private properties to maintain fish passageways.

Spring Recap. The decline in river herring spawning run counts seen from 2019 to 2020 continued in 2021. Of the more than 40 herring runs in Massachusetts with count data, very few had higher counts in 2021 than the previous two years. The Nemasket River declined modestly from 811,000 fish to 739,000 fish, reclaiming its position as the largest herring run among rivers with counts. The Nemasket River has had the highest counts among all counting stations over the last 20 years with the exceptions of the Mystic River, Medford, in 2017 and Herring River, Harwich, from 2018–2020. The fewer returning adult herring in 2021 was not unexpected given possible impacts on juvenile herring recruitment due to near drought condition in 2016–2017. Much anticipation awaits the returning wave of fish next spring, as three consecutive years of declining spawning run counts would trigger substantial concerns.

Fishway Work. This year was perhaps the slowest year for construction projects by the DMF Fishway Crew in over a decade. The season began with low flows throughout coastal Massachusetts and drought conditions on Cape Cod. This changed in a hurry as the Boston region set records for the most rainfall during July–September. Coastal rivers in this region with streamflow gauge stations routinely ran at least 2–3 times their daily median flows with common spikes to set daily records in the stations' time series. Most planned large cooperative and small Fishway Crew jobs in 2021 were in this zone of high rainfall and had to be postponed. Further, the impact of the COVID pandemic continued to bring inefficiencies into project preparations and material purchasing. Despite preparing for several jobs, only a single project was completed in the summer of 2021 the reconstruction of the fishway entrance box at Tom Matthews Pond in Yarmouth. With time on our hands, the Crew enhanced efforts with stream maintenance in 2021 and launched the update of the coastwide diadromous fish survey.

Diadromous Fish Survey. DMF began a survey of diadromous fish passage in Massachusetts coastal rivers in the summer of 2021. This effort is a continuation 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. Many changes have occurred since the last survey with the advent of dam removal as a restoration tool, wider participation in the restoration community, increased federal funding sources, and greater appreciation for diadromous species beyond river herring. The survey update will be conducted during 2021–2022 and 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 with DMF's Diadromous Fish Restoration Priority List and the Diadromous Fish GIS datalayer that was developed by DMF and MA Dept. of Transportation and now managed as an MassGIS datalayer. The integrated survey, priority list, and GIS datalayer should become valuable tools for restoration, resiliency, and transportation planning at local, state, and federal levels. To date, nearly all locations in the Cape Cod and Southeastern MA regions have been assessed by the survey.



2021 Survey - Plashes Pond, Yarmouth.

Stream Maintenance. Stream maintenance has been practiced in Massachusetts herring runs for centuries to maintain open passage for these inspired spawning migrations. This topic was described in detail in the 2020 fall edition of DMF News. This summer and fall, the Fishway Crew worked in 10 coastal river systems with large efforts in the Jones River, Kingston, and the Fore River, Braintree, in anticipation of long-developing, cooperative restoration efforts in those watersheds. Focused efforts were also made in the Acushnet River, Acushnet; Island Creek Pond, Duxbury; and Mill Creek, Yarmouth following the identification of significant debris jams and wetland shrub overgrown during DMF's river herring spawning and nursery habitat assessments in those watersheds. DMF is working with MassDEP to develop a policy to clarify how this essential service can be accomplished under contemporary Wetland Protection Act processes.

By Brad Chase, Diadromous Fisheries Project Leader

Monitoring and Understanding Low Dissolved Oxygen in Cape Cod Bay

Researchers point towards a changing physical environment and the introduction of a new species of algae as the probable cause for the hypoxic conditions that developed in Cape Cod Bay in 2019 and 2020. Data collection continues with an eye towards predicting the occurrence of future hypoxic events.

Background: During late summer 2019 and 2020, bottom waters in southern Cape Cod Bay (CCB) became depleted of dissolved oxygen (DO). Bottom DO levels became severely hypoxic (<2mg/L) in water depths from 10 to 25 m (~30–80 ft) from west of the Cape Cod Canal east to Barnstable Harbor. In mid-September 2019, there were numerous reports of dead lobsters and scallops from the local fishing community indicating that DO levels had dropped to lethal levels in this region. In response to this unprecedented event, DMF began working with other scientists and the local lobster fleet to begin to understand what was driving hypoxia in southern CCB. As part of this effort the Massachusetts Lobster Foundation, in collaboration with DMF, created the Cape Cod Bay Study Fleet, which has provided oxygen probes to a number of lobster fishers in the region. These small probes are deployed in lobster pots and provide near real-time measurements of bottom DO. The goal of this program is to monitor bottom DO throughout CCB and alert the public when low DO conditions begin to develop.

Dissolved oxygen (DO) levels

- Severely hypoxic: < 2 mg/L
- Hypoxic: 2 - 4 mg/L
- Low: 4 - 6 mg/L
- Normal (normoxic): > 6 mg/L

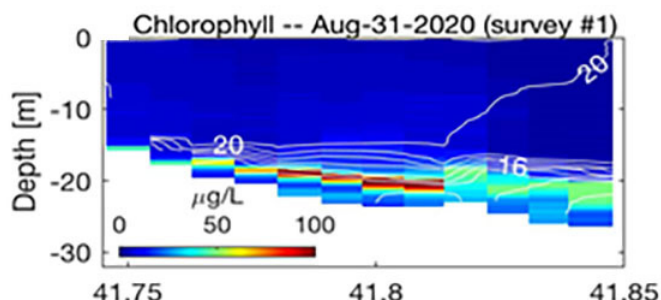
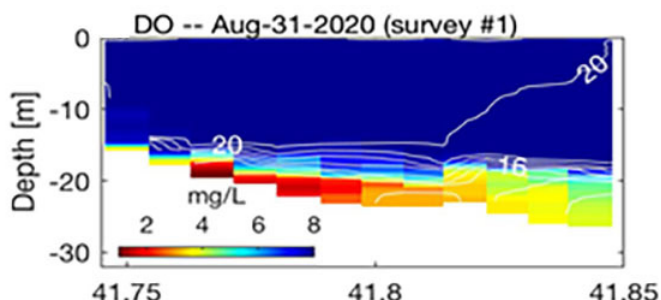
2021 Season: In 2021, the Cape Cod Bay Study Fleet's data loggers again detected hypoxia (see figure), but not the severely hypoxic conditions that occurred in the southern portion of the Bay in 2019 and 2020. The Fleet's monitoring efforts detected declining DO levels in mid-August, earlier than the declines seen in 2020, which prompted concerns that 2021 might be another bad year. DMF issued an advisory to notify the commercial fleet and

other stakeholders about these declining conditions, but fortunately conditions improved, apparently related to the passage of Tropical Storm Henri through the region on August 21–22. DO values declined again in September, but never reached severely hypoxic levels. Unlike previous years, some of the lowest DO values recorded in 2021 were to the north and east, near Wellfleet. Mild hypoxia was also observed in similar locations as previous years, in the area from Sandwich to Barnstable.

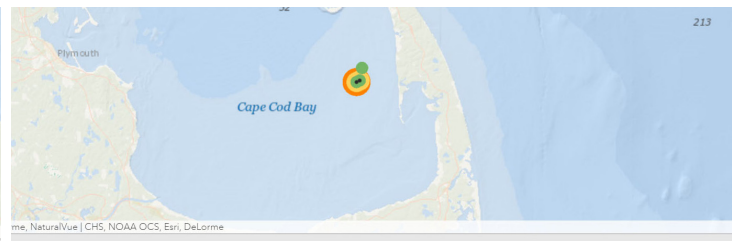
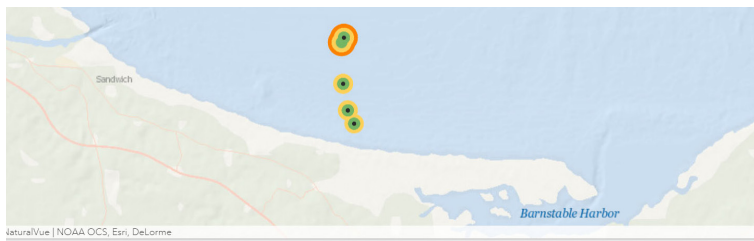
The Role of Environmental Changes: Even though severe hypoxia did not develop in 2021, understanding why these conditions have developed in recent years is important to managing the resources of this region. To that end, DMF is part of a team of researchers trying to understand how changing environmental conditions may be contributing to the emergence of hypoxia. DMF is collaborating with researchers from the Woods Hole Oceanographic Institution, the Center for Coastal Studies, and the Rhode Island Department of Environmental Management to collect and analyze data to better understand how changing physical and biological conditions in CCB are causing the unprecedented hypoxia observed in recent years.

Like the rest of the Gulf of Maine, water temperatures in CCB are increasing rapidly. However, bottom temperatures are not warming quite as fast as surface temperatures, which means that the late summer vertical temperature gradient is increasing. The presence of a strong vertical temperature gradient effectively isolates the cold bottom waters from the warmer oxygenated surface waters, cutting off the supply of DO and contributing to hypoxia. Wind patterns also appear to be changing—adding to the formation of a physical environment that may be more prone to depletion of oxygen from bottom waters than in the past.

These changes to the physical environment may also be leading to significant changes in the algal species that bloom in the water during late summer. Chlorophyll is an easily measured pigment that is used to detect and quantify blooms of small algal species known as phytoplankton. In late summer 2019 and 2020, chlorophyll levels were nearly three times higher than any previously documented year; with the highest concentrations occurring deep in the water column, at the interface between the cold bottom waters and the warmer surface waters (see figure). The unusually large blooms in summer 2019 and 2020 most likely provided excess organic matter that sank to the bottom and decomposed, utilizing nearly all of the bottom DO, which in partnership with the strong near-bottom temperature gradient, created the hypoxic conditions.



Dissolved oxygen values (left) and chlorophyll levels (right) detected during a 2020 Center for Coastal Studies survey. The vertical axis shows depth in the water column, and the horizontal axis shows location along a transect from south to north near Sandy Neck Beach in Sandwich.



Dissolved oxygen (DO) values measured by two of the Cape Cod Bay Study Fleet's data loggers.

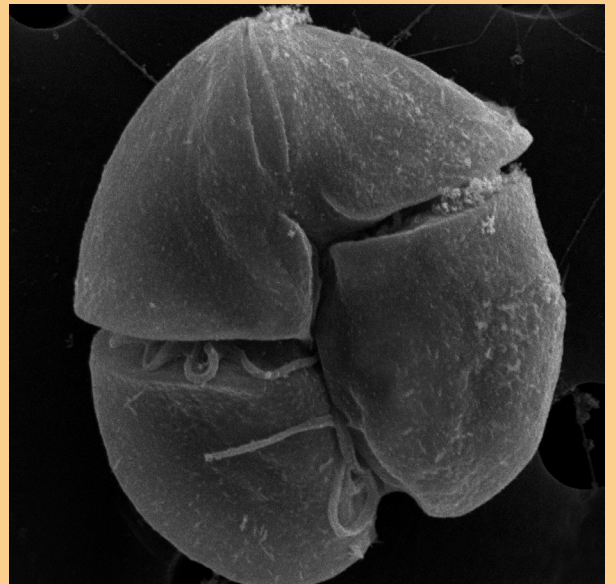
Why did such large blooms occur in 2019 and 2020? This is the key question that researchers are trying to answer. Algal cells take advantage of nutrients to grow and reproduce, and when there are a lot of nutrients available, growth and reproduction can be very rapid and result in a bloom. This normally happens in surface waters in the spring or early summer, when the algae can take advantage of lots of sunlight and nutrients that are available near the surface. Later in the summer and fall, when the water column becomes stratified (with warm, less dense water at the surface and cold, dense water near the bottom), surface waters become depleted in nutrients. Ample nutrients are available in the colder bottom waters, but there is often not enough light to support a bloom. However, that may be changing due to a combination of warmer waters, changing summer winds and a new species of algae.

In 2017, a species of dinoflagellate (a type of algae) named *Karenia mikimotoi* was detected for the first time in Massachusetts and Cape Cod Bays. Comprehensive monitoring in the region that began in the early 1990s never detected this species in any sample prior to 2017. However, after its initial detection that year, samples collected during summer 2019 and 2020 found very high levels of *K. mikimotoi* (more than 800,000 cells/liter). Unlike many of the species more commonly found in the bay, *K. mikimotoi* is adapted to low light conditions and can vertically migrate, allowing it to use the nutrient-rich bottom waters present during late summer. Routine monitoring conducted by the Center for Coastal Studies found that the anomalously large algal blooms in the summers of 2019 and 2020 were accompanied by anomalously low bottom nutrient levels, suggesting that prior to 2019 there were plenty of nutrients available in the bottom waters, but nothing was able to use them.

The coincidental emergence of *K. mikimotoi* and severe hypoxia in CCB is consistent with a rapidly changing environment. The research team hypothesizes that the changes to the physical environment in CCB have created conditions that *K. mikimotoi* is particularly well-suited to exploiting. Combined, these new physical and biological conditions are what the team thinks is causing the bottom waters in Cape Cod Bay to tip over the threshold from low DO to hypoxic levels, and in 2019 and 2020, severely hypoxic. The research team is in the process of presenting these results to the scientific community for review, and in the meantime will add the information collected this year to the larger dataset. Hopefully with the addition of the 2021 data we can begin to understand how year-to-year differences in these variables determine whether we tip the scales into severe hypoxia, getting us one step closer to our goal of being able to predict hypoxic events.

By Tracy Pugh, Ph.D., Invertebrate Fisheries Project Leader, and Malcolm Scully, Ph.D., Associate Scientist, Woods Hole Oceanographic Institution

Creature Feature: *Karenia mikimotoi* Algae



Karenia mikimotoi - Photo by FWC Fish and Wildlife Research

What is *Karenia mikimotoi*?

Karenia mikimotoi is a dinoflagellate species and less toxic than its sister species *Karenia brevis*. *Karenia mikimotoi* is more widespread with blooms reported in several countries as well as Alaska, Texas, and the east coast of the U.S. The blooms of this species can stretch many kilometers, persist for multiple months, and reach concentrations of several million algal cells per liter.

Blooms of this species can cause large-scale mortality events of marine fauna such as shellfish, echinoderms, crustaceans, and fish. Although overall concentrations of toxins in *K. mikimotoi* appear to be relatively low, there is evidence that their effect may be enhanced when the cells come into direct contact with fish gills. Anoxic conditions can also occur when *K. mikimotoi* cells die in large numbers and subsequent breakdown by bacteria deplete oxygen in the surrounding waters. These anoxic events have also contributed to die-offs.

Read more at: <https://northeasthab.who.edu/habs/karenia-mikimotoi/>

Recreational Permitting System Modernized

MassFishHunt—the official recreational fishing, lobstering, and hunting permitting system for Massachusetts—has been upgraded! The new system went live on December 1, 2021. As always, anglers, hunters, and trappers will be able to buy licenses and permits, report a harvest, and access account information through the online system. Recreational saltwater fishing permits and Mass-Wildlife licenses are also available online in the new system. The new MassFishHunt's secure, modern platform offers new features designed with the customer in mind.

What's changing?

Setting up your account in the new MassFishHunt (<https://massfishhunt.mass.gov>) is simple. With just a few clicks, you will have access to new features, including:

- Upgraded log in with email and password to keep your account secure
- Linked accounts for families and other groups
- Auto-renew option to let you “set it and forget it” to keep your permits up to date
- Buy-it-again option which saves your favorite products for quick checkout
- Improved mobile experience
- Sign up for angler education classes

What are the transaction fees in the new online system?

Overall, transaction fees for online purchases are staying the same or decreasing for most online customers in the new system. The previous online system charged an administrative fee of \$1.34 per permit and a 3% convenience fee on the total transaction. The new online system charges an administrative fee of \$1.45 per permit and a 2% convenience fee on the total transaction. So, if you bought a \$10 recreational saltwater fishing permit online in 2021, the transaction fees were \$1.68, and this will be the same in 2022.

Can customers still buy permits in-person?

Yes. If you do not wish to purchase your recreational saltwater fishing permit online, you can still visit the Gloucester or New Bedford Division of Marine Fisheries offices, a MassWildlife office, or one of many authorized license vendor locations to buy in-person. There are no transaction fees if permits are purchased at DMF or Mass-Wildlife offices. Please note, permits can no longer be purchased over the phone.

As a reminder, all permit fees collected from the sale of recreational saltwater fishing permits are deposited in the Marine Recreational Fisheries Development Fund. This Fund finances recreational fishing improvement programs administered by DMF.

We hope you enjoy the improved customer interface and enhanced features of the new system.

By Story Reed, Permitting & Statistics Program Manager

State Legislature Formalizes the Shellfish Advisory Panel

In last summer's approval of the FY 2022 budget, the legislature enacted a new section of state law that created a formal panel of stakeholders and agency representatives to advise DMF on ways to improve shellfish management in the Commonwealth. This action was in response to a request from DMF and many stakeholder groups who understand the benefit of regular communications and public forums to identify and solve problems in a collaborative way.

The formal creation of the Panel was also the primary objective identified by members of the Massachusetts Shellfish Initiative (MSI), a stakeholder-driven working group begun in 2018 with NOAA Fisheries funding to develop a strategic plan for shellfish. Panel members look forward to opportunities for these meetings to create forums for sharing of technical information and policy development to address emerging issues. The MSI Strategic Plan and related supporting documents can be found here: www.massshellfishinitiative.org.



Massachusetts Shellfish Initiative
2021-2025 STRATEGIC PLAN

Massachusetts Shellfish Initiative's Strategic Plan Cover Page.

Prior to the legislation, there was an ad-hoc Shellfish Advisory Panel of stakeholders that was created by DMF back in 2014 which met on an as-needed basis to enhance communication between DMF and its stakeholders in an open forum. This advisory panel was designed to share information across the range of shellfish interests. It also provided a periodic check-in with stakeholders about the national shellfish management meetings held every two years by the Interstate Shellfish Sanitation Conference where so much takes place concerning the changes to federal standards the states must abide by. Massachusetts is one of a few unique states that allows municipalities to manage shellfish fisheries at the local level, meaning that DMF must deal directly with municipal officials in at least 38 coastal communities with managed shellfish resources.

The newly created panel is large: 20 members total, including 14 members of industry and public stakeholders and an additional six members from within state government representing other agencies and the Legislature. The stakeholder membership is diverse, consisting of two seafood dealers, three commercial fishermen, three aquaculturists, one recreational shellfisherman, two municipal constables, a member of the Marine Fisheries Advisory Commission, a Sea Grant representative, and a representative of a nongovernmental organization involved with shellfish conserva-

tion. State government representatives will include Dept. of Agricultural Resources, Dept. of Environmental Protection, Dept. of Public Health Food Protection Program, Office of Coastal Zone Management, Commission on Indian Affairs, and chairs of the Legislature's Joint Committee on Environment, Natural Resources and Agriculture. DMF's Director will serve as the Chair.

The Panel will tackle many of the goals and objectives of the MSI Strategic Plan, including some of the following: the state laws governing transfers of municipal aquaculture licenses, propagation of oysters by municipalities for nitrogen remediation, improved training and education to improve compliance with seafood safety-related rules, support for municipalities' shellfish harvest data collection, and the need to address the increase in harmful algal blooms that may impact health of shellfish consumers. Any interested readers should review the MSI Strategic Plan. Three meetings are anticipated each year with the potential for additional meetings as needed.

A formalized version of the Panel was universally embraced by all members of the MA Shellfish Initiative. Many stakeholders have appreciated and benefited from having this type of open forum, especially the exchange of technical and policy information and the increased transparency that resulted. This Panel will function similarly to DMF's Marine Fisheries Advisory Commission in its advice and insights provided to the agency. Citizen panels such as these help keep agencies grounded and ensure their work products are relevant and useful. The Panel is also expected to assist DMF in responding (if requested) to any legislative inquiries about shellfish issues and any need for statutory changes. With its many distinguished members, the advice that emanates from the panel and DMF will be well-informed and balanced. The membership of the Panel includes:

- Stephen Kirk, The Nature Conservancy
- Mike Trupiano, Ipswich Shellfish Company
- Alex Hay, Wellfleet Shellfish Company
- Ron Bergstrom, Chatham Shellfisherman
- Allen Rencurrel, Surf clam vessel owner and fisherman
- Amy Croteau, Barnstable Shellfish Constable
- Bill Doyle, MFAC Member & Plymouth Rock Oyster Growers
- Bob Colby, North Shore wild harvester
- Michael DeVasto, Field Point Oyster Farm
- Seth Garfield, Cuttyhunk and MAA President
- Dale Leavitt, Blue Stream Shellfish
- Jim Abbott, Barnstable recreational harvester
- Renee Gagne, Chatham Shellfish Constable
- Josh Reitsma, Woodshole Sea Grant
- Dan McKiernan, Director of Division of Marine Fisheries
- John Lebeaux, Commissioner of Agricultural Resources
- Martin Suuberg, Commissioner of Environmental Protection
- Michael Moore, Director of Food Protection within DPH
- Lisa Engler, Director of Coastal Zone Management
- Jim Peters, Executive Director of the Commission on Indian Affairs
- Rebecca Rausch, Senate Chair of the Joint Committee on Environment, Natural Resources, and Agriculture
- Carolyn Dykema, House Chair of the Joint Committee on Environment, Natural Resources, and Agriculture

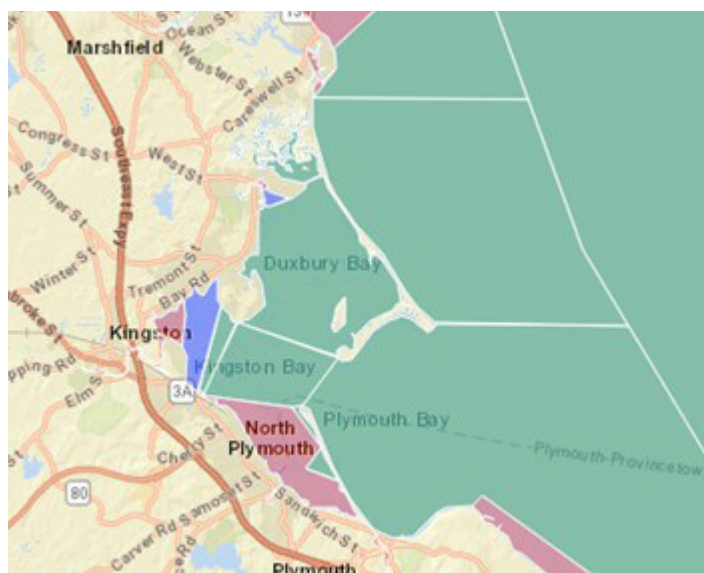
By Daniel McKiernan, Director

DMF Reclassifies the Three-Bays: 2018 Dye Study Results in Shellfish Area Classification Change

In June 2018, the U.S. Food and Drug Administration (FDA) conducted a hydrographic dye study of the Plymouth Wastewater Treatment Plant (WWTP) at the request of, and with assistance from, DMF. The purpose of the dye study was to determine the extent and impact of the WWTP on the Plymouth-Kingston-Duxbury "three-bays" system. The three bays are extremely productive shellfish areas for commercial and recreational harvesting as well as for shellfish aquaculture. Plymouth, Kingston, and Duxbury combined produce approximately \$8 million in value of oyster landings annually, pre-pandemic (2018).

From June 12–15, 2018, three boat teams consisting of FDA, DMF and Plymouth personnel monitored the release of dye and tracked its movement throughout the system. Several weeks prior to the dye injection, nine shellfish cages with quahogs and oysters, along with fluorimeters were deployed throughout the system. The shellfish would be tested for pathogen bioaccumulation to determine potential uptake. Dye concentration data from the fluorimeters would be used to correlate effluent in marine waters originating from the Plymouth WWTP outfall. Boat work started prior to day-break and lasted past sunset for most of the week. The following weekend, a DMF boat crew retrieved the cages.

DMF previously classified and managed Duxbury, Kingston, and Plymouth Bays waters as a combination of Approved; Conditionally Approved based on rainfall and season; and Prohibited (green, blue, and red respectively in figure below). In addition, waters inside the breakwater and shellfish areas inside Long Beach were classified/managed based on operation of the Plymouth WWTP.



Shellfish Classification Areas as of 2018.

After review and analysis of the dye study results, USFDA recommendations, and then conducting an evaluation of the Plymouth WWTP with the cooperation of the Town of Plymouth, the WWTP operators, and assistance of MassDEP, DMF determined the need for classification changes to waters in Plymouth Harbor, Plymouth Bay, Kingston Bay, and Duxbury Bay.

Reclassifications

- Plymouth Harbor, 'the triangle' west of Long Beach reclassified to Prohibited
- Prohibited Zone expanded to include waters to the northern end of Long Beach and a portion north into the main channel
- Plymouth Harbor North reclassified to Conditionally Approved
- All Kingston Bay reclassified to Conditionally Approved
- Duxbury Bay South reclassified to Conditionally Approved

Based on dye study results indicating time of travel from the WWTP to the Duxbury Pier Light of approximately three hours, DMF determined the Prohibited Closed Safety Zone around the outfall pipe needed to be expanded. Dye study results, combined with dilution calculations, indicate that Plymouth Harbor waters north of the Closed Safety Zone including Kingston Bay, southern Duxbury Bay, and portions of Plymouth Bay may be impacted by a WWTP upset. Those calculations showed effluent excursion of 3.6 miles from the outfall during an upset. Such an upset would impact a portion of Plymouth Bay east of Long Beach and south of Saquish Neck. As such Kingston Bay, Southern Duxbury Bay, northern portions of Plymouth Harbor, and westerly portions of Plymouth Bay have been reclassified to Conditionally Approved.

The handling of product harvested from an Approved area or Conditionally Approved area based on WWTP performance, in daily practice and under average conditions with normal operations, is the same. The sanitary quality of shellfish harvested from either an Approved or Conditionally Approved area are equivalent.

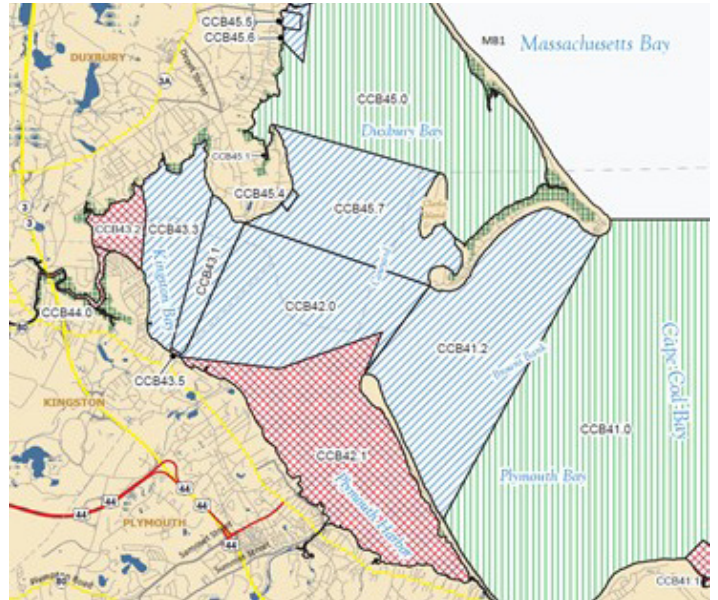
The impact of these changes is significant for the growers. In the past 10+ years there has been no trade between the US and European Union for raw bivalve molluscan shellfish. A much-anticipated trade agreement is on the verge of opening molluscan trade once again. Unfortunately, as part of the agreement, only shellfish harvested from US waters classified as Approved are eligible for export to the EU. Shellfish produced and harvested by aquaculture growers in Plymouth and Kingston will be unable to take advantage of this new market. This is a significant blow to these aquaculturists and may curtail expansion of shellfish aquaculture in these communities. A reclassification from Approved to Conditionally Approved would not impact the sale of shellfish harvested from these areas within state or nationally.

Shellfish Area Sanitary Classifications

- **Approved** Open to shellfish harvesting for direct human consumption subject to local rules and regulations. Closed only during major coast-wide events.
- **Conditionally Approved** Closed some of the time due to rainfall, wwtp performance, season, mooring area or other predictable event. When open, it is treated as an Approved area.
- **Restricted** Contains a limited degree of contamination at all times. When open, shellfish can be relayed to an Approved or Conditionally Approved area for depuration.
- **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, wwtp performance, season, mooring area, or other predictable event. When open, it is treated as a Restricted area.
- **Prohibited** Closed to the harvest of shellfish under all conditions, except the gathering of seed for municipal propagation programs under a DMF permit.

Wastewater Treatment Plant Dilution Analysis Requirements

DMF is required to meet National Shellfish Sanitation Program (NSSP) requirements when classifying shellfish growing areas, particularly around WWTP outfalls. As a member of the Interstate Shellfish Sanitation Conference (a state-industry-FDA partnership), Massachusetts is committed to remaining in compliance with the NSSP. State law and regulations require that DMF follow the NSSP when classifying shellfish growing areas. The reclassifications within the three-bay system is but one necessity to remain in compliance with the NSSP and at its simplest is a sound public health measure employed by DMF at numerous plants coast-wide. Failure to comply with the NSSP could result in significant sanctions on Massachusetts' interstate shipping of shellfish, something that must be avoided to protect our shellfish industry at large.



Shellfish Area Classifications as of May 2021.

Establishing Closed Safety Zones and closure delineation lines is a calculation based on estimates of dilution rates as effluent dissipates in waters adjacent to a treatment plant outfall. The need to create and verify dilution analyses around wastewater treatment plants is not limited to the Plymouth facility but extends to all plants which impact shellfish growing areas in the Commonwealth as well as nation wide. Certainly, wastewater effluent transcends municipal and shellfish growing area boundaries requiring a comprehensive approach. To address this need, DMF approached the UMASS Dartmouth School for Marine Science and Technology (SMAST) specifically to conduct hydrographic modeling of DMF-identified WWTPs. To enable this cooperative effort the Massachusetts legislature increased the DMF budget appropriation in the state FY2022 budget passed this past July. This funding will allow SMAST to conduct a dilution analysis for our treatment plants coastwide. We believe these hydrodynamic modeling studies will provide the most timely and accurate depiction of WWTP effluent dilution and dispersion resulting in more precise Closed Safety Zones.

By Jeff Kennedy, Shellfish Project Manager & Greg Sawyer, Shellfish Biologist

2022 Quota Outlook

The quotas described herein are subject to change. Check the Division's quota monitoring webpage for updates.

Atlantic Herring: 9,034,544 pounds (coastwide quota)

The Atlantic herring fishery will face another quota reduction in 2022, roughly 15% from 2021, bringing it to a new all-time low. This decrease was expected as it was set as part of a 3-year specification package for 2021–2023 that followed on the heels of the 2019 stock assessment. Based on that assessment, the stock was declared overfished by NOAA Fisheries in October 2020, putting the New England Fishery Management Council on a two-year clock to implement a rebuilding plan. The Council submitted its plan to NOAA Fisheries in late 2021 (Framework 9), which will use Amendment 8's ABC control rule as the basis for setting F(rebuild). Due to the anticipated mid-year implementation, 2022 is considered a "bridge year" in the rebuilding plan and the previously adopted limits won't be affected. The status quo limits for 2023 however are expected to be reconsidered in light of the scheduled 2022 stock assessment update. The coastwide limit is allocated among four management areas in allocations of 28.9% to Area 1A (inshore Gulf of Maine), 4.3% to Area 1B (offshore Gulf of Maine), 27.8% to Area 2 (south of Cape Cod), and 39% to Area 3 (Georges Bank).

Atlantic Menhaden: 5,417,812 pounds (MA quota)

The 2022 coastwide commercial quota—and MA's 1.27% share of it—are status quo with 2021. The Atlantic States Marine Fisheries Commission (ASMFC) adopted the 2021–2022 coastwide commercial quotas at a 10% reduction from 2020 based on projections that this level of harvest (roughly 428 million pounds) would have a 50% probability of achieving the newly-adopted ecological reference point (ERP) fishing mortality target by the second year. The ERP target and threshold levels of fishing mortality are more conservative than the single-species reference points in order to account for menhaden's role as forage in the ecosystem. Massachusetts' initial quota of roughly 5.4 million pounds has the potential to be increased by state transfers of quota, and the state may also opt into the episodic event fishery which provides access to a 1% set-aside of the coastwide quota (~4.3 million pounds for 2022 which is available to ME–NY when certain conditions apply). In 2021, the MA fishery landed over 9.9 million pounds of menhaden, which was made possible by an additional 2.5 million pounds of quota via state transfers, over 1.9 million pounds of landings under the episodic event set-aside quota, and limited use of the incidental catch and small-scale fishery allowance during closed periods. The ASMFC is expected to take public comment this winter on potential changes to the state-by-state quotas, episodic event set-aside, and incidental catch and small-scale fishery allowance for implementation in 2023.

Black Sea Bass: 998,901 pounds (MA quota)

Massachusetts's 2022 quota for black sea bass is up 26% from 2021 (when it was 791,700 pounds) due to a combination of factors: an increase in the coastwide commercial quota and the implementation of a new allocation formula. Regarding the coastwide quota, it has been increased 6% from 6.09 million pounds in 2021 to 6.47 million pounds based on the results of the most recent stock assessment. The allocation approach is changing per Addendum XXXIII to the interstate management plan. The addendum adjusts the states' shares in response to changes in the species' distribution since they were initially set in 2003 based loosely on landings from 1980–2001 (see sidebar). For 2022, this means a state share of 15.4% for Massachusetts.

Three Different Approaches Taken to Commercial Quota Reallocation for Fluke, Black Sea Bass, and Bluefish

Reallocation of quotas has been a major focus of discussion at the Atlantic States Marine Fisheries Commission and Mid-Atlantic Fishery Management Council in recent years, and will continue to be so as allocation approaches based on historical landings data get revisited in response to changing species distribution and fisheries performance. These management bodies have selected three different mechanisms for updating the state-by-state commercial allocations for fluke, black sea bass, and bluefish, taking into consideration unique characteristic of each species and its fisheries. Each decision has attempted to balance many competing needs among the states. Making these decisions was difficult, especially after so many years of operating under the initial allocations. More frequent review of the allocations is anticipated for future years.

- **Fluke:** Implemented in 2021, the approach for fluke uses a trigger mechanism for reallocation that is meant to increase equity in the state allocations when the stock is in better condition. Previously, the state allocations were based on 1980–1989 landings, which for Massachusetts resulted in a 6.82% share. Under the new allocation scheme, the first 9.55 million pounds of the coastwide quota is allocated in this same manner, while any quota above this amount is allocated in equal shares of 12.375% to all states (except ME, NH, and DE which share 1% of the additional quota). The states' percent shares are thus variable depending on the magnitude of the quota, but will always be an increase for MA unless the coastwide quota is 9.55 million pounds or less in which case our historical quota share applies.

- **Black Sea Bass:** The new approach for black sea bass that is being implemented in 2022 recognizes expansions and shifts in the species' spatial distribution, making use of the regional nature of the stock assessment. Due to the expansion of sea bass into Long Island Sound, Connecticut's initial allocation is increased from 1% to 3% and New York's from 7% to 8%, by pulling a fraction of a percent from the remaining states (except Delaware, which has only a 5% allocation to begin with). Seventy-five percent of the coastwide quota is allocated based solely on these shares. The remaining 25% of the coastwide quota is first allocated regionally based on the most recent regional biomass (SSB) proportions from the stock assessment, and then distributed to the states within each region in proportion to their initial allocation (except that ME and NH each receive 1% of the northern region quota). Because New Jersey straddles the Hudson Canyon which roughly delineates the regions in the stock assessment, its allocation reflects the biomass proportion in both the northern and southern regions. Similar to fluke, the states' shares are variable year to year, but in this case, based on the changing distribution of the resource as reflected in stock assessments.

- **Bluefish:** The approach to reallocation for bluefish recognizes changes in the state fisheries' performance with their quota by shifting to more recent landings for the reference period. Rather than allocating quota based on 1981–1989 landings, the years of 2009–2018 will be used, with a 0.1% minimum allocation to all states. The new allocations are being phased in over seven years beginning in 2022 to ameliorate negative impacts of reallocation under the current low quotas. Massachusetts' state share will transition from its original value of 6.72% in 2021 to its final value of 10.12% in 2028, in 0.49% increments per year.

Bluefish: 254,748 pounds (MA quota)

The coastwide commercial quota for bluefish is increasing from 2.77 million pounds in 2021 to 3.54 million pounds in 2022, a 28% increase. However, due to a revision in the state shares allocation formula, Massachusetts' quota will increase 37% (up from 185,904 pounds in 2021). The 2022 coastwide quota incorporates the results of the 2021 stock assessment, the implementation of rebuilding for the overfished stock, and a revised commercial/recreational allocation of the overall catch limit. The rebuilding plan, based on a constant fishing mortality approach, is expected to allow catches to increase as the stock rebuilds. The original sector allocation of 17% commercial/83% recreational based on 2009-2018 landings data as well as 1981–1989 landings data have been replaced by a 14%/86% split consistent with 1981–2018 catch data. New state-by-state commercial allocations that reflect more recent landings are being phased in over seven years, the projected timeline for rebuilding (see sidebar). For 2022, this means a state share of 7.20% for Massachusetts. Landings in 2021 would have been restricted by the state's initial quota if not for a 50,000-pound quota transfer from New Jersey, which allowed for landings in excess of 220,000 pounds for the year (95% of the adjusted quota).

Horseshoe Crab: 165,000 crabs (MA quota)

Massachusetts' commercial quota for horseshoe crabs remains unchanged. This quota is for crabs harvest for bait purposes (primarily used in the whelk and eel pot fisheries). Horseshoe crabs harvested for other purposes (primarily biomedical use) and released are not counted against this quota. Landings in 2021 amounted to roughly 92% of the quota.

Scup: 1,713,747 pounds (MA Summer Period quota)

At 20.38 million pounds, the 2022 coastwide commercial quota for scup is nearly status quo with 2021 (20.50 million pounds), as are the seasonal and state-specific allocations of it. The quota is divided among three seasons. The Winter I (January–April) and Winter II (October–December) Periods receive 45.11% and 15.94% of the coastwide quota, respectively; this equates to 9.19 and 3.25 million pounds for 2022. Quota during these periods is open to all states at federally-set trip limits. The fisheries have not been constrained by these quotas in recent years. The Summer Period fishery (May–September) receives 38.95% of the coastwide quota (7.94 million pounds for 2022), which is further distributed into state shares with Massachusetts' at 21.6% (or 1.71 million pounds for 2022). Our Summer Period harvest in 2021 was roughly 535,000 pounds, continuing a downward trend. Overall, the commercial scup fishery is unconstrained by its quota due to insufficient market demand for this abundant stock.

Spiny Dogfish: 17,144,556 pounds (ME–CT regional quota)

The coastwide commercial quota is status quo at 29.56 million pounds for the May 1, 2022 through April 30, 2023 fishing year. The Northern Region of Maine through Connecticut receives 58% of the coastwide quota, or roughly 17.14 million pounds. Most of the landings in our region occur in Massachusetts and between the months of June and November. This year's Northern Region fishery is nearing its conclusion with below 5 million pounds landed, about 40% less than the year prior at this time. The NEFMC and MAFMC voted in favor of an incremental increase to the federal water trip limit, from 6,000 pounds to 7,500 pounds, and the ASMFC is likely to establish the same for the Northern Region state waters limit for FY2022.

Striped Bass: 735,240 pounds (MA quota)

Massachusetts' 2022 commercial striped bass quota will be unchanged from that in 2020–2021. All states' commercial quotas were reduced in 2020 in order to end overfishing and achieve the target fishing mortality rate. While only landing 53% of that quota in 2020, the fishery made use of a slightly earlier season opening date and additional fishing day per week in 2021 to achieve the year's quota. The fishery was closed on October 2 for the year.

Summer Flounder: 1,391,846 pounds (MA quota)

Massachusetts' 2022 state quota for summer flounder (fluke) is up 37% from 2021. The coastwide commercial quota of 15.53 million pounds represents a 24% increase from 2021 (12.49 million pounds). Massachusetts' share increases to a larger degree because of the new allocation approach implemented in 2021 (see sidebar). For 2022, this method results in an effective share of 8.96% of the commercial quota for MA, rather than its historic 6.82% share. State landings in 2021 totaled roughly 700,000 pounds, or 69% of the 1.02-million-pound quota. The Division will be proposing revisions to the state fishing regulations for 2022 to make use of its increased share of the commercial quota amidst changing conditions in the state's fishery.

Tautog: 60,986 pounds (MA quota)

Massachusetts' 2022 tautog quota will be slightly lower than its baseline amount of 64,753 pounds due to a small overage of the 2021 quota (which was set at the baseline amount). The quota sustained the 2021 fishery until early November, similar to recent years, with less than a 6% overage to account for in 2022. 2021 marked the second year of mandatory commercial harvester tagging in the tautog fishery, an interstate management plan requirement aimed at curtailing illegal commercial harvest and sales.

By Nichola Meserve, Fishery Policy Analyst

Recent Publications

The following publications are recent articles written or co-written by DMF staff and published in scholarly journals or the DMF technical series. A full list of publications can be found at <https://www.mass.gov/marine-fisheries-publications>.

Technical Reports

TR-76: Nelson, G. A. 2021. Massachusetts striped bass monitoring report for 2020.

Gary Nelson published the 2020 striped bass monitoring report for 2020. This technical report summarizes the commercial and recreational striped bass fisheries conducted in Massachusetts during 2020.

Annual Report

DMF published its 2020 Annual Report and it is available for viewing online at: <https://www.mass.gov/doc/2020-dmf-annual-report/download>.

Division Comings and Goings



Greg Bettencourt began a new role at DMF in October as the North Shore Regional Shellfish Supervisor. He will be directing classification activities in the Gloucester office as well as supervising the Shellfish Purification Plant in Newburyport, which involves staff and facility administration and managing the softshell clam depuration fishery. Greg first began working in the Shellfish program more than twenty years ago as a seasonal contractor out of

the Pocasset office. From there, he transitioned into a full-time role split out of the Newburyport lab and Gloucester field office, continuing to expand into managing the Boston Harbor softshell clam enhancement project, bacterial and biotoxin database administration, classification area mapping, and sanitary classification duties. Greg received his BS in Biology from UMass Dartmouth.



Matt Duggan joined DMF in July as a permitting specialist. Based in Boston, he will assist in issuing permits and developing new permitting systems, as well as helping recreational and commercial fishers with regulatory questions. Matt graduated from Roger Williams University in 2014 with a Bachelor's in marine biology and a minor in aquaculture, and got his feet wet in the fishing industry as an At-Sea Monitor with the Northeast Fisheries Observer Program. He also

spent time working with the NOAA Fisheries industry data investigation team, and most recently was responsible for dealer reporting as Compliance and Data Manager for Red's Best seafood in Boston.



Simi Harrison joined DMF in October as a Fisheries Habitat Specialist based in the New Bedford office. She will support the Fisheries Habitat Program in performing technical review of coastal alteration projects and conducting field research on the quality and distribution of marine fisheries habitats. She holds a Bachelor's in Biology from Bowdoin College and a Master's in Marine Biology from Northeastern University. While completing her Master's degree, Simi

conducted fish community surveys on DMF's artificial reefs as an intern. Before beginning her role at DMF, she worked as a marine biologist supporting Tetra Tech's Offshore Wind Team.



Although sad to see her go, we are wishing **Nicole (Ward) Marques** good luck on her new endeavor as a mom of their newly born son, Archie, and their two K9 rescues, June and Cash. Nicole joined DMF in 2015 as a seasonal technician for the North Shore diadromous fisheries project in support of the annual spring river herring monitoring project. In

2016, she moved up from being a contract technician to a full-time employee, joining the Fisheries Dependent Investigations project as an Aquatic Biologist I, where her prior experience as a professional fisheries observer working was put to good use. There, Nicole was responsible for sea sampling and port sampling many of our state commercial fisheries, and was a chief scientist on the industry-based survey for GOM cod, bringing her customary tenacity to operating during some of the toughest times of the year in grueling conditions. When not on the survey and sampling commercial fisheries, she assisted in the conduct of acoustic telemetry fisheries research studying movement and post-release mortality of several important Massachusetts recreational and commercial species.



After more than 14 years of service, **Rosemary Mitchell** retired from DMF in August. Rosemary spent her career at DMF as a permitting clerk in the Gloucester office. Over the years, she answered constituent questions, assisted fishermen with catch reporting, and issued thousands of permits. Many fishermen will miss visiting Rosemary at our office. She is looking forward to spending time with her family, two puppies, and long-time friends.



Jennifer Poniatowski left the Division in August for a position at MilliporeSigma in Burlington, MA. Jenn joined the Division's Shellfish Program as a bacteriologist in 2019. Her role was split between the Newburyport Shellfish Purification Plant and the bacteriological and biotoxin labs in Gloucester. At the Shellfish Plant, Jenn provided essential weekend lab support which allowed for continued softshell clam harvest in Conditionally

Restricted shellfish areas. She played a vital role in Gloucester's Shellfish Lab during the pandemic through scheduling and assisting in critical biotoxin monitoring testing. We wish her the best with her new endeavor.



After 18 months with DMF, **Einat Sandbank** left the New Bedford Shellfish Program in early December to pursue a career in GIS analysis. She accepted a position with SubCom, a subsea fiber optic cable company in New Hampshire, as a GIS Specialist. While at DMF, Einat was the lead biologist responsible for running field activities associated with two major shellfish restoration projects in Buzzards Bay. The work

included the coordination and monitoring of contaminated quahog relays and municipal quahog and oyster nursery grow-out activities and out-plantings. Einat also designed new dive survey methodology to be used in future DMF shellfish surveys. We thank Einat for her dedication and best wishes for her new career and studies in the future.



Dr. Sara Turner has left DMF to take a Statistician position with the Monitoring and Analysis Section of NOAA Fisheries Greater Atlantic Regional Office in Gloucester. Sara worked for the Diadromous Fish Project for six years with much interest and dedication towards several species of sea-run fish. Sara had previously worked for DMF as a diadromous fish technician in Gloucester before completing her graduate de-

grees with a focus on river herring.

Adjudicatory Proceedings

Under state law, DMF may 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 (constables) authorized to enforce the marine fishery laws of the Commonwealth.

During the period of June 1, 2020–December 31, 2021, DMF initiated two adjudicatory proceedings. Both proceedings remain ongoing.

Additionally, DMF concluded two outstanding adjudicatory proceedings. These matters were initiated during the period of January 1 through May 31, 2021. One matter addressed violations of the state's for-hire bag limit and size limit regulations for black sea bass and tautog; commercial minimum size limit, trip limit, and harvester tagging regulations for tautog; and rules governing the mixing of recreational and commercial fishing activities during a single trip. This matter proceeded to hearing and a Final Agency Action was issued resulting in the revocation of the individual's for-hire charter boat permits and commercial regulated fishery permit endorsements for black sea bass and tautog. The other matter addressed the issuance of a Seasonal Student Lobster Permit to a non-resident. This matter was withdrawn by DMF, as the seasonality of the permit resulted in the issues to be adjudicated becoming moot.



Regulatory Updates

During the period of July 1, 2021 through December 31, 2021 the following regulatory changes were enacted by DMF after public hearings and Marine Fisheries Advisory Commission approval, or by the Director under his declaratory and emergency authorities.

In-Season Adjustments to Commercial Black Sea Bass Limits for 2021 (322 CMR 6.28). On August 30, 2021, DMF enacted in-season adjustments to the commercial black sea bass limits for the remainder of the 2021 calendar year. This action added Mondays and Wednesdays as open fishing days in the directed black sea bass pot and hook and line fisheries, resulting in an open fishing day schedule of Sunday–Thursday, with a scheduled increase to also add Fridays and Saturdays on October 1. Additionally, the trip limits for the directed black sea bass pot and hook and line fisheries were increased by 25%, resulting in the pot limit being increased from 400 pounds to 500 pounds and the hook and line limit being increased from 200 pounds to 250 pounds.

In-Season Adjustments to Period II Commercial Summer Flounder Limits for 2021 (322 CMR 6.22). On September 26, 2021, DMF enacted in-season adjustments to the commercial summer flounder limits for the remainder of the 2021 fishing season. This action added Fridays and Saturdays as open fishing days, thus allowing commercial fishing to occur seven days per week. Additionally, the trip limits were increased to 800 pounds for all gear types effective September 26, with a scheduled increase to 2,000 pounds effective October 10. Without these adjustments, the limits would have been 400 pounds for net fishermen and 250 pounds for hook and line fishermen through the end of October and 1,000 pounds for all gear types during November–December.

Recreational Catch Limits for Gulf of Maine Cod and Haddock (322 CMR 6.03). On August 18, 2021 NOAA Fisheries finalized its recreational fishing limits for Gulf of Maine cod and haddock during the 2021 Fishing Year (May 1, 2021–April 30, 2022). State regulations conformed to these final federal recreational fishing limits with one exception: a September 8–October 7 for-hire season for Gulf of Maine cod allowing a one-fish per angler bag limit and 21-inch minimum size. To ensure state rules complemented the final federal regulations, DMF conditioned all 2021 recreational for-hire permits to provide the same allowance.

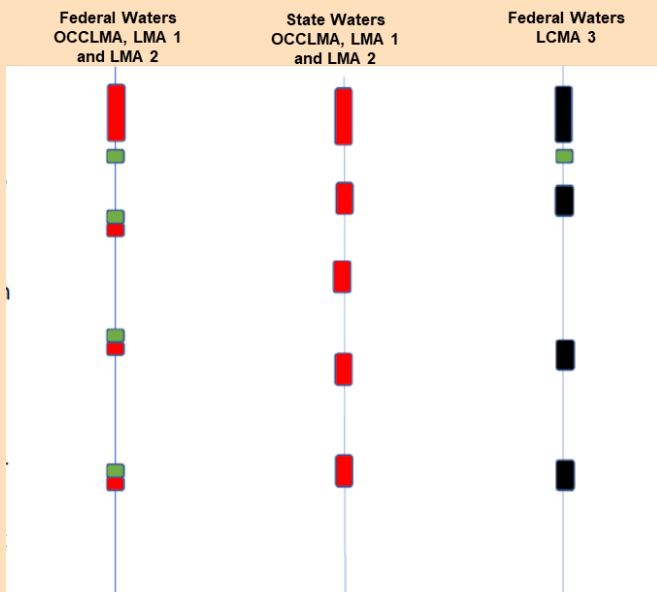
Winter II Scup Limit (322 CMR 6.27). The 2021 Winter II (October 1–December 31) commercial scup possession and landing limit was set at 21,000 pounds. This matches the federal limit set for this period by NOAA Fisheries and thereby allows vessels fishing offshore to possess and land scup lawfully caught in the federal zone in Massachusetts.

Buoy Line Marking Rules (322 CMR 4.13). DMF adopted new buoy line marking rules affecting the state's commercial lobster and crab trap fishermen. These rules become effective on February 1, 2022. For state waters, the buoy lines are to be marked with one solid red mark of at least three feet in length in the first two fathoms (12 feet) of the buoy line extending down from the buoy ("surface system mark"). Then following the surface system mark, there are to be at least four solid or non-solid red marks measuring at least two feet in length throughout the remainder of the buoy line ("body of the buoy line"). Two of these marks are to occur in the top 50% of the body of the buoy line, two are to occur in the bottom 50% of the body of the buoy line, and there shall not be a length of buoy line greater than 60 feet without such a red mark.

For federal waters, the surface system is to be marked with one solid red mark of at least three feet in the surface system followed by a one-foot solid green mark no more than one foot below the three-foot solid red mark. Then there is to be at least one mark of at least two feet in length in each third of the body of the buoy line. Each mark is to consist of a solid or non-solid red mark measuring at least one foot in length and a solid or non-solid green mark measuring at least one foot in length. Within the body of the buoy line the red and green marks need not be adjacent but are not to be more than six inches apart.

A solid mark refers to a mark of uniform color throughout the length of marking (e.g., tape or paint). A non-solid mark refers to marking that may be woven into the buoy line (e.g., tracer). Legal contrivances designed to have the buoy line break at 1,700 pounds of tension (e.g., South shore sleeves or splices of red weak rope) may be used as a red mark within the body of the buoy line.

DMF engaged in ongoing rule making to (1) extend these gear marking requirements to all trap gear fisheries; and (2) to modify the regulations to prevent gear being fished in state or federal waters as being wrongly misattributed to the other jurisdiction and if adopted these changes would go into effect immediately.



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